



UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

October 30, 2015

Mr. Joseph W. Shea
Vice President, Nuclear Licensing
Tennessee Valley Authority
1101 Market Street, LP 3R-C
Chattanooga, TN 37402-2801

SUBJECT: NUCLEAR REGULATORY COMMISSION REPORT FOR THE AUDIT OF TENNESSEE VALLEY AUTHORITY'S FLOOD HAZARD REEVALUATION REPORT SUBMITTALS RELATING TO THE NEAR-TERM TASK FORCE RECOMMENDATION 2.1-FLOODING FOR: BROWNS FERRY NUCLEAR PLANT, UNITS 1, 2 AND 3; SEQUOYAH NUCLEAR PLANT, UNITS 1 AND 2; AND WATTS BAR NUCLEAR PLANT, UNITS 1 AND 2 (TAC NOS. MF6034, MF6035, MF6036, MF6032, MF6033, MF5857 AND MF5858)

Dear Mr. Shea:

By letter dated April 17, 2015 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML15106A632), the U.S. Nuclear Regulatory Commission (NRC) informed you of the staff's plan to conduct a regulatory audit of Tennessee Valley Authority's (TVA) Flood Hazard Reevaluation Report (FHRR) submittals related to the Near-Term Task Force Recommendation 2.1-Flooding for Browns Ferry Nuclear Plant, Units 1, 2 and 3; Sequoyah Nuclear Plant, Units 1 and 2; and Watts Bar Nuclear Plant, Units 1 and 2. The audit was intended to support staff reviews of FHRRs and the subsequent issuance of a staff assessment.

The audit(s) were conducted over multiple sessions from April 2015 to July 2015 and were performed consistent with NRC Office of Nuclear Reactor Regulation, Office Instruction LIC-111, "Regulatory Audits," dated December 29, 2008, (ADAMS Accession No. ML082900195). Therefore, the purpose of this letter is to provide you with the final audit report, which summarizes and documents the NRC's regulatory audit of TVA's FHRR submittals. The details of this audit report have been discussed with Mr. Russell Thompson of your staff.

Attachment 2 transmitted herewith contains Security-Related Information. When separated from the Enclosure, this document is decontrolled.

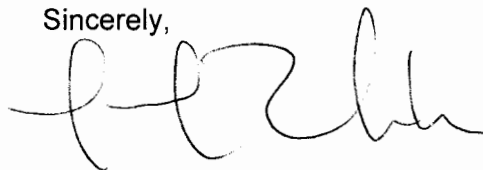
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J. Shea

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If you have any questions, please contact me at (301) 415-3809 or by e-mail at Juan.Uribe@nrc.gov.

Sincerely,

A handwritten signature in black ink, appearing to read 'Juan Uribe', written in a cursive style.

Juan Uribe, Project Manager
Hazards Management Branch
Japan Lessons-Learned Division
Office of Nuclear Reactor Regulation

Docket Nos. 50-259, 50-260, 50-296,
50-327, 50-328, 50-390 and 50-391

Enclosure:
Audit Report

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UNITED STATES
NUCLEAR REGULATORY COMMISSION
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NUCLEAR REGULATORY COMMISSION AUDIT SUMMARY FOR THE AUDIT OF
TENNESSEE VALLEY AUTHORITY'S FLOOD HAZARD REEVALUATION REPORT
SUBMITTALS RELATING TO THE NEAR-TERM TASK FORCE RECOMMENDATION 2.1-
FLOODING FOR: BROWNS FERRY NUCLEAR PLANT, UNITS 1, 2 AND 3; SEQUOYAH
NUCLEAR PLANT, UNITS 1 AND 2; AND WATTS BAR NUCLEAR PLANT, UNITS 1 AND 2

BACKGROUND AND AUDIT BASIS:

By letter dated March 12, 2012, the U.S. Nuclear Regulatory Commission (NRC) issued a request for information to all power reactor licensees and holders of construction permits in active or deferred status, pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR), Section 50.54(f) "Conditions of license" (hereafter referred to as the "50.54(f) letter"). The request was issued in connection with implementing lessons-learned from the 2011 accident at the Fukushima Dai-ichi nuclear power plant, as documented in The Near-Term Task Force Review of Insights from the Fukushima Dai-ichi Accident. Recommendation 2.1 in that document recommended that the staff issue orders to all licensees to reevaluate seismic and flooding for their sites against current NRC requirements and guidance. Subsequent Staff Requirements Memoranda (SRM) associated with Commission Papers SECY 11-0124 and SECY-11-0137, instructed the NRC staff to issue requests for information to licensees pursuant to 10 CFR 50.54(f).

By letter's dated March 12, 2015, Tennessee Valley Authority (TVA, the licensee) submitted its Flood Hazard Reevaluation Reports (FHRRs) for Browns Ferry Nuclear Plant, Units 1, 2, and 3 (BFNP, Browns Ferry) (Agencywide Documents Access and Management System (ADAMS) Accession No. ML15072A130); Sequoyah Nuclear Plant, Units 1 and 2 (SQN, Sequoyah) (ADAMS Accession No. ML15071A462); and Watts Bar Nuclear Plant, Units 1 and 2 (WBN, Watts Bar) (ADAMS Accession No. ML15071A262). The NRC is in the process of reviewing the aforementioned submittals and has completed a regulatory audit of TVA to better understand the development of the submittals, identify any similarities/differences with past work completed and ultimately aid in its review of licensees' FHRRs. This audit summary is being completed in accordance with the guidance set forth in NRC Office of Nuclear Reactor Regulation, Office Instruction LIC-111, "Regulatory Audits," dated December 29, 2008, (Agencywide Documents Access and Management System (ADAMS) Accession No. ML082900195).

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AUDIT LOCATION AND DATES:

The audit was completed over multiple sessions over a period of 4 months, as described below:

- April 22, 2015 from 1:00pm to 4:00pm- webinar session
- May 12, 2015 from 1:00pm to 4:00pm- webinar session
- June 3-4, 2015 from 8:00am to 4:00pm- TVA Head Quarters Chattanooga, TN
- July 30, 2015 from 1:00pm to 2:00pm- Exit Meeting Conference call.

AUDIT TEAMS:

Title	Team Member	Organization
Team Leader, NRR/JLD	Juan Uribe	NRC
Branch Chief, NRO/DSEA	Christopher Cook	NRC
Technical Lead	Michael Willingham	NRC
Technical Support	Yuan Cheng	NRC
Technical Support	Stephen Breithaupt	NRC
Licensing	Russell Thompson	TVA
Projects	Thomas Spink	TVA
Engineering	Penny Selman	TVA
Projects	Kevin Dutton	TVA
Projects	Kyle Bianco	TVA
Engineering	Karen Carboni	TVA
Projects	Scott Carter	TVA
Projects	Dennis Lundy	TVA
Engineering	Justin Huber	TVA
Contractor	Trevor Cropp	BWSC
Contractor	Eric King	BWSC
Contractor	Heather Smith	BWSC
Contractor	Stu Henry	BWSC

DOCUMENTS AUDITED:

Attachment 1 of this report contains Table 1, which details the documents that were reviewed by the NRC staff, in part or in whole, as part of this audit. The documents were located in an electronic reading room during staff review.

AUDIT ACTIVITIES:

In general, the audit activities consisted mainly of the following actions:

- Review background information on site topography and geographical characteristics of the watershed.
- Review site physical features and plant layout
- Understand the selection of important assumptions and parameters that would be the basis for evaluating the individual flood causing mechanisms described in the 50.54(f) letter.
- Review model input/output files to computer analyses, such as the Hydrologic Engineering Center (HEC)- River Analysis System (RAS) and HEC- Hydrologic Modeling System (HMS) to have an understanding of how modeling assumptions were programmed and executed

Attachment 2 of this report contains Table 2, which provides more detail and summarizes specific technical topics (and resolution) of important items that were discussed and clarified during the audit. The items discussed in Table 2 may be referenced/mentioned in the staff assessment in more detail.

EXIT MEETING/BRIEFING:

During the audit exit meeting held on July 30, 2015, the NRC communicated that:

- No findings or open/unresolved items were found during the audit,
- TVA did not provide information in its FHRR or during the audit related to certain flood event duration parameters (including warning time and period of inundation) and flood related associated effects.

Based on discussions with your staff, these are being developed by TVA and will be evaluated by the NRC during the NRC staff's review of the Mitigating Strategies Assessment (MSA). Additional information related to the MSAs is described in NRC letter, "Coordination of Request for Information Regarding Flooding Hazard Reevaluation and Mitigating Strategies for Beyond-Design-Basis External Events" (ADAMS Accession No. ML15174A257). This letter describes the changes in the NRC's approach to the flood hazard reevaluations that were approved by the Commission in its SRM to COMSECY-15-0019, "Closure Plan for the Reevaluation of Flooding Hazards for Operating Nuclear Power Plants" (ADAMS Accession No. ML15209A682).

1. Attachment 1- List of References
Reviewed by the NRC

2. Attachment 2- Information Needs
Discussed During Audit-Security Related Information

Table 1: List of References Reviewed by the NRC

Calculation Packages Cited
TVA (Tennessee Valley Authority), 2008, Calculation CDQ000020080053, Revision 1, PMF Inflows, EDMS #B41 120628 004.
TVA (Tennessee Valley Authority), 2012, Calculation CDQ0000002012000006, Revision 001, BWSC Calculation TVAGENQ114007, Revision 0, HEC-RAS Model Calibration and Model Set-up- Main Stem, EDMS #B41140919 002.
TVA (Tennessee Valley Authority), 2013a, Calculation CDQ0000002013000007, Revision 001, BWSC Calculation TVAGENQ14001, Revision 1, Main Stem Initial Dam Rating Curves.
TVA (Tennessee Valley Authority), 2013b, Calculation CDQ0000002014000013, Revision 000, BWSC Calculation TVAGENQ13004, Revision 0, Baseflow.
TVA (Tennessee Valley Authority), 2013c, Calculation CDQ0000002013000057, Fukushima NTTF Recommendation 2.1: Sequoyah Local Intense Precipitation Analysis, Revision 1.
TVA (Tennessee Valley Authority), 2013d, Calculation CDQ0000002013000163, Fukushima NTIF Recommendation 2.1: Watts Bar Local Intense Precipitation Analysis, Revision 1, EDMS #T71 140606 801.
TVA (Tennessee Valley Authority), 2014a, Calculation CDQ0000002014000012, Revision 000, BWSC Calculation TVAGENQ13005, Revision 0, Unit Hydrograph Adjustment.
TVA (Tennessee Valley Authority), 2014b, Calculation CDQ0000002014000014, Revision 000, BWSC Calculation TVAGENQ13003, Revision 0, Curve Number Determination.
TVA (Tennessee Valley Authority), 2014c, Calculation CDQ0000002014000015, Revision 000, BWSC Calculation TVAGENQ13008, Revision 0, Inflows
TVA (Tennessee Valley Authority), 2014d, Calculation CDQ0000002014000016, Revision 001, BWSC Calculation TVAGENQ14001, Revision 1, Tributary Initial Dam Rating Curves.
TVA (Tennessee Valley Authority), 2014e, Calculation CDQ0000002014000018, Revision 000, BWSC Calculation TVAGENQ13007, Revision 0, HEC-RAS Tributary Model Calibration, EDMS #B41140919 003.

TVA (Tennessee Valley Authority), 2014f, Calculation CDQ0000002014000019, Revision 001, BWSC Calculation TVAGENQ14003, Revision 1, HEC-RAS Tributary Unsteady Flow Rules.
TVA (Tennessee Valley Authority), 2014g, Calculation CDQ0000002014000023, Revision 000, BWSC Calculation TVAGENQ14009, Revision 0, Fukushima NTIF Recommendation 2.1: HEC-RAS Probable Maximum Flood Simulations.
TVA (Tennessee Valley Authority), 2014h, Calculation CDQ0000002014000024, Revision 000, BWSC Calculation TVAGENQ14010, Revision 0, Fukushima NTIF Recommendation 2.1: Seismic Dam Failure Simulations
TVA (Tennessee Valley Authority), 2014i, Calculation CDQ0000002014000025, Revision 000, BWSC Calculation TVAGENQ14011, Revision 0, Fukushima NTIF Recommendation 2.1: Sunny Day Dam Failure Simulations
TVA (Tennessee Valley Authority), 2014j, Calculation CDQ0000002014000030, Revision 000, BWSC Calculation TVAGENQ14015, Revision 0, Inflow Hydrograph Development for Seismic Events
TVA (Tennessee Valley Authority), 2014k, Calculation CDQ0000002014000032, Revision 000, BWSC Calculation TVAGENQ14018, Revision 0, Fukushima NTIF Recommendation 2.1: Uncertainty Simulations.
TVA (Tennessee Valley Authority), 2014l, Calculation CDQ0000002014000033, Revision 000, BWSC Calculation TVAGENQ14020, Revision 0, Fukushima NTIF Recommendation 2.1: Wind Waves for Combined - Effect Floods
TVA (Tennessee Valley Authority), 2014m, Calculation CDQ00000020140000249, Revision 1, BWSC Calculation TVABFNQ13001, Revision 1 Fukushima NTTF Recommendation 2.1: Browns Ferry Local Intense Precipitation Analysis.
Additional Cited Documents from the ERR
TVA (Tennessee Valley Authority), 2015a, Technical Memorandum, "National Inventory of Dams Inflows." December 19, 2014, EDMS #W50 150107 001.
TVA (Tennessee Valley Authority), 2015b, Multiple Dam Failure Screening Analysis for the Tennessee Valley Authority's Dams, March 31, 2014, EDMS #W50 150108 001.
TVA (Tennessee Valley Authority), 2015c, Simplified Volume Analysis for Multiple Dam Failures, November 24, 2014. EDMS #W50 141126 001
TVA (Tennessee Valley Authority), 2015d, From Electronic Reading Room, "NRC Flood HRR Audit Meeting (6-3 4-2015)
TVA (Tennessee Valley Authority), 2015e, From Electronic Reading Room, "6_3_2015 Webinar Main Slides 6_1 final R3.pdf"

TVA (Tennessee Valley Authority), 2015f, "NRC Flood HRR Audit Meeting (5-12-2015)"
TVA (Tennessee Valley Authority), 2015g, "5_12_2015 Webinar Main Slides 5_9_2015_bwsc_edits(2)"
TVA (Tennessee Valley Authority), 2015h, "21400 PMF SQN Inundation Time"
TVA (Tennessee Valley Authority), 2015i, "21400 PMF WBN Inundation Time"
TVA (Tennessee Valley Authority), 2015j, "7980 No EAP-BFN.pptx"
TVA (Tennessee Valley Authority), 2015k, "Attachment 2-Multiple Seismic Volumes"
TVA (Tennessee Valley Authority), 2015l, "Sediment WBN (2).pptx"
TVA (Tennessee Valley Authority), 2015m, "Seismic Warning Time SQN.pdf"
TVA (Tennessee Valley Authority), 2015n, "W50 150309 002 Watts Bar Dam Sediment.pdf"
TVA (Tennessee Valley Authority), 2015o, "Army Corps of Engineers Engineering Technical Letter (ETL) 1110-2-8 [1966]"
TVA (Tennessee Valley Authority), 2015p, "BFN_EAST_Storage_and_XS_Stage_comparison.pdf"
TVA (Tennessee Valley Authority), 2015q, "BFN_East_Time_of_Concentration_paths.pdf"
TVA (Tennessee Valley Authority), 2015r, "CRH 23W201SR9_SD1.pdf"
TVA (Tennessee Valley Authority), 2015s, "CRH 23W203SR4_SD2 & SD3.pdf"
TVA (Tennessee Valley Authority), 2015t, "CRH_20020130_TVA_Dwg23W202R12_SouthEmbankmentPlansSections (2).pdf"
TVA (Tennessee Valley Authority), 2015u, "CRH_20141218_Stantec_ExcerptFromPMFModificationsForWBN2byRCC (4).pdf"
TVA (Tennessee Valley Authority), 2015v, "CRH_20150604_TVA_SaddleEmbankmentWaveEffects"
TVA (Tennessee Valley Authority), 2015w, "Douglas Overtopping.pptx"
TVA (Tennessee Valley Authority), 2015x, "Rouse number.docx"
TVA (Tennessee Valley Authority), 2015y, "W50 150129 001 Breach Selection Memo_20121219_150490258"
TVA (Tennessee Valley Authority), 2015z, "W50 150604 001, Wind Wave Methodology Comparison Memo Final"
TVA (Tennessee Valley Authority), 2015aa, "WBN Intake Channel Configuration.pdf"
TVA (Tennessee Valley Authority), 2015ab, "Wind Gage Height.pptx"
TVA (Tennessee Valley Authority), 2015ac, "WBN 7980.pdf"
TVA (Tennessee Valley Authority), 2015ad, "Seismic Warning Time WBN"
TVA (Tennessee Valley Authority), 2015ae, "Sediment WBN (2)"
Other Referenced Documents

ANSI/ANS (American National Standards Institute/American Nuclear Society), 1992, ANSI/ANS-2.8-1992, "Determining Design Basis Flooding at Power Reactor Sites," American Nuclear Society, LaGrange Park, IL, July 1992. [Section 5.5.4.2.3 Earth and Rockfill]

Breithaupt, S., R. Prasad, J. Staeheli, C. Lee, T. Kim, and R. Labiosa. 2010. Bellefonte Units 3 and 4, Development of Confirmatory Model of the Tennessee River. Prepared for the U.S. Nuclear Regulatory Commission under an Interagency Agreement with the U.S. Department of Energy Contract DE-AC05-76RL01830. PNNL-19698. Pacific Northwest National Laboratory, Richland, Washington.

Chow, V.T., 1959, Open-Channel Hydraulics, McGraw-Hill, New York.

NRC, (U.S. Nuclear Regulatory Commission). 2015. "Watts Bar Nuclear Plant, Unit 1 – Issuance of Amendment to Revise Updated Final Safety Analysis Report Regarding Changes to Hydrology Analysis." January 28, 2015. ADAMS Accession No. ML15005A314.

TVA, (Tennessee Valley Authority). 2014. Supplement to Application to Revise Watts Bar Nuclear Plant Unit I Updated Final Safety Analysis Report Regarding Changes to Hydrologic Analysis (WBN-UFSAR-12-01). September 30, 2014. Page E7-2 of part 6 of 6, Enclosure 7-Dam Modifications. (ML14289A112 [part of ML14289A106]).

USACE (U.S. Army Corp of Engineers), "Hydraulic Design Criteria", U.S. Army Engineer Waterway Station, Eighteenth Issue, Hydraulic Design Chart 711 (HDC 711), Vicksburg, MS, 1998.

J. Shea

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If you have any questions, please contact me at (301) 415-3809 or by e-mail at Juan.Uribe@nrc.gov.

Sincerely,
/RA/

Juan Uribe, Project Manager
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Docket Nos. 50-259, 50-260, 50-296,
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