May 6, 2009

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE SECRETARY

In the Matter of	)	
Tennessee Valley Authority	)	
Construction Permit for	)	Docket Nos. 50-438 and 50-439
Bellefonte Nuclear Plant Units 1 & 2	)	
	)	

DECLARATION OF SHAWN PAUL YOUNG, PH.D.

County of Latah)
) ss.
State of Idaho)

I, Shawn Paul Young, being duly sworn, depose and say as follows:

Background

1. My name is Shawn Paul Young, Ph.D. I am currently a Research Assistant Professor at the University of Idaho, Moscow, Idaho. I have previously held the positions of Visiting Assistant Professor of Fisheries Biology at Purdue University, West Lafayette, Indiana, and Lecturer / Adjunct Faculty of Fisheries and Aquatic Ecology at Clemson University, Clemson, South Carolina. My business address is 1008 Jefferson Court, Moscow, ID 83843. I submit this declaration as a private consultant to the Intervenors in this matter.

2. My professional and educational experience is summarized in the curriculum vitae attached to this declaration. I received a B.S. in Environmental Studies from Northland College; a M.S. in Aquaculture, Fisheries, and Wildlife Biology from Clemson University; and a Ph.D. in Fisheries and Wildlife Sciences from Clemson University. I have eleven years experience researching the effects of human activities on fisheries and aquatic ecosystems. In addition to

my professional qualifications, I have been an avid outdoorsman, fishing, hunting, and enjoying nature in every manner since my early childhood.

3. I previously held teaching positions at the University of Idaho, and Purdue and Clemson Universities with course responsibilities in the topics of Fish Ecology, Limnology/Aquatic Ecology, Fisheries Management, Environmental Conservation, and Watershed Hydrology. I have completed 22 peer-reviewed publications relevant to fisheries and aquatic ecology. I have been consulted by public, state, federal, and academic sectors in the subject area of fish and aquatic ecology. I have presented scientific presentations at numerous professional meetings, academic seminars, and citizen fishing association functions.

4. I am providing this declaration in support of Intervenors' contentions outlined in Contention 9a-9e -- Impacts on Aquatic Resources including Fish and Mussels of the Tennessee River. The opinions and conclusions expressed in this declaration are my own. My declaration explains justification for the contentions stated and the request that additional data are collected and modeling be performed to properly evaluate potential effects of operating units 1 & 2 and cumulative impacts of units 1 & 2 in conjunction with the proposed addition of units 3 & 4 at Bellefonte Nuclear Plant ("BLN") on aquatic resources of the Tennessee River. I have arrived at conclusions dealing with the matters stated herein and believe them to be true and correct.

No data was provided as rationale for a "finding of no significant impact" nor have recent studies been conducted to evaluate the impacts of resumption of construction and operation of Units 1 & 2 on aquatic resources including fish and benthic invertebrates in the vicinity of the BLN, Guntersville Reservoir, Town Creek and the Tennessee River Basin from proposed units should be substantiated and may be large. Further, no evaluation of cumulative impacts of Units 1 & 2 combined with the proposed Units 3 &4 has been conducted.

5. Four new nuclear reactor units, especially in conjunction with the current operation of the numerous thermoelectric fossil-fuel plants, nuclear reactors, and impoundments, have the

potential for large cumulative impacts on the Tennessee River fish and mussel assemblage. The impacts on aquatic resources from operating the four reactors may be large. Proper scientific study and analysis is warranted. The following information has been previously supplied for contentions concerning Units 3 & 4. The information is wholly relevant to Units 1 & 2 also, especially given the four units will be operated simultaneously in the same vicinity.

6. The Tennessee River Basin as a whole is considered to be the single most biologically diverse river system for aquatic organisms in the United States, and harbors the highest number of imperiled species of any large river basin in North America with 57 fish species and 47 mussel species considered to be "at-risk" (Master et al. 1998). Many fish and mussel populations throughout the entire Tennessee River Basin including the middle Tennessee River, which encompasses Guntersville Reservoir, site of BLN, are greatly reduced from their historical numbers. Fisheries and aquatic invertebrate experts cite the incremental impacts from dams, urbanization, industrialization, and power-generation facilities (including nuclear) are the cause for decline within the Tennessee River and for other major river systems (Etnier and Starnes 1993; Parmalee and Bogan 1998; Marcy et al. 2005). This includes the operation of TVA's facilities (Etnier and Starnes 1993). Etnier and Starnes (1993; *The Fishes of Tennessee*) state, "the natural character of the Tennessee River has been completely altered by the series of impoundments, constructed by the Tennessee Valley Authority from the late 1930s to 1960s (Table 1), that punctuate it over its entire length from just above its mouth in western Kentucky to Knoxville." This area includes the BLN site. Parmalee and Bogan (1998; *The Freshwater Mussels of Tennessee*) reiterate the same destruction of the Tennessee River basin. Human alterations have caused severe decline in aquatic resources, and further alteration by nuclear power expansion will only exacerbate the decline of fish and mussels in the Tennessee River.

8. The Tennessee River supports at least 205 fish species representing 29 families (Etnier and Starnes 1993; Simon and Wallus 2006) including 32 fish species that are found only in the Tennessee River (Simon and Wallus 2006). Just in the upper-basin, 15 fish species are federally listed as endangered or threatened and 50 species are listed under management categories used by four states (Hampson et al. 2000). Within Guntersville Reservoir alone, there has been a 44% decline of freshwater fish captured in TVA sampling since 1994. ER § 2.4.2.4. Of the fish species no longer found in Guntersville reservoir ER § 2.4.2.4. (Table 2.4-7, page 2.4-37), paddlefish, river carpsucker, quillback carpsucker, highfin carpsucker, silver redhorse, and river redhorse are migratory species adversely affected by habitat alteration, blocked migration, loss of spawning habitats, altered flow-regimes (Pflieger 1975; Hubert et al. 1984; Etnier and Starnes 1993; Rohde et al. 1994) and by disruption of early life history stages by altered flow-regimes, impingement, and entrainment of eggs, larvae, and juveniles caused by power-plants (Etnier and Starnes 1993; Marcy et al. 2005). Also, numerous darters and shiner species have disappeared from the fish assemblage of Guntersville Reservoir. ER § 2.4.2.4. Literature reports disappearance of these species is due to fragmented and degraded rivers (Angermeier 1995).

9. Pre-1960 mussel surveys found 89 species in the lower Tennessee River Basin, and 94 species of freshwater mussels in the upper Tennessee River (Starnes and Bogan 1988; Vaughan 1997). Since 1960, a 14% decline of mussel species present in the lower basin and a 36% decline of mussel species present in the upper basin have been reported (Starnes and Bogan 1988; Vaughan 1997). In the upper-Tennessee River alone, 30 species are under Federal protection and 52 species are listed for protection by four states (Hampson et al. 2000). In the Guntersville Reservoir section, 14 species of mussel are considered threatened or endangered by the Alabama Department of Conservation and Natural Resources. Nuclear power expansion at

BLN will only increase the stress that the Tennessee River ecosystem is already experiencing. Further increasing water-withdrawal, increasing the potential for entrainment at intake structures, and increasing thermal discharge will perpetuate the poor condition of Tennessee River fish and mussel populations.

Tennessee Valley Authority's (TVA) analysis for Units 3 & 4 does not adequately address potential impacts of operating two, or four, additional nuclear reactor units on fish and mussels throughout the Tennessee River basin.

A. TVA concludes within three sections of the ER that BLN may be significantly affected by or may affect both upstream and downstream portions of the Tennessee River basin. However, no investigation, analysis, or discussion of these concluding statements was presented.

10. ER (2.3.1.2.6 page 2.3-10) states, "If the total volume of water flowing into Chickamagua Reservoir, which is the location of measure to indicate flow for the upper half of TN River basin as stated in previous sentence, is less than what is needed to meet system-wide flow requirements, additional water is released from upstream reservoirs to augment the natural inflows (a function of rainfall and runoff), resulting in some drawdown of these projects." This statement acknowledges that there will be impacts to the upper-Tennessee River aquatic resources because those reservoirs will bear the burden of downstream water withdrawal. There is no elaboration, investigation, analysis, or discussion of this statement.

11. ER (2.3.1.3.6, p. 2.3-18) states, "Five upstream dams and/or reservoirs (storage) can affect future plant operations." There is no investigation, analysis, or discussion of such an important recognition within the ER. This statement acknowledges upstream management may also affect BLN operations, which then may differentially affect aquatic resources. There is no elaboration, investigation, analysis, or discussion of this statement.

12. ER (2.3.1.3, page 2.3-14) further states, "Three, large manmade impoundments are located within 100 river mi. of the BLN site. These impoundments can significantly affect or be

affected by BLN plant operations. The impoundments are: Nickajack Reservoir TRM 471 – TRM 425; Guntersville Reservoir TRM 425 – TRM 349; and Wheeler Reservoir TRM 349 – TRM 275." There is no discussion of how these impoundments can significantly affect or be affected by BLN operations beyond stating general descriptions and that Guntersville Reservoir does not fluctuate more than 2 ft annually. This statement acknowledges significant effects on downstream aquatic resources. Given the profound ramifications of these three statements, surely elaboration, investigation, analysis, and discussion are warranted.

13. TVA's overall conclusion (ER 2.3.3.4.3 p. 2.3-48), "Operations of these dams are not expected to have a direct effect on water quality in the vicinity of the BLN," is inconsistent with above statements in paragraphs 10 – 12 and therefore erroneous. If these impoundments can affect operation of BLN as stated in paragraphs 10 – 12, then their operation most certainly affects water quality in the vicinity of BLN.

Tennessee Valley Authority's (TVA) analysis does not adequately address potential impacts to increased water intake and increased thermal discharge on fish and mussels in the vicinity of BLN, Town Creek, nor in Guntersville Reservoir. TVA's assumptions that potential impacts of the intake system on the environment are small is not substantiated, and impacts may be large.

A. TVA's assumption that potential impacts of the intake system on the environment are small is not substantiated, and impacts may be large.

14. TVA's conclusion regarding potential impacts of entrainment and impingement as a consequence of increasing water intake is not based on actual data, but rather improper assumptions. There is no data provided for evaluating entrainment losses by species or by life history stage to support TVA's conclusions. TVA states the following as rationale for conclusions, "Species collected are common and community structure uniform for all sampling

locations. Because species composition is similar for intra-reservoir sampling and habitat near the intake and discharge structures are not rare or unique to the reservoir, additional sampling at the intake and discharge structures was not warranted (ER 5.3.1.2.1, page 5.3-3)." TVA does not present data at individual sampling stations; does not present any statistical analysis to substantiate a similar community structure at sampling stations; and, does not provide any data and acknowledges no sampling of ichthyoplankton (eggs and larvae), juveniles, and adult fish near BLN. At a minimum, sampling of adult and early life history stages of fish in the vicinity of water intakes to properly determine potential impacts is warranted due to the potential for large impacts to fish populations.

15. In addition, the use of the term "common" to describe population size or abundance is disingenuous as no abundance data was presented for any fish species at any sampling station. The term "common" was also used to describe mussel distribution and abundance (ER page 2.4-19). Given extinction of some fish and mussel species, and the decline of the fish and mussel species in Guntersville Reservoir and throughout the Tennessee River, these vague summations and generalities provide no basis for examination of impacts and are improper and misleading.

16. Also, adult fish assemblages and patterns of drift community distribution (i.e. the pattern of egg, larval, and early juvenile stages of fishes) likely vary in time and space as the Tennessee River fish assemblage utilizes several life history strategies (Etnier and Starnes 1993; Mettee et al. 1996; Simon and Wallus 2006). Also, dispersal mechanisms and migrations also vary from species to species and also across life history stages of each species. Differences in physiology make some species more susceptible to entrainment than others. TVA erroneously assumes fish that spawn eggs in benthic substrates also have benthic larvae. Darters and suckers may spawn benthic eggs but then develop into pelagic larvae that are part of the drift community (Wiltz

1983; Simon and Wallus 2006). TVA only provided a list of species present in Guntersville Reservoir and a vague summation of a few fish species' life histories, of which TVA only discusses those that would have a lower probability of entrainment and neglects to address those with high susceptibility.

17. Also, TVA described the vicinity of BLN as lacustrine; however, satellite imagery of Guntersville Reservoir exhibits a more-riverine type habitat near BLN than suggested. This area may be more categorized as a transitional zone from tailwater/riverine habitat to the lacustrine habitat. This area may support a substantial ichthyoplankton community comprised of eggs and larvae spawned above BLN near Nickajack Dam tailwaters. TVA fails to provide any such data to evaluate impacts of entrainment at BLN. TVA actually states (ER 5.3.2, page 5.3-8), "the actual spawning grounds within the TN River system are not known for any species." This statement is erroneous. There are several established publications outlining spawning habitats selected by Tennessee River fish species (Etnier and Starnes 1993; Mettee et al. 1996; Simon and Wallus 2006). Etnier and Starnes (1993) and Simon and Wallus (2006) were both sponsored by TVA. Further, if this is truly a gap in data necessary to evaluate impacts of BLN operation, then field studies are necessary and warranted.

B. TVA's conclusion regarding potential impacts of increased thermal and chemical discharge is not supported by any evidence.

18. TVA provides no evidence in the form of scientific study or field observation as justification for the following statements, "given the plume's small size within the reservoir, any impacts to drifting organisms is small" (ER 5.3.2.2, page 5.3-8). First, TVA provides no data on overall drift community. Second, the discharge pipes total 120 ft in length and are near mid-channel, and TVA presents no data on temporal or spatial composition of fish of any life history stage in this immediate area.

19. TVA states (ER 5.2.2.2.1, page 5.2-7), “A molluskicide will be used as a water treatment chemical.” This molluskicide will be discharged into mussel habitat. TVA failed to state whether the molluskicide is harmful to freshwater mussels, which are mollusks, nor does TVA disclose what concentration will be present in the discharge plume(s). Further, (ER p. 5.3-9), TVA states the BLN’s discharged chemical effluent must remain within a lethal concentration 25 percent (LC25) limitation. If deleterious, an additional 25% mortality of already vulnerable and declining mussel species is allowed. If such a concentration were discharged, this would effectively kill all remaining mussels in the vicinity. Further investigation is warranted.

20. Maximum thermal discharge temperature is stated as 95ºF. This temperature kills the early life history stages of several important game fish that would be found near BLN including largemouth bass (Stuber et al. 1982), striped bass (Bain and Bain 1982; Fay et al. 1983), and smallmouth bass (Edwards et al. 1983), and causes mortality in many less-studied and less-desired yet important non-game fish species such as the creek chub (McMahon 1982).

TVA uses its own biased rating systems to justify the lack of data in concluding that impacts of BLN operation will be small or non-existent. TVA’s aquatic resources health and status ratings should not be used to evaluate potential impacts on aquatic resources in the Tennessee River from operating BLN.

21. TVA states the following (ER page 2.4-18), “Most of the species identified at TRM 375.2 were also identified at TRM 424. Because the fish community is substantially similar at these locations and no unique reservoir habitats exists adjacent to the BLN, it is reasonable to assume the fish community adjacent to the BLN (TRM 391) is similar to the fish community determined for river miles 375.2 and 424. Therefore, sampling fish species in Guntersville reservoir adjacent to the BLN is not warranted, and the ongoing TVA Vital Signs sampling scheme for

Guntersville reservoir has, and continues to be, an adequate measure and monitor of any substantive changes which might occur to the aquatic community of the reservoir." TVA's aquatic resources health and status ratings are erroneous, misinterpreted, and biased in support of the unsubstantiated conclusions of impacts to aquatic resources from operation of BLN. Figure 2.3-28 (ER 2.3.3.2.6, page 2.3-44) lists ratings for individual ecological health indicators at Guntersville Reservoir in 2004. The listed ratings of 'fair' or 'good' for fish and benthic organisms is not accurate and disingenuous in this matter. My assertion is supported by the declining fish species in Guntersville reservoir as well as fish and mussel species throughout the Tennessee River basin. This decline has been attributed to TVA facilities and management of the river basin (Etnier and Starnes 1993). If TVA's rating system were an adequate measure to monitor changes in aquatic resources, a 44% decline would most certainly rate as 'poor.' Therefore, TVA should scrutinize this rating system or should consult unbiased experts to address ecosystem health.

22. In conclusion, the entire reservoir and river continuum is unique and should be treated as so. It is obvious the compounding effects of the multitude of disruptions within the river continuum have been detrimental to the aquatic community of the Tennessee River. Sampling at BLN is absolutely warranted and would be considered standard practice to evaluate impacts from construction and operation of additional nuclear reactors. The TVA Vital Signs sampling scheme is not an adequate proxy to the appropriate field studies that are warranted to properly evaluate potential impacts from the operation of BLN.

Further the declarant sayeth naught.

I declare under penalty of perjury that the foregoing is true and correct.

Date: May 6, 2009

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