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United States Department of the Interior

OFFICE OF THE SECRETARY
OFFICE OF ENVIRONMENTAL POLICY AND COMPLIANCE
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February 25, 2005

Division of Regulatory Improvement Programs
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

RE: Draft Generic Environmental Impact Statement (GEIS), Supplement 21, for License Renewal of Tennessee Valley Authority's (TVA), Browns Ferry Nuclear Plant. Units 1, 2, and 3, Alabama (NUREG – 1437, Supplement 21)

Dear Sir/Madame:

The Department of the Interior (Department) has completed review of the U.S. Nuclear Regulatory Commission's (NRC) Draft GEIS for License Renewal of the Tennessee Valley Authority) (TVA) Browns Ferry Nuclear Plant, Units 1, 2, and 3. We submit the following comments for your consideration.

Project Description

In December 2003, the TVA submitted an application to the NRC to renew the operating licenses for Browns Ferry Nuclear Plant, Units 1, 2, and 3 for an additional 20-year period. TVA's license renewal at Browns Ferry Nuclear plant (BFN) also proposes to increase the power production at each of the three units to 120% of their originally licensed power production capacity. It should be noted that Unit 1 at BFN has not operated since 1985, and the applicant is currently engaged in activities necessary to return this unit to service. In TVA's application to NRC to renew current operating licenses, TVA stated that almost all of the activities associated with this effort are confined to existing on-site structures, and little new construction is necessary. Therefore, any impacts associated with the construction of new facilities on-site would be bounded by those impacts discussed in the 1972 EIS prepared by TVA. Subsequently, NRC reviewed TVA's request and produced the Draft GEIS.

The NRC's Draft GEIS defined the purpose and need of re-licensing BFN in the following way: "...the proposed action (renewal of the operating licenses) is to provide an option that allows for power generation capability beyond the term of a current nuclear power plant operating license to meet future system generating needs, as such needs may be determined by State, utility, and where authorized, Federal (other than NRC) decision makers." Secondly, the goal of NRC's environmental review was to meet requirements in 10 CFR 51.95(c)(4) and the Draft GEIS, to determine whether or not the adverse environmental impacts of license renewal are so great that

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preserving the option of license renewal would be unreasonable for energy planning decision makers. Collectively, the statement of purpose and need and evaluation criterion mentioned above have guided NRC in determining whether or not an existing nuclear power plant could continue to operate beyond the period of the current operating license.

Environmental Concerns

Effects of plant operation on health of fish and other aquatic organisms in the Tennessee River

Based on TVA's Vital Signs Monitoring Reservoir Fish Assemblage Index, the fisheries resources in Wheeler Reservoir in the vicinity of BFN have maintained a "fair" or "good" rating since the early 1990's. Coupled with the monitoring of fish assemblages, TVA has also monitored overall ecological health via use of their Vital Signs Monitoring Program. The Vital Signs Monitoring Program divides TVA reservoirs into three zones: the inflow area (riverine-like segment), transition zone (mid-reservoir segment), and the fore bay (lake-like segment). This program has systematically monitored key physical, chemical, and biological indicators (i.e. dissolved oxygen, chlorophyll, sediments, benthic macro invertebrates, and fish) to evaluate ecological conditions of TVA reservoirs. When needed, TVA targets detailed assessments to identify significant problems and address those conditions as appropriate. TVA has sample/monitoring sites located upstream and downstream of BFN. The transition zone sampling site for Wheeler Reservoir is located at Tennessee River Mile (TRM) 295.9, approximately 1 mile upstream of BFN. The fore bay zone sampling site is located at TRM 277, near the confluence of the Elk River with Wheeler Reservoir. Based on the period of record for these two monitoring sites, they appear to maintain a "fair" to "good" rating from year to year for ecological health.

In 2000, TVA initiated macro invertebrate monitoring in support of BFN's thermal variance monitoring program. Since a number of federally-listed mussels are known to occur in Wheeler Reservoir and the Tennessee River, we were especially interested in reviewing TVA data on benthic macro invertebrate sampling and water quality chemistry at various monitoring sites in Wheeler Reservoir. The monitoring resulted in ratings of "excellent" for community density at TRM 295.9 monitoring site (approximately 1 mile upstream of BFN) in 2000 and "good" condition in 2001 and 2002. At TRM 291.7 (approximately 2 miles downstream of BFN diffusers) the rating was "excellent" for community density in 2001 and "good" in 2002.

These ratings can be deceptive, however, giving the impression that the mussels and other invertebrates found at these locations are the desirable, native fauna. As mentioned in the Draft GEIS, Asiatic clams, an introduced exotic species, can dominate benthic environments, competing for food, nutrients, and space with native benthic organisms and may feed directly on native, unionid sperm, glochidia, and newly metamorphosed juvenile mussels. Since its first detection in the Tennessee River system in the early 1960's, the Asiatic clam has increased in number and spread throughout the entire Tennessee River system. These data should be reanalyzed to determine if TVA's assessment is an accurate measure of conditions for the native aquatic biota, or native federally or state listed species in or adjacent to these sampling sites.

These and similar monitoring/sampling efforts by TVA are critical to ensuring that BFN's National Pollutant Discharge Elimination System (NPDES) permit limits, state water quality standards, and other environmental permit requirements are followed. Taken separately, the data

suggest that there are relatively low or insignificant impacts occurring further downstream of the BFN site; however, a more detailed assessment is clearly necessary to evaluate conditions immediately downstream of the BFN site.

In addition to an examination of general conditions at individual sample sites, the detailed assessment should include an analysis of any episodically poor water quality conditions and specific conditions in bottom waters. For instance, if dissolved oxygen levels drop for extended periods of time at, or near the stream bottom in the reservoir within, adjacent to, or within the mixing zone downstream of the effluent/diffuser site; benthic-dwelling species, such as mussels, could be severely impacted or killed. If a toxic substance was released through the diffusers into the reservoir, benthic species near, downstream, or within the mixing zone of BFN would likely be adversely affected. These are the conditions, although sometimes short-lived, which may, nonetheless, exert profound effects on aquatic organism health and viability, particularly of non-mobile species such as mussels and other invertebrate fauna.

The proposed license renewal at BFN seeks to increase the power production at each of the three units to 120% of their originally licensed power production capacity. Unit 1 has been off-line and not in service since 1985. By bringing Unit 1 back on-line, TVA's short term goal (within the next 5 years), there will be a need to increase the amount of water withdrawn from Wheeler Reservoir. The proposed operation of all three units at the new operating license levels will also require BFN to increase the amount of cooling water withdrawn from Wheeler Reservoir. These increases in water withdrawn from the reservoir will have a two-fold effect: first, an increase in entrainment of aquatic organisms into the intake structures from the reservoir and, secondly, significant increases in the volume of thermal heated water released back to the reservoir.

Entrainment and subsequent mortality of aquatic organisms in intake cooling water, and biocides

We are concerned about uptake of aquatic organisms into the boiler reactor water by entrainment, including larvae and early life stages of federally-protected mussels (if present), as well as other mussels, fish), phytoplankton, and zooplankton. Opportunities to divert fish from entrainment (e.g. strobe lights) and use of angled trash racks with sluiceways, and appropriate screens may mitigate for increased entrainment of larger fish and invertebrates, if incorporated into design plans. There may also be methods to minimize entrainment depending on depth of water withdrawal and location of water withdrawal structures.

Boiler reactor water is subjected to intense pressure, heat, and biocide treatment. The raw water intake for BFN is treated biannually with a molluscicide to control bio-fouling by zebra mussels and Asiatic clams. Raw water samples are taken biweekly during the months of April to September and analyzed for zebra mussel larvae as an early detection system aimed at reducing the potential of bio-fouling of BFN's raw water intake structure. Without adequate screening and fish rack sluiceways, aquatic organisms taken up by entrainment into the intake pipe and subjected to such environment will be killed by these treatments.

Water withdrawal, temperature, chlorine, copper, and hydrazine effects in the Tennessee River

We are not sure what biocides are utilized at BFN; however, chlorine is often used in biocides. Chlorine is extremely toxic to a wide variety of freshwater organisms (Hunn and Schnick 1990). Safe concentrations (i.e. those that do not produce any lethal or sub lethal effects) are likely

much lower, especially considering the relatively sessile nature and long life span of mussels relative to these short-term test exposures. Under longer-term exposures (>96 hours), lethality to fish and aquatic invertebrates has been documented at chlorine concentrations between 3.4 and 26 ug/L (EPA 1985). Because chlorine" extreme toxicity, the EPA established a Federal ambient water quality criterion maximum concentration of 0.019 mg/L and a continuous concentration (CCC) of 0.011 mg/L for chlorine, respectively, to protect aquatic life (EPA 2002). Studies have shown that mussels are very similar in sensitivity to other sensitive aquatic organisms and that 0.019 mg/L is likely protective (Ingersoll 2003). To meet these limits, a dechlorination unit or use of alternatives such as UV or ozonation could be utilized. Alternatively, high flow rate velocity flushes, ultrasound, or robotic mechanical cleaning devices could occur on influent and effluent pipes.

The toxicity of chlorine to aquatic life is a function of total residual chlorine (TRC), which includes both free chlorine and chloramines (Flora et al. 1984). Monitoring of free chlorine does not serve as an adequate indicator of the potential toxicity of facility effluents nor does it provide adequate data to avoid toxic effects to listed mussels. Therefore, TRC should be measured rather than free chlorine.

Hydrazine has been used to scavenge oxygen during blow downs of cooling towers in an effort to help reduce oxidization from occurring in the towers. Discharges of this potential toxicant into the Tennessee River may cause more than detrimental effects to federally listed mussels, if present, as well as many other aquatic organisms. The rate of degradation of hydrazine in water is highly dependent on factors such as pH, temperature, oxygen content, alkalinity, hardness, and the presence of organic material and metal ions. The toxicity of hydrazine increased for guppies in soft water (at pH <7.0) compared with the toxicity in hard water at pH ~ 8.0 (Slonim 1977), indicating increased persistence of hydrazine in soft, non-alkaline water such as that of Wheeler Reservoir (TVA 1971). Increased water temperature also enhances the toxicity of the compound for bluegills (Hunt el al., 1981) (http://www.inchem.org/dcouments/ehc/ehc/ehc68.htm#SectionNumber:5.1). Because the Tennessee River at BFN's point of discharge is expected to have low alkalinity and elevated in-stream water temperatures due to BFN's thermal discharge, these conditions raise our concerns for the toxicity of hydrazine in the discharge, and its potential adverse effects on aquatic biota.

To operate units 2 and 3 at their current operating license level, BFN withdraws 1,635 cfs per unit. With the addition of Unit 1, the projected total withdrawal from Wheeler Reservoir through all three units would be approximately 4,907 cfs. TVA is seeking extended power up-rates (EPUs), which would increase the total combined power level produced at BFN. TVA claims an increase in power production would not require further increases in intake flows. When Units 1, 2, and 3 are generating at the proposed 120% capacity level, TVA believes BFN can continue to meet current ADEM regulatory limits of the NPDES permit by employing various mitigating strategies like de-rating and the use of the cooling tower helper mode of operation. TVA has committed to the construction of a sixth cooling tower to enable BFN to meet current NPDES permit limits.

Due to various system limitations, BFN cannot pull the entire condenser circulating water through the cooling towers when it operates in the helper mode. TVA estimates that during helper mode operation approximately 3,725 cfs is directed through the six cooling towers. Therefore, the remaining 1,000 cfs of thermal heated water bypasses the towers and will need to

be directly routed to the river. TVA operates the cooling towers only when necessary to meet NPDES permit requirements, typically a few weeks during the hottest part of the summer (usually during July and August). Since July and August are the critical months for approaching maximum river water temperature limits specified in BFN's NPDES permit, BFN would be required to utilize the cooling towers or be forced to de-rate the plant.

The TVA modeled the daily average flow for Wheeler Reservoir at BFN. The TVA used an unsteady flow model of Wheeler Reservoir, utilizing data from Guntersville Dam and Wheeler Dam to assess a time series of the daily average flow for the period of 1976 to 2002. The average river flow past BFN was estimated as 46,606 cfs, ranging from a high of 378,742 cfs to a low of 2,638 cfs. Therefore, the water intake flow for Units 1, 2, and 3 of 4,907 cfs encompasses a significant fraction of the daily average and low river flow past BFN. The 7Q10 flow at BFN (as defined in the NPDES permit) is 8,700 cfs. Target minimum flows for Wheeler Reservoir were established by TVA's river operations environmental impact statement completed in 1990. The minimum daily average flows at BFN are 10,000 cfs for July through September, 8,000 cfs for December through February, and 5,000 cfs in other months.

These average flows are targets determined by a computer model that has been given certain data sets or variables based on historic flow data. If these variables are inaccurate or erroneous, the model would produce an artificial reading of forecasted water quality conditions and aquatic organisms would bear the consequences. Our concern is for the welfare of the aquatic species located in, near, and downstream of BFN's effluent plume.

We understand TVA has committed to complying with NPDES permit requirements at BFN. However, we find it difficult to understand how BFN can manage bringing Unit 1 back into service and up-rate the three units, when under current operations and during hot weather events, BFN has difficulty meeting NPDES water temperature limits on a consistent basis with units 2 and 3. Although a sixth cooling tower would aid in reducing condenser circulating water temperatures, we fail to see how BFN could operate all three units at 120% power production capacity during these hot weather/high water temperature periods of the year without de-rating or without creating additional cooling systems to cool heated water. It is unclear how these units could be up-rated if cooling capacity at BFN is insufficient. De-rating seems to be the only valid option in this case. Again, we have difficulty understanding the reasoning behind up-rating when, generally, the highest power consumption by the public occurs during the hottest weather periods of the year (i.e. as air conditioning use increases).

During hot weather, high-demand periods in July or August, TVA would be forced to request waivers from ADEM to exceed water quality standards and limitations for temperature designed to protect aquatic life. Such episodic violations are highly likely to occur in the future, especially during low flow, drought years in the Tennessee River. As mentioned earlier, these critical periods of the year create difficult environmental conditions on the aquatic biota in the Tennessee River. Mussels may be especially vulnerable since the July to August period is when mussel metabolism increases and when dissolved oxygen availability decreases. Careful consideration of environmental impacts would need to be made by TVA as these events occur. We believe TVA should closely re-examine opportunities for thermal water storage and/or for storage of excess uptake water during high-temperature, low-flow conditions to prevent episodic lethal conditions for fish (including potential fish host of listed mussels) and invertebrates during such periods of high water use, even if water must be pumped from off-site locations. During

such periods, there could be significant population-level effects on aquatic invertebrates and fish both near the discharge and downstream.

Higher water temperatures, in concert with nutrient loading into the Tennessee River from point and non-point sources, generally promote the growth of aquatic plants, particularly nuisance and invasive species, and may trigger algal blooms. Federal and state environmental agencies must then employ eradication programs that typically result in herbicidal treatments. These programs are extremely expensive and are difficult to effectively implement.

Maintenance Practices for Transmission Line Rights-of-Way

We are concerned about the maintenance practices employed along BFN's transmission line rights-of-way. Our understanding of TVA's maintenance practices follow the strict guidance and protocols developed in the Guide for Environmental Protection and Best Management Practices for Tennessee Valley Authority Transmission Construction and Maintenance Activities manual. We have reviewed this manual and are comfortable with the protocols developed. We understand TVA's Heritage staff (which consists of biologist, ecologists, and cultural resources staff) reviews all maintenance activities associated with transmission line rights-of-way. We support and strongly recommend that the TVA Heritage staff remain involved in the process of all maintenance proposals associated with BFN's power distribution facilities. We also encourage continued surveys of sites along or adjacent to maintained rights-of-way for rare, threatened, or endangered plants and animals, particularly in any previously un-surveyed portions of the system with unusual habitat conditions.

We remain concerned about BFN's practice of controlling vegetation in the transmission line rights-of-way at stream crossings, using mowing and herbicide applications to reduce the cover to herbaceous species. This modification to the natural vegetative cover may lead to erosion and sedimentation of streams. We are particularly concerned about this practice at stream crossings where federally-listed mussels may occur, specifically Bear Creek, the designated critical habitat for the federally-listed mussel, Cumberlandian combshell, *Epioblasma brevidens*.

We have provided TVA Heritage staff a table listing acute toxicity of various nonionic surfactants/spreaders used with glyphosate products and toxicity of formulated glyphosate products. We encourage the TVA Heritage staff to work with TVA maintenance staff to ensure that appropriate herbicides and surfactants, with low toxicity to aquatic invertebrates and fish, are utilized and applied by spot methods only near streams, and that EPA label rates are not exceeded.

Recommendations

Effects of plant operation on health of fish and other aquatic organisms in the Tennessee River

- Reinitiate the ichthyoplankton characterization study done between the years of 1974 and 1979, prior to startup of BFN and continue a similar type study during the initial years of operations of the proposed up-rate of BFN's Units 1, 2, and 3.

Entrainment and subsequent mortality of aquatic organisms in intake cooling water, and biocides

- Quantify the diversity and abundance of organisms entrained by water withdrawal at all intake pipes and evaluate screening mesh size, low velocity intake, and other techniques to minimize entrainment. Quantification should occur at least monthly for the year of the study and for the year following screen changes.

Water withdrawal, temperature, chlorine, copper, and hydrazine effects in the Tennessee River

- Monitor temperature, dissolved oxygen, alkalinity, pH, TRC, copper, and hydrazine at the downstream end of the mixing zone on a monthly basis to determine if modeling has accurately predicted concentrations. Target bottom waters at those times of the year that have historically produced the lowest river flow and warmest river water temperatures. Conduct a formal risk assessment using EPA methods to assess whether concentrations are protective of sensitive fish and invertebrates, particularly federally-listed mussels, if present. Include low-flow, high-temperature conditions in the risk assessment.

- If hydrazine is determined to pose a risk to aquatic species (particularly mussels), eliminate discharge of hydrazine by designing a system for separating and containing hydrazine from all discharges to the Tennessee River/Wheeler Reservoir. If copper in bottom sediments appears to occur at concentrations above ecological risk levels, implement a plan to replace copper components at the plant with brass, titanium, or other typical replacement parts used by other nuclear power facilities to reduce copper.

- Reduce or eliminate discharge of chlorine to the Tennessee River through use of a dechlorination unit for removal of chlorine before discharge. If there is a discharge of chlorine, then at least monitor TRC daily. To provide adequate protection of aquatic life, the permit should establish EPA criterion chronic concentration of 0.011 mg of TRC per liter as a permit limitation for continuous discharges and monitor it daily. If chlorine treatments are intermittent, the criterion for protection of aquatic life from acute toxicity can be substituted. Mechanical cleaning (e.g. robotic) and flushing controls should be considered as an alternative to chlorine.

Maintenance Practices for Transmission Line Rights-of-Way

- Use mowing or prescribed burns as an alternative to herbicide use for controlling vegetation along transmission line rights-of-way, particularly near stream crossings and riparian habitats. Mowing should be timed to avoid periods of nesting ground birds. If herbicides are used, use Roundup Custom or Accord or similar low toxicity, low-solubility herbicides, together with a low-toxicity surfactant such as LI 700 or Agri-Dex in strict adherence to the label. Near streams and other water bodies, evaluate toxicity based on toxicity to aquatic species. Periodically survey to determine if federally-listed plant species have become established in rights-of-way.

- At all stream crossings, especially where federally-listed mussels are known to occur, maintain or plant stream riparian areas with native shrub species and insure that BMPs are installed to control erosion.

Currently, NRC is informally consulting with the Service's Daphne Ecological Services Field Office on the proposed BFN re-license project. NRC has provided to the Daphne FO a biological assessment on the federally-listed species located in the vicinity of BFN's facilities. We are currently reviewing NRC's biological assessment for the proposed BFN re-license proposal and will more fully address impacts of this project on listed species in a separate review. We are not able, at this time, to conclude informal consultation on this project. We continue to cooperatively work with NRC and TVA to gather information on listed species potentially affected by the proposed re-licensing of BFN.

We welcome the opportunity to assist in the design of monitoring plans. Upon our review of all the pertinent water quality data and threatened and endangered species information, we will provide our final comments and consultation under section 7 of the Endangered Species Act. Initiation of formal consultation with the NRC may be necessary after our review of this information.

If you have any questions or need additional information, please contact Mr. Rob Hurt at the Fish and Wildlife Service, in Decatur, Alabama, (256) 353-7243 ext. 29.

Sincerely,

Gregory Hogue
Regional Environmental Officer

cc:
FWS, R4
OEPC, WASO
TVA

References:

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