WBN2Public Resource

From: Boyd, Desiree L [dlboyd@tva.gov]
Sent: Friday, December 17, 2010 2:32 PM
To: Epperson, Dan; Wiebe, Joel; Poole, Justin; Raghavan, Rags; Milano, Patrick; Campbell, Stephen
Cc: Crouch, William D; Hamill, Carol L; Boyd, Desiree L; Elton, Thomas L
Subject: TVA letter to NRC_12-17-10_SSER22 RAI Response
Attachments: 12-17-10_SSER22 RAI Response_NRC Copy.pdf

Please see attached TVA letter that was sent to the NRC today.

The attachments are too large to send by e-mail. For those of you who receive a cc in the mail, the attachments will be included with your letter.

Thank You,

~*~*~*

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Subject: TVA letter to NRC_12-17-10_SSER22 RAI Response
Sent Date: 12/17/2010 2:32:03 PM
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From: Boyd, Desiree L

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Tennessee Valley Authority, Post Office Box 2000, Spring City, Tennessee 37381-2000

December 17, 2010

10 CFR 50.4(b)(6)
10 CFR 50.34(b)
10 CFR 2.390(d)(1)

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 – Safety Evaluation Report Supplement 22 (SSER22) – Response to Requests for Additional Information**

This letter responds to a number of NRC staff requests for additional information (RAIs) necessary to complete Supplement 22 to the WBN SER.

Enclosure 1 provides the responses to the RAIs.

There are no new regulatory commitments contained in this letter. If you have any questions, please contact William Crouch at (423) 365-2004.

I declare under penalty of perjury that the foregoing is true and correct. Executed on the 17th day of December, 2010.

Sincerely,

M. Bajestani

Masoud Bajestani
Watts Bar Unit 2 Vice President

Enclosure 1: Response to RAIs Necessary to Complete Supplement 22 to the WBN SER

Attachment 1: Procedures Noted in Response to RAI 3.11 - EQ - 2.

cc (Enclosure):

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ENCLOSURE 1

Response to RAIs Necessary to Complete Supplement 22 to the Watts Bar SER

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

Qualification Methods

3.11 - EQ - 1. *In its FSAR amendments and supplemental letters, TVA stated that qualification tests and analyses for safety-related electrical equipment were conducted in accordance with the requirements of 10 CFR 50.49 and the guidelines of NUREG-0588, Revision 1. In NUREG-0588, Revision 1, the NRC staff presents detailed procedures for qualifying safety-related electrical equipment in a harsh environment. The NUREG-0588 criteria apply to equipment that is important to safety as defined in 10 CFR 50.49.*

The staff concluded that the qualification methods used by TVA are consistent with NRC regulations and are, therefore, acceptable. However, based on the extensive layup period of equipment within WBN Unit 2, the NRC staff must review, prior to fuel load, the assumptions used by TVA to re-establish a baseline for the qualified life of equipment. The purpose of the staff's review is to ensure that TVA has addressed the effects of environmental conditions on equipment during the layup period.

Please provide the assumptions used by TVA to re-establish a baseline for the qualified life of equipment based on the extensive layup period of equipment within WBN Unit 2.

Response: For WBN Unit 2 equipment and cables that are not being replaced prior to startup, the layup period will be addressed in the qualified life evaluations. Engineering defines the service temperature and radiation dose conditions for the period following installation and prior to Unit 2 startup. The aging that occurred during this pre-operational period will be addressed in the qualified life calculations.

For the Reactor Building and Main Steam Valve Vault, the temperature will be assumed to be 100º F for conservatism (Calculation MDQ00200020100374, Unit 2 Layup Temperatures inside Reactor Building and Main Steam Valve Vault, has shown the value to be less than 100º F). All other areas are per the environmental drawings.

For all areas except the Reactor Building, the radiation dose will be assumed to be 1.5 times the normal 40 year dose for conservatism (the actual layup period from Unit 1 criticality to Unit 2 startup will be significantly less than 20 years). For the Reactor Building, the normal dose per the environmental drawings would be unreasonably high; thus, a conservative value of 1.5 times the normal 40 year dose of the Annulus is assumed (this is significantly higher than the actual dose since no dose source is present inside the Unit 2 Reactor Building during the layup period).

For cables which were installed during the layup period from Unit 1 criticality to Unit 2 startup, consideration is given to additional heat rise due to energized Unit 1 cables. Engineering will document applicable cases for input to the qualified life evaluations.

Electrical Equipment in a Harsh Environment

3.11 - EQ - 2. *Please provide TVA's EQ program procedures for WBN Unit 2.*

Response: The EQ program procedures for WBN Unit 2 are:

- 25402-3DP-GEE-00001, Rev. 0, "Equipment Environmental Qualification (EQ) Program"; and
- 25402-000-GPP-0000-N1106, Rev. 3, "Equipment Environmental Qualification."

These procedures were created for the construction phase of Unit 2 based on the existing Unit 1 EQ program to implement the equivalent requirements. Upon completion of construction, the Unit 1 procedures will be the governing documents.

Attachment 1 provides copies of the two procedures.

3.11 - EQ - 3. *The NRC staff requested TVA confirm that equipment being replaced or refurbished will be qualified as Category I, as required by 10 CFR 50.49. In its response dated September 1, 2010, TVA stated that "replaced equipment is being procured qualified to the NUREG-0588, Category I requirements." TVA also stated, however, that a small population of components is being refurbished. The NRC staff reviewed these components as noted below.*

a. *All 6.9 kV motors will be refurbished*

TVA considers the refurbishment activities to be routine maintenance that do not impact the qualification of the motors. The staff considers that routine maintenance activities should result in increasing the EQ of the motors to Category I status in accordance with 10 CFR 50.49. Please justify refurbishment of all 6.9 kV motors impact on EQ.

Response: The refurbishment of the 6.9 kV motors for Unit 2 involves routine maintenance activities. These maintenance activities do not modify the Category II motor insulation system originally supplied by Westinghouse. Motors which only require routine maintenance will remain Category II qualified.

In some cases, the maintenance activities determine the need to rewind the motor. The rewound motor insulation system will be qualified in accordance with the EPRI motor rewind program which meets Category I criteria. Motors which

require a rewind will be Category I qualified. Currently, one of the Unit 2 Containment Spray pump 6.9 kV motors is being rewound to repair insulation damage.

b. *Terminal Blocks*

TVA stated that it noted during a field walkdown that the terminal blocks installed in the EQ application for WBN Unit 2 are GE-make CR151B. According to TVA, these terminal blocks are qualified to NUREG-0588, Category I. TVA further noted that design modifications have been issued to inspect and replace the EQ terminal blocks that are found damaged or degraded with equivalent CR151B blocks.

Please clarify the use of the term "equivalent" (e.g., identical, similar) regarding the replacement terminal blocks. If the blocks are similar, please complete a similarity analysis and provide it to the NRC staff for review.

Response: For EQ applications, the replacement terminal blocks will be new GE CR151B terminal blocks certified to test reports that document qualification to NUREG-0588, Category I criteria.

c. *Main Steam Isolation Valves (MSIVs)*

TVA stated that the original WBN Unit 2 MSIVs are qualified to NUREG-0588, Category II. The MSIVs are being refurbished by replacing the missing subcomponents, including the solenoid valves, terminal blocks and manufacturing wiring, with components of the same make, model, and type as supplied on the original purchase order. With the exception of the solenoid valves, the subcomponents will be qualified to NUREG-0588, Category I requirements. According to TVA, the solenoid valves cannot be upgraded because equivalent subcomponents qualified to NUREG-0588, Category I requirements are not available.

Please justify not upgrading the MSIV solenoid valves to Category I in light of 10 CFR 50.49(l).

Response: 10 CFR 50.49(l) requires replacement equipment to be qualified in accordance with 10 CFR 50.49 unless there are sound reasons to the contrary. Regulatory Guide 1.89 (Revision 1), paragraph C.6.d indicates that one of the sound reasons for not upgrading replacement equipment is that replacement equipment qualified in accordance with the provisions of 10 CFR 50.49 does not exist. The MSIV supplier (Weir) has indicated that replacement solenoids qualified in accordance with the provisions of 10 CFR 50.49 are not available for the Unit 2 MSIVs.

Mild Environment

3.11 - EQ - 4. *The NRC staff requested that TVA clarify that, for a mild environment, the threshold for electronic components such as semiconductors or electronic components containing organic material is a total integrated dose of less than $1x10^3$ Rads, and that a threshold for a mild radiation environment for other equipment is less than $1x10^4$ Rads. In its response dated August 30, 2010, TVA stated that the upper threshold for the EQ Mild Environment is $1x10^4$ Rads for all components, which is consistent with WBN Unit 1. Since certain components may have a lower threshold for impacts from radiation exposure, TVA stated that it requires the following at WBN:*

- *Per design standards, any device, whether in a mild, essentially mild, or harsh environment, is required to be purchased to the environmental conditions where it is to be located. That includes the usual radiation, temperature, humidity, etc. guidelines. An environmental conditions data sheet with the stated environmental parameters is sent to the manufacturer along with the purchase request and [TVA asks] the vendor to meet those conditions.*

- *For MOS [metal oxide semiconductors], CMOS or like circuitry, the same holds true. But, the design standard for qualification of electrical equipment in a harsh environment specifically requires that any of this type circuitry be evaluated on a case-by-case basis for any gamma dose exceeding $1x10^3$ Rads.*

Please provide supporting documentation to justify TVA's establishment of a mild environment threshold for total integrated dose of less than $1x10^3$ Rads for electronic components such as semiconductors or electronic components containing organic material.

Response: Note: NRC verbally provided the clarification that "$1x10^4$ Rads" was the intended value in the last paragraph of the request.

In order to establish the upper threshold cutoff value for radiation levels in EQ Mild Environments, TVA did an analysis of a pertinent segment of available literature on radiation effects on both individual electronic components and electronic component assemblies. The literature was primarily EPRI documents, articles published in the IEEE Transactions on Nuclear Science, Radiation Effects Research Institute (REIC) reports, and other industry publications (References 1 through 17). The publications addressed both organic and inorganic materials. TVA concluded that typical, non-selected electronic components will, with certain notable exceptions, tolerate a total integrated radiation dose of greater than $5x10^4$ Rads without significant degradation of their performance. Based on this analysis, TVA established a radiation cutoff for mild environments of $1x10^4$ Rads. The evaluation of the "notable exceptions" (e.g., metal oxide semiconductors) was

addressed in the earlier August 30, 2010, response as outlined the second bullet above in the request.

1. Radiation Effects Information Center (REIC) Report No. 36, "The Effect of Nuclear Radiation on Electronic Components, Including Semiconductors," October 1, 1964

2. Electric Power Research Institute (EPRI) NP-2129, "Radiation Effects on Organic Materials in Nuclear Plants," November 1981

3. Effects of Radiation on Materials and Components, by John F. Kircher and Richard F. Bowman, Reinhold Publishing Corporation, New York, New York, 1964

4. REIC Report No. 21, "The Effect of Nuclear Radiation on Elastomeric and Plastic Components and Materials," September 1, 1961

5. EPRI NP-4172M, "Radiation Data for Design and Qualification of Nuclear Plant Equipment," August 1985

6. EPRI NP-3326, "Correlation Between Aging and Seismic Qualification for Nuclear Plant Electrical Components," December 1983

7. Johnson, R.T., Jr., Thome, F.V. and Craft, C.M., "A Survey of Aging of Electronics with Application to Nuclear Power Plant Instrumentation," IEEE Transactions on Nuclear Science, Vol. NS-30, No. 6, December 1983

8. Johnson, R.T., Jr., Thome, F.V. and Craft, C.M., "Aging of Electronics with Application to Nuclear Power Plant Instrumentation," IEEE Transactions on Nuclear Science, Vol. NS-31, No. 1, February 1984

9. Gleason, James F., "Aging and Seismic Performance for Safety-related Equipment in a Mild Environment," IEEE Transactions on Nuclear Science, Vol. NS-31, No. 1, February 1984

10. Binkley, David M., "A Low-Cost Radiation-Hardened Preamplifier for Piezoelectric Accelerometers in Nuclear Power Plants," IEEE Transactions on Nuclear Science, Vol. NS-29, No. 6, December 1982

11. EPRI NP-4172SP, "Radiation Data for Design and Qualification of Nuclear Plant Equipment," August 1985

12. Nuclear Radiation Detection, by William J. Price, McGraw-Hill Book Co., New York, New York, 1964

13. Transistor, Thyristor and Diode Manual, Radio Corporation of American (RCA), Harrison, New Jersey 1969

14. SCR Manual, Sixth Edition, General Electric Semiconductor Products Department, published by Prentice-Hall, Inc., Englewood Cliffs, NJ, 1982

15. Meyers, D.K. and Herzog, Williams, "Feasibility Study on the Design and Radiation Testing of Complex Functions for $2X10^8$ (Si)", IEEE Transactions on Nuclear Science, Vol. NS-29, No. 6, December 1982

16. Measel, P.R., Greegor, R.B., and Wahlin, K.L., "Radiation Response of Several Memory Device Types," IEEE Transactions on Nuclear Science, Vol. NS-27, No. 6, December 1980

17. Myers, D.K., Herzog, W., Phy, W., and Coppage, F., "Ionizing Radiation Effects on Copperclad Polyimide," IEEE Transactions on Nuclear Science, Vol. NS-31, No. 6, December 1984