

**UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION
BEFORE THE ATOMIC SAFETY AND LICENSING BOARD**

In the Matter of)	
Tennessee Valley Authority)	Docket No. 50-391-OL
(Watts Bar Unit 2))	
)	

**SOUTHERN ALLIANCE FOR CLEAN ENERGY’S
STATEMENT OF DISPUTED MATERIAL FACTS**

Southern Alliance for Clean Energy (“SACE”) respectfully submits the following statement of disputed material facts in response to Tennessee Valley Authority’s (“TVA’s”) Statement of Material Facts on Which No Genuine Issue Exists (Nov. 21, 2011). SACE responds as follows:

I. Procedural Background

A. Licensing History for Watts Bar Nuclear Plant

1. On May 14, 1971, TVA applied for a Construction Permit (“CP”) for the Watts Bar Nuclear Plant (“WBN”). The NRC issued CPs for WBN Units 1 and 2 on January 23, 1973, and construction began. TVA substantially completed construction of Unit 1 in 1985. **Undisputed.**

2. On June 30, 1976, TVA first filed an application for an operating license (“OL”) for WBN Units 1 and 2. On February 7, 1996, the NRC issued an OL for Unit 1 that authorized operation at 100% power. **Undisputed.**

3. Between 1973 and 2008, the NRC extended the CP for Unit 2 on several occasions. During this time, TVA maintained WBN Unit 2 in deferred plant status, in accordance with the NRC’s “Policy Statement on Deferred Plants.” **Undisputed.**

4. On August 3, 2007, TVA informed the NRC Staff its intention to resume and complete construction of WBN Unit 2. TVA updated its original OL application for WBN Unit 2 on March 4, 2009, prompting the NRC to publish a notice of hearing in the Federal Register on May 1, 2009. **Undisputed.**

5. Throughout this time, TVA and the NRC completed a number of environmental reviews of WBN. On November 9, 1972, TVA issued a Final Environmental Statement for WBN Units 1 and 2 (“TVA 1972 FES”). On December 1, 1978, the NRC issued its Final Environmental Statement evaluating the operation of Units 1 and 2 (“NRC 1978 FES”). The NRC supplemented its 1978 FES on April 1, 1995 (“NRC 1995b”), in order to re-examine environmental considerations before issuing an OL for WBN Unit 1. **Undisputed.**

6. When TVA reactivated construction of WBN Unit 2, it also submitted its Final Supplemental Environmental Impact Statement (“2007 FSEIS”) to the NRC on February 15, 2008. The NRC published its draft supplement to the final environmental statement (“Draft SFES”) on October 31, 2011. **Undisputed.**

B. Intervention in Current Proceeding

7. After TVA updated its OL application for WBN Unit 2 and the NRC issued a Notice of Opportunity for Hearing on May 1, 2009, five organizations (Southern Alliance for Clean Energy (“SACE”), Tennessee Environmental Council, We the People, the Sierra Club, and Blue Ridge Environmental Defense League) jointly filed a Petition to Intervene and Request for Hearing, which included seven contentions. Among those, Contention 7 challenged TVA’s analysis of the impact of operation of WBN Unit 2 on the aquatic environment. In Contention 7, SACE alleged:

TVA claims that the cumulative impacts of WBN Unit 2 on aquatic ecology will be insignificant (FSEIS Table S-1 at page. S2, and Table 2-1 at page. 30). [sic] TVA’s conclusion is not reasonable or adequately supported, and therefore fails to satisfy 10 C.F.R. § 51.53(b) and NEPA.

TVA’s discussion of aquatic impacts is deficient in three key respects. First, TVA mischaracterizes the current health of the ecosystem as good, and therefore fails to evaluate the impacts of WBN2 in light of the fragility of the host environment. Second, TVA relies on outdated and inadequate data to predict thermal impacts and the impacts of entrainment and impingement of aquatic organisms in the plant’s cooling system. Third, TVA fails completely to analyze the cumulative effects of WBN2 when taken together with the impacts of other industrial facilities and the effects of the many dams on the Tennessee River. **Undisputed.**

8. The NRC Staff and TVA subsequently filed answers addressing the Petition. On September 3, 2009, SACE filed a Motion for Leave to Amend Contention 7, along with an Amended Contention 7. Both TVA and the NRC Staff filed responses opposing SACE’s Motion and Answers to the Amended Contention. SACE thereafter filed a reply to the Answers to the Amended Contention on October 5, 2009. **Undisputed.**

9. On November 19, 2009, this Board granted the Petition to Intervene on behalf of SACE, admitting two contentions. The Board denied SACE’s Motion to Amend Contention 7, instead admitting Contention 7 as originally presented. Although the Board admitted Contention 1 along with Contention 7, TVA moved to dismiss Contention 1 as moot on April 19, 2010. The Intervenor did not oppose that motion, and the Board granted TVA’s unopposed Motion and dismissed Contention 1 accordingly. As a result, only Contention 7 remains to be resolved. **Undisputed.**

C. New Information on the Record – TVA’s Aquatic Studies and NRC’s Draft SFES

10. In direct response to the issues raised by SACE in Contention 7, TVA collected extensive new data on the current health of the aquatic environment and the impact of operation

of WBN Unit 1 on that environment, prepared numerous updated and expanded aquatics-related analyses, documented the analyses in published reports and studies, and disclosed these reports and studies to the NRC Staff and SACE. **Undisputed except with respect to TVA's characterization of the data as "extensive." As discussed throughout Dr. Young's Declaration, there are significant gaps and inadequacies in the data.**

A complete list of those studies, including the dates that TVA disclosed each to SACE and the NRC Staff, follows:

- a. Comparison of Fish Species Occurrence and Trends in Reservoir Fish Assemblage Index Results in Chickamauga Reservoir Before and After [WBN] Unit 1 Operation (June 2010) ("RFAI Study"), which TVA disclosed to SACE and the NRC Staff on July 15, 2010;
- b. Analysis of Fish Species Occurrences in Chickamauga Reservoir – A Comparison of Historic and Recent Data (Oct. 2010) ("Fish Species Order (Granting TVA's Unopposed Motion to Dismiss SACE Contention 1) (June 2, 2010) (unpublished). Occurrences Study"), which TVA disclosed to SACE and the NRC Staff on November 15, 2010;
- c. Mollusk Survey of the Tennessee River Near [WBN] (Rhea County, Tennessee) (Nov. 2010) ("Mollusk Survey"), which TVA disclosed to SACE and the NRC Staff on January 18, 2011;
- d. Discussion of the Results of the 2010 Mollusk Survey of the Tennessee River Near [WBN] (Rhea County, Tennessee) (Mar. 2011) ("Discussion of Mollusk Survey"), which TVA disclosed to SACE and the NRC Staff on March 15, 2011;
- e. Aquatic Environmental Conditions in the Vicinity of [WBN] During Two Years of Operation, 1996-1997 (June 1998, Revised June 2010) ("Revised Aquatics Study"), which TVA disclosed to SACE and the NRC Staff on July 15, 2010;
- f. Comparison of 2010 Peak Spawning Seasonal Densities of Ichthyoplankton at [WBN] at Tennessee River Mile 528 with Historical Densities during 1996 and 1997 (Apr. 2011, Revised Nov. 2011) ("Peak Spawning Entrainment Study"), which TVA disclosed to SACE and the NRC Staff on April 15, 2011;
- g. Fish Impingement at [WBN] Intake Pumping Station Cooling Water Intake Structure during March 2010 through March 2011 (Mar. 2011, Revised Apr. 2011) ("Impingement Study"), which TVA disclosed to SACE and the NRC Staff on May 16, 2011; and
- h. Hydrothermal Effects on the Ichthyoplankton from the [WBN] Supplemental Condenser Cooling Water Outfall in Upper Chickamauga Reservoir (Jan. 2011) ("Hydrothermal Study"), which TVA disclosed to SACE and the NRC Staff on February 15, 2011. **Undisputed.**

11. SACE has not raised any concerns with respect to these studies with the NRC or this Board. **Undisputed.**

12. The NRC Staff's Draft SFES, dated October 31, 2011, concurs with TVA's findings in its aquatics studies. Section IV, below, discusses the specific conclusions drawn by the Staff that are relevant to TVA's aquatic studies. **Undisputed.**

II. Description of the Proposed Project

A. General Information

13. The WBN site is located in Rhea County, Tennessee, on the west bank of the Tennessee River, in the upper Chickamauga Reservoir at Tennessee River Mile (“TRM”) 528. **Undisputed.**

14. The Tennessee River System is approximately 650 miles long and is comprised of riverine and lacustrine environments, created by numerous dams and locks on the system, most of which have been in place since the 1940s. Chickamauga Dam, completed in 1940 at TRM 471, impounds Chickamauga Reservoir downstream of WBN. Watts Bar Hydroelectric Dam impounds the Watts Bar Reservoir 1.9 miles upstream of WBN. **Undisputed.**

15. The Tennessee River is also host to numerous industrial facilities. For example, WBN is located approximately one mile downstream of the decommissioned Watts Bar Fossil Plant. **Undisputed.**

16. TVA is the licensee and operator of the existing WBN Unit 1, a Westinghouse pressurized water reactor that began full commercial operation on May 27, 1996. **Undisputed.**

17. WBN Unit 1 was originally designed to operate only in a closed cycle cooling mode via the Condenser Cooling Water (“CCW”) system. After TVA began operation of Unit 1, it determined that a supplemental cooling system would increase the efficiency of the plant. Accordingly, TVA began to use a Supplemental Condenser Cooling Water (“SCCW”) system in 1998. **Disputed as to the reason TVA began to use the SCCW. The original cooling system was under-designed and would have prevented WB1 from achieving rated power output on hot summer days. Some form of cooling tower enhancement or supplemental cooling was/is necessary for WB1 to achieve rated output on hot summer days (when the highest annual demand is experienced on the TVA system). This is supported by the NRC’s Draft SFEIS at page 3-4, which states:**

Evaporation of cooling-water system water from the cooling-tower increases the concentration of dissolved solids in the cooling-water system. In most closed-cycle wet cooling systems, a portion of the cooling water is removed and replaced with makeup water from the source (for WBN, the Tennessee River) to limit the concentration of dissolved solids in the cooling system and in the discharge to the receiving water body.

Because the WBN cooling tower cannot remove the desired amount of heat from the circulating water during certain times of the year, TVA added the Supplemental Condenser Cooling Water (SCCW) system to the cooling system for the WBN reactors (TVA 1998). The SCCW draws water from behind Watts Bar Dam and delivers it, by gravity flow, to the cooling-tower basins to supplement cooling of WBN Unit 1. This cooling system would also be used for Unit 2. The temperature of this water is usually lower than the temperature of the water in the cooling-tower basin and, as a result, lowers the temperature of the water being used to cool the steam in the

condensers. Slightly less water enters the cooling-tower basins through the SCCW intake than leaves the cooling-tower basins and is discharged to the Tennessee River through the SCCW discharge structure (TVA, 2010). *Since the SCCW has been operating, elevated total dissolved solids in blowdown water have not been a concern because a large volume of water continually enters and leaves the cooling-tower basins (PNNL 2009).*

(emphasis added). Had TVA more robust cooling system in the first place, the SCCW would never have been considered necessary by TVA and TVA would not now be proposing to operate WBN2 with the SCCW.

18. The present proceeding pertains to the OL for WBN Unit 2. The added operation of WBN Unit 2 may result in minimal increased demands on that aquatic environment both for cooling water intake and cooling water discharge. **Disputed as to the term “minimal.” As discussed in Dr. Young’s Declaration throughout, the already-stressed Tennessee River aquatic environment will be further stressed by additional CCW intake and discharge and increased SCCW discharge to accommodate the operation of both WB1 and WB2 cooling towers and the increased cumulative cooling tower blowdown discharge to the Tennessee River as a result of WB2 operation. The combined operation of two units will have substantial impacts on the Tennessee River.**

B. WBN Cooling System Intake

19. WBN Unit 2 shares intake channels with Unit 1. Operation of Unit 1 withdraws cooling water from CCW and SCCW intake channels. Under dual unit operation, WBN will continue to draw cooling water from the CCW and SCCW intake channels. **Undisputed.**

20. The SCCW system is gravity driven. As a result, intake flow and velocity for the SCCW depends on the water level behind the Watts Bar Dam. **Undisputed.**

21. Flow through the CCW is driven by the IPS, rather than gravity. The IPS will draw more water at a higher flow rate under dual unit operation than for operation of Unit 1 alone. CCW maximum intake velocities will not increase under dual unit operation because the intake will draw water through additional openings. **Undisputed.**

22. Studies show that the hydraulic entrainment from dual unit operation will result in an additional entrained amount of 0.2% of the flow in the Chickamauga Reservoir. The resulting total hydraulic entrainment represents approximately 0.5% of the flow in the Chickamauga Reservoir. This increased hydraulic entrainment will result in a proportionate increase in entrainment of the ichthyoplankton present in the water column. **Disputed as to this calculation is only partly correct, and only accurate at a very specific river flow past WBN Plant. As discussed in Dr. Young’s Declaration at par. III-A.13-14, the 0.2% hydraulic entrainment for WB1 is based upon TVA using a long term average river flow past WBN of 27,000 cfs. Using 3,500 cfs, which is the minimum amount of flow from Watts Bar Dam that permits TVA to discharge thermal and chemical effluent through Outfall 101, the hydraulic entrainment increases to 2.1% (10 times higher). Then, with the addition of Unit 2 almost doubling hydraulic entrainment, the hydraulic entrainment at a flow of 3,500 cfs further increases to approximately 4.0% (20 times higher). Also, only data collected by field studies**

in combination with proper methods for calculation may accurately characterize ichthyoplankton entrainment under any level of hydraulic entrainment.

23. Studies show that CCW flow rates resulting from dual unit operation will average 134 cubic feet per second (“cfs”) at summer pool levels and 113 cfs at winter pool levels, an increase from those rates observed under operation of Unit 1 alone: 73 cfs and 68 cfs, respectively. (The maximum intake velocities will not change under dual unit operation because of the additional IPS openings available to accommodate increased flow.) The increased flow rates in the CCW intake channel resulting from dual unit operation will result in a proportionate increase in the rates of fish impingement. **Disputed. It is important to note that TVA identifies the makeup flow through the IPS as 174 fps, double the withdrawal from the Tennessee River that would occur with only WBN1 online, and an increase in warm blowdown discharge to the Tennessee River from 135 cfs to 170 cfs, a 26 percent increase. These are substantial increases, independent of the role of the SCCW. See Table 3-1 of the DFES, at page 3-9:**

	WB1&WB2	WB1 only
Blowdown rate when diffusers are discharging from cooling towers and YHP	4.81 m ³ /s (170 cfs) ^(b)	3.82 m ³ /s (135 cfs) ^(b)
IPS makeup flow	4.93 m ³ /s (174 cfs) ^(c)	2.5 m ³ /s (88 cfs)
SCCW		
Intake flow rate	7.1 m ³ /s (250 cfs)	7.31 m ³ /s (258 cfs)
Discharge flow rate	8.46 m ³ /s (299 cfs)	7.48 m ³ /s (264 cfs)

The rates of fish impingement may exponentially increase. Similar to the issue of hydraulic versus ichthyoplankton entrainment, only field monitoring will accurately determine impingement rates. See Young Declaration, ¶¶ III-A.13-14.

C. WBN Cooling System Output

24. WBN Unit 2 shares cooling water discharge outfalls with Unit 1. **Undisputed.**

25. The thermal discharge from WBN operation is bound by thermal limits established by TVA’s NPDES permit. The NPDES system establishes legally enforceable, aquatic health-based limits on hydrothermal discharges, in accordance with state and federal statutes. The Tennessee Water Pollution Control Division (“TDEC”) issued a new NPDES permit for the operation of WBN Units 1 and 2 on June 30, 2011, most recently revised on August 31, 2011. **Undisputed, except for the facts that the existence of a legal limit does not ensure there will be no significant impacts to aquatic organisms and is not a guarantee that the operation will stay within the limit.**

26. TVA’s NPDES permit sets discharge limits for each of the WBN outfall points under operation of WBN Units 1 and 2 that are unchanged from the limits set for Unit 1 operation. **Undisputed.**

27. For Outfall 101, the discharge point for blowdown water from the CCW system, the NPDES permit for operation of WBN Units 1 and 2 allows discharge only when the release from Watts Bar Dam is at least 3500 cfs, and specifies a discharge temperature limit of 35°C.

These requirements are unchanged from those set in TVA’s NPDES permit for operation of Unit 1 alone. **Undisputed.**

28. For Outfall 102, the discharge point for the CCW holding ponds, the NPDES permit for dual unit operation allows discharge only under emergency situations. Even then, the NPDES permit limits the temperature of discharged water to 35°C and requires that TVA make every effort to use this outfall only when the flow of the receiving waters meets or exceeds 3500 cfs. This condition is unchanged from that in the NPDES permit for WBN Unit 1. **Undisputed.**

29. For Outfall 113, the discharge point for the SCCW system, the NPDES permit for operation of Units 1 and 2 specifies a discharge temperature limit based on the receiving water. For example, the NPDES permit requires that the temperature rise at the edge of the mixing zone shall not exceed 3°C relative to an upstream control point. The limits that apply to Outfall 113 in the current NPDES permit are unchanged from those established in the NPDES permit for WBN Unit 1 operation. **Undisputed.**

30. Because the thermal discharge limits established by TVA’s NPDES permit for dual unit operation are unchanged from those for Unit 1 operation, thermal impacts on the aquatic environment resulting from WBN operation will not be materially different under dual unit operation than they are for operation of Unit 1 alone. **Disputed. There will be substantial increases in discharge from the CCW and SCCW. See Table 3-1 of the DFES, at page 3-9:**

	WB1&WB2	WB1
Blowdown rate when diffusers are discharging from cooling towers and YHP	4.81 m ³ /s (170 cfs) ^(b)	3.82 m ³ /s (135 cfs) ^(b)
IPS makeup flow	4.93 m ³ /s (174 cfs) ^(c)	2.5 m ³ /s (88 cfs)
SCCW		
Intake flow rate	7.1 m ³ /s (250 cfs)	7.31 m ³ /s (258 cfs)
Discharge flow rate	8.46 m ³ /s (299 cfs)	7.48 m ³ /s (264 cfs)

Also, as discussed in Dr. Young’s Declaration at pars. III-C.1-11, the already-stressed Tennessee River aquatic environment will be further stressed by additional CCW and SCCW thermal discharge from cumulative cooling tower blowdown discharge to the Tennessee River as a result of WB2 operation.

II. Description of TVA’s Aquatics Studies

31. As noted in ¶ 10 above, TVA conducted a number of aquatics studies in direct response to the assertions made by SACE and its expert, Dr. Young, in Contention 7. Those studies, which are described in more detail below, collectively provide data on fish and mussel populations in the WBN vicinity, and the entrainment, impingement, and hydrothermal impacts on those species that result from operation of WBN Unit 1. In addition, TVA conducted some of the studies to resolve alleged errors in TVA’s original studies identified by SACE and Dr. Young. **Undisputed that TVA conducted the studies described in pars. (A) through (G) below. Disputed that the studies resolve Dr. Young’s concerns, as discussed throughout his Declaration.**

A. Comparison of Fish Species Occurrence and Trends in Reservoir Fish Assemblage Index Results in Chickamauga Reservoir Before and After WBN Unit 1 Operation (June 2010) (“RFAI Study”)

32. In Contention 7, SACE and Dr. Young claimed that TVA relies on poor and outdated data about the health of the aquatic community in the WBN vicinity in lieu of recent monitoring studies. Dr. Young challenged TVA’s characterization of the health of the fish community in the WBN vicinity, which TVA based in part on measured RFAI data. In response to those allegations, TVA conducted this new study to explain RFAI methodology and evaluate the aquatic community in the WBN vicinity using that methodology. **Undisputed.**

33. First, this study provides a detailed explanation of TVA’s RFAI methodology. TVA created the RFAI methodology based on industry standards for biological indices, including those approved by TDEC and the U.S. Environmental Protection Agency (“EPA”), for use in its Vital Signs monitoring program. TVA has conducted fish sampling in the Chickamauga Reservoir every year since 1993, in support of this program. **Undisputed as to the conduct of the RFAI study every year since 1993. Disputed as to the consistency, accuracy, and usefulness of the study to portray aquatic health in the Tennessee River near WBN1. See Young Declaration, ¶¶ III-E.1-20.**

34. RFAI methodology uses twelve fish community metrics from four general categories: Species Richness and Composition; Trophic Composition; Abundance; and Fish Health. For each metric, scores are given on a scale from 1 to 5, with a score of 5 indicating optimum health. The resulting scores range from 12-60, broken down as follows: 12-21 (“Very Poor”), 22-31 (“Poor”), 32-40 (“Fair”), 41-50 (“Good”), or 51-60 (“Excellent”). RFAI scores have an intrinsic variability of ± 3 points. **Undisputed as to the description of the RFAI methodology. Disputed as to the consistency, accuracy, and usefulness of the RFAI methodology to portray aquatic health in the Tennessee River near WBN1. See Young Declaration, ¶¶ III-E.3-17.**

35. RFAI methodology addresses all five attributes or characteristics of a Balanced Indigenous Population (“BIP”), which is required by the Clean Water Act. If an RFAI score reaches 70% of the highest attainable score of 60 (i.e., 42), or if fewer than half of the RFAI metrics receive a low (1) or moderate (3) score, then normal community structure and function are considered to be present, indicating that BIP is maintained. **Undisputed that this is a description of TVA’s methodology for compliance with the BIP requirement. Disputed as to the fact that RFAI methodology only addresses four not five attributes, and to the consistency, accuracy, and usefulness of this methodology to portray aquatic health in the Tennessee River near WBN1. See Young Declaration, ¶¶ III-E.1-20.**

36. Second, this study evaluates the health of the aquatic environment in the WBN vicinity based on recent fish surveys and the RFAI methodology. The study found that RFAI scores from the site downstream of the WBN intake and thermal discharge have averaged 44 from 1996 to 2008 (i.e., during operation of WBN Unit 1), indicating that the aquatic health of that area is “good” even during WBN operation. **Undisputed that this is a description of TVA’s RFAI study, results, and conclusions. Disputed as to the consistency, accuracy, and usefulness of this methodology to portray aquatic health in the Tennessee River near**

WBN1 and the concluding scores to properly correlate with the true health of the fish community. See Young Declaration, ¶¶ III-E.1-20.

37. Third, this study compares the health of that environment as reflected in RFAI scores from before and after WBN operation. Scores from every sample year (1993-2008) were at least 42, i.e., 70% of the highest attainable score of 60. As a result, the study concluded that both before and after WBN operation, BIP has been maintained. **Undisputed that this is a description TVA’s RFAI study, results, and conclusions. Disputed as to the consistency, accuracy, and usefulness of this methodology to portray aquatic health in the Tennessee River near WBN1. See Young Declaration, ¶¶ III-E.1-20.**

38. SACE has not challenged the methodology or findings of this study with this Board. **Undisputed that SACE has not challenged the most recent iteration of the RFAI study before the Board. Contention 7, however, criticizes the methodology and results of previous RFAI studies, which have not changed in any significant respect. See Young Declaration, ¶ E-III.1.**

B. Analysis of Fish Species Occurrences in Chickamauga Reservoir – A Comparison of Historic and Recent Data (Oct. 2010) (“Fish Species Occurrences Study”)

39. SACE claimed in Contention 7 that TVA relies on inadequate and outdated data to form its conclusion that fish populations in the WBN vicinity are in good health, and has not taken steps necessary to evaluate how effluent from WBN may affect fish communities. In direct response, TVA conducted this study to analyze extensive historic and recent fish survey data from the WBN vicinity, and compare the current prevalence of fish species to historic (i.e., pre-operational) values. **Undisputed except with respect to TVA’s characterization of the data as “extensive.” As discussed in Dr. Young’s Declaration at pars III-E.2-3, there are significant inadequacies in the analyses found in this report.**

40. This study uses the extensive fish survey data available for the WBN vicinity, dating back to 1947. Because it also provides recent survey data for the fish populations in the WBN vicinity, this study inherently reflects the impact of the current operation of WBN Unit 1 on those populations. **Undisputed to the extent that TVA states it used fish survey data back to 1947 and provides recent survey data. Disputed with respect to TVA’s characterization of the data as “extensive” and TVA’s conclusion that this study alone inherently reflects the impact of the current operation of WBN1 on fish populations. See Dr. Young’s Declaration throughout.**

41. In analyzing the collective historical fish survey data for the Chickamauga Reservoir, this study takes into consideration the variations in survey methods employed over the past 60 years. Variations in survey methodology preclude direct comparisons between historical and recent surveys. This study also compared the results of fish sampling efforts in various Tennessee River reservoirs subject to similar conditions to understand widespread patterns and behavior of species in reservoir environments. **Disputed. While the study may acknowledge the variations in survey methods employed over the years, it does not cure the mistakes of the past, and instead perpetuates them. TVA either has an “extensive” fish species survey/study for historical comparison, which shows significant decline of fish species overtime, including since operation of Unit 1, or TVA has an unreliable, outdated, and**

inadequate means to properly evaluate impacts from WBN. The different sampling methods do not detract from the fact that there has been a decline in fish species pre- and post-WBN operation, which is evidence that the health of the fish community is poor See Dr. Young's Declaration at pars. III-E.1-20.

42. This study found that species occurrence and abundance in the Chickamauga Reservoir has changed from 1947 to 2009. Many of these changes took place before operation of WBN Unit 1 began. **Undisputed to the extent that TVA asserts that many of the changes in species occurrence and abundance in the Chickamauga Reservoir took place before the operation of WBN1 began. Disputed to the extent that TVA implies that changes after WBN1 operation began are insignificant. See Young Declaration, ¶¶ III-E.1-20.**

43. One major cause of this change is impoundment of the Tennessee River, which began in the 1930s and has altered habitats required for various life stages of aquatic species. Some of the species not found in recent surveys require unimpounded, free flowing riverine environments. **Undisputed to the extent that impoundment of the Tennessee River is a major cause of the decline in species occurrence and abundance. Disputed to the extent that TVA implies that changes after WBN1 operation began are insignificant. See Young Declaration, ¶¶ III-E.1-20 and III-D.4-7, III-D.10, and III-A.6-9.**

44. The study found that another reason for the change in species diversity and abundance is that most species that have not been collected in recent times have historically never been caught frequently or in large numbers in Chickamauga Reservoir. **Undisputed that this is a conclusion of the study. Disputed as a rationale for the decline of indigenous species present and decline of indigenous species abundance. The fact that species have not been caught in the reservoir is a meaningful indication of the decline of indigenous fish species. See Young Declaration, ¶¶ III-E.1-20.**

45. Finally, the study found that changes in fish survey methods account for some of the changes in findings of species occurrence and abundance. Certain survey methods, such as hoop nets, trap nets, and cove rotenone sampling, that were effective for targeting certain species, are no longer in use. **Undisputed in that this is a conclusion of the study. Disputed as being used as rationale for the decline of the fish community. Even with TVA's many changes in methods, a clear pattern of declining indigenous fish species and their abundance pre- and post-WBN operation is clear. See Young Declaration, ¶¶ III-E.1-20 and III-D.4-7, III-D.10, and III-A.6-9.**

46. As a result, this study concluded that there is no basis to support a finding that operation of WBN Unit 1 caused the observed changes in fish species and occurrence in the Chickamauga Reservoir. **Undisputed as to the study's stated conclusion. Disputed as to whether the conclusion is accurate that there is no basis to support a finding that operation of WBN1 caused the observed changes in fish species and occurrence. See Young Declaration, ¶¶ III-A.1-14, III-B.1-5, III-C.1-12, and III-E.1-20.**

47. SACE has not challenged the methodology or findings of this study with this Board. **Undisputed.**

C. Mollusk Survey of the Tennessee River Near [WBN] (Rhea County, Tennessee) (Oct. 28, 2010, Revised Nov. 24, 2010) (“Mollusk Survey”), and Discussion of the Results of the 2010 Mollusk Survey of the Tennessee River Near [WBN] (Rhea County, Tennessee) (Mar. 2011) (“Discussion of Mollusk Survey”)

48. In Contention 7, SACE claimed that TVA relies on inadequate and outdated data to estimate the effects of WBN operation on mussels in the WBN vicinity. In support, Dr. Young alleged that the mussel community in the WBN vicinity is not in good health, and that TVA has not given sufficient consideration of the impact of WBN operation on that community. **Undisputed.**

49. To remedy those alleged deficiencies, TVA engaged an outside consultant to conduct a survey of the mussel community in the WBN vicinity in 2010. The consultant conducted semi-quantitative and quantitative mollusk sampling in three sample areas at which TVA has previously conducted pre-operational and operational mollusk surveys. **Undisputed.**

50. Because WBN Unit 1 was in operation in 2010 and had been in operation for more than a decade, this survey inherently reflects the impact of the operation of WBN Unit 1 on the mussel community in the WBN vicinity. **Disputed as to a one year survey capturing the population trend of a mussel community. It was reasonable for TVA to have contracted for a multi-year study when it was decided to apply for the operating license.**

51. The consultant provided the results in the Mollusk Survey. TVA subsequently produced Discussion of Mollusk Survey, analyzing the results of the Mollusk Survey and comparing those results to preoperational (1983 to 1994) and operational (1996 to 1997) monitoring of the mollusk communities at WBN. **Undisputed.**

52. These studies agree that the Chickamauga Reservoir in the WBN vicinity is not the ideal habitat for mussels. Still, the 2010 survey found that the mussel community in the WBN vicinity is in substantially similar condition as it was near the end of the previous operational monitoring period (1996 to 1997), in both species composition and the number of mussels collected. In addition, the 2010 survey collected juveniles of at least five mussel species, evidencing reproduction of mollusks in the WBN vicinity. **Undisputed as to the agreement a reservoir may not be ideal habitat for mussels. Disputed as to what results the consultant produced versus what conclusions TVA drew from that data. Disputed as to the mussel community in the WBN vicinity being in substantially similar condition as it was near the end of the previous operational monitoring period and the significance of the collection of five juvenile mussel species. See Young Declaration, ¶¶ III-D.1-7.**

53. As a result, this study concluded that there is no basis to support a finding that the relatively low densities of mussels in the WBN vicinity are the result of operation of WBN Unit 1. **Undisputed that this is the conclusion stated. Disputed as to the accuracy and reasonableness of the conclusion. See Young Declaration, ¶ III-D.4-7.**

54. SACE has not challenged the methodology or findings of this study with this Board. **Undisputed.**

D. Aquatic Environmental Conditions in the Vicinity of Watts Bar Nuclear Plant During Two Years of Operation, 1996-1997 (June 1998, Revised June 2010) (“Revised Aquatics Study”)

55. TVA completed the initial Aquatics Study in 1998, comparing pre-operational (1973 to 1979, 1982 to 1985) and operational (1996 to 1997) aquatic monitoring in the WBN vicinity. The original study focused on the effects of WBN operation on fish (juveniles and adults), benthic macroinvertebrates, and water quality. As part of the analysis of the effects on fish, the study estimated entrainment of ichthyoplankton and impingement of fish resulting from operation of WBN Unit 1. **Undisputed.**

56. The original study concluded that ichthyoplankton were present in relatively low densities in the vicinity of the WBN intake, and that those that were present had passed through the turbines of the Watts Bar Dam. The study also found that most spawning that occurs in Chickamauga Reservoir occurs downstream of the WBN intake. In other words, relatively few ichthyoplankton were available to be entrained at the WBN intake. The original study concluded that the percent of ichthyoplankton entrained was very low, and that WBN entrainment has no impact on the fish populations in the WBN vicinity. **Undisputed with respect to TVA’s description of the study. Disputed in Contention 7. Disputed as to accuracy of results and conclusions. See Young Declaration, ¶ III-A.2 and III-A.12.**

57. TVA revised this study in direct response to concerns raised by SACE in Contention 7, and by Dr. Young in support of Contention 7, that TVA’s methods for estimating entrainment were flawed. Dr. Young claimed that TVA erroneously assumed that distribution of ichthyoplankton across the reservoir is uniform, and did not take into account variations in seasonal abundance of ichthyoplankton. Dr. Young also alleged that TVA should estimate entrainment using actual intake water demand and river flow values. **Undisputed as to stated information. Disputed as to the Aquatics Study was also revised after Dr. Young identified major clerical and mathematical errors that had gone unnoticed for over a decade.**

58. In response to Dr. Young’s concerns, TVA revised the entrainment analysis to account for seasonality of ichthyoplankton occurrence and reservoir releases from Watts Bar Dam. TVA also used actual intake water demand and reservoir flow values. **Undisputed that TVA revised its entrainment analysis to account for seasonality of ichthyoplankton occurrence and reservoir releases and that TVA used actual intake water demand and reservoir flow values. Disputed as to whether TVA did, in fact, account for seasonality of ichthyoplankton occurrence prior to the Peak Entrainment Study in 2010. See Young Declaration, ¶ III-A.2.**

59. After conducting the revised entrainment estimates, TVA found that its overall conclusions regarding entrainment were unchanged. Estimated entrainment rates remained very low. For samples collected in 1996, percent entrainment in the revised analysis was estimated to be 0.29% for fish eggs and 0.57% for fish larvae. For samples collected in 1997, percent entrainment in the revised analysis was estimated to be 0.02% for fish eggs and 0.22% for fish larvae. **Undisputed that TVA has describe the results of the study. Disputed is the accuracy and validity of these results. See Young Declaration, ¶ III-A.2.**

60. TVA's experts concluded that these rates are "low" and therefore there is no impact to the ichthyoplankton populations of Chickamauga Reservoir as a result of operation of WBN Unit 1. **Undisputed as to the description of the conclusion by TVA's experts. Disputed as to the reasonableness of the conclusion. The data were not sufficient to support the conclusion as this study was only for a 3-month period during only 2 years, one of which Unit 1 was not even operational or only at partial-capacity for a majority of time. The Revised Aquatics Study has the same shortcomings and still arrives at the same conclusions that are disputed in Contention 7. See Young Declaration, ¶ III-A.2 and III-A.12.**

61. SACE has not challenged the methodology or findings of this study with this Board. **Undisputed.**

E. Comparison of 2010 Peak Spawning Seasonal Densities of Ichthyoplankton at [WBN] at Tennessee River Mile 528 with Historical Densities During 1996 and 1997 (Apr. 2011, Revised Nov. 2011) ("Peak Spawning Entrainment Study")

62. TVA conducted this study to respond to SACE and Dr. Young's concerns that TVA's methods for estimating entrainment were flawed, and that TVA should have taken direct measurements of entrainment. **Undisputed.** TVA collected raw data on actual entrainment at WBN during Unit 1 operation from March 2010 through March 2011, to ensure that all of SACE and Dr. Young's concerns regarding entrainment estimates were addressed, and in direct response to requests from SACE and Dr. Young for recent actual entrainment monitoring at WBN during operation of WBN Unit 1. **Undisputed with respect to the assertion that TVA collected raw data on actual entrainment at WBN1 in 2010-11. Disputed as to whether the data collected were sufficient to resolve Dr. Young's concerns. See Young Declaration, ¶ III-A.4.**

63. This study reports entrainment resulting from operation of WBN Unit 1, as measured during the peak spawning period of April through June, 2010. TVA used this timeframe to address SACE and Dr. Young's concern that TVA account for the spawning patterns of fish species in the Chickamauga Reservoir and the high abundance of ichthyoplankton during certain times of year. **Disputed with respect to the assertion that the study reports entrainment from operation of WBN1 as measured through the peak spawning period in 2010. This study only reports entrainment at the CCW, and does not report entrainment by the SCCW. Thus, the cumulative entrainment due to operation of WBN Unit1 is not known. Disputed with respect to whether the data collected were sufficient to resolve Dr. Young's concerns. See Young Declaration, ¶ III-A.5.**

64. This study concluded that measured entrainment rates at the WBN in 2010 were below one half of one percent of the ichthyoplankton population in the WBN vicinity, and consistent with those calculated for the same period during the first two years of operation of Unit 1, 1996 to 1997, when consistent calculation methods were applied. Specifically, the study found that the percent of entrained eggs in 2010 (0.12%) was within the range for 1996 (0.2%) and 1997 (0.2%). Likewise, the study found that the percent of entrained larvae in 2010 (0.40%) was within the range for 1996 (0.88%) and 1997 (0.22%). **Undisputed that TVA correctly describes the study's results. Disputed with respect to the accuracy of the results. See Young Declaration, ¶¶ III-A.2, III-A.5, and III-A.10-11.**

65. TVA's experts concluded that these entrainment rates are "very low," and are not adversely affecting the fish population in the WBN vicinity. **Undisputed that this is the conclusion by TVA's experts. Disputed as to the accuracy and reasonableness of the conclusion.** *See Young Declaration, ¶ III-A.1-12.*

66. The increased water intake demand for the CCW caused by dual unit operation will result in an estimated increase in hydraulic entrainment of approximately 0.2%. This study found that ichthyoplankton entrainment will increase proportionately with hydraulic entrainment. This increase will result in entrainment percentages that are still less than 1% of the ichthyoplankton population. This study concluded that, as a result, dual unit operation will not result in a material change in entrainment impacts. **Disputed as to the accuracy and reasonableness of this conclusion, and the rationale/methodology to arrive at this conclusion.** *See Young Declaration, ¶ III-A.13-14.*

67. SACE has not challenged the methodology or findings of this study with this Board. **Undisputed.**

F. Fish Impingement at [WBN] Intake Pumping Station Cooling Water Intake Structure During March 2010 through March 2011 (Mar. 2011, Revised Apr. 2011) ("Impingement Study")

68. This study analyzes raw impingement data collected at the CCW intake during operation of WBN Unit 1 from March 2010 through March 2011. **Undisputed.** TVA used this data, in combination with the existing recent SCCW impingement data, to estimate the annual impingement mortality of fish in the vicinity of WBN as the result of operation of WBN Unit 1, and to predict the impact from operation of Unit 2. **Disputed as to the fact that TVA did not update the SCCW impingement in conjunction with the CCW impingement in this study.** TVA conducted this study in response to allegations by SACE and Dr. Young that TVA's analysis of the effects of WBN operation on the aquatic community was deficient because TVA had not conducted recent studies of actual impingement at the CCW intake. **Undisputed with respect to the assertion that TVA conducted the study. Disputed as to whether the study was sufficient to resolve Dr. Young's concerns.** *See Young Declaration, ¶ III-B.1-5.*

69. This study found that total impingement values in 1996 to 1997 (161) were less than those measured in 2010 to 2011 (13,573). This study also found, however, that mortality resulting from a cold shock event dominated impingement mortality at WBN in 2010 to 2011. Shad in the Southeastern United States, including the Chickamauga Reservoir, are susceptible to cold shock. When temperatures fall below 50°F, they become lethargic and more susceptible to impingement. The study found that the most significant impingement events observed at WBN in 2010 to 2011 were the result of cold shock. **Undisputed as to the accuracy of TVA's description of the study's conclusions. Disputed as to the implication that cold shock, not the operation of WBN1, is the most significant cause of impingement mortality.** *See Young Declaration, ¶ III-B.1-4.*

70. Excluding the cold shock event, this study found that fewer fish and number of species were impinged in 2010 to 2011, than in 1996 to 1997. The EPA endorses an impingement modeling approach that excludes the effects of extreme environmental conditions.

The EPA also acknowledges the effects of cold shocks on shad. **Disputed as to the cause of mortality. The mortality was caused by impingement against a man-made structure due to intake flow velocities not just the physiological consequences of cold temperatures. See Young Declaration, ¶ III-B.1-4.**

71. This study concludes that low numbers of impinged fish in both 1996-97 and 2010-11 indicate that impingement resulting from operation of WBN Unit 1 will not materially affect fish populations in the WBN vicinity. **Disputed as to the reasonableness of the study duration being adequate to determine this conclusion, and as to the reasonableness of the conclusion. See Young Declaration, ¶ III-B.1-5.**

72. Dual unit operation will result in increased withdrawal of water through the CCW intake channel. Impingement will likewise increase at a rate that is proportional to the increase in flow rate. This study concluded that the impingement increase from dual unit operation would still be very small when compared to the effects of cold shock and winter kills on shad. As a result, TVA's experts concluded that operation of Unit 2 will not result in material increases in impingement at WBN. **Disputed as to this methodology that was also used similarly by TVA to arrive at conclusions of entrainment from the combined operation of Unit 1 and 2. See Young Declaration, ¶ III-A.13-14.**

73. SACE has not challenged the methodology or findings of this study with this Board. **Undisputed.**

G. Hydrothermal Effects of the Ichthyoplankton from the Watts Bar Nuclear Plant Supplemental Condenser Cooling Water Outfall in Upper Chickamauga Reservoir (Jan. 2011) ("Hydrothermal Study")

74. This study analyzes the hydrothermal impacts of WBN operation, based on in-river testing in the vicinity of the WBN outfall during WBN operation in May and August, 2010. TVA conducted this study in direct response to claims by SACE and Dr. Young that TVA should study the hydrothermal effects of operation of WBN Unit 1 on the aquatic environment in the WBN vicinity. Dr. Young alleged that TVA does not provide data on spatial or temporal distribution of ichthyoplankton in relation to thermal mixing zones, does not evaluate the impact of discharge temperatures on ichthyoplankton, and does not account for impacts of variations in the size or temperature profile of the mixing zone. **Undisputed**

75. In direct response to these claims, TVA designed this study to document the flow patterns and characteristics of the thermal plume from WBN, and track the thermal plume in conjunction with ichthyoplankton sampling. This allowed TVA to understand the temporal and spatial distribution of ichthyoplankton and exposure rates to thermal discharges. **Disputed as to the fact that TVA failed to study the thermal discharge from Outfall 101 in conjunction with Outfall 113 to encompass the cumulative thermal discharge from WBN, and failed to address exposure rates and the effects of abrupt temperature changes on ichthyoplankton in this study. See Young Declaration, ¶ III-C.3-4.**

76. TVA conducted this study in May and August, 2010, because those time frames represented extreme conditions: peak abundance of fish eggs and larvae, near maximum ambient water temperatures, and no release from the upstream Watts Bar Dam. **Undisputed as to**

timeframe of study. **Disputed as to whether this would be representative over time as this study only represents a few points in time, not adequately addressing environmental variability. See Young Declaration, ¶ III-C.2.**

77. This study found that, even under these extreme conditions, water temperatures did not approach the limits established by TVA's NPDES permit for operation of WBN Units 1 and 2. **Disputed as study results directly stated to the contrary. See Young Declaration, ¶ III-C.11.** Because discharge temperatures did not exceed those set in TVA's NPDES permit, this study concluded that there was no risk of thermal damage to ichthyoplankton from operation of WBN. **Disputed as to accuracy and reasonableness of these conclusions. See Young Declaration, ¶ III-C.1-11.**

78. Even if operation of WBN Units 1 and 2 causes effluent temperatures to rise above those measured even under extreme conditions for Unit 1, TVA is bound by its NPDES discharge limits. Accordingly, dual unit operation does not pose any greater risk of thermal damage to the aquatic community in the WBN vicinity than does operation of Unit 1 alone. **Disputed as to accuracy and reasonableness of these conclusions. See Young Declaration, ¶ III-C.1-11.**

79. SACE has not challenged the methodology or findings of this study with this Board. **Undisputed.**

IV. Overview of the Draft SFES Conclusions Regarding TVA's Aquatic Studies

80. As noted previously, the NRC Staff's Draft SFES concurs with the findings presented in TVA's aquatics studies. **Undisputed.**

81. Specifically, the Staff concurred with TVA's findings regarding entrainment impacts, concluding in the Draft SFES that hydraulic entrainment would have a very minor impact on the aquatic biota in the vicinity of WBN. The Staff agrees that existing levels of measured entrainment under Unit 1 operation are too low to be readily detected in the aquatic populations in the WBN vicinity, and the additional water withdrawn via the CCW intake will not be noticeable or furthermore destabilizing to the aquatic ecology in the WBN vicinity. Moreover, the Staff concludes that the water withdrawn from the SCCW intake will actually decrease under dual unit operation. In drawing these conclusions, the Staff relies in part on the Revised Aquatics Study and the Peak Spawning Entrainment Study. **Undisputed. It should be noted that the NRC Staff has not conducted any independent studies to support its conclusions.**

82. The Staff's conclusions regarding impingement impacts are similar. The Staff finds that measured levels of impingement under operation of WBN Unit 1 are low and impingement effects are too minor to be readily detected in aquatic populations in the WBN vicinity. The increased flow rates for the CCW intake under dual unit operation will not alter that conclusion, concludes the Staff, and the decreased flow rates for the SCCW intake will not increase impingement effects. The Staff relied in part on the Impingement Study in drawing these conclusions. **Undisputed. It should be noted that the NRC Staff has not conducted any independent studies to support its conclusions.**

83. With respect to thermal impacts from operation of WBN Unit 2, the Staff concludes that this effect also will be undetectable and will not destabilize or noticeably alter the aquatic biota in the WBN vicinity. The Staff based this conclusion in part on the Hydrothermal Study, as well as limits set by the NPDES permit. **Undisputed. It should be noted that the NRC Staff has not conducted any independent studies to support its conclusions.**

84. The Staff concludes in the Draft SFES that although the impoundments and industrial facilities have a significant cumulative impact on the aquatic biota in the WBN vicinity, “the overall impacts on aquatic biota, including Federally listed threatened and endangered species, from impingement and entrainment at the SCCW and IPS [i.e., CCW] intakes and from thermal . . . discharges as a result of operating Unit 2 on the WBN site are SMALL.” **Undisputed. It should be noted that the NRC Staff has not conducted any independent studies to support its conclusions.**

Respectfully submitted,

Electronically signed by

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