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MAY 23 1994

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555

Gentlemen:

In the Matter of the Application of) Docket No. 50-390
Tennessee Valley Authority)

WATTS BAR NUCLEAR PLANT (WBN) UNIT 1 - EAGLE-21 PROCESS PROTECTION SYSTEM
(TAC M81063)

This letter provides supplemental information concerning WBN's Eagle-21 process protection system in response to questions from the NRC staff that were posed during telephone conversations on January 12, 1994, and January 31, 1994. Both of these telephone conversations between the NRC and TVA included participation by Messrs. Eric Lee and Peter Tam of the NRC staff. The first telephone conversation also included participation by Messrs. Harry Balukjian, Matt Chiramal, and Kulin Desai of the NRC staff.

A number of different questions were discussed in the two telephone conversations and some of these questions were resolved without requiring TVA followup. However, four questions required either further investigation by TVA or confirmation in writing. These four questions are summarized in Enclosure 1 and TVA's response to each one is presented. Note that most of the questions involve clarifying information previously submitted by TVA in a letter dated December 27, 1993. This letter provided details of the design and testing of WBN's Eagle-21 system in response to a request for additional information from the NRC staff.

Enclosure 2 is a list of commitments made in Enclosure 1.

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If you have any questions about the information provided in this letter,
please telephone John Vorees at (615) 365-8819.

Sincerely,



Dwight E. Nunn

Enclosures

cc (Enclosures):

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ENCLOSURE 1

1. Electromagnetic Interference/Radio Frequency Interference (EMI/RFI) Testing

NRC Question:

TVA's letter dated December 27, 1993, stated that "TVA has contracted with Westinghouse to perform an EMI/RFI site survey of WBN's Eagle-21 system during hot functional testing. TVA will submit the results of this survey to NRC. The submittal will include a description of the methodologies and test equipment that were used to perform the survey, a comparison between on-site and factory EMI/RFI test results, and an assessment of the margin between the measured EMI/RFI spectrum and a conservative threshold above which EMI/RFI problems could occur."

NRC expects that the proposed EMI/RFI site survey will demonstrate qualification of the Eagle-21 system for the full spectrum of EMI/RFI frequencies that can be generated at WBN. Westinghouse factory testing of Eagle-21 equipment only demonstrated qualification in the range of 20 MHz - 1 GHz, as described in WCAP-11733 ("Noise, Fault, Surge, and Radio Frequency Interference Test Report for Westinghouse Eagle-21 Process Protection Upgrade System," June 1988). EMI/RFI at lower frequencies needs to be addressed by WBN's site survey. The NRC staff noted that previous site surveys at Zion and Diablo Canyon, which recently installed Eagle-21 systems, adequately addressed the full spectrum of EMI/RFI frequencies.

TVA Response:

The commitment for an EMI/RFI site survey at WBN is changed as follows:

TVA has contracted with Westinghouse to perform an EMI/RFI site survey of WBN's Eagle-21 system during hot functional testing using methods and test equipment equivalent to those used for EMI/RFI surveys at Zion and Diablo Canyon. TVA will submit the results of this survey to the NRC. The submittal will include a description of the methodology and test equipment that were used to perform the survey, a comparison between onsite and factory EMI/RFI test results, and an assessment of the margin between the measured EMI/RFI spectrum and a conservative threshold above which EMI/RFI problems could occur.

2. Testing of Software Modifications

NRC Question:

TVA's letter dated December 27, 1993, stated that the extent of software retesting after a modification has been made is based on an "impact analysis." What criteria are used in this impact analysis to decide if a particular software element must be retested? Has there ever been any review and approval of these criteria by the NRC (perhaps during a verification and validation (V&V) audit of another plant's Eagle-21 system)?

TVA Response:

The "impact analysis" referred to in TVA's letter dated December 27, 1993, is a regression analysis that is performed by Westinghouse as part of their standard practice for modifying safety-related software. Westinghouse performs this regression analysis and any subsequent software testing twice. First, the software design team performs an analysis, makes the required documentation and computer code changes, and develops a procedure to test the modification. In addition, the design team determines whether or not other subsystems are affected by the design modification. The process is documented using a "Library Control Software Revision" form (see attached sample form) that has been reviewed and approved by the NRC. After completion of these evaluations and tests, the computer code modification is released to the verification team.

The verification team performs an independent regression analysis to determine the amount of V&V that is required for the code modification. The regression analysis uses a structured approach to evaluate the design modification, which involves a particular safety-related portion of the computer code, with respect to its effect on the operation of the total system and the system's ability to satisfy its functional design requirements. During regression analysis, changes to the functional design are determined by reviewing any changes that have been made to the system design output documentation (i.e., system design requirements, system design specification, software design requirements, software design specification, software source code, etc.). Then, changes made to the software source code are identified by comparing the current revision of the code to the last version of the code that passed the verification process. This step is performed by using computer utility routines that detect software file differences. After evaluating the changes made to design documents and differences in the source code, the verifier determines the extent of the design modification and the corresponding extent of V&V analysis and testing that must be repeated for any software modules that were previously examined and approved.

Retesting is performed whenever functional changes or modifications are made to an existing software structure (i.e., software and functional requirements that are currently being verified or have previously passed verification). Typically, minor code changes are only inspected and not subjected to retesting. Changes are considered minor if either (a) the change does not affect the executable code (such as comment changes or changes in variable names) or (b) the change is obvious and only a few lines of source code are modified. Retesting of such minor changes does not

improve the quality or reliability of the software or assist the verifier in finding anomalies.

The above criteria that are used for software testing and retesting are identified in Section 5.4.4.2 of the Eagle-21 V&V plan, which is Westinghouse Design Specification (DS) 408A47, Revision 3 ("EAGLE 21 Replacement Hardware Design, Verification and Validation Plan," May 12, 1989). DS 408A47, Revision 3, is Appendix A in WCAP-12374, Revision 1 (Eagle-21 Microprocessor-Based Process Protection System," December 1991). WCAP-12374, Revision 1, was submitted for NRC staff review by a letter dated February 26, 1992. Section 5.4.4.2 of DS 408A47, Revision 3, refers to Table 1 in the V&V plan. This table outlines the software verification process and specifically includes "impact analysis" as one of the items to be performed.

Westinghouse informed TVA that their software verification process, including impact analysis as described above, has been discussed with the NRC staff during several Eagle-21 audits (WBN's first four Eagle-21 cabinets, Sequoyah, Zion, etc.). These audits looked at many of the Westinghouse procedures that form the basis for developing their generic software and performing their review and V&V processes. The NRC staff did not challenge the existing software verification process during any of these audits, and Westinghouse has not changed it since that time. Also note that the NRC staff's safety evaluation report dated June 13, 1989, for WBN's original implementation of Eagle-21 hardware (i.e., four Eagle-21 cabinets used in conjunction with the design modification for resistance temperature detector bypass elimination) approved Westinghouse's V&V plan.

EAGLE 21 LIBRARY CONTROL SOFTWARE REVISION
DFP, DLH, FTP, MMI and TSP SUBSYSTEMS

Revision Control # _____ HEX ID & Version: _____
 Initiated by: (Software Designer) _____ Date: _____
 Reason: ___ REA ___ Engineering Change ___ Customer/Spec Change ___ V&V

CODE REVISION (completed by lead subsystem software engineer)

- A. Description of Changes: (Attachment if needed) _____

- B. List of Files Modified (Attach list if necessary) _____

- C. ___ Attach File Difference Listings (difference between modified file and current library version, or new file listing)
- D. Software Subsystem Impacted: _____
- E. Extent of Impact by Subsystem (attachments if needed) _____

- F. Second Party Review: _____ Date: _____

IMPACT CONFIRMATION

Subsystem			Signature	Date
LCP	___ YES	___ NO	_____	_____
DCI	___ YES	___ NO	_____	_____
TSP	___ YES	___ NO	_____	_____
SRVT	___ YES	___ NO	_____	_____
MMI	___ YES	___ NO	_____	_____
DLH	___ YES	___ NO	_____	_____
DFP	___ YES	___ NO	_____	_____
DIAGNOSTIC	___ YES	___ NO	_____	_____
UTILITY	___ YES	___ NO	_____	_____
COMMON	___ YES	___ NO	_____	_____
SYSTEM	___ YES	___ NO	_____	_____
HARDWARE	___ YES	___ NO	_____	_____
I & T	___ YES	___ NO	_____	_____
FAT	___ YES	___ NO	_____	_____

APPROVED FOR INTEGRATION TEST:

MANAGER _____ DATE _____

Tested & Approved: Initiator _____ Date _____ Integration Test _____ Date _____

APPROVED FOR RELEASE: _____

Manager _____ Date _____

3. Power Supply Sequencing

NRC Question:

Installation of an Eagle-21 system at Zion required a design change to sequence the starting of Eagle-21 equipment racks. This was done to limit the in-rush current during starting and, thereby, avoid overloading the inverters that supply power to the Eagle-21 equipment. Has WBN performed a similar design change to sequence the starting of Eagle-21 equipment racks?

TVA Response:

The power supply modules that are built into each of WBN's Eagle-21 equipment racks (i.e., cabinets) contain time-delay relays that automatically sequence individual racks onto their associated vital inverters during starting of the Eagle-21 system. These time-delay relays were included as part of the original Westinghouse design for the power supply modules. WBN has not experienced any problems with power supply capacity or inverter overloading during the Eagle-21 tests that have been performed to date. Further details concerning the power sources that supply WBN's Eagle-21 equipment are included in the response to Question 19 in Enclosure 1 of TVA's letter dated December 27, 1993.

4. Median Signal Selector (MSS)

NRC Question:

TVA's letter dated July 10, 1991, included a general description of the MSS equipment that WBN has installed as part of the Eagle-21 upgrade. This letter noted that, except for the addition of an environmental allowance modifier at Sequoyah Nuclear Plant (SQN), the design of WBN's Eagle-21 system is "virtually identical" to that of SQN's Eagle-21 system. TVA's letter dated February 26, 1992, stated that the technical description of MSS equipment in WCAP-12417 ("Median Signal Selector for Foxboro Series Process Instrumentation - Application to Deletion of Low Feedwater Flow Reactor Trip," October 1989) was applicable to both WBN and SQN, where a "similar" design change had already been completed. TVA's letter dated October 26, 1992, stated that "The characteristics and number of channels for the MSSs at WBN are identical to those at SQN. The changes in the channel assignments for SG (steam generator) level input signals that are described above in Part A (of the letter's enclosure) and minor differences in interconnecting cables have no effect on the MSS module characteristics or its function."

Confirm that the MSS equipment at WBN is "virtually identical" to the MSS equipment at SQN, which has already been reviewed and approved by the NRC.

TVA Response:

The purpose, function, and design of the MSS equipment at WBN are identical to those of the MSS equipment at SQN. TVA has not compared the individual electronic components and circuitry within the MSS equipment modules at WBN and SQN. However, the modules are interchangeable even if minor internal differences do exist. As stated in TVA's letter dated February 26, 1992, WCAP-12417 applies to the MSS equipment at both WBN and SQN. Since WCAP-12417 is the principal licensing-basis document for the MSS equipment, it is accurate to characterize WBN's MSS equipment as "virtually identical" to SQN's MSS equipment for licensing purposes.

ENCLOSURE 2

List of Commitments

- TVA has contracted with Westinghouse to perform an electromagnetic interference/radio frequency interference (EMI/RFI) site survey of WBN's Eagle-21 system during hot functional testing using methods and test equipment equivalent to those used for EMI/RFI surveys at Zion and Diablo Canyon. TVA will submit the results of this survey to NRC. The submittal will include a description of the methodology and test equipment that were used to perform the survey, a comparison between onsite and factory EMI/RFI test results, and an assessment of the margin between the measured EMI/RFI spectrum and a conservative threshold above which EMI/RFI problems could occur.