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Richard T. Purcell
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MAR 3 0 1998

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

Gentlemen:

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

WATTS BAR NUCLEAR PLANT (WBN) UNIT 1 - REQUEST FOR ADDITIONAL INFORMATION ON SLAVE RELAY TEST FREQUENCY EXTENSION (TAC. NO. M94425)

The purpose of this letter is to reply to the NRC request for additional information (RAI) dated January 27, 1998, concerning slave relay test frequency extension in support of NRC review of the subject proposed license amendment. The NRC RAI questions 1 through 3 are restated with responses provided by Westinghouse in Enclosure 1. The response to question 4 prepared by TVA is also included in this enclosure. Enclosures 2 and 3 provide information discussed in Enclosure 1.

Please note that the revised WCAP 13877 pages in Enclosure 2, although marked as proprietary information, do not contain proprietary information. This was confirmed through a telephone call with Westinghouse on March 25, 1998, and by a comparison of the original WCAP 13877 information and its non-proprietary WCAP 14129 version which revealed that both versions contained the same information. Enclosure 4 contains the commitment made in this letter.

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If you should have any questions, please contact P. L. Pace at (423) 365-1824.

Sincerely,

R. T. Purcell

Enclosures
cc: See page 3

cc (Enclosures):
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ENCLOSURE 1

Response to NRC Request for Additional Information
License Amendment Request - Slave Relay Test

References:

1. Letter from J. A. Scalice to the U.S. NRC, "Watts Bar Nuclear Plant (WBN) - Unit 1 -Request for Additional Information Pertaining to the Proposed Slave Relay Test Frequency Extension (TAC NO. M94425), dated October 2, 1997

2. "Evaluation of Surveillance Frequencies and Out of Service Times for the Engineered Safety Features Actuation System", WCAP-10271-P-A, Supplement 2, Revision 1, May 1989.

3. "Probabilistic Risk Analysis of the RPS and ESFAS Test Times and Completion Times", WCAP-14333-P, May 1995.

The following questions are from Robert E. Martin (NRC) letter to O. J. Zennque (TVA), "Request for Additional Information on Slave Relay Test Frequency Extension" (TAC NO. M94425), dated January 27, 1998. The questions (reproduced for reviewer convenience) and answers are provided below.

Question 1

In response to Question No 12, it was stated that the failure identified as number 7 should appear in Table 9-7 only. However, this failure does not appear in Table 9-7, it appears in Table 9-8. Clarify this discrepancy.

Response 1

In the October 2, 1997 letter from J. A. Scalice to the U.S. NRC (Reference 1), Section 9.3.3 (paragraph 3) discusses that event ID number 7 was due to contact overloading. Contact overloading is not a relay reliability issue. Therefore, ID number 7 should not have been included in Reference 1 response to question 12 (paragraph 3) as being only in Table 9-7. This relay non-failure for ID number 7 is correctly included in Table 9-8 as provided in Reference 1.

While addressing the above question, it was noted that the discussions about Tables 9-6, 9-7 and 9-8 in Reference 1 were not complete in regards to event ID numbers 20, 21, 22, 23 and 24. The following clarifications are provided in regard to event ID numbers 20, 21, 22, 23 and 24.

a. Event ID numbers 20 and 21 appear in Table 9-6 in WCAP-13877 but do not appear in either Table 9-7 or Table 9-8 in WCAP-13877. ID numbers 20 and 21 are included in Reference 1 Table 9-8 as discussed in Section 9.3.4 (paragraph # 1) of Reference 1.

b. Event ID number 22 is included in both Table 9-7 and 9-8 in WCAP-13877. ID number 22 is eliminated from Table 9-8 and remains in Reference 1 Table 9-7 as discussed in Section 9.3.4 (paragraph # 2) of Reference 1.

c. Event ID numbers 23 and 24 do not appear in WCAP-13877 Table 9-6, 9-7 or 9-8. ID numbers 23 and 24 are included in Reference 1 Tables 9-6 and 9-8 as discussed in WCAP-13877 Section 9.3.1.1.

The clarifications provided in the above items (a, b and c) do not require any changes to the discussions or Tables 9-6, 9-7 or 9-8 provided in Reference 1.

Question 2

The New Table 9-8 does not clearly address the basis for why some of the failures such as those identified as numbers 25, 29 through 35 and 38, which resulted in repair/replacement are considered non-failures of the relay. Provide this information.

Response 2

Responses for the above event Identification Numbers are provided below:

Event ID Number 25 (Sequoyah Unit 1, Relay K647-A)

Technician error is suspected because the reported relay anomaly could not be repeated. The relay was not repaired, it was disassembled, cleaned then returned to service. (Reference: WCAP-13877 Section 9.3.1.3). Deleted "Repaired" from Event/Date column in Tables 9-6 and 9-8 in Enclosure 2.

Event ID Number 29 (Sequoyah Unit 2, Relay K615-A)

This is a not an accepted failure because it is suspected that technician error may have contributed to the event. The reported anomaly could not be repeated. (Reference: WCAP-13877 Section 9.3.1.2) Added "replaced latch" to Notes column in Tables 9-6 and 9-8 in Enclosure 2.

Event ID Number 30 (Sequoyah Unit 2, Relay K615-A)

Event ID Number 30 is included in Table 9-7 as a valid failure.

Event ID Number 31 (Sequoyah Unit 2, Relay K622-A)

The reported anomaly is not a relay failure. The anomaly is an assembly error. A screw was tightened, the relay reinstalled and proper operation of the relay was verified. (Reference: WCAP-13877 Section 9.3.1.6) This event remains in Table 9-8 as shown in Enclosure 2.

Event ID Number 32 (Sequoyah Unit 2, Relay K607-B)

Technician error is suspected because a parallel path circuit may have caused the anomaly. Subsequent testing could not repeat the reported anomaly. The relay was not replaced. (Reference: WCAP-13877 Section 9.3.1.11) Deleted "Repaired" from Event/Date column, changed "A/L" to "U" in the Failure column and added "parallel path circuit" to the Notes column in Tables 9-6 and 9-8 in Enclosure 2.

Event ID Number 33 (Sequoyah Unit 2, Relay K615-B)

This is not an accepted failure because it is suspected that technician error may have contributed to the event. The reported anomaly could not be repeated. (Reference: WCAP-13877 Section 9.3.1.2) Changed "Repaired" to "Replaced" in Event/Date column in Tables 9-6 and 9-8 in Enclosure 2. Also corrected typographical error from "replace" to "replaced" in Table 9-8 in Enclosure 2.

Event ID Number 34 (Sequoyah Unit 2, Relay K620-B)

Technician error is suspected because the reported anomaly could not be repeated. The relay was verified to energize and returned to service. (WCAP-13877 Section 9.3.1.7) Deleted "Repaired" from Event/Date column,

changed "A/L" to "U" in Failure column and corrected typographical error from "U/OE" to "U/TE" in Tables 9-6 and 9-8 in Enclosure 2.

Event ID Number 35 (Sequoyah Unit 2, Relay K622-B)

This is a not an accepted failure because it is suspected that technician error may have contributed to the anomaly. The reported anomaly could not be repeated. (Reference: WCAP-13877 Section 9.3.1.2) Corrected typographical error from "replace" to "replaced" in Notes column in Table 9-8 in Enclosure 2.

Event ID Number 38 (Sequoyah Unit 2, Relay K-622B)

This is not an accepted failure because the failure mechanism suspected is an infant mortality due to the apparent tolerance incompatibility between the relay and the latch mechanism. Testing of the assembled relay and latch mechanism will detect this failure mode. (Reference: WCAP-13877 Section 9.3.1.8)

Question 3

If more failures are added to Table 9-7 as a result of responses to Question 1 and 2 above, then revise Tables 9-1, 9-2 and 9-5. Also discuss the specific reliability of AR relays with respect to the reliability value of the slave relays used in calculation core damage frequency in other topical reports.

Response 3

There are no additional failures, therefore, no additional items are added to Reference 1 New Tables 9-1, 9-2, 9-5 or 9-7 as a result of responding to Questions 1 and 2 above.

Core Damage Frequency

The reliability of the slave relays is used in WOG topical reports (References 2 and 3) related to evaluating extensions to allowed outage times for components of the reactor protection system (RPS). This includes signals that are generated in the RPS to produce a reactor trip and actuate engineered safety features, such as safety injection and auxiliary feedwater. Components modeled in these systems include the analog channels, logic cabinets, master relays, slave relays, and reactor trip breakers.

In Reference reports 2 and 3, the slave relay failure rate is developed from several potential failure modes that will cause the slave relay to fail to actuate equipment when required. The analyses in both of these reports use the same slave relay failure rate. The identified failure modes and the failure rates for each mode are listed in Reference 2 as follows:

Failure Mode	Failure Rate
Mechanically bound	4.0E-07/hr
Contact short	1.9E-08/hr*
Shorted coil	1.0E-07/hr
Open coil	1.0E-08/hr
Total	5.3E-07/hr

* Converted to an hourly failure rate by assuming 20 demands per year.
8.5E-06/d x 20 d/yr x 1 yr/8760 hr = 1.9E-08/hr

WCAP-13877 calculates an AR relay failure rate of 4.40E-08/hr and an AR latch relay failure rate of 1.10E-07/hr based on plant experience. This failure rate is based on all the slave relay data collected during the program to assess the reliability of type AR relays and includes failure data for plants with slave relay surveillance test intervals of 1 month, 3 months, and 18 months.

A comparison of the relay failure rate used in the topical reports (5.3E-07/hr) to the failure rate based on plant experience (4.40E-08/hr for AR relays and 1.10E-07/hr for AR latch relays) leads to the conclusion that the analysis results presented in the topical reports are conservative. The following paragraphs explain this conclusion.

The analyses discussed in References 2 and 3 use detailed fault trees of the reactor trip and engineered safety features (ESF) actuation signals to determine the impact of allowed outage time changes on signal unavailability. The ESF actuation signal unavailabilities are then used in the accident sequence quantification to determine the frequency of core damage related to ESF actuation signal unavailability.

Component unavailability in these fault trees includes contributions from random and common cause failures, and test and maintenance activities. Increases to the allowed outage times impact the time available for testing and maintenance activities; the longer the allowed outage time, the more time available to perform test and maintenance activities during power operation. The slave relay failure rate is used to determine the slave relay unavailability (or failure probability) related to random and common cause failures. Lower slave relay failure rates result in lower ESF actuation signal unavailabilities and a more reliable system. Since the ESF actuation system is more reliable, with more reliable slave relays, when one ESF actuation signal train is unavailable for a test or maintenance activity, the operable train is more reliable than originally assumed so the impact on core damage frequency will be reduced. Therefore, the Reference 2 and 3 analyses are conservative and remain applicable.

Miscellaneous Corrections Not Related to Questions 1, 2 and 3 Above

1. Because of an accounting error in WCAP-13877 Table 9-7, relay failures are reapportioned in Table 9-1. The Beaver Valley 1&2 relay failure is decreased from 1 to 0 and the D.C. Cook 1&2 relay failure is increased from 1 to 2 in Table 9-1. This reapportionment does not change the total number of relay failures. The failure rate for the 18 month test period is changed by an insignificant amount (i.e., from 2.71E-04 to 4.06E-04). Enclosure 2 includes corrected pages of WCAP-13877 Table 9-1.

   As a result of the above change in WCAP-13877 Table 9-1, WCAP-13877 Table 9-5 is also changed. The relay failures per demand for the 1 month Surveillance Test Interval (STI) is changed from 1 to 0 and the failures/demand is changed to N/A. In addition, the relay failures per hour for the 1 month STI is changed from 1 to 0 and the failures/hr is changed to N/A. The relay failures per demand for the 18 month STI is changed from 2 to 3 and the failures/demand is changed by an insignificant amount (i.e., from 2.71E-04 to 4.06E-04). In addition, the relay failures per hour for the 18 month STI is changed from 2 to 3 and the failures/hr is changed by an insignificant amount (i.e., from 2.80E-08 to 4.13E-08). Enclosure 2 includes corrected pages of WCAP-13877 Table 9-5.

2. In WCAP-13877 Section 9.3.1.10, Sequoyah Unit 1 Relay K606-A is discussed. However, this relay does not appear in either WCAP-13877 Table 9-6, 9-7 or 9-8 nor in Tables 9-6, 9-7 or 9-8 in Reference 1.

   Enclosure 2 includes corrected pages of Tables 9-6 and 9-8 that incorporates relay K606-A as ID number 39. The relay was found to be fully operational. Other circuit components were then examined. Adding an item to Table 9-8 does not increase the number of failures nor does it require that any new relay failure calculations be performed.

3. Event ID Number 4: Corrected typographical error from "A4" to "A4L" in Relay Type column in Tables 9-6 and 9-8 in Enclosure 2.

4. Event ID Number 15: Corrected typographical error from "A41-8" to "A4L-8" in Relay Type column in Tables 9-6 and 9-7 in Enclosure 2.

5. Event ID Number 22: Corrected typographical error from "A8" to "A8L" in Relay Type column in Tables 9-6 and 9-7 in Enclosure 2.

6. Event ID Number 36: Corrected "repaired" to "replaced" in Event/Date column in Tables 9-6 and 9-7 in Enclosure 2. Corrected typographical error from "replace" to "replaced" in Relay Type column in Table 9-7 in Enclosure 2. These corrections make Tables 9-6 and 9-7 consistent.

TVA RESPONSE TO QUESTION 4

RAI QUESTION NO. 4:

Your response to Question No. 18 states that the Maintenance Rule Program cover slave relays. Confirm that this program meets the concern identified in Question 18.

RESPONSE:

Question 18 and TVA's response from letter dated October 2, 1997, are provided below:

> **"18. QUESTION---RAI#1**
>
> When two or more AR relays fail in a 12-month period, the staff requires licensees to re-evaluate the adequacy of the proposed extended surveillance interval and if it is determined that the interval is inadequate for detecting single relay failures, the surveillance interval should be decreased. The revised surveillance interval should be such that the licensee can detect an ESFAS subgroup relay failure prior to the occurrence of a second failure. Provide a commitment to implement this requirement.
>
> **18. RESPONSE---RAI#1**
>
> The WBN Maintenance Rule program implements the requirements of 10CFR50.65 and provides instructions for initiation, analysis, retrieval, trending, and periodic reporting of data relative to performance indicators of plant systems and components. The program includes guidance for trending and reporting of repetitive preventable failures of functions which are within the scope of the Maintenance Rule. It also includes performance of cause determinations for failures to meet performance criteria and for repetitive failures. The program assigns plant system engineers responsibility for identifying when performance criteria are not met and increased monitoring under paragraph (a)(1) of the Maintenance Rule is required, along with the corrective actions necessary to restore acceptable performance. The functions performed by the slave relays are in the scope of the program."

WBN Technical Instruction TI-119, Maintenance Rule Performance Indicator Monitoring, Trending, And Reporting, Attachment 30, REACTOR PROTECTION SYSTEM (099) will be revised prior to implementation of the approved TS change. This procedure change will require that the surveillance interval be evaluated and reduced, when needed, if two or more Westinghouse AR ESFAS subgroup relays fail within a 12-month interval.