Tennessee Valley Authority, Post Office Box 2000, Decatur, Alabama 35609-2000

June 27, 2006

TVA-BFN-TS-431
TVA-BFN-TS-418

10 CFR 50.90

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Mail Stop OWFN, P1-35
Washington, D. C. 20555-0001

Gentlemen:

In the Matter of	)	Docket Nos. 50-259
Tennessee Valley Authority	)	50-260
	)	50-296

BROWNS FERRY NUCLEAR PLANT (BFN) - UNITS 1, 2, AND 3 - TECHNICAL SPECIFICATIONS (TS) CHANGES TS-431 AND TS-418 - EXTENDED POWER UPRATE (EPU) - REPLACEMENT COOLING TOWER (TAC NOS. MC3812, MC3743, AND MC3744)

By letters dated June 28, 2004 (ADAMS Accession No. ML041840109) and June 25, 2004 (ML041840301), TVA submitted applications to the NRC for EPU of BFN Unit 1 and BFN Units 2 and 3, respectively. With regard to the EPU of the BFN units and initiatives to recover and restart Unit 1, TVA is planning to provide additional cooling tower capacity at the BFN site. By letter dated May 25, 2006 (ML061420156), the NRC requested TVA provide additional information on the cooling tower to support completion of the Environmental Assessment for EPU. A number of environmental reviews have discussed and examined this matter. This letter provides updated information regarding the design and cooling capacity of a sixth, mechanical draft cooling tower, which would replace the cooling tower that was accidentally destroyed in 1986.

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Installation of a sixth cooling tower at BFN is planned to support the operation of all three units at EPU conditions. TVA envisions erecting a cooling tower in the currently vacant position where a previously-existing cooling tower was located. Like the current cooling towers, the new cooling tower will be a mechanical draft design consisting of several cooling cells. Preliminary design studies considered constructing a cooling tower consisting of 20 cells. However, more recent environmental and engineering evaluations conducted by TVA that take into account the environmental considerations together with other operational aspects of the project, indicate that a cooling tower with a heat removal capacity greater than or equal to that of existing cooling tower # 3 (a newer 16-cell design as discussed in Enclosure 1) is preferred in meeting TVA's overall power generation objective while ensuring the continued protection of the environment. Changing from a 20-cell tower to a 16-cell tower would result in approximately a 4% decrease in heat removal capability.

Analyses indicate that no significant environmental impacts would be expected as a result of operation of the three BFN units at EPU conditions with operation of the cooling towers as needed. The maximum discharge temperature and the temperature rise between upstream and downstream will remain within approved regulatory limits {National Pollutant Discharge Elimination System (NPDES) permitted thermal limits}. Enclosure 1 to this letter provides greater detail regarding the environmental factors associated with operating a cooling tower with a heat removal capacity greater than or equal to that of existing cooling tower # 3.

Cooling towers are operated as necessary to meet thermal discharge temperature limits. For EPU operation of three BFN units, use of cooling towers is expected to increase, and on those rare occasions when NPDES permitted thermal limits cannot be met with the operation of the cooling towers, the plant would be derated to remain in compliance. This operating strategy is unaffected by the type of replacement tower that is selected. A replacement cooling tower with a heat removal capacity greater than or equal to that of existing cooling tower # 3 would not materially affect plant or cooling tower operations and would continue to be environmentally acceptable. As discussed in Enclosure 1 to this letter, with an operating strategy of plant derating for maintaining the NPDES limits, there is no significant difference between cooling tower cell designs. For a replacement cooling tower with a heat removal capacity greater than or equal to that of existing cooling tower # 3, derates would be triggered by a slightly lower river water temperature (0.3°F), would last slightly longer, and would occur somewhat more frequently. The result is small differences in the total hours of cooling tower operation.

Other environmental considerations associated with a replacement cooling tower with a heat removal capacity greater than or equal to that of existing cooling tower # 3 are expected to be insignificant and do not change the conclusions previously reached regarding environmental impacts. Accordingly, this difference in cooling tower design is not considered material in assessing the environmental impacts.

Commencement of construction activities for the replacement cooling tower is currently planned for October 2006, with the additional cooling capability being available by the summer of 2007. TVA has issued a request for proposal to suppliers for cooling tower designs with a heat removal capacity greater than or equal to that of existing cooling tower # 3. The response to this inquiry and other information will be used by TVA to make its final determination on cooling tower design.

The Alabama Department of Environmental Management and the United States Department of the Interior, Fish and Wildlife Service (F&WS) were briefed on the conclusions of this analysis and had no objections given that TVA's commitment to continuing to meet NPDES limits remained unchanged.

During the briefing of the F&WS, the requests and recommendations contained in the April 20, 2006, letter from Elaine Snyder-Conn (F&WS) to Pao-Tsin Kuo (NRC) were discussed. These 6 requests and 3 recommendations and TVA's response to each are provided in Enclosure 2 to this letter for information. F&WS agreed that TVA's responses were acceptable.

There are no new regulatory commitments contained in this letter. If you have any questions regarding this letter, please contact me at (256)729-2636.

I declare under penalty of perjury that the foregoing is true and correct. Executed on this 27th day of June, 2006.

Sincerely,

William D. Crouch

William D. Crouch
Manager of Licensing
and Industry Affairs

Enclosures:

1. ANALYSIS OF THE ENVIRONMENTAL EFFECTS OF RESIZING THE PROPOSED NEW 20-CELL COOLING TOWER AT BROWNS FERRY NUCLEAR PLANT TO A 16-CELL COOLING TOWER

2. RESPONSE TO REQUESTS AND RECOMMENDATIONS FROM FISH AND WILDLIFE SERVICE LETTER OF APRIL 20, 2006

cc: Page 5

Enclosure
cc (w/Enclosure):

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ENCLOSURE 1

TENNESSEE VALLEY AUTHORITY
BROWNS FERRY NUCLEAR PLANT (BFN)
UNITS 1, 2, AND 3

TECHNICAL SPECIFICATIONS (TS) CHANGES TS-431 AND TS-418 -
EXTENDED POWER UPRATE (EPU)

ANALYSIS OF THE ENVIRONMENTAL EFFECTS OF RESIZING THE PROPOSED NEW 20-CELL COOLING TOWER AT BROWNS FERRY NUCLEAR PLANT TO A 16-CELL COOLING TOWER

(See attached report, "*Analysis of the Environmental Effects of Resizing the Proposed New 20 Cell Cooling Tower at Browns Ferry Nuclear Plant to a 16 Cell Cooling Tower.*")

Document Type:	**Non-project NEPA Correspondence**
Index Field:	**NEPA Guidance and Scoping**
Project Name:	**Analysis, 16-Cell Cooling Tower, BFN**
Project Number:	**2006-82**

Analysis of the Environmental Effects of Resizing the Proposed New 20-Cell Cooling Tower at Browns Ferry Nuclear Plant to a 16-Cell Cooling Tower

Tennessee Valley Authority

June 2006

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Analysis of the Environmental Effects of Resizing the Proposed New 20-Cell Cooling Tower at Browns Ferry Nuclear Plant to a 16-Cell Cooling Tower

1. Introduction

In May 2002, the Tennessee Valley Authority (TVA) Board of Directors adopted the preferred alternative (Refurbishment and Restart of Unit 1 with Relicensing of All Units) from TVA's *Final Supplemental Environmental Impact Statement* (FSEIS) *for Operating License Renewal of the Browns Ferry Nuclear Plant in Athens, Alabama* (TVA 2002a). Subsequent analyses indicate that changing the cooling tower configuration in the preferred alternative may provide savings for TVA without appreciably increasing adverse environmental effects.

As explained in the FSEIS, the restart of Unit 1 at Browns Ferry Nuclear Plant (BFN) under the preferred alternative requires additional cooling capacity in combination with derating of the plant under infrequently occurring conditions. After considering four approaches to achieving adequate cooling capacity, the FSEIS identified as preferred Option 2D, the addition of one 20-cell cooling tower to be constructed at the site of the old Cooling Tower No. 4, which was destroyed by fire in 1986 and never replaced (TVA 2001). Option 2D was identified because at that time it was considered best from a financial standpoint and because it would provide flexibility for future operations. However, no material environmental difference between cooling tower options was identified because of the way the plant operates when near thermal limits (TVA 2002b).

Subsequent financial analyses comparing the cost of additional cooling capacity with the cost of potential derates needed to maintain compliance with the requirements of the plant's National Pollutant Discharge Elimination System (NPDES) permit prompted a reanalysis of the decision to choose Option 2D as the preferred alternative. Accordingly, in the winter of 2006, an interdisciplinary team was asked to evaluate the feasibility of a new 16-cell cooling tower alternative in contrast to Option 2D (i.e., the 20-cell cooling tower option). This paper compares the hydrothermal and environmental effects of these two cooling tower configurations and concludes that with some additional derates, the expected environmental effects for the configuration containing a 16-cell tower are essentially the same as those for the configuration containing a 20-cell tower (i.e., Option 2D).

2. Hydrothermal Evaluation

Hydrothermal evaluations were performed to examine heat shock and the impact of the number of cooling tower cells on: (1) plant operation, (2) near-field reservoir hydrothermal conditions, and (3) far-field reservoir water quality conditions. The evaluation of impacts on plant operations considered the frequency and magnitude of cooling tower usage and derate events needed to comply with the river temperature requirements in the NPDES permit. The impact on near-field reservoir hydrothermal conditions considered the three-dimensional (3-D) behavior of the plant thermal effluent in and near the diffuser mixing zone. The impact on far-field reservoir water quality considered the effects on water temperature, algae biomass, and dissolved oxygen (DO) in regions of the reservoir beyond the diffuser mixing zone.

2.1 Source Water Body Characterization

As shown in Figure 1, the plant is located on the northern shore of Wheeler Reservoir at Tennessee River Mile (TRM) 294.0. The reservoir extends from Guntersville Dam at TRM 349.0 (55.0 miles upstream of BFN) to Wheeler Dam at TRM 274.9 (19.1 miles downstream of BFN). The upper 40 miles of the reservoir is riverine in character with a channel depth of about 20 feet. The water column in this region of the reservoir tends to be fully mixed. Starting near Decatur, Alabama, about 15 miles upstream of BFN, the reservoir becomes wider, including both a deep main channel and adjacent shallow overbanks. At BFN, the main channel is about 2,000 feet wide and 30 feet deep, whereas the overbanks have a total width of about 5,000 feet and depths ranging between 2 and 10 feet. Downstream of BFN the reservoir becomes deeper, reaching a depth of about 60 feet in the forebay of Wheeler Dam. Additional details about the surface water resources for BFN are given by TVA (2002a).

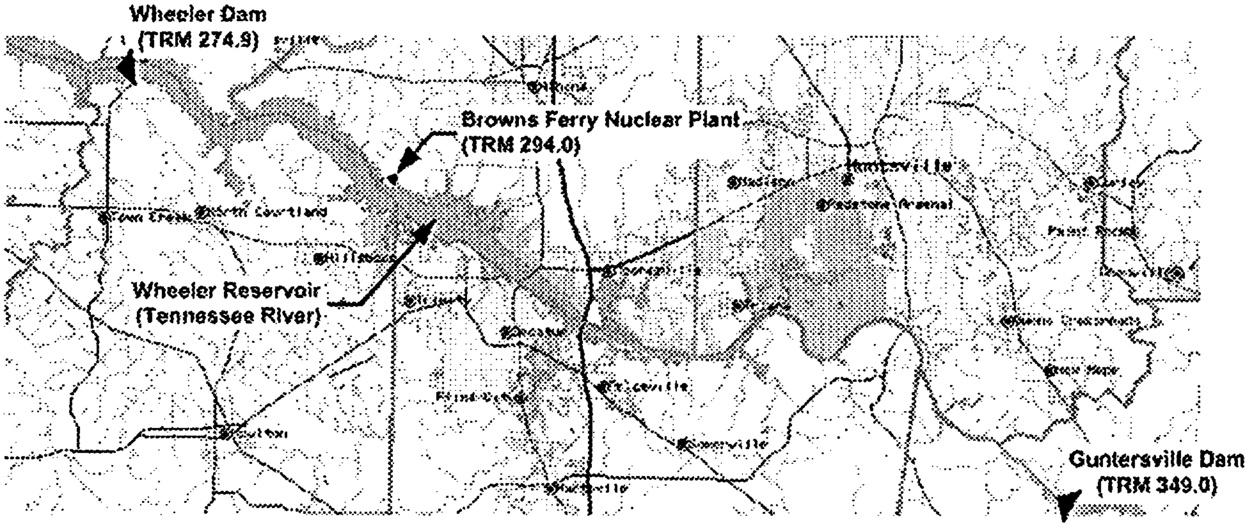


Figure 1. Map Showing Location of Wheeler Reservoir

The geometry of Wheeler Reservoir in the area surrounding BFN is shown in Figure 2. Condenser cooling water is withdrawn from the reservoir by an intake pumping station located just upstream of the plant. The pumping station is separated from the main body of the reservoir by a skimmer wall containing movable gates. After passing through the plant, the heated water is returned to the reservoir through multiport diffuser pipes located on the bottom of the main channel. The diffuser for Unit 1 is located in the middle of the channel, whereas the diffusers for Unit 2 and Unit 3 are situated on the opposite and nearshore sides of the main channel, respectively. The NPDES permit defines a mixing zone spanning the main channel and extending downstream 2,400 feet for the purpose of safely diluting the thermal effluent from the plant diffusers. Three temperature stations, one for each diffuser, are provided at the end of the mixing zone for the purpose of monitoring compliance with the downstream temperature requirements in the NPDES permit. The ambient temperature of the reservoir prior to impacts by the plant is monitored by a temperature station on the southern edge of the main channel about 4 miles upstream of the plant.

The current NPDES temperature limits for the BFN thermal discharge include two parameters—the maximum temperature downstream of the plant and the maximum temperature rise from upstream to downstream of the plant. The maximum temperature downstream of the plant includes a 1-hour average limit and a 24-hour average limit. The 1-hour average limit is 93 degrees Fahrenheit (°F) [33.9 degrees Celsius (°C)] and the 24-hour average limit is 90°F (32.2°C). The maximum temperature rise includes only a 24-hour average limit, which is 10°F (5.6°C). Historical data show that it is possible for the 24-hour average upstream (i.e., ambient) water temperature to exceed 90°F. To allow plant operation under these conditions, if the upstream 24-hour temperature exceeds 90°F, the 24-hour downstream temperature may equal, but not exceed, the upstream value. That is, the temperature rise must be zero or less. As ambient temperature increases, this type of operation is acceptable until the 1-hour average limit of 93°F is obtained.

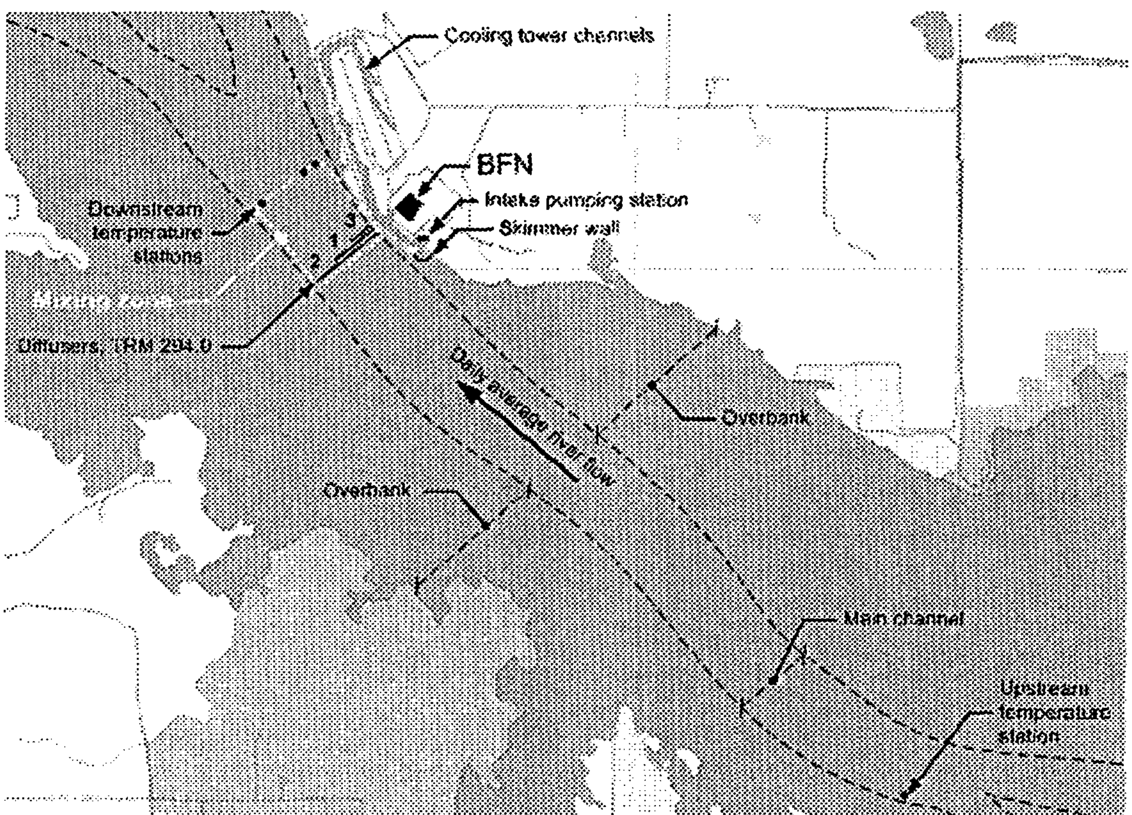


Figure 2. Map showing the Location of the BFN Cooling Towers Structures and Related Geometry of Wheeler Reservoir

2.2 Impact on Plant Operation

The potential impact of the number of BFN cooling tower cells on plant operation was evaluated using a computer model. This model simulated the combined operation of the river and plant, and the resulting influence of the plant thermal effluent on the instream water temperature at the downstream end of the diffuser mixing zone. The model simulations are used to determine the timing and duration of cooling tower operations and plant derates needed during the simulation period to comply with NPDES thermal limits. This is accomplished by adjusting model inputs on cooling tower operation and plant derates until there are no permit violations.

The detailed aspects of the model formulation, data, assumptions, and simulation results are given by Hopping and Harper (2005). Briefly, the model includes an algorithm to compute the water temperature at the compliance depth at the downstream end of the diffuser mixing zone, based on the temperature and flow of water in the river and the temperature and flow of effluent from the plant. The simulated plant operation includes the use of cooling towers and plant derates, as needed, to prevent the water temperature from exceeding the NPDES river temperature limits. The simulations were conducted based on the historical period from 1985 to 2004, which includes a range of meteorological conditions of the type expected at the site in the future (i.e., cold-wet years and hot-dry years). The ambient river temperature for BFN was assumed to correspond to actual river temperatures recorded at the upstream temperature station shown in Figure 2. The river flow at the plant was determined based on historical inflows to the Tennessee River and the expected operation of the river system as specified by the recent TVA Reservoir Operations Study (TVA 2004).

In the model, the amount of waste heat released to the river by the plant in extreme temperature events depends on the capacity of the plant cooling system (i.e., number of BFN cooling tower cells). Scenarios examined by the model include the following:

- Current Plant: Unit 1 not operating, Units 2 and 3 operating at 105 percent of original power level; five cooling towers—four original Ecodyne 16-cell towers (Tower Nos. 1, 2, 5, 6) and one newer Balcke-Durr 16-cell tower (Tower No. 3).

- Scenario A -16-Cell Tower: Units 1, 2, and 3 operating at 120 percent of original power level; five cooling towers of the current plant (Tower Nos. 1, 2, 3, 5, 6) plus one new cooling tower (Tower No. 4) equivalent to the existing Balcke-Durr 16-cell cooling tower (Tower No. 3).

- Scenario B - 20-Cell Tower (SEIS Preferred Alternative): Units 1, 2, and 3 operating at 120 percent of original power level; five cooling towers of the current plant (Tower Nos. 1, 2, 3, 5, 6) plus one new cooling tower (Tower No. 4) similar to the existing Balcke-Durr cooling tower (Tower No. 3), but containing 20 cells rather than 16 cells.

Simulation results for the derate energy loss are shown in Table 1. For the current plant, significant derates (i.e., those in excess of 3,840 megawatt hours [MWh]) occurred in two of the 20 simulation years with an average annual energy loss of 8,000 MWh. With the restart of Unit 1 and the addition of a 20-cell cooling tower, plant derates occurred in four of the 20 simulation years and had an average annual energy loss of 19,000 MWh. The 16-cell tower also resulted in derates in four of the 20 years, but the average annual energy loss increased 2,000 MWh to 21,000 MWh. The year of highest simulated derate losses was 1993 with 133,000 (current plant), 300,000 (20-cell tower), and 325,000 MWh (16-cell tower).

Table 1. Derate Energy Loss Over 20-Year Simulation Period

Scenario	Years with Significant Derates[1]	Derate Energy Loss (1,000 MWh)	
		Annual Average	Highest Derate Year - 1993
Current Plant	2	8	133
A. 16-Cell Tower	4	21	325
B. 20-Cell Tower	4	19	300

[1] Number of years with derates in excess of 3,840 MWh (one unit shut down for 3 hours).

Simulation results for cooling tower operation are shown in Table 2. For the current plant, cooling towers were used in excess of 24 hours in 16 of the 20 simulation years for an average of 206 hours per year. With the restart of Unit 1 and a new 20-cell tower, cooling tower usage in excess of 24 hours occurred in 17 of the 20 years for an average of 322 hours per year. The 16-cell tower also required cooling towers in 17 of the 20 years. The average usage was 330 hours per year. During the highest use year of 1993, cooling towers were used for 607 (current plant), 793 (20-cell tower), and 826 hours (16-cell tower) using the midrange numbers. For more details on the inherent uncertainties in the model formulation, data, and assumptions and the effect on simulation results, see Hopping and Harper (2005).

Table 2. Cooling Tower Operation Over 20-Year Simulation Period

Scenario	Years with Significant Operation[1]	Cooling Tower Operation (Hours)	
		Annual Average	Highest Use Year – 1993[2]
Current Plant	16	206	593 – 607 – 953
A. 16-Cell Tower	17	330	811 – 826 – 1677
B. 20-Cell Tower	17	322	777 – 793 – 1675

[1] Number of years of cooling tower operation in excess of 24 hours.
[2] The number of hours at least one cooling tower is in service. The ranges are based on sensitivity analyses; the middle number was used for baseline assumptions.

2.3 Impact on Near-Field Hydrothermal Conditions

Simulations of the mixing zone were performed using a 3-dimensional model for the region of the reservoir in the immediate vicinity of the plant (Lin and Hecker 2002). Model conditions correspond to an approximate worst-case situation before entering a derate event (i.e., all cooling towers in operation and thermal conditions approaching NPDES limits). The purpose of the near-field modeling analysis is to provide more detailed information on river flow and thermal conditions within the immediate vicinity of the plant diffuser mixing zone. The results are used in comparing alternative scenarios and in assessing potential aquatic impacts (e.g., fish passage).

The input conditions for the near-field model were estimated using the plant operations model described in the previous section. Two simulations were performed, one based on a 16-cell cooling tower (Scenario A) and one based on a 20-cell cooling tower (Scenario B). The basic conditions of the plant and river for the two simulations are summarized in Table 3. Compared to the 20-cell tower scenario, the 16-cell cooling tower scenario results in a slightly higher flow (4,420 cubic feet per second [cfs] versus 4,410 cfs) and a slightly higher temperature (98.2°F versus 97.4°F) for the plant discharge. Consequently, the 16-cell tower scenario requires a plant derate slightly sooner than the 20-cell tower scenario (i.e., when the river temperature reaches 86.7°F compared to 87.0°F for the 20-cell tower scenario). For both scenarios, the river flow is 10,000 cfs, corresponding to the minimum daily average flow for the period of peak summertime reservoir temperatures, as specified by TVA (2004).

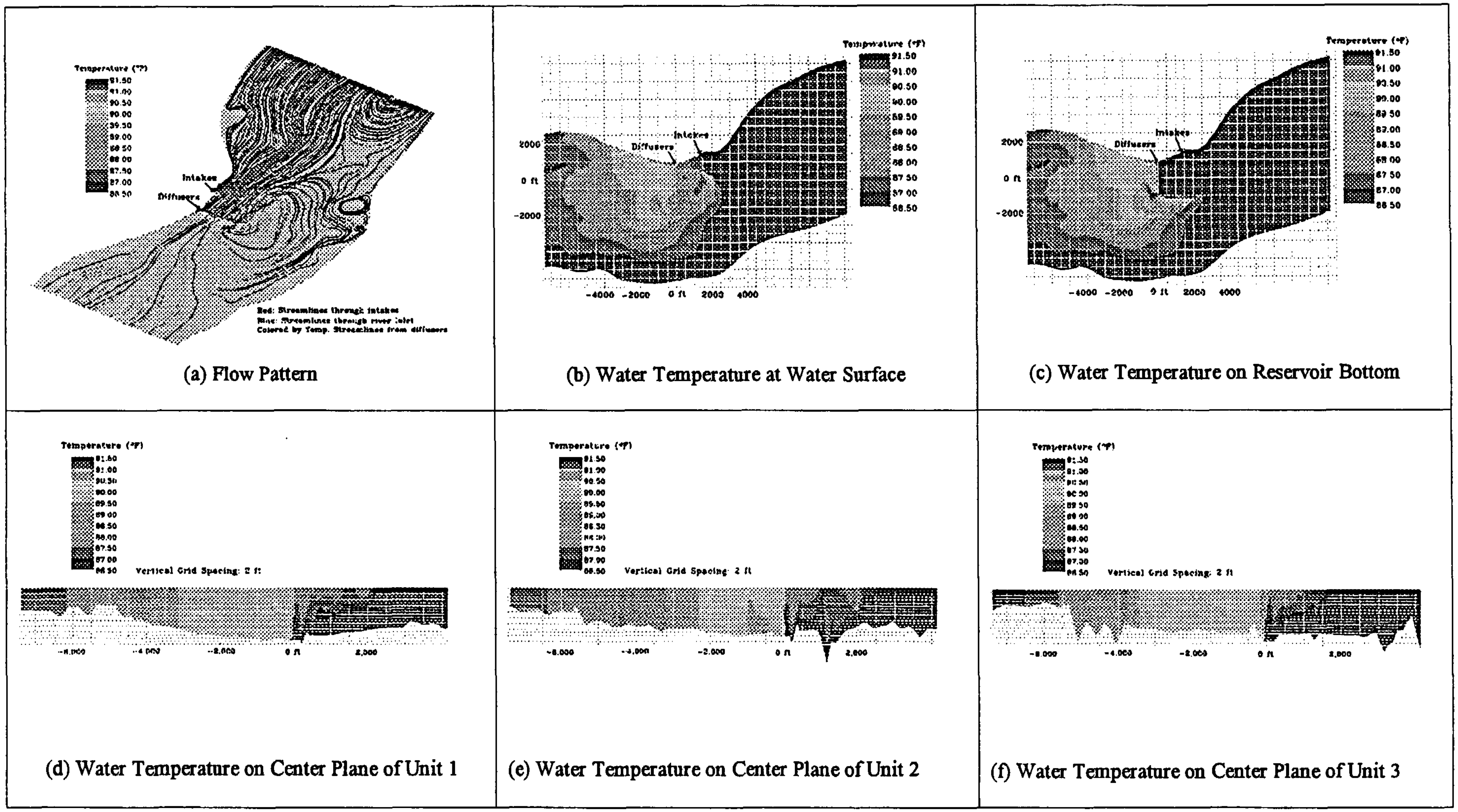
Figures 3 and 4 illustrate the results for the near-field model for Scenario A and Scenario B, respectively. In each figure, frame (a) shows the computed flow pattern, and frames (b) through (f) the computed water temperatures for various plan views and longitudinal sections through the diffuser mixing zone. The results of the near-field model predict only subtle, insignificant differences between the 16-cell tower and the 20-cell tower scenarios. Both cases show similar flow patterns and contain river temperature close to the 90°F NPDES limit near the edge of the mixing zone. In comparing Figures 3 and 4, the temperature at the water surface [frame (b)] is slightly warmer for the 20-cell tower scenario. This merely indicates that the assumed trigger temperature for a derate for the 20-cell tower scenario (87.0°F) is slightly less conservative than the assumed trigger temperature for a derate for the 16-cell tower scenario (i.e., 86.7°F).

Table 3. Model Conditions Prior to Derate and Near-Field Simulations

Scenario	Plant Conditions			River Conditions	
	Intake	Diffuser Discharge			
	Flow (cfs)	Flow (cfs)	Temp (°F)	Flow (cfs)	Temp (°F)
A. 16-Cell Tower	4490	4420	98.2	10,000	86.7
B. 20-Cell Tower	4490	4410	97.4	10,000	87.0

2.4 Impact on Far-Field Reservoir Water Quality

Potential impacts on reservoir water quality were examined using a two-dimensional (2-D) water quality model of Wheeler Reservoir as described by Shiao, Bender, and Hauser (1993). The year examined in this analysis, 1988, was one of the hottest and driest years of the 20-year period of record from 1985 to 2004. A fourth (Base Case) scenario also was included: the plant as originally licensed, with three units operating at 100 percent capacity and six Ecodyne 16-cell cooling towers. The analysis included the reservoir operation strategy as specified by TVA (2004). It also included the cooling tower operation and derates necessary to avoid exceeding NPDES temperature limits. The only differences in input data for the four modeled scenarios were the flows and temperature of the discharge from the BFN diffusers as determined by the computer model described earlier in the section entitled, "Impact on Plant Operation."



(a) Flow Pattern

(b) Water Temperature at Water Surface

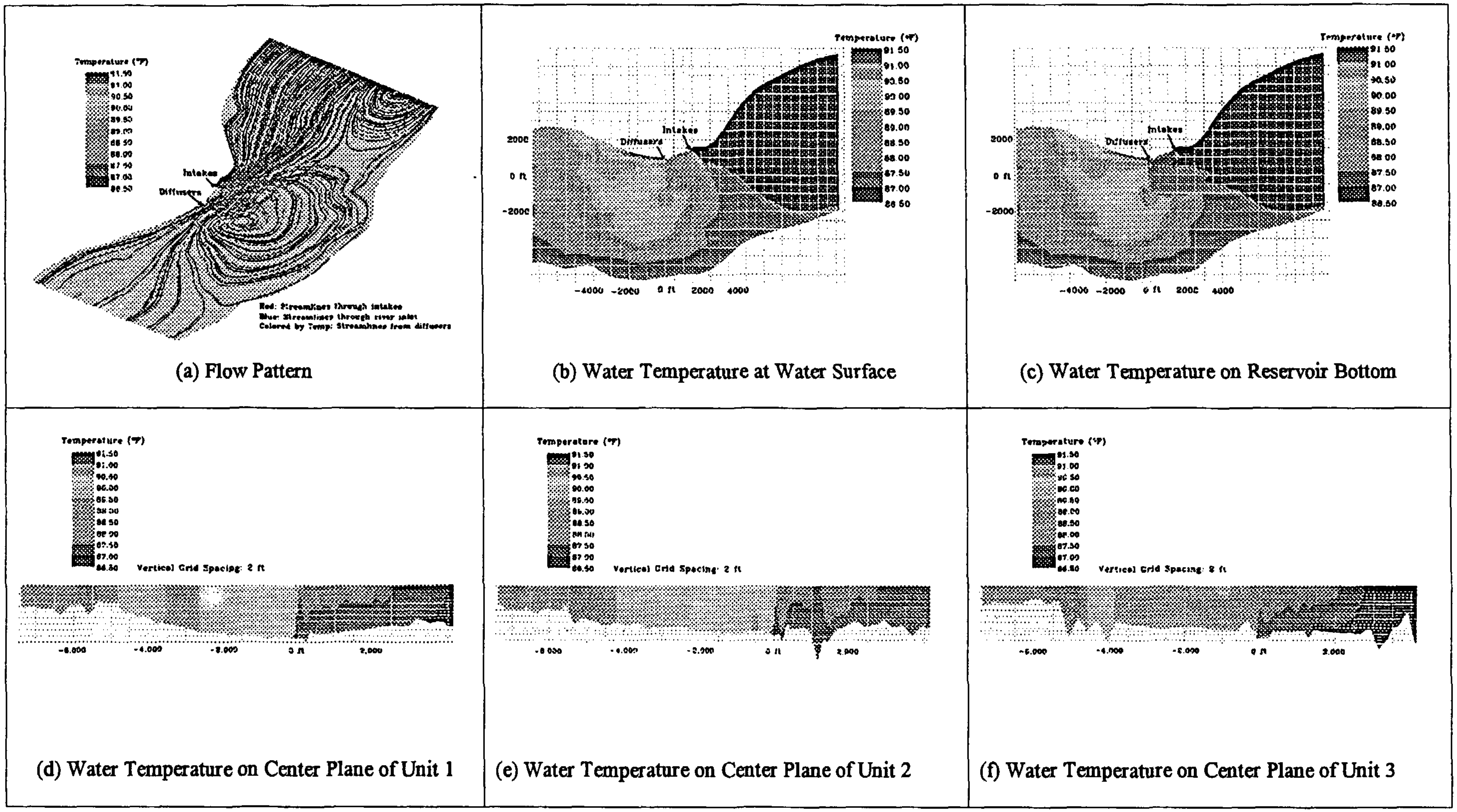
(c) Water Temperature on Reservoir Bottom

(d) Water Temperature on Center Plane of Unit 1

(e) Water Temperature on Center Plane of Unit 2

(f) Water Temperature on Center Plane of Unit 3

Figure 3. BFN 3-D Near-Field Hydrothermal Simulation Results for the 16-Cell Cooling Tower (Scenario A)



(a) Flow Pattern

(b) Water Temperature at Water Surface

(c) Water Temperature on Reservoir Bottom

(d) Water Temperature on Center Plane of Unit 1

(e) Water Temperature on Center Plane of Unit 2

(f) Water Temperature on Center Plane of Unit 3

Figure 4. BFN 3-D Near-Field Hydrothermal Simulation Results for the 20-Cell Cooling Tower (Scenario B)

Table 4 compares the computed temperature, algal biomass, and DO concentration at the 5-foot depth for three reservoir locations: upstream of BFN, downstream of BFN, and in the reservoir forebay (Hopping 2006). Both the maximum day and annual mean values are given. With cooling tower operation and derates, deviations from the Base Case for the 16-cell tower and the 20-cell tower scenarios are essentially the same for all three parameters. Thus, no significant difference is expected between the 16-cell and 20-cell cooling tower scenarios for the maximum day and annual mean reservoir temperature, algal biomass, or DO concentration.

Table 4. Summary of 1988 Simulation Results at 5-Foot Depth From 2-D Far-Field Reservoir Water Quality Model[1]

Scenario	Parameter	Upstream of BFN		Downstream of BFN		Reservoir Forebay	
		Maximum Day	Annual Mean	Maximum Day	Annual Mean	Maximum Day	Annual Mean
Base Case[2]	**Temperature (°F)**	**87.6**	**64.9**	**87.6**	**65.3**	**88.0**	**65.3**
Current Plant	Change from base (°F)	-0.4	-0.7	-0.5	-0.6	-0.3	-0.5
A. 16-Cell Tower	Change from base (°F)	0.0	0.4	0.0	0.5	0.0	0.3
B. 20-Cell Tower	Change from base (°F)	0.0	0.4	0.0	0.5	0.1	0.3
Base Case[2]	**Algae (mg/L[3])**	**7.2**	**3.7**	**7.0**	**3.5**	**8.0**	**3.7**
Current Plant	Change from base (mg/L)	0.2	0.1	0.0	0.0	0.3	0.0
A. 16-Cell Tower	Change from base (mg/L)	0.0	0.0	0.0	0.0	-0.1	0.0
B. 20-Cell Tower	Change from base (mg/L)	0.0	0.0	0.0	0.0	-0.1	0.0
Base Case[2]	**DO (mg/L)**	**6.2**	**9.1**	**5.2**	**8.8**	**6.5**	**9.2**
Current Plant	Change from base (mg/L)	-0.1	0.1	-0.1	0.0	0.0	0.1
A. 16-Cell Tower	Change from base (mg/L)	0.0	0.0	0.2	0.0	0.0	0.0
B. 20-Cell Tower	Change from base (mg/L)	0.0	0.0	0.2	0.0	0.0	0.0

[1]Based on BFN discharge flow and temperature from the plant operation model.

[2]Base Case is BFN operating as originally licensed with three units operating at 100 percent capacity with six 16-cell Ecodyne cooling towers.

[3]mg/L = milligrams per liter.

3. Environmental Evaluation

3.1 Noise

In Section 3.19.5 of the FSEIS (TVA 2002a), the affected environment was assessed using six cooling towers that were previously considered in the Environmental Assessment for the Extended Power Uprate (TVA 2001). See the discussion in Section 2.2.3 of the FSEIS. The sixth cooling tower was planned to be similar to Tower 3, the 16-cell replacement for the previously destroyed cooling tower. The first row of Table 3.19-2 presents the current environmental noise levels in the Paradise Shores area. The table gives the background noise, total noise, 24-hour day/night noise (DNL), and the average annual DNL for the average (17 days) and maximum (27 days) cooling tower use over the past five years. These values are based on the measured and calculated noise levels for six cooling towers.

This row of noise levels from Table 3.19-2 is also used as the first row in Table 4.3.19-1 as part of the tabular comparisons of the current noise environment at Paradise Shores to the projected noise environments from the proposed alternatives. The row for Option 2D gives the calculated noise level for a 20-cell tower at Tower No. 4 added to the measure values for the current five operating towers. By reducing the planned 20-cell tower to 16 cells at Tower No. 4, the projected noise level is the same as in Row 1. This shows an approximately 1 decibel (dB) decrease in the Paradise Shores area going from 20 to 16 cells for the Cooling Tower No. 4.

The potential noise impact of increasing the operation of the cooling towers is strongly dependent on two variables. Most important is which towers are used, and second is how long they run. There are many possible combinations of towers that could be used, but for this assessment, a worst case is assumed that Towers 3 and 4 will always be used. Towers 3 and 4 are the closest to the Paradise Shores area and have a dominant noise effect over the other towers when used.

In the simulation, the worst-case usage for the 16-cell Cooling Tower No. 4 is modeled at 1,677 hours (see Table 2). This is about 35 days if all the hours were used by operating only Towers 3 and 4. In this worst case, the 24-hour DNL is the same as given in Row 1 of Table 4.3.19-1, but the average annual DNL needs to be recalculated for 35 days versus 17 and 27 days used in the FSEIS. This time-weighted average recalculation is sound-energy based and gives an increase in the average annual DNL of about 0.02 dB more than the average annual DNL for 17 days of operation. In addition, it is about 0.05 dB greater than the 27-day average annual DNL. Both are negligible increases, even under these worst-case assumptions.

The Paradise Shores area has the greatest potential for impact of the noise receivers around BFN cooling towers. Based on the revised calculation, there is a negligible potential impact on the noise environment in the Paradise Shores area from the combination of using a 16-cell cooling tower instead of a 20-cell Tower No. 4 and operating some or all of the cooling towers more days than previously used.

3.2 Water Quality

The potential environmental impacts to water quality resulting from construction of a 16-cell cooling tower with increased plant derate verses building a 20-cell cooling tower were assessed using the hydrothermal modeling results presented above (Hopping 2006). Modeling results indicate that with appropriate cooling tower use and plant derates, the near-field and far-field hydrothermal effects are essentially the same for both cooling towers and that water temperature differences are minor. Therefore, measurable differences in reservoir temperatures, DO concentrations, and algal biomass are not expected.

All water bodies in each state are classified under the Clean Water Act for certain uses, and those uses are protected by state water quality standards that limit the amount of various pollutants that can be present. One of the pollutants regulated in this program is heat. Wheeler Reservoir has multiple use classifications: Public Water Supply, Swimming, and Fish and Wildlife. A 10.0-mile segment (approximately TRM 275 to 285) of Wheeler Reservoir was placed on the State of Alabama's 303(d) use impairment list in 1996 for pH, organic enrichments/DO, and flow alteration. Organic enrichment/DO and flow alteration impairments were removed from Alabama's 303(d) use impairment list in 1998, but temperature/thermal modification impairment was added to the 1998 list.

In 2002, the Alabama Department of Environmental Management (ADEM) reviewed data from 1990 to 2001 from seven long-term monitoring locations on four similar Tennessee Valley reservoirs (Pickwick, Wilson, Wheeler, and Guntersville). This analysis demonstrated that mean pH and temperature values in the photic zone (top 4 meters of the water column) of Wheeler Reservoir were no different than pH and temperature values measured at similar locations in neighboring Tennessee River reservoirs. ADEM determined that the elevated pH and temperature readings of Wheeler Reservoir were due to natural conditions and subsequently delisted Wheeler Reservoir for pH and temperature exceedences.

In addition, Wheeler Reservoir has a specific water quality criterion for chlorophyll-a, which was established in January 2001. Wheeler Reservoir is currently in compliance with the established chlorophyll-a criterion.

3.3 Aquatic Ecology

Determination of potential environmental impacts to the fish and benthic macroinvertebrate communities resulting from construction of a 16-cell cooling tower with increased plant derate verses building a 20-cell cooling tower were made from hydrothermal modeling results (Hopping 2006), FSEIS (TVA 2002a), and biological monitoring data reported in Baxter and Lowery (2005).

Results from the model (Hopping 2006), at a uniform ambient water temperature of 86.7°F, show that the thermal plume occupies less than half of the main river channel, providing a pathway for avoidance or migration of fish past the thermal influence. It was determined from the previous Phase II B study assessing movement and temperature selection by radio tagged sauger in Wheeler Reservoir during 1997 (Baxter and Buchanan 1998), that the movement/migration patterns for sauger were not affected by BFN operation. In addition, saugers were not found to reside in the vicinity of the BFN diffuser during seasonal extreme ambient water temperatures.

TVA studies have documented that thermal releases from BFN have not had a significant impact on the aquatic community of Wheeler Reservoir (TVA 1983, Baxter and Buchanan 1998). The TVA Vital Signs Monitoring Program evaluates annually any impacts to the fish and macroinvertebrate communities in the vicinity of BFN. The Reservoir Fish Assemblage Index (RFAI) sampling stations in Wheeler Reservoir, the upstream location at TRM 295 above the intake, and the downstream location at TRM 292.5 below the discharge on average scored "good" between 1993 and 2004 (Figure 5 and Table 5). The Benthic Macroinvertebrate Index stations in Wheeler Reservoir, the upstream location at TRM 295.5 above the intake, and the downstream location at TRM 291.7 below the discharge on average scored "good" and "excellent" between 1993 and 2004 (Table 6). This trend supports the hypothesis that BFN thermal discharge is not adversely affecting the Wheeler Reservoir fish and benthic macroinvertebrate communities. TVA plans to continue the Vital Signs Monitoring Program.

To maintain compliance with NPDES discharge limitations as described in the earlier section, *Source Water Body Characterization*, BFN discharge temperature at the diffusers would, under either cooling tower option, not exceed the current thermal limit, maximum temperatures downstream of the plant (including both 1-hour and 24-hour maximums), and maximum temperature rise upstream to downstream of the plant. With the continued use of derating as a part of the operational strategy for maintaining these limits for the 16-cell cooling tower option (therefore producing no significant differences in the hottest average thermal discharge) the conclusions reached about the potential for thermal shock in TVA's SEIS (TVA 2002a) and the NRC's Supplemental Generic Environmental Impact Statement (NRC 2005) are still correct. Additionally, based on the model results (Hopping 2006) in conjunction with the work by Baxter and Buchanan (1988) and Baxter and Lowery (2004), TVA has concluded that the proposed change from a 20-cell to a 16-cell cooling tower is not expected to cause an adverse impact to the fish and macroinvertebrate communities in Wheeler Reservoir.

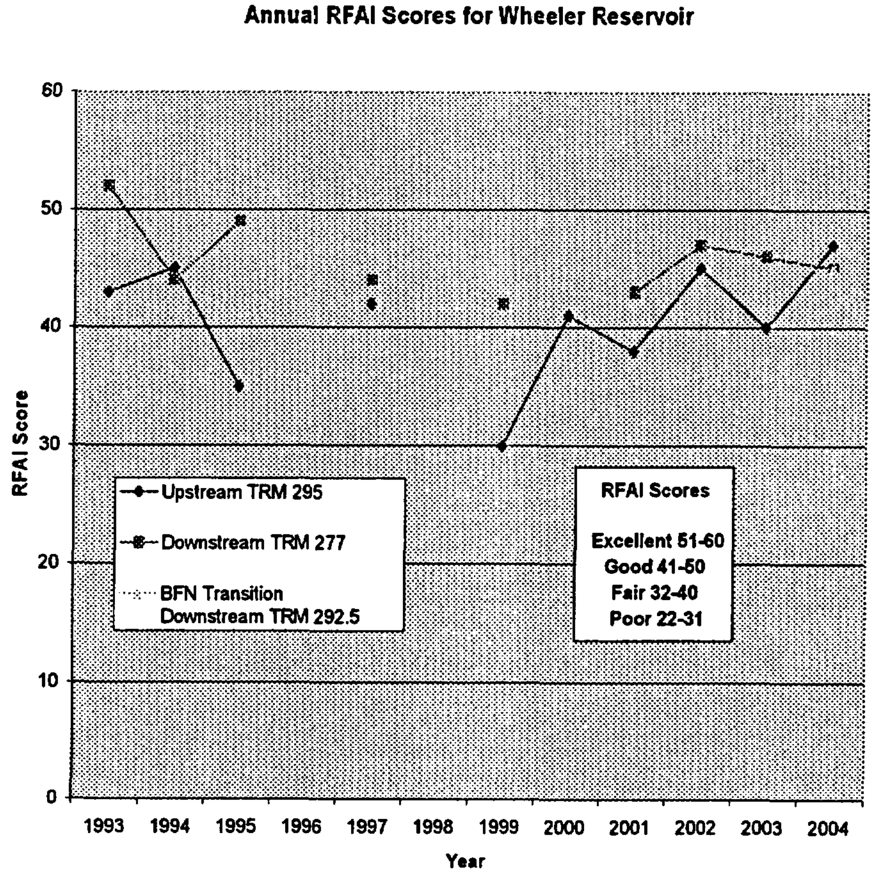


Figure 5. Annual Wheeler Reservoir RFAI Scores at Three Fixed Stations Between the Years 1993 and 2004

Table 5. Wheeler Reservoir RFAI Scores for Sample Years Between 1993 and 2004

Station	Reservoir	Location	Year											1993-2004 Average
			1993	1994	1995	1997	1999	1993-1999 Average	2000[1]	2001	2002[1]	2003	2004	
Upstream of BFN	Wheeler	TRM 295.9	43	45	35	42	30	39 (Fair)	41	38	45	40	47	41 (Good)
Downstream Forebay	Wheeler	TRM 277	52	44	49	44	42	46 (Good)		43	47	46	45	46 (Good)
Downstream Transition	Wheeler	TRM 292.5							43	42	43	43	45	43 (Good)

[1]The 2000 and 2002 sample years were not part of the Vital Signs Monitoring Program; however, the same methodology was applied.

Table 6. Individual Metric Ratings and the Overall Benthic Community Index Score for Upstream and Downstream Sites Near Browns Ferry Nuclear Plant, Wheeler Reservoir, November 2004[1]

Metric	TRM 295.9 - Upstream		TRM 291.7- Downstream	
	OBS[2]	Rating	OBS	Rating
1. Average number of taxa	6.2	3	7.9	5
2. Proportion of samples with long-lived organisms	100%	5	100%	5
3. Average number of EPT[3] taxa	1.2	3	1.7	5
4. Average proportion of oligochaete individuals	1.1%	5	1.6%	5
5. Average proportion of total abundance comprised by the two most abundant taxa	71.9%	5	73.5%	5
6. Average density excluding chironomids and oligochaetes	336.2	3	551.7	3
7. Zero-samples - proportion of samples containing no organisms	0	5	0	5
Benthic Index Score		**29 Excellent**		**33 Excellent**

[1]Scored with transition criteria
[2]Overall Benthic Community Index Score
[3]Ephemeroptera, Plecoptera, and Trichoptera

3.4 Threatened and Endangered (T&E) Aquatic Species

Five federally listed as endangered aquatic species are known to occur in the vicinity of BFN. The rough pigtoe (*Pleurobema plenum*) and the pink mucket (*Lampsilis abrupta*) are freshwater mussels that historically occurred in silt-free, stable gravel and cobble habitats in large river habitats throughout the Tennessee River system (Parmalee and Bogan 1998). These species are now extremely rare and are primarily found in unimpounded tributary rivers and in the more riverine reaches of the largely impounded mainstem Tennessee River. In Wheeler Reservoir, most of the surviving large river habitat occurs upstream of BFN. All recent records of these two species are from upstream of BFN (Ahlstedt and McDonough 1993; Colaw and Carroll 1982; Jeffrey T. Garner, State Malacologist, Alabama Game and Fish Division, personal communication, 1998 and 2001; Gooch et al. 1979; Henson and Pryor 1982; TVA Natural Heritage Database 2006; Yokely 1998). It is very unlikely that populations of these species exist in Wheeler Reservoir adjacent to or downstream of BFN.

Three aquatic snails, restricted to streams entering Wheeler Reservoir in Limestone County, Alabama, are listed as endangered by the U.S. Fish and Wildlife Service. The armored snail (*Pyrgulopsis pachyta*), the slender campeloma (*Campeloma decampi*), and Anthony's river snail (*Leptoxis* [=*Athearnia*] *anthonyi*) are restricted to tributary creeks to Wheeler Reservoir, located upstream from BFN. No evidence exists to suggest that populations of these species exist in Wheeler Reservoir adjacent to or downstream of BFN.

There is little likelihood that any of the listed aquatic animal species found in Wheeler Reservoir or its tributaries are present in the area potentially impacted by thermal effects of BFN. Even if these species are present, the proposed changes to the cooling tower arrangement at BFN would result in little or no increase to water temperatures in Wheeler Reservoir, and represent essentially no change from the conditions evaluated in the FSEIS (TVA 2002a). Therefore, no listed aquatic animal species would be adversely affected by the proposed change.

3.5 Air Quality

The SEIS for BFN Operating License Renewal (TVA, 2002a) discusses potential impacts on ambient air quality from the operation of a new 20-cell cooling tower via particulates emitted as part of drift losses. The SEIS concludes that impacts would be far less than those predicted in the original BFN EIS because actual tower operation is only 8 percent of the average year as compared to the predicted 29 percent. The duration of tower operation in the original EIS was probably based on meeting the instream temperature limits that existed at that time, which were different than the current limits and would require more tower operation.

Total liquid drift emissions from the cooling towers is proportional to cooling-tower condenser-circulating-water (CCW) flow. The original plant design capacity of the cooling towers (six 16 cell towers) was 1,650,000 gallons per minute (gpm). Due to aging, the flow capacity of the four remaining original 16 cell cooling towers is bout 7.3 percent less than their original design capacity. Tower 3 was rebuilt in 1998 with 16 cells, and is estimated to have a flow capacity of about 281,800 gpm. Under these conditions, the estimated CCW flow capacity of the alternative with a new 16 cell cooling tower is 1,583,600 gpm, about 4 percent less that the original cooling towers. And the estimated CCW flow capacity of the alternative with a new 20 cell cooling tower is 1,654,000 gpm, only about 0.2 percent more than the original cooling towers. For a given total-dissolved-solids (TDS) loading, then, and compared to the plant original cooling towers, the hourly particulate-matter (PM) emissions would increase only about 0.2 percent for the alternative with a new 20-cell tower, and would be reduced by about 4 percent for the alternative with a new 16-cell tower.

The hydrothermal evaluation shows that cooling towers will be operated, on the average, about 4 percent of the year for either the 16 or 20-cell towers. With different temperature limitations than originally analyzed, maximum expected cooling tower operations in an extreme year, for both options (up to 19 percent of the year) is still less than that of the original BFN EIS estimate of 29 percent. Therefore, in terms of the production of drift, and based on the expected duration of cooling tower operation, the impact on air quality of the 16 cell tower vs. the 20 cell tower from drift is expected to be negligible, and both alternatives appear to be bounded by the original EIS.

4. Conclusion

The hydrothermal modeling conducted for this study showed only minor differences in near-field and far-field effects over the 20-year simulation period of the two scenarios under consideration for alternative cooling capacity and derating. Use of a 16-cell cooling tower would result in an average annual energy loss of an additional 2,000 MWh more than the 20-cell configuration to maintain compliance with the existing BFN NPDES permit, but derates would occur in the same number of years (e.g., four years). For the 16-cell tower, derates would be triggered by a slightly lower temperature (by 0.3°F) compared to the 20-cell tower scenario, would last slightly longer, and would occur somewhat more frequently, resulting in slight differences in the total hours of cooling tower operation. The predicted difference in near- and far-field hydrothermal conditions in the reservoir was minor.

Environmental effects of the proposed 16-cell tower as compared to a 20-cell cooling tower were evaluated for noise, water quality, aquatic ecology, aquatic T&E species, and air quality. Based on the results of the hydrothermal modeling (Hopping 2006), with derates, the difference in environmental effects between the two scenarios for cooling capacity are expected to be negligible. As long as the plant is operated within the NPDES limits, no significant impacts to aquatic organisms from heat shock are anticipated. Impacts from drift would be less than those originally estimated for the proposed 20-cell cooling tower.

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ENCLOSURE 2

TENNESSEE VALLEY AUTHORITY
BROWNS FERRY NUCLEAR PLANT (BFN)
UNITS 1, 2, AND 3

TECHNICAL SPECIFICATIONS (TS) CHANGES TS-431 AND TS-418 - EXTENDED POWER UPRATE (EPU)

RESPONSE TO REQUESTS AND RECOMMENDATIONS FROM FISH AND WILDLIFE SERVICE LETTER OF APRIL 20, 2006

The following are the 6 requests from the April 20, 2006, letter from Elaine Snyder-Conn (F&WS) to Pao-Tsin Kuo (NRC) and TVA's response to each. TVA's responses were discussed with, and agreed upon, by F&WS.

Fish and Wildlife Service Request 1

"The TVA would continue to maintain their Heritage Program and staff biologists through appropriate funding and training so that Federally-listed fish, wildlife, and plant resources are tracked and surveyed on TVA-managed lands and along BFN's transmission line rights-of-way. The TVA would continue to follow and implement the practices outlined in TVA's best management practices document entitled: A Guide for Environmental Protection and Best Management Practices for Tennessee Valley Authority Transmission Construction and Maintenance Activities."

TVA's Response to Request 1

TVA is continuing to implement these programs and practices.

Fish and Wildlife Service Request 2

"The TVA would implement a trial usage period of the surfactants recommended by the Service to determine efficacy of these recommended (or other) low-toxicity surfactants (with 96-hr LC_{50} toxicity for larval fish or daphnids >> 100 mg/L) in combination with herbicides TVA currently uses near water. Beyond this, TVA commits to adjusting their evaluated surfactant use near aquatic sites and substituting new low-toxicity herbicides and surfactants, as efficacious products are identified. The TVA has committed to engage expert assistance to evaluate the effectiveness of different spray mixtures for optimal vegetation control on associated TVA rights-of-way Streamside Management Zones (SMZs). Based on the surfactant evaluation, the TVA would consider utilizing these products on an extended schedule in the BFN's SMZs, as well as on a wider scale across the TVA region. Near surface waters with known listed species, TVA is also encouraged to avoid use of ammonia-based adjuvants; if sediment-free, low-hardness water is used as a diluent in pesticide tank mixes, such ammonia based adjuvants are usually unnecessary."

TVA's Response to Request 2

TVA is continuing to implement these practices.

Fish and Wildlife Service Request 3

"Prior to initiating the EPU at BFN, TVA would establish an environmental baseline for current BFN operations (Unit 2 and 3) by implementing an ichthyoplankton characterization study similar to the one conducted before BFN's initial startup, from 1974 - 1979. Biological surveys would continue on a regular basis following the initiation of EPU to monitor effects of the EPU and license renewal on the aquatic biota and their habitats. Those data would then be provided to the Service for review. Should data disclose measurable impacts to fish species which are rare in the reservoir and may serve as hosts to listed mussels, the TVA will reinitiate consultation with the Service."

TVA's Response to Request 3

A baseline study, including an ichthyoplankton characterization, has been completed and was provided at the June 21, 2006, meeting with F&WS. This study was performed in support of TVA's assessment of current conditions in the reservoir under the new 316b regulations of the Clean Water Act.

With regard to continuing biological surveys, TVA began a program to systematically monitor the ecological condition of its reservoirs in 1990. Reservoir Monitoring is one of five components of TVA's overall river and reservoir monitoring effort, termed Vital Signs (VS) Monitoring. Objectives of Reservoir Monitoring are to provide information on the "health" or integrity of the aquatic ecosystem in major Tennessee Valley reservoirs. Ecological monitoring activities provide the necessary information from key physical, chemical, and biological indicators (dissolved oxygen, chlorophyll, sediment quality, benthic macro invertebrate and fish communities) to evaluate conditions in reservoirs and to target detailed assessment studies if significant problems are found. In addition, this information establishes a baseline for comparing future water quality conditions in TVA's reservoirs. TVA intends to continue this program.

In 1995, TVA completed a 10-year monitoring program that evaluated the effects of the thermal effluent on the balanced indigenous populations of fish, shell fish and wildlife in Wheeler Reservoir that resulted from the initial granting of the thermal variance under Section 316a of the Clean Water Act. TVA submitted a final report on this program to the Alabama Department of Environmental Management (ADEM). This report was reviewed by F&WS.

TVA discussed with ADEM and F&WS the results of the monitoring program and appropriate next steps to provide ADEM with sufficient information to continue to evaluate the impacts of the Browns Ferry thermal effluent as a part of subsequent NPDES permit renewals. As part of this discussion, TVA proposed use of the fish and benthic macro-invertebrate community data and analyses from the Vital Signs (VS) Monitoring Program in its 1999 NPDES permit application for BFN. To provide current data and focus monitoring in the vicinity of the plant, TVA proposed to add a sampling transect located just downstream of the BFN mixing zone, and to collect data each year to supplement the normal biennial VS Monitoring Program sampling schedule.

ADEM approved the proposed sampling and incorporated appropriate requirements in the issued NPDES permit. Fish and benthic community monitoring is summarized annually to identify any trends reflecting the balanced indigenous population of fish and shellfish in Wheeler Reservoir. Annual reports of the monitoring have been submitted each year as required under the NPDES permit. A copy of the 2005 report entitled "*Biological Monitoring of the Tennessee River near Browns Ferry Nuclear Plant Discharge, 2005*" was previously provided to ADEM. A copy was provided to F&WS at the TVA/F&WS meeting on June 21, 2006.

Fish and Wildlife Service Request 4

"The TVA would monitor water temperature, dissolved oxygen, alkalinity, pH, total residual chlorine, copper, ammonia, and hydrazine at the downstream end of the mixing zone on a monthly basis to determine if modeling has accurately predicted concentrations, targeting bottom waters at those times of the year that have historically produced the lowest river flow and warmest river water temperatures. Additional bottom water data (bottom meter) are desirable in the future during early-morning, summer hours within the modeled plume area after startup and power output at the predicted 120% EPU. The TVA will conduct a formal risk assessment using Environmental Protection Agency methods to assess whether concentrations are protective of sensitive fish and invertebrates, particularly Federally-listed mussels, with extended low-flow, high-temperature conditions modeled in the risk assessment."

TVA's Response to Request 4

As a part of the normal VS Monitoring Program for Wheeler Reservoir, a stratified water quality sample is collected once per month. This sample includes dissolved oxygen, temperature and pH at the sampling sites located just upstream of the plant and downstream near Second Creek (TRM 277). Additionally, BFN collects temperature information from the entire water column at the downstream end of the mixing zone as a part of the required compliance monitoring for the NPDES permit. F&WS can access this information via the reports for the VS Monitoring Program and the Discharge Monitoring Reports. Based on the amount of data being collected, TVA does not see any benefit to additional monitoring, and does not plan to implement it.

The current NPDES permit requires residual chlorine monitoring at the NPDES discharge point for Condenser Cooling Water (DSN 001). TVA has been collecting samples since 2001 and has never observed chlorine in the discharge above the detectable limits. ADEM is proposing to continue to require chlorine monitoring in the draft permit. The DSN 001 sample location is much more conservative than monitoring below the mixing zone since it measures chlorine levels prior to mixing with river flow. Table 1 provides a summary of the monitoring data collected under the NPDES permit, and includes the detection limit. This was discussed at the TVA/F&WS meeting on June 21, 2006. Given this NPDES permit requirement, TVA does not see any benefit in additional chlorine monitoring, and does not plan to implement it.

TVA's experience is that concerns over copper concentrations downstream of power plants have historically been related to the use of admiralty brass (contains copper) which was previously used in the cooling water condenser tubes for the plants. Condenser tubes at all three BFN units are stainless steel which does not contain copper. In addition, BFN uses no cooling water additives in either the condenser cooling water or in other cooling water systems that contain copper (See Table 2.). Therefore, TVA does not see any benefit in additional copper monitoring, and does not plan to implement it.

Ammonia (as ammonia hydroxide) and hydrazine are used as additives to the auxiliary boilers and building heat systems for pH control and as an oxygen scavenger. Less than 5 gallons of 30% ammonia hydroxide and 250 pounds of 35% hydrazine hydrate are added annually to these systems. The potential pathway to the Tennessee River is via the auxiliary boiler blow down to the Condenser Cooling Water System which flows at a rate of 2065.3 MGD. From 1992 through 2000 under previous NPDES permits, TVA monitored for hydrazine once per week at DSN 001. Table 1 provides a summary of the hydrazine data. Hydrazine was never found above the detectable limits. ADEM removed the requirement for sampling for hydrazine in the 2000 NPDES permit, and given the small amounts of ammonia used, has not required monitoring for ammonia in the NPDES permits. As a result, TVA sees no benefit in sampling for ammonia or hydrazine at the downstream end of the mixing zone, and does not plan to implement it.

TABLE 1

Summary of Sample Results for Hydrazine and Total Residual Chlorine at the Condenser Cooling Water Discharge Compliance Point

Type Sample	Results (mg/l)	Years	Detection Limits (mg/l)
Hydrazine	< 0.01	Jan 1992 - Jul 1998	0.01
Hydrazine	< 0.005	Aug 1998 - Jun 2001	0.005
Total Residual Chlorine	< 0.05	Mar 2002 - Jun 2006	0.05

TABLE 2

Sample Results From NPDES Permit Application at BFN for Ammonia and Copper

Year	Type Sample	Intake (mg/l)	Condenser Cooling Water Discharge (mg/l)
1982	Copper	< 0.01	< 0.01
	Ammonia	0.03	0.03
1988	Copper	< 0.01	< 0.01
	Ammonia	0.08	0.07
1994	Copper	< 0.01	< 0.01
	Ammonia	0.21	0.29
1999	Copper	< 0.01	< 0.01
	Ammonia	0.02	0.02
2005	Copper	0.002	0.003
	Ammonia	0.04	0.03

F&WS also requests that BFN conduct a formal risk assessment using Environmental Protection Agency methods to assess whether concentrations of the aforementioned water quality parameters are protective of sensitive species. Based on information / conclusions in the preceding paragraphs of this response (request 4), TVA does not believe that a risk assessment as recommended in *Guidelines for Ecological Risk Assessment, EPA/630/R-95/002F, April 1998*, is necessary, and does not plan to implement it.

One of the purposes of the VS Monitoring Program described above is to collect the data necessary to evaluate conditions in the reservoirs and target detailed assessment studies if significant problems are found that could also affect sensitive species. For example, see the 2005 report (referenced in response to Request 3 above) where additional data will be collected this fall with regard to the reservoir fish community. TVA believes that this approach provides adequate data to assure continued protection of a "balanced indigenous population of fish, shellfish and wildlife," and that it is also protective of sensitive species.

Fish and Wildlife Service Request 5

"The TVA has proposed the construction and operation of a sixth 20-cell cooling tower at BFN and has committed placing the tower in operation prior to the first summer following the return of Unit 1 to service. We understand the construction and operation of this cooling tower would help TVA in meeting their requirements under the National Pollutant Discharge Elimination System (NPDES) limits for water quality, particularly during the hot summer months."

TVA's Response to Request 5

TVA will place in service additional cooling tower capacity at Browns Ferry prior to the first summer following Unit 1's return to service. Initial environmental evaluations assumed a single 20 cell replacement tower for Tower # 4. The capacity of the cooling tower to be constructed is discussed in the cover letter for transmitting this Enclosure 2, as well as in Enclosure 1.

TVA has discussed this proposal with the NRC, the ADEM, and the F&WS. NRC concurs with the proposal. ADEM and F&WS concur with the proposal, provided TVA continues to comply with permitted discharge limitations.

Fish and Wildlife Service Request 6

"The TVA will promptly report any fish or invertebrate die-offs in the reservoir to the Service and will allocate additional resources to determine sources of the die-off that could be related to BFN and/or TVA reservoir operations related to flow and volume management."

TVA's Response to Request 6

As a federal agency with environmental stewardship responsibilities for land and water resources in the Valley, should TVA observe, during the course of its monitoring activities, any major degradation in fish or invertebrate communities or populations in the reservoir, TVA will work in concert with other federal and state agencies to ascertain the source or cause of such change(s).

The following is a list of the 3 recommendations contained in the April 20, 2006, letter from Elaine Snyder-Conn (F&WS) to Pao-Tsin Kuo (NRC) and TVA's response to each. TVA's responses were discussed with, and agreed upon, by F&WS.

Fish and Wildlife Service Recommendation 1

"If poor and/or declining water quality conditions persist in the mixing zone and the plume area as modeled or measured, or if poor water quality conditions extend beyond previously modeled areas or depths of high temperature or poor water quality in Wheeler Reservoir or downstream, we recommend TVA and NRC consider modifications to the existing intake and outfall structures. Relocation of these structures further apart from one another may alleviate or/or remediate thermal conditions in Wheeler Reservoir. If ichthyofaunal losses relate to screening at water intakes or pump operations, additional screening or modifications should also be considered."

TVA's Response to Recommendation 1

The VS Monitoring Program described above is designed to sample and analyze ecological conditions, and identify areas that may need additional attention. TVA has been monitoring conditions in Wheeler Reservoir in the vicinity of BFN for over 30 years using a variety of techniques, and the data collected does not indicate that BFN has had a negative impact on maintenance of a balanced, indigenous population of fish, shellfish and wildlife in or on the water body. Under the recently issued Section 316b regulations for cooling water intakes, TVA is in the process of performing the required studies and analyses to identify and mitigate any intake related impacts. TVA will adhere to the requirements in these regulations and will work with ADEM to implement any required mitigation.

Fish and Wildlife Service Recommendation 2

"De-rating of BFN's units, during extreme drought conditions, is the option TVA has committed to exercising for the purposes of meeting water quality standards for the protection of fish and wildlife and to meet requirements of the NPDES permit. We concur that this is a critical option to ensure that environmental conditions for aquatic species in Wheeler Reservoir are protected. However, during extended drought conditions in north Alabama, when BFN is operating at full EPU capacity (120% of original operating license) and NPDES limits are continually being exceeded and de-rating does not occur; we recommend TVA and NRC consider upgrades to cooling tower capacity and/or upgrades to BFN's capacity for placing BFN on "helper mode" operation to ensure discharged cooling water to Wheeler Reservoir meets NPDES limits."

TVA's Response to Recommendation 2

Regarding the following statement, When discussing de-rating in this recommendation, *"However, during extended drought conditions in North Alabama, when BFN is operating at full EPU capacity (120% of original operating license)* ***and NPDES limits are continually being exceeded and de-rating does not occur;*** *…"* (Emphasis added), it is TVA's policy to comply with our NPDES limits at all of our facilities under all circumstances. Since returning the BFN units to service in 1991, there has been only one instance in which a thermal limit was exceeded (by 0.1 degree F for one hour in the middle of the night). TVA took prompt steps to correct the problem, performed an in-depth analysis, and developed several corrective actions to ensure that the event was not repeated. At BFN, as well as at other facilities in Alabama, TVA closely monitors the thermal conditions and adjusts plant output as necessary, specifically to avoid violations of permitted limits.

Fish and Wildlife Service Recommendation 3

"We recommend TVA consider locating a standard Vital Signs monitoring station near the edge of BFN's mixing zone. Water quality data collected at this station could be used to calibrate modeled water quality conditions on the perimeter of the mixing zone. These data could lead to more accurate predictions of water quality conditions within the mixing zone and/or downstream of BFN. Additionally, a station located on the edge of the mixing area would likely detect anomalies, such as toxic substances unintentionally released through the diffusers during short periods of time. Such short-lived pulses, if they occur, could, nonetheless, exert profound effects on aquatic organism health and viability, particularly of non-mobile species such as mussels and other invertebrate fauna."

TVA's Response to Recommendation 3

As noted in the response to request 3, and as discussed in more detail in the 2005 Annual Report, TVA has established a Vital Signs monitoring transect at the downstream edge of the mixing zone (TRM 292.5) to more closely monitor Wheeler Reservoir aquatic communities in close proximity to the BFN thermal effluent.