

WBN2Public Resource

From: Wiebe, Joel
Sent: Tuesday, April 20, 2010 10:47 AM
To: 'Stegen, Amanda'; 'Keller, Tonya K'
Cc: Beissel, Dennis; WBN2HearingFile Resource
Subject: FW: Letter to NRC - Environmental Review
Attachments: 4-9-10_Env. Response RAI_TVA ccs .pdf

From: Arent, Gordon [mailto:garent@tva.gov]
Sent: Thursday, April 15, 2010 5:07 PM
To: Milano, Patrick; Wiebe, Joel
Subject: FW: Letter to NRC - Environmental Review

Please see attached letter sent to NRC on April 9, 2010.

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From: Wiebe, Joel

Created By: Joel.Wiebe@nrc.gov

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Tracking Status: None

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April 9, 2010

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, D.C. 20555-0001

Watts Bar Nuclear Plant, Unit 2
NRC Docket No. 50-391

Subject: **Watts Bar Nuclear Plant (WBN) Unit 2 - Response to U.S. Nuclear Regulatory Commission (NRC) Request for Additional Information Regarding Environmental Review (TAC No. MD8203)**

- References:
1. NRC letter to TVA dated December 3, 2009, "Watts Bar Nuclear Plant, Unit 2 - Request for Additional Information Regarding Environmental Review (TAC No. MD8203)" [ML093030148 / ML093290073]
 2. TVA letter to NRC dated February 15, 2008, "Watts Bar Nuclear Plant (WBN) - Unit 2 - Final Supplemental Environmental Impact Statement for the Completion and Operation of Unit 2" [ML080510469]
 3. TVA letter to NRC dated July 2, 2008, "Watts Bar Nuclear Plant (WBN) - Unit 2 - Final Supplemental Environmental Impact Statement - Request for Additional Information (TAC MD8203)" [ML081850460]
 4. TVA letter to NRC dated January 27, 2009, "Watts Bar Nuclear Plant (WBN) Unit 2 - Final Supplemental Environmental Impact Statement - Severe Accident Management Alternatives (TAC MD8203)" [ML090360588]
 5. TVA letter to NRC dated December 23, 2009, "Watts Bar Nuclear Plant (WBN) Unit 2 – Additional Information Regarding Environmental Review (TAC No. MD8203)" [ML100210350]
 6. TVA Letter to NRC dated February 25, 2010, "Watts Bar Nuclear Plant (WBN) Unit 2 - Additional Information Regarding Environmental Review (TAC No. MD8203)" [ML100630115]

The purpose of this letter is to provide additional information in support of NRC's environmental review of WBN Unit 2 as requested by the NRC in Reference 1 subsequent to a site audit in October 2009.

The WBN Unit 2 Final Supplemental Environmental Impact Statement (June 2007) was submitted to the NRC on February 15, 2008 (Reference 2). By letter dated July 2, 2008 (Reference 3), TVA responded to an NRC request for additional information. By letter dated January 27, 2009 (Reference 4), TVA provided the Severe Accident Management Alternatives analysis report for WBN Unit 2. By letter dated December 23, 2009 (Reference 5), and February 25, 2010 (Reference 6), TVA provided additional information in support of NRC's environmental review of WBN Unit 2.

Enclosure 1 provides the NRC environmental review requests for additional information and TVA's responses as of April 7, 2010. Attached to Enclosure 1 is an Optical Storage Media (OSM) containing supporting files and documents as listed below. Paper copies of the documents, as applicable, are also attached. TVA expects to provide the remaining RAI response by April 23, 2010. Enclosure 2 identifies those actions committed to by TVA in this letter.

If you have any questions, please contact me at (423) 365-2351.

Sincerely,

Original signed by

Masoud Bajestani
Watts Bar Unit 2 Vice President

Enclosures:

1. Response to NRC Request for Additional Information Regarding Environmental Review
2. List of Regulatory Commitments

Attachments to Enclosure 1:

1. Groundwater Investigation Report, Watts Bar Nuclear Plant, Spring City, Tennessee, Prepared by ARCADIS G&M Inc. for TVA, August 2004
2. Table G-5, Federal, State, and Local Authorizations
3. TVA Nuclear Power Group (NPG) Calculation WBNTSR-008 R11, "Control Room Operator and Offsite Doses Due to a Steam Generator Tube Rupture"
4. FENCDOSE Run, Time Dependent Releases, 21 uCi/g I-131 equivalent preaccident Iodine spiking case (TSR8F11Aout.txt)

5. FENCDOSE Run, Time Dependent Releases, 0.265 uCi/g I-131 equivalent accident initiate Iodine spike case (TSR8FBout.txt)
6. TVA NPG Calculation WBNTSR-009 R11, "Control Room Operator and Offsite Doses from a Fuel Handling Accident"
7. TVA NPG Calculation WBNTSR-080 R6, "Control Room Operator and Offsite Doses Due to a Loss of AC Power"
8. FENCDOSE File, Time Dependent Releases, realistic case (TSR80FA6.txt)
9. FENCDOSE File, Time Dependent Releases, 1% failed fuel case (TSR80FB6.txt)
10. TVA NPG Calculation WBNAPS3-077 R11, "Offsite and Control Room Operator Doses Due to a Main Steam Line Break"
11. FENCDOSE Run, Time Dependent Releases, preaccident 21 uCi/gm I-131 equivalent case (APS77F10A.txt)
12. FENCDOSE Run, Time Dependent Releases, 0.265 uCi/gm I-131 accident initiated Iodine spike (APS77F10B.txt)
13. TVA NPG Calculation WBNTSR-064 R8, "Offsite and Control Room Operator Doses Due to a Waste Gas Decay Tank Rupture"
14. TVA NPG Calculation TI-RPS-197 R21, "Offsite Doses Due to a Regulatory Guide 1.4 Loss of Coolant Accident"
15. Met files used in the ARCON96 X/Q calculations
16. 1976 TVA Report, "Impingement at Watts Bar Steam Plant"
17. Table 3-7, "Total Numbers of Each Native Mussel Species Collected During Preoperational (1983-1994) and Operational (1996-1997) Surveys Near Watts Bar Nuclear Plant"
18. Appendix A-2, "Results of 14 Native Mussel Surveys at 12 Sites in the Vicinity of Watts Bar Nuclear Plant, 1983-1997"

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cc (Enclosures):

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A. L. Sterdis, LP 5A-C*
E. J. Vigluicci, WT 6A-K
K. W. Whittenburg, SP 2B-C*
EDMS, WT 3B-K (Re: A02 091208 001; T02 080215 001; T02 080702 003;
T02 090127 001; T02 091223 001; T02 100225 001)

*These cc's received only Enclosures 1 and 2, not the attachments to Enclosure 1.
The attachments to Enclosure 1 are available by contacting the WBN Unit 2
Licensing office.

Enclosure 1

Response to NRC Request for Additional Information Regarding Environmental Review

Tennessee Valley Authority
Watts Bar Nuclear Plant - Unit 2, Docket No. 50-391

Socioeconomics

S-3 NRC Request

Provide recent information on the total number of Watts Bar Unit 1 and 2 permanent operations-related employees and describe where these employees live (county-level residence is sufficient).

TVA Response

TVA reviewed the records of approximately 700 permanent employees to obtain the following county-level residence information:

| County of Residence | Percentage |
|---------------------|------------|
| Rhea | 22.1 |
| Hamilton | 15.2 |
| Knoxville | 12.6 |
| McMinn | 12.5 |
| Roane | 7.5 |
| Meigs | 5.7 |
| Loudon | 5.4 |
| Monroe | 4.1 |
| Bradley | 3.2 |
| Blount | 2.0 |
| Cumberland | 2.0 |

Hydrology

H-1 NRC Request

During the site audit, staff reviewed a document titled "Groundwater Investigation Report" prepared by ARCADIS G&M Inc. for TVA August 12, 2004. Provide this document in a referenceable format.

TVA Response

An electronic and paper copy of the ARCADIS report is attached (Attachment 1).

H-2 NRC Request

If the ARCADIS report cannot be provided, provide a current water-table map of the Watts Bar site including locations of monitoring wells.

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Response to NRC Request for Additional Information Regarding Environmental Review

TVA Response

An electronic and paper copy of the ARCADIS report is attached.

H-3 NRC Request

If the ARCADIS report cannot be provided, provide an analysis of groundwater travel time from WBN Unit 2 facilities to nearby surface water bodies (accessible environment) taking into account the properties of the site following construction of Unit 2.

TVA Response

An electronic and paper copy of the ARCADIS report is attached.

H-4 NRC Request

Provide a current summary of tritium distribution in groundwater at the WBN site.

TVA Response

TVA provides results and a summary of tritium distribution in groundwater at the WBN site in the Annual Radiological Environmental Operating Report (AREOR) and the Annual Radioactive Effluent Release Report (ARERR). The 2008 AREOR (ML091390288) and the 2008 ARERR (ML091260369) were submitted to the NRC April 30, 2009. Since the 2004 ARCADIS report was issued, TVA has provided the following AREORs and ARERRs to the NRC:

| Year | AREOR | ARERR |
|------|-------------|-------------|
| 2004 | ML051380366 | ML051250623 |
| 2005 | ML061290369 | ML061220258 |
| 2006 | ML071280378 | ML071230082 |
| 2007 | ML081430029 | ML081300025 |

H-16 NRC Request

The figure included in Appendix B of the 2007 TVA EIS shows water flow rates for plant systems with one unit in operation. Provide an update of this figure showing the flow rates for the system with WNB Unit 1 and 2 in operation. Provide an update to the table on page 3-3 of 1978 EIS to include values that include the flow rates needed for both units in operation.

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Response to NRC Request for Additional Information Regarding Environmental Review

TVA Response

TVA will provide this information on or before April 23, 2010.

H-19 NRC Request

ESRP 5.2.1 directs staff to consider hydrologic alterations such as maintenance dredging. Is periodic maintenance dredging of the intake canal required/planned? If so, how are intake operations conducted to supply the plant's raw water demand while dredging of the intake channel. Would maintenance dredging of the barge unloading facility be required prior to future use? Are any other dredging actions associated with operation of WBN Unit 2 being considered? How would dredged material be disposed of?

TVA Response

TVA routinely (every two years) inspects the river channel for silt formation in the forebay of the Intake Pumping Station (IPS) channel. The results of this inspection determine if dredging is required and if there should be an increase in monitoring. A calculation specifies that flow will be maintained if the average depth at Elevation 663.0 feet is available. The review was last performed in October 2008. The data satisfied the requirement, and no dredging is required or planned.

H-22 NRC Request

The ER states that potable water will be obtained from the Watts Bar Utility District. What is the volume of water provided by WBUD to support the operation of Unit 1 and what is the anticipated additional increment of water needed from the utility district to support the operation of Unit 2? What is the total anticipated water need from the district in the future? What are the environmental impacts associated with the WBUD obtaining and providing the additional water.

TVA Response

The steady state staffing level for WBN Units 1 and 2 after Unit 2 construction is completed and is currently targeted at 1,200 excluding major project and outage staffing. Therefore, assuming a normal daily volume at approximately 20 gallons per person would equal 24,000 gallons per day to support the steady state staffing target. The peak staffing for Unit 2 completion and a Unit 1 Refueling Outage at the same time is estimated to be approximately 4,000, which would result in a volume of 80,000 gallons per day using the 20 gallons per person daily factor.

Watts Bar Utility District has a capacity of 1.8 million gallons per day. WBN is a small fraction of this capacity, and thus no environmental impact is expected.

Enclosure 1

Response to NRC Request for Additional Information Regarding Environmental Review

H-29 NRC Request

Provide a recent analysis of groundwater quality on the WBN site. ESRP 2.3.3 calls for staff to review water quality parameters including total dissolved solids, hardness, odor, conductivity, phosphorus forms (total and orthophosphate), nitrogen forms (ammonia, nitrate, nitrite, organic), alkalinity, chlorides, sulfate, sodium, potassium, calcium, magnesium, heavy metals (e.g., Hg, Pb), pH, silica, iron, carbon dioxide, and bicarbonate.

How will the operation of Unit 2 impact groundwater quality on the WBN site?

TVA Response

The results of groundwater samples taken February 2010 are shown in the table on the following page.

TVA Nuclear Power Group (NPG) Ground Water Protection Program (GWPP), defined in SPP-5.15, "Fleet Ground Water Protection Program," implements the requirements specified in Nuclear Energy Institute (NEI) 07-07. The fleet GWPP provides guidance and instructions for implementing requirements of NEI's Industry Ground Water Protection Initiative - Final Guidance Document (August 2007). SPP-5.15 minimizes the potential for inadvertent releases to the environment from plant activities. Implementation of this initiative further demonstrates TVA's commitment to the control of licensed material through prevention, early detection, and mitigation and remediation of impacts associated with potential ground water and subsurface contamination. SPP-5.15 also incorporates as applicable the guidance set forth in the EPRI Report 1015118, "Ground Water Protection Guidelines for Nuclear Power Plants," for implementing a GWPP.

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Response to NRC Request for Additional Information Regarding Environmental Review

Results of Groundwater Samples Taken February 2010

| Parameter | Result | Det. Limit | Units | Method | Prep | | PID | Analyzed | |
|--|--------|------------|----------|---------|----------|------|-----|----------|------|
| Chloride | 9.6 | 1.0 | mg/l | 9056 | 02/04/10 | 1007 | 245 | 02/04/10 | 1855 |
| Nitrate | BDL | 0.10 | mg/l | 9056 | 02/04/10 | 1007 | 245 | 02/04/10 | 1855 |
| Nitrite | BDL | 0.10 | mg/l | 9056 | 02/04/10 | 1007 | 245 | 02/04/10 | 1855 |
| Sulfate | 78. | 5.0 | mg/l | 9056 | 02/04/10 | 1007 | 245 | 02/04/10 | 1855 |
| Alkalinity, Bicarbonate | 120 | 20. | mg/l | 2320B | 02/09/10 | 1306 | 397 | 02/09/10 | 1317 |
| Alkalinity, Carbonate | BDL | 20. | mg/l | 2320B | 02/09/10 | 1306 | 397 | 02/09/10 | 1315 |
| Alkalinity | 120 | 20. | mg/l | 2320B | 02/09/10 | 1155 | 397 | 02/09/10 | 1230 |
| Free Carbon Dioxide | 390 | 0.020 | mg/l | 406B | 02/09/10 | 1305 | 397 | 02/09/10 | 1326 |
| Hardness, Total (mg/L as CaCO ₃) | 210 | 30. | mg/l | 130.1 | 02/10/10 | 1009 | 234 | 02/10/10 | 1438 |
| Ammonia Nitrogen | 0.13 | 0.10 | mg/l | 350.1 | 02/08/10 | 1009 | 397 | 02/09/10 | 1334 |
| Odor | BDL | 1.0 | T.O.N. | 140.1 | 02/04/10 | 1754 | 477 | 02/05/10 | 0730 |
| pH | 5.8 | | su | 9040C | 02/05/10 | 1645 | 477 | 02/06/10 | 1004 |
| Organic Nitrogen | 0.52 | 0.10 | mg/l | CALC. | 02/05/10 | 1741 | 494 | 02/09/10 | 0000 |
| Phosphate, Ortho | 0.032 | 0.025 | mg/l | 4500P-E | 02/05/10 | 1655 | 477 | 02/06/10 | 1154 |
| Phosphorus, Total | BDL | 0.10 | mg/l | 365.1 | 02/05/10 | 1742 | 494 | 02/09/10 | 0537 |
| Specific Conductance | 440 | | umhos/cm | 9050A | 02/05/10 | 1808 | 494 | 02/09/10 | 1140 |
| Kjeldahl Nitrogen, TKN | 0.65 | 0.10 | mg/l | 351.2 | 02/08/10 | 1356 | 494 | 02/10/10 | 1107 |
| Dissolved Solids | 280 | 10. | mg/l | 2540C | 02/08/10 | 1001 | 36 | 02/09/10 | 1238 |
| Lead | BDL | 0.0010 | mg/l | 6020 | 02/05/10 | 1545 | 388 | 02/06/10 | 1625 |
| Mercury | BDL | 0.00020 | mg/l | 7470A | 02/05/10 | 0856 | 429 | 02/06/10 | 1642 |
| Calcium | 51. | 0.50 | mg/l | 6010B | 02/04/10 | 2132 | 117 | 02/07/10 | 1355 |
| Iron | 1.4 | 0.10 | mg/l | 6010B | 02/04/10 | 2132 | 117 | 02/07/10 | 1355 |
| Magnesium | 14. | 0.10 | mg/l | 6010B | 02/04/10 | 2132 | 117 | 02/07/10 | 1355 |
| Potassium | 2.7 | 0.50 | mg/l | 6010B | 02/04/10 | 2132 | 117 | 02/07/10 | 1355 |
| Silicon | 7.1 | 0.20 | mg/l | 6010B | 02/04/10 | 2132 | 117 | 02/07/10 | 1355 |

BDL - Below Detection Limit

Det. Limit - Practical Quantitation Limit (PQL)

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Response to NRC Request for Additional Information Regarding Environmental Review

H-30 NRC Request

Identify the survey datum used to establish elevations reported for the WBN site and facilities (for example NAVD88 or NGVD29).

TVA Response

In general, WBN site elevations were established on National Geodetic Vertical Datum (NGVD) 1929 prior to site construction.

General

G-5 NRC Request

Provide a list of all authorizations, consultations, and environmental permits and approvals needed for operation of Unit 2 and provide a status for each item.

TVA Response

All federal, state, and local authorizations, consultations, and environmental permits needed for operation of Unit 2 and the status of each is provided in Attachment 2.

Design Basis Accidents (DBAs)

DBA-1 NRC Request

As discussed at the site audit, provide analyses of the DBAs considered in the FSAR that use realistic (50 percent) X/Qs with sufficient information to permit staff to independently evaluate the doses.

TVA Response

The following documents and files (Attachments 3 through 15) provide analyses of the DBAs considered in the Final Safety Analysis Report (FSAR) that use conservative FSAR X/Qs. The calculations may be used as input to the PNNL analyses of realistic offsite doses for environmental assessment using more realistic (50 percent) X/Qs:

- TVA NPG Calculation WBNTSR-008 R11, "Control Room Operator and Offsite Doses Due to a Steam Generator Tube Rupture"
- FENCDOSE Run, Time Dependent Releases, 21 uCi/g I-131 equivalent preaccident Iodine spiking case (TSR8F11Aout.txt)

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- FENCDOSE Run, Time Dependent Releases, 0.265 uCi/g I-131 equivalent accident initiate Iodine spike case (TSR8FBout.txt)
- TVA NPG Calculation WBNTSR-009 R11, "Control Room Operator and Offsite Doses from a Fuel Handling Accident"
- TVA NPG Calculation WBNTSR-080 R6, "Control Room Operator and Offsite Doses Due to a Loss of AC Power"
- FENCDOSE File, Time Dependent Releases, realistic case (TSR80FA6.txt)
- FENCDOSE File, Time Dependent Releases, 1% failed fuel case (TSR80FB6.txt)
- TVA NPG Calculation WBNAPS3-077 R11, "Offsite and Control Room Operator Doses Due to a Main Steam Line Break"
- FENCDOSE Run, Time Dependent Releases, preaccident 21 uCi/gm I-131 equivalent case (APS77F10A.txt)
- FENCDOSE Run, Time Dependent Releases, 0.265 uCi/gm I-131 accident initiated Iodine spike (APS77F10B.txt)
- TVA NPG Calculation WBNTSR-064 R8, "Offsite and Control Room Operator Doses Due to a Waste Gas Decay Tank Rupture"
- TVA NPG Calculation TI-RPS-197 R21, "Offsite Doses Due to a Regulatory Guide 1.4 Loss of Coolant Accident"
- Met files used in the ARCON96 X/Q calculations

Aquatic Ecology

AE-1 NRC Request

Additional data has been collected since the publication of the FES-CP. The vast majority of the impingement in 2005 to 2006 was due to threadfin shad. The ESRPs state that cropping rates in relation to standing stock estimates for species populations should be considered. As discussed at the site audit, provide a population estimate of threadfin shad in the Watts Bar Reservoir to use as a metric for standing stock estimates.

TVA Response

Threadfin shad constitute a high percentage of total fish impinged at most power plants in the Southeastern United States. Extreme population fluctuations which result from their low tolerance of cold water and high reproductive potential often mask the effect of impingement, which is normally a relatively small proportion of

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Response to NRC Request for Additional Information Regarding Environmental Review

the population. It is highly unlikely that impingement significantly affects the Watts Bar Reservoir population of threadfin shad.

Schneider and Tuberville (1980) reported mean annual standing stock estimates (No/ha) of young and adult threadfin shad collected with rotenone in Watts Bar Reservoir from 1960 to 1980. Based on the eight years of cove rotenone data collected from 1960 to 1980, an average of 4,933.6 threadfin shad per hectare (ha) was derived. Of the total area of Watts Bar Reservoir (15,621 ha), a total of 4,100 ha consists of cove and embayment habitat similar to the study areas.

Given this information, it was estimated that a total of 20,227,274.9 threadfin shad inhabit the cove and embayment area of the reservoir, which is 26 percent of the total area of the reservoir. The remaining 74 percent of the reservoir consists of pelagic areas that were not sampled for standing stock information due to the lack of proper estimation collection techniques for large bodies of water. The threadfin shad population of Watts Bar Reservoir is estimated to be much greater than the 20 million found in cove and embayment habitats.

The presence of a quality largemouth bass population in Watts Bar Reservoir indicates that forage species, such as threadfin shad, are abundant.

The Sport Fishing Index (SFI) was developed by TVA and state fishery resource agencies in the Tennessee River Valley. The SFI uses data from each of these agencies to measure sport fishing quality for individual sport fish species (Hickman 2000). In 2008, the SFI score for largemouth bass in Watts Bar Reservoir (40) was higher than the Valley-wide average of SFI scores for largemouth bass (35) (TVA 2010). This information suggests an abundant forage base to support a quality largemouth bass fishery in Watts Bar Reservoir.

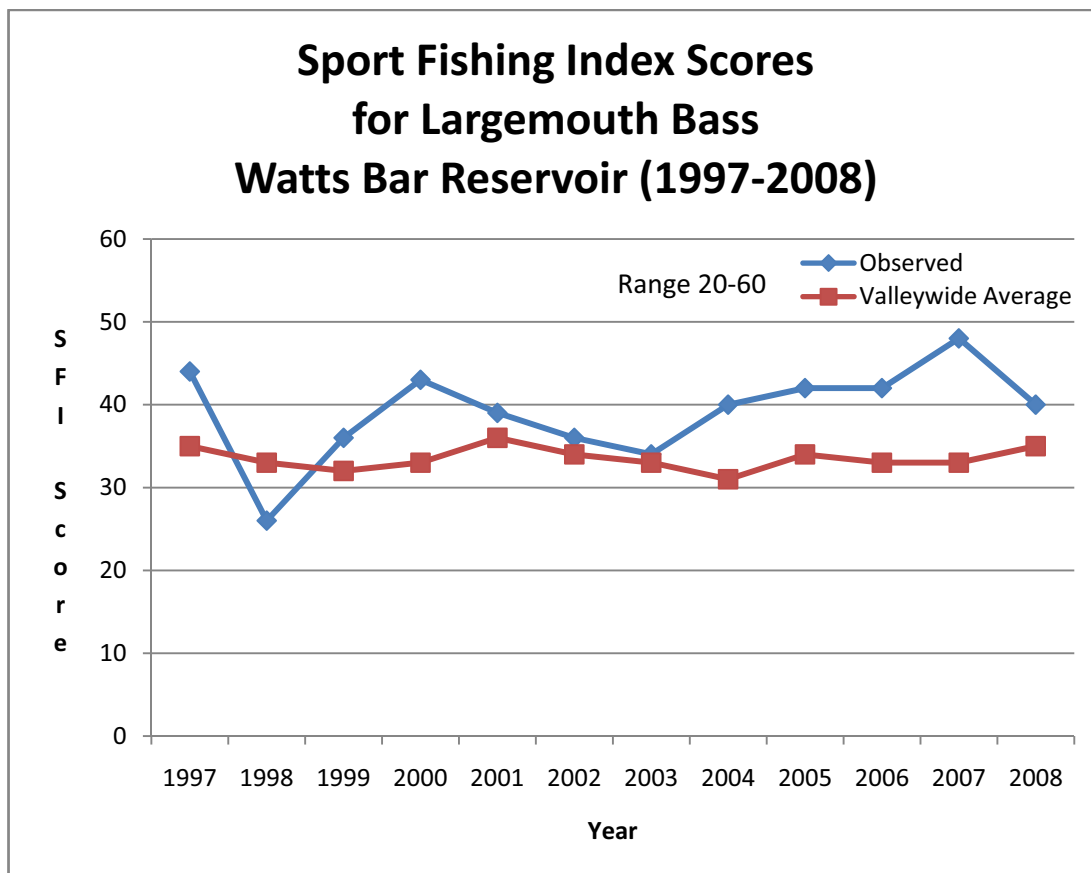
TVA Unpublished SFI Data from 1997 through 2008

| | Observed | Valley-wide Average |
|------|----------|---------------------|
| 1997 | 44 | 35 |
| 1998 | 26 | 33 |
| 1999 | 36 | 32 |
| 2000 | 43 | 33 |
| 2001 | 39 | 36 |
| 2002 | 36 | 34 |
| 2003 | 34 | 33 |
| 2004 | 40 | 31 |
| 2005 | 42 | 34 |
| 2006 | 42 | 33 |
| 2007 | 48 | 33 |
| 2008 | 40 | 35 |

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Response to NRC Request for Additional Information Regarding Environmental Review

TVA Unpublished SFI Scores for Largemouth Bass Watts Bar Reservoir (1997-2008)



AE-2 NRC Request

Explain the apparent difference between the number of fish impinged during the August 1974 to July 1975 impingement sampling from the intake for the WBF as reported on pages 34 and 35 of the SCCW EA, and the discussion of impingement during the same timeframe on pages 3 and 4 and Table 4 for the 316(b) analysis, dated 2007 ("Fish Impingement at Watts Bar Nuclear Plant Supplemental Cooling Water Intake Structure during 2005-2007").

TVA Response

The differences in the impingement estimates provided in the Supplemental Condenser Cooling Water (SCCW) Environmental Assessment (EA) and the 2007 impingement report "Fish Impingement at Watts Bar Nuclear Plant Supplemental Cooling Water Intake Structure during 2005-2007" are due to differences in the number of samples relied on in extrapolating the estimates and the manner in which the estimates were derived.

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Response to NRC Request for Additional Information Regarding Environmental Review

The SCCW EA used sample data from 42 samples taken between August 1974 and July 1975 and estimated impingement by month to reach a total annual impingement estimate of 21,787. The estimates are broken down by month in Table 3.3.6 of the EA.

The 2007 impingement report references two distinct but related data sets. Pages 3 and 4 of the 2007 report recites data included in a 1976 TVA report, "Impingement at Watts Bar Steam Plant." The 1976 report used 33 samples collected from August 1974 to May 1975, resulting in 2,130 fish collected; and then estimated an annual impingement at 16,421 based on the assumption that Watts Bar Steam Plant was operating 69.7 percent of the time. Table 4 of the 2007 report provides a slightly higher annual impingement estimate, which was calculated using the original sample records from 43 samples taken between August 1974 and July 1975, including the 33 samples cited in the 1976 report. A total of 2,525 fish were counted in the 43 samples, and this total was extrapolated on a weekly basis to determine the estimated annual impingement of 17,675 cited in Table 4.

The 1976 report is included in this report as Attachment 16.

AE-3 NRC Request

As discussed at the site audit, provide an updated Table C-7 from the 2007 TVA EIS that corrects the discrepancy in the heading of the sixth column, and appropriately describes the use of the word "Total" in the last column heading.

TVA Response

Table C-7 of the Final Supplemental Environmental Impact Statement (FSEIS) is a condensed form of data contained and tabulated in Appendix A-2 and Table 3-7 of "Aquatic Environmental Conditions in the Vicinity of Watts Bar Nuclear Plant During Two Years of Operation, 1996-1997." Appendix A-2 provides the results of 14 native mussel surveys at 12 sites in the vicinity of WBN, 1983-1997. The species lists are arranged in order of abundance within each table of Appendix A-2. The data are then summarized in Table 3-7 of the report. This table, and the supporting data from Appendix A-2, may be used in lieu of FSEIS Table C-7. Table 3-7 and Appendix A-2 are included in this submittal as Attachments 17 and 18.

As explained in TVA's response to AE-4, the final data column in FSEIS C-7, "529.2R (1997)," was not contained in the report cited here, but came from Table 3.3.4 of the 1998 SCCW EA.

Enclosure 1

Response to NRC Request for Additional Information Regarding Environmental Review

AE-4 NRC Request

TVA 1998 Figure 3-2 shows the location of the sampling stations at three native mussel beds surveyed during the preoperational and operational monitoring programs (Tennessee River Mile [TRM] 520-521L; TRM 526-527R and TRM 528-529L). Table C-7 of the FSEIS (pages 155 and 156) indicates that sampling was conducted in 1997 at TRM 529.2R. Indicate whether this is an additional existing mussel bed and provide the extent of this mussel bed and/or the reference that discusses the sampling and its location. If additional mussel beds are known to occur in this reach beyond those specified above, provide the locations of the beds.

In addition, Table C-7 of the FSEIS shows that monitoring of mussels only occurred at 529.2R during the 1997 sampling period. However, Table 3-6 of TVA 1998 provides results of mussel surveys at TRM 528.2 to 528.9. Provide an updated Table C-7 that provides the data for all of the surveys that were conducted in the mussel beds closest to the Watts Bar site from surveys in 1990, 1992, 1994, 1996 and 1997.

TVA Response

The final data column in Table C-7 in the FSEIS, titled "529.2R (1997)," relies on data contained in the August 1998 EA for the WBN SCCW. Table 3.3.4 of the SCCW EA provides data on freshwater mussels encountered during diver-conducted searches of transects located just off shore from the Watts Bar Fossil Plant discharge at TRM 529.2. This survey was a special study done as part of the SCCW analysis and does not represent an additional mussel bed.

As discussed in TVA's response to AE-3, the rest of FSEIS Table C-7 comes from Table 3-7 and Appendix A-2 of "Aquatic Environmental Conditions in the Vicinity of Watts Bar Nuclear Plant During Two Years of Operation, 1996-1997." This report includes data from all surveys conducted in 1990, 1992, 1994, 1996 and 1997, with the exception of the diver-conducted transect searches at TRM 529.2 described above. A summary of the data is presented in Table 3-7 of this report. Table 3-7 and Appendix A-2 should be used in lieu of FSEIS Table C-7. Table 3-7 and Appendix A-2 are included in this submittal as Attachments 17 and 18.

AE-7 NRC Request

Provide a statement regarding whether any operational monitoring programs of aquatic organisms including fish and mussels will be conducted after WBN 2 begins operation. If so, provide details related to the type of monitoring, location, and frequency of monitoring.

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TVA Response

TVA will conduct preoperational and operational monitoring to characterize the aquatic communities in the vicinity of the plant in Watts Bar and Chickamauga Reservoirs due to the proposed operation of an additional nuclear reactor at the WBN site. This monitoring will serve to update and verify historical monitoring data on entrainment and impingement of fish and freshwater mussel community assemblages.

The data collected prior to operation of Unit 2 (2010-2011) and after Unit 2 is in operation will provide additional information to assess the potential for any direct, indirect and cumulative effects to the fish and shellfish communities of Chickamauga Reservoir from operating two units at WBN.

Entrainment (fish eggs and larvae)

Ichthyoplankton sampling to estimate temporal densities and species composition of fish eggs and larvae began in March 2010 and will continue at least two years after Unit 2 is in operation. Samples will be collected weekly on a diel schedule (day and night) during March through August and monthly September through February at TRM 528.0 to 528.3 and TRM 529.9 to 530.3 for the IPS and SCCW IPS, respectively. This sampling will estimate temporal abundance of fish eggs and larvae at five stations at each site within a transect perpendicular to river flow just upstream of the plant intake channel and SCCW (upstream of Watts Bar Dam). Samples will consist of one ten-minute tow filtering approximately 150 m³ of water at each sampling location. Additional samples will be collected at each of the plant cooling water intake to estimate entrainment of fish eggs and larvae (Baxter et al. 1998).

Impingement Mortality

Impingement mortality of fish and shellfish at the IPS (TRM 528) traveling screens will be sampled to update the historical database. Weekly counts of fish and shellfish impinged during a 24-hour period on the IPS traveling screens at WBN will be collected beginning March 2010 and continue for at least one year for preoperational and one year for operational monitoring (Baxter et al. 1998).

Freshwater Mussels

To characterize the current freshwater mussel fauna in the vicinity of WBN, qualitative and quantitative mussel surveys will be conducted during June 2010 at three known mussel beds in the vicinity of WBN and in the mid-channel approximately 1 mile below Watts Bar Dam to evaluate four experimental plots within the boulder field to characterize species composition and relative abundance of juvenile and adult freshwater mussel fauna.

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Study Area Descriptions

In 1983, mussel monitoring sites were established in three known concentrations of mussels (mussel beds) downstream from Watts Bar Dam near WBN: TRM 520-521L (left descending bank), TRM 526-527R (right descending bank), and TRM 528-529L. The most upstream of these beds (TRM 528-529L) is located on the opposite side of the river from WBN and upstream from its diffuser discharge. The middle bed (TRM 526-527R) is on the same side of the river as WBN and is just downstream from the confluence of Yellow Creek and the WBN diffuser discharge. The downstream bed (TRM 520-521L) is 6 river miles downstream from WBN and is located on the opposite side of the river. All three beds exist on submerged gravel and cobble bars in water approximately 9 to 21 feet deep (Baxter et al. 1998).

In 2002, four experimental plots within a boulder field were conducted in the Tennessee River approximately 1 mile (~1.6 km) downstream from Watts Bar Dam approximately 164 feet from the right (descending) shore in water approximately 12 to 14 feet deep (TRM 528.3 - 528.8). This location was chosen along the right (descending) margin of the navigation channel, between the loading facility at Watts Bar Fossil Plant and the intake channel for WBN (Fraley et al. 2002).

The purpose of these additional mussel surveys is to determine whether the mussel populations have changed and whether operation of WBN has had any obvious effect on the mussel resources in this part of the Tennessee River.

References

Baxter, D.S., J.P. Buchanan, G.D. Hickman, J.J. Jenkinson, J.D. Milligan, and C.J. O'Bara (1998). "Aquatic environmental conditions in the vicinity of Watts Bar Nuclear Plant during two years of operation, 1996-1997." Norris, TN: Tennessee Valley Authority.

G. D. Hickman. 2000. Sport Fishing Index (SFI): A Method to Quality Sport Fishing Quality. Environmental Science & Policy 3 (2000), S117-S125.

S. J. Fraley, Jenkinson, J. J., and Smith, B.T. (2002). "Preliminary Evaluation of an Artificial Boulder Field for Enhancing Native Mussel Habitat in the Watts Bar Tailwater, Tennessee River Mile 528.5." Norris, TN: Tennessee Valley Authority.

TVA 2010. <http://www.tva.com/environment/water/sportfish.htm#29>

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Radiological Protection

RP-1 *As discussed during the site audit, the analysis on dose to the population was updated in the 2007 FSEIS. However, the data was not sufficient for staff to conduct independent validation of the conclusions. Based on the data needs found in the revised ESRP 5.4, Exposure Pathways, provide the following data (including references for where data were obtained).*

a NRC Request

Confirm that there are no milk goat or meat animals are present in the 5-mi radius.

TVA Response

The annual land use survey process includes the search for milk cow and milk goat locations. No milk goat locations were identified within the five mile radius. The identification of meat animals is not required for Radiological Environmental Monitoring Program (REMP) Land Use Survey process covered in NUREG 1301 and is not performed for WBN.

b NRC Request

Provide the direction and distance for the nearest residence, nearest garden, and nearest milk cow.

TVA Response

This information is reported in Appendix G of the WBN AREOR.

c NRC Request

Confirm that releases are calculated as ground level releases.

TVA Response

FSAR Section 11.3.9, Atmospheric Dilution, states "Releases from the Shield Building, Turbine Building (TB), and Auxiliary Building (AB) vents are treated as ground level."

d NRC Request

Provide nearest site boundary distances for the 16 cardinal compass directions.

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TVA Response

| | Sector | Distance (Meters) |
|----------------------------|--------|-------------------|
| Unrestricted Area Boundary | N | 1550 |
| Unrestricted Area Boundary | NNE | 1980 |
| Unrestricted Area Boundary | NE | 1580 |
| Unrestricted Area Boundary | ENE | 1370 |
| Unrestricted Area Boundary | E | 1280 |
| Unrestricted Area Boundary | ESE | 1250 |
| Unrestricted Area Boundary | SE | 1250 |
| Unrestricted Area Boundary | SSE | 1250 |
| Unrestricted Area Boundary | S | 1340 |
| Unrestricted Area Boundary | SSW | 1550 |
| Unrestricted Area Boundary | SW | 1670 |
| Unrestricted Area Boundary | WSW | 1430 |
| Unrestricted Area Boundary | W | 1460 |
| Unrestricted Area Boundary | WNW | 1400 |
| Unrestricted Area Boundary | NW | 1400 |
| Unrestricted Area Boundary | NNW | 1460 |

e NRC Request

Confirm that FSAR Section 11 (11.3.10.1 "worst case feeding factor identified during the 1994 land use census for any real cow location (i.e., 70% pasture feeding)." Milk feeding factors are listed in FSAR Table 11.3-10 is the appropriate data for determining the grazing seasons and fraction of daily intake of milk cows derived from pasture or fresh forage during the grazing season.

TVA Response

The FSAR table containing the milk feeding factors is Table 11.3-9 (currently Unit 1 FSAR) versus Table 11.3-10 (currently Unit 2 FSAR). The following table shows the feeding factors for 1993, 1994, and 1995. During this period, the annual feeding factors were determined and supplied to WBN. WBN now determines the annual feeding factors based on the monthly fraction that each milk farmer is using substitutional feed.

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| Location Sector / Distance (meters) | Feeding Factor | | |
|--|----------------|------|------|
| | 1993 | 1994 | 1995 |
| ESE / 5791 | 0.17 | 0.60 | 0.38 |
| ESE / 6553 | 0.21 | 0.70 | 0.33 |
| ESE / 7620 | 0.13 | 0.50 | 0.38 |
| SSW / 2073 | 0.02 | 0.65 | 0.06 |
| WNW / 7925 | 0.17 | 0.60 | 0.41 |
| WSW / 7010 (goat) | 0.17 | 0.67 | none |

f NRC Request

Provide data on fraction of the year that leafy vegetables are grown (Note: FSAR Section 11 (11.3.10.1 "TVA assumes that enough fresh vegetables are produced at each residence to supply annual consumption by all members of that household.") Confirm and provide basis for absolute humidity: Factor H Table 6.3 p. 85/195 of ODCM (9 g/m³).

TVA Response

During the Annual Land Use Survey, it was determined that the fraction of the year that the leafy vegetables are grown ranges between 4 to 6 months.

The basis for absolute humidity: Factor H Table 6.3 p. 85/195 of the Offsite Dose Calculation Manual (ODCM) (9 grams per cubic meter [g/m³]) is based on the following calculations, which were performed for Sequoyah and Browns Ferry Nuclear Plants. WBN assumed the (9 g/m³) due to plant region and the over-estimation that is inherent in the calculation.

TVA's ODCMs include absolute humidity in the denominators of equations for ingestion dose factors. An estimated value of 9 g/m³ is used based on the calculations performed for Browns Ferry and Sequoyah. The methodology used to determine the absolute humidity is examined as follows:

Absolute humidity (H) is "the ratio of the mass of water vapor present to the volume occupied by the mixture; that is, the density of the water vapor component." (Glossary of Meteorology) Absolute humidity is not directly measured, but must be calculated from those variables which are measured by TVA. TVA measures the temperature (T) and dewpoint (Td) at 10m at each nuclear plant. In the 1970s and early 1980s TVA also measured the barometric pressure. These three values can be used to

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calculate other measures of moisture which then yield the absolute humidity by the following steps:

1. T and Td must be converted to Kelvin. Since they are measured in Fahrenheit the conversion is

$$(T \text{ or } T_d) \text{ in (Kelvin)} = \frac{5 * (T-32)}{9} + 273.16$$

2. Barometric pressure (p) must be converted to millibars. The conversion is

$$P \text{ (mb)} = 33.8639 * p \text{ (in Hg)}$$

3. The saturation vapor pressure (e) in millibars must be calculated from an approximation given in the Smithsonian Meteorological Tables, page 350. It is dependent only on the dewpoint.

$$\begin{aligned} \log_{10} (e) = & -7.90298(373.16/T_d-1) + 5.02808 * \log_{10} (373.16/T_d) \\ & -1.3816*10^{-7}(10^{11.344(1-T_d/373.16)}-1) \\ & +8.1328 * 10^{-3} (10^{-3.49149(373.16/T_d-1)}-1) \\ & + \log_{10} (1012.25) \end{aligned}$$

(This approximation is sufficiently accurate to apply it to the normal range of temperatures below 273.16K in the TVA region even though it is specifically derived for temperature above 273.16K.)

4. The saturation mixing ratio (w) can then be calculated from:

$$w = \frac{0.622 (e)}{p - e} * 10^3 \text{ (g/kg)}$$

(from Hess, p59).

5. The density of dry air (d) is calculated from:

$$d = \frac{p * 10^6}{R * T} \text{ (kg/m}^3\text{)}$$

Where R is the gas constant for dry air ($2.8704*10^6 \text{ m}^2 \text{ g}^{-2} \text{ K}^{-1}$)
(from Hess, p16., equation 2.8)

6. Absolute Humidity can then be calculated from:

$$H = w * d \text{ (g/m}^3\text{)}$$

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This methodology was used in the computer code RELABSHMREV to generate annual and seasonal average values of absolute humidity for Browns Ferry and Sequoyah using meteorological data collected for the period January 1, 1978, through December 31, 1979. These values and the extreme maximum and minimum values are given in the table below.

| Browns Ferry | | | | Sequoyah | | | |
|---------------------------------------|---------|-------------|-------------|---------------------------------------|---------|-------------|-------------|
| Absolute Humidity (g/m ³) | | | | Absolute Humidity (g/m ³) | | | |
| | Average | Extreme Max | Extreme Min | | Average | Extreme Max | Extreme Min |
| Winter | 4.6 | 16.6 | 1.3 | Winter | 4.2 | 16 | 0.8 |
| Spring | 9.6 | 20.1 | 2.1 | Spring | 8.9 | 20.2 | 1.8 |
| Summer | 17.7 | 24.1 | 7.5 | Summer | 16.7 | 23.6 | 8 |
| Fall | 11.0 | 22.1 | 2.1 | Fall | 10.5 | 20.8 | 1.9 |
| Average | 10.7 | 24.1 | 1.3 | Average | 10.1 | 23.6 | 0.8 |

These data indicate that use of 9 g/m³ on an annual basis would result in an overestimate of the associated dose factors by a factor of about 1.1 to 1.2 for the average. On average, overestimation in the summer would be by a factor of 1.9 to 2.0. Underestimation in the winter would be by a factor of about 2.0 to 2.1. The largest overestimation would occur in the summer and the largest underestimation in the winter. The extreme differences would be overestimation by a factor as large as 2.7 or an underestimation by a factor as large as 11.3.

References

Hess, S. L., 1959: Introduction to Theoretical Meteorology, Holt, Rinehart and Winston, Inc., NY.

Huschke, R. E., 1959: Glossary of Meteorology, R. E. Huschke, ed., American Meteorological Society, Boston, MA.

List, R. J., 1949: Smithsonian Meteorological Tables, Smithsonian Institution Press, Washington, DC.

g NRC Request

For the locations from which an individual can obtain aquatic food and/or drinking water and the shoreline areas that an individual can use for recreational purposes, provide the transit time of each facility discharge stream containing liquid radwaste discharge from the point at which the

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Response to NRC Request for Additional Information Regarding Environmental Review

stream enters an unrestricted area to the identified location, and the estimated stream dilution at that location.

TVA Response

For conservatism, a transit time of zero was assumed for releases to reach aquatic recreation areas; therefore, we do not assume any stream dilution.

h NRC Request

For each liquid radwaste discharge, the transit time from input to a facility discharge stream to the point at which the stream enters an unrestricted area, and the stream discharge in m³/sec (Note: Reg Guide 1.109 P 1.109-12 lists 12 hours as a minimum transit time for potable water.)

TVA Response

Decay time for water ingestion is equal to the travel time from the plant to the water supply plus one day to account for the time of processing at the water supply per Regulatory Guide 1.109.

i NRC Request

Provide the following distributional data for each of the 22.5-degree radial sectors centered on the 16 cardinal compass directions for radial distances of 2, 4, 6, 8, 10, 20, 40, 60, and 80 km (1.2, 2.5, 3.7, 5, 6.2, 12, 25, 27, and 50 mi) from the reactor: (1) projected population for five years from the time of the licensing action under consideration, (2) present annual meat production (kg/yr), (3) present annual milk production (L/yr), (4) present annual vegetable production (kg/yr), and (5) estimate of direct radiation doses from sources within the site.

TVA Response

For item RP-1i, NRC Staff will use information previously submitted by TVA to complete this analysis.

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j NRC Request

Provide the present commercial fish catch (in kg/yr from waters within 50 mi downstream of the facility radwaste discharge (Note: Fish harvest -3.04 lb/acre/y (variable HVST P77/195 of ODCM. From reference 12 (1 TVA memorandum on fish harvest. Dated Dec 15, 1987.) Confirm that there is no invertebrate catch to be considered. Provide transit time from the point at which the discharge stream enters an unrestricted area to each major catch location, the estimated dilution at each location, and the basis for calculating transit time and dilution.

TVA Response

TVA's information relating to commercial fish catch downstream of the facility is contained in the annual WBN REMP report which samples fish representative of the commercial and recreational species in the areas downstream of the WBN radwaste discharge.

k NRC Request

Provide the transit time and estimated dilution at each major location for drinking water intake locations within 80 km (50 mi) of the facility radwaste discharge (downstream or radius), the basis for calculating transit time and dilution, and the populations served or the daily water consumption at each location.

TVA Response

WBN is located on the Tennessee River at TRM 528. FSAR Section 11.2.8 states "The Dosimetry calculations for drinking water are based on the assumption that the liquid effluent will be mixed with 10% of the river flow between the point of discharge and Tennessee River Mile 510.0, where 100% dilution is assumed to occur." The transit times are based on the average quarterly river flow of 25,657 cubic feet per second (cfs) recorded from 1985 to 1994. Annual drinking water quantities for the average and maximally exposed individual were referenced from NRC Regulatory Guide 1.109.

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Response to NRC Request for Additional Information Regarding Environmental Review

Public Water Supplies Within 50-Mile Radius Downstream of WBN

| Name | TRM | Transit Time Days | 1990 Population |
|---|-----|----------------------|-----------------|
| Dayton, TN | 504 | 1.9 | 13,500 |
| Soddy-Daisy/Falling Water Utility District | 487 | 5.2 | 10,000 |
| East Side Utility, TN | 473 | 8.3 | 35,000 |
| Chattanooga, TN | 465 | 9.9 | 167,500 |

Note: Tennessee River mile locations are rounded to the nearest mile for dose calculation purposes.

l NRC Request

Confirm that irrigation is not used for crops in the vicinity.

TVA Response:

The potential use of irrigation from the Tennessee River is reviewed for home garden locations identified by the REMP annual land use survey. No locations using irrigation from the Tennessee River were identified in the most recent land use survey.

m NRC Request

Confirm that there are no unusual animals, plants, agricultural practices, game harvests, or food processing operations having the potential to contribute 10 percent or more to either individual or population doses in areas affected by liquid effluents, and food-processing operations involving large quantities of water.

TVA Response

Not required for REMP land use survey.

n NRC Request

Provide the reference(s) for the sources of radioactive liquid and gaseous waste released from Unit 2, as addressed in the TVA FSEIS, Section 3.14, pp. 91-94.

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Response to NRC Request for Additional Information Regarding Environmental Review

TVA Response

- TVAN WBNTSR-093, "Liquid Radioactive Waste Release," which is based on NUREG-017 and ANSI/ANS-18.1-1984.
- TVAN TI-534, "Annual Routine Radioactive Airborne Releases from Operation of One Unit," which is also based on NUREG-017.

o NRC Request

Identify (preferably on a diagram) and provide a reference for principal release points for gaseous and liquid radioactive materials to the environment.

Identify and provide a reference for direct radiation sources within or onsite out-of-plant as solid waste (e.g., independent fuel storage).

TVA Response

Principal release points to the environment for liquid and gases were provided in Figures 3-7, 3-8, and 3-9 in the TVA FSEIS.

Radiation fields are produced in nuclear plant environments as a result of radioactivity contained within the reactor and its associated components. Doses from sources within the plant are primarily due to nitrogen-16, a radionuclide produced in the reactor core. Since primary coolant of pressurized water reactors is contained in a heavily shielded area of the plant, dose rates in the vicinity of pressurized water reactors are generally undetectable (less than 5 millirem per year) (FEIS for the Production of Tritium in a CLWR March 1999). This can be contrasted with the annual background dose (NCRP 1987) estimated to be 300 millirems.

Low-level direct radiation sources located outside at WBN are the Old Steam Generator Storage Facility (OSGSF), Radwaste Pad, and Decon Building. See WBN Unit 1 FSAR, Chapters 11.5.5.2; 12.3. (The first two buildings are in the Unit 1 FSAR; all three will be included in one of the next updates to the Unit 2 FSAR.) These storage locations are estimated to contribute less than 0.01 millirem per year at the site boundary. (FEIS for the Production of Tritium in a CLWR March 1999.)

Enclosure 2

List of Regulatory Commitments

Tennessee Valley Authority
Watts Bar Nuclear Plant - Unit 2, Docket No. 50-391

TVA will provide a response to the following Request for Additional Information on or before April 23, 2010:

| | |
|-------------|---|
| <i>H-16</i> | <i>The figure included in Appendix B of the 2007 TVA EIS shows water flow rates for plant systems with one unit in operation. Provide an update of this figure showing the flow rates for the system with WNB Unit 1 and 2 in operation. Provide an update to the table on page 3-3 of 1978 EIS to include values that include the flow rates needed for both units in operation.</i> |
|-------------|---|

The first two buildings are in the Unit 1 FSAR; TVA will include all three buildings (the Old Steam Generator Storage Facility, Radwaste Pad, and Decon Building) in one of the next updates to the Unit 2 FSAR.

| | |
|--------------|---|
| <i>RP-1o</i> | <i>Identify (preferably on a diagram) and provide a reference for principal release points for gaseous and liquid radioactive materials to the environment.</i> <i>Identify and provide a reference for direct radiation sources within or onsite out-of-plant as solid waste (e.g., independent fuel storage)..</i> |
|--------------|---|