Tennessee Valley Authority, 1101 Market Street, Chattanooga, Tennessee 37402-2801

August 9, 2002

10 CFR 50.90

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

Gentlemen:

In the Matter of)	Docket Nos.50-327, 328, 390
Tennessee Valley Authority)	

SEQUOYAH (SQN) AND WATTS BAR (WBN) NUCLEAR PLANTS - REQUEST FOR RISK-INFORMED INFORMATION RE: TRITIUM PRODUCTION PROGRAM (TAC NO. MB1884)

The purpose of this letter is to respond to NRC questions provided in a letter dated July 29, 2002. This information is being provided to support the ongoing NRC review of WBN and SQN License Amendment Requests submitted by TVA on August 20, 2001, and September 21, 2001, respectively. TVA has separated the responses into two enclosures. Enclosure 1 provides the SQN responses. Enclosure 2 provides the WBN responses.

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There are no regulatory commitments made by this letter. The delay in submitting this information was coordinated via telecon with the NRC staff on August 7, 2002. If you have any questions, please contact me at (423) 751-2508.

Sincerely,

Mark J. Burzynski

Mark J. Burzynski
Manager
Nuclear Licensing

Subscribed and sworn to before me
on this 9th day of August

Lillian G. Martin
Notary Public

My Commission expires 1-25-03

Enclosures
cc: See page 3

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ENCLOSURE 1
SEQUOYAH NUCLEAR PLANT (SQN)
RESPONSES

1. Please provide the SQN maintenance rule program (a)(2) performance criteria for the following systems:

A. Emergency Diesel Generators (EDGs)
B. Turbine Driven Auxiliary Feedwater Pump
C. Emergency 125 VDC Supply
D. Emergency 120 VAC Supply
E. Hydrogen Igniters
F. Containment Air Return Fans
G. Emergency Raw Cooling Water (ERCW)
H. Ice Condenser

TVA RESPONSE

The maintenance rule program (a)(2) performance criteria for the systems listed above is as follows:

A. Emergency Diesel Generators - Please note that the term Valid Failure is equivalent to Functional Failure (FF) and Valid Test is equivalent to valid Demand.

- Unavailability - No more than 2.5% for each DG average over a rolling 24 months (438 hrs/24 months).

- Function Level Unreliability - The DG target reliability of 97.5% is met provided the following trigger values are not reached:
  - 3 combined functional failures (FFs) (start demand and/or load run demand) out of 20 combined demands (all DGs combined)
  - 4 combined FFs out of 50 combined demands (all DGs combined)
  - 5 combined FFs out of 100 combined demands (all DGs combined)
  - 4 FFs out of 25 demands (for each DG)

- Component Level Unreliability - No more than 2 Component (Pump) Failures (CFs) per Fuel Oil Transfer Pump per rolling 24 months.

B. Turbine Driven Auxiliary Feedwater Pump

- Unavailability - No more than 2.5% per train or 219 hrs/year, based on a 24 month rolling average when risk significant.

- Unreliability - No more than 1 FF per 24 months per train.

C. Emergency 125 VDC Supply

- Unavailability - No more than 0.194% or 17 hours/year, based on a 12 month rolling average (all modes and all Outage Risk Assessment Management (ORAM) states).

- Unreliability - No more than one FF of a vital battery or vital battery board per 24 months.

D. Emergency 120 VAC Supply

- Unavailability - No more than 16.4% or 60 days/year, based on a 12 month rolling average (all modes and all ORAM states).

- Unreliability - No more than four FFs of a 120 VAC vital instrument power board per 24 months.

E. Hydrogen Igniters

- Unavailability - No more than 0.95% average unavailability per unit during a rolling 24-month interval when risk significant (Modes 1&2). The function is unavailable whenever there are no functional igniters in one or more of the 34 zones.

- Unreliability - No more than 1 FF per unit during a rolling 24-month interval. A FF in Modes 1 & 2 is 1) a loss of two igniters in the same zone, or 2) a loss of any combination of three or more igniters in any combination of zones. When in State 11 or 12, a FF is the loss of either Train A or Train B.

F. Containment Air Return Fans

- Unavailability - No more than 0.28% per train every 24 months when risk significant (Modes 1&2 and ORAM States 1&2).

- Unreliability - No more than one FF per train every 24 months. A FF is defined as a failure of the train to start or operate as required.

G. Emergency Raw Cooling Water (ERCW)

- Unavailability - Train Level - No more than 2.7% per train per 24-month rolling average.

- Unreliability

    - Train/Functional Level - No more than two FFs per train per 24 months.

    - Component (ERCW Pump) Level - No more than one failure per pump per 24 months.

H. Ice Condenser

- Unavailability - In Mode 1, no actual unplanned capability loss events attributable to the ice condenser system are permitted in a rolling 24 month interval. In Modes 1 and 2 or ORAM states 1 and 2, no unavailability that if it had occurred at 100% power, it would have caused a greater than 20% power loss.

- Unreliability - No failure of a required flow path is permitted in a rolling 24 month interval.

- Condition -

    - No more than one failure to maintain the ice bed temperature at or below 27°F during Modes 1 and 2, ORAM States 1 and 2, and States 11 and 12 when required is permitted in a rolling 24 month period.

- No failure to maintain the design basis ice mass is permitted in a rolling 24 month interval when required.

- No failure to maintain the minimum sodium tetraborate concentration and proper range of pH as defined in LCO 3.6.5.1.a is permitted in a rolling 24 month interval.

2. **Are any of the above systems currently in maintenance rule program (a)(1) status and if so why?**

TVA RESPONSE

None of the systems listed in Item 1 are currently in maintenance rule program (a)(1) status.

3. **How many EDG failures (failure-to-start and failure-to-run) have occurred in the previous 100 starts for each of the EDGs?**

TVA RESPONSE

As of June 30, 2002, the number of EDG valid failures which have been recorded for the last 100 starts are as follows:

Generator	Number of Failures
EDG 1A	1
EDG 1B	0
EDG 2A	6*
EDG 2B	0

*This data is consistent with the response to Question 2. As indicated in the response to Question 1, the trigger criteria for each individual Sequoyah EDG is 4 FF out of 25 demands. The maximum number of valid failures per 25 demands EDG 2A has reached in the past is 2.

4. **Are any of the above EDG failures a common-mode failure of the SQN EDGs (i.e. were the other EDGs actually**

unavailable because the root cause of the failed EDG also actually affected the other EDGs)?

TVA RESPONSE

None of the EDG failures listed in Item 3 resulted from a common-mode failure.

5. **Do all reactor coolant pumps (RCPs) at SQN have the newer style high-temperature O-ring seals? If not, how many do not and on which unit? For those RCPs that do not have the new O-ring design, what is the schedule to replace them?**

TVA RESPONSE

All Sequoyah RCPs currently have the high temperature O-ring seals installed.

6. **Does SQN conduct Severe Accident Management Guidelines (SAMG) drills and how often?**

TVA RESPONSE

Severe Accident Management Guidelines (SAMG) training for SQN emergency preparedness teams normally consists of classroom instruction and a table top drill and are conducted annually with the teams being trained based on a four year rotation.

7. **How many failures of the ice condenser lower inlet doors have occurred during the previous two operating cycles (i.e. did not meet technical specifications surveillance requirements)? Are any of these failures attributed to floor upheaval/buckling causing door binding? Does Tennessee Valley Authority continue to monitor ice condenser floor growth from cycle-to-cycle?**

TVA RESPONSE

Surveillance instructions performed during the past two refueling outages, Cycle 10 and Cycle 11, for both Sequoyah Unit 1 and Unit 2 were evaluated for failures. Based on the data packages reviewed, all lower inlet doors met the Technical Specification surveillance requirements.

No lower inlet door surveillance requirement failures during the specified time period were due to floor upheaval/buckling.

SQN continues to monitor ice condenser floor movement during operation under Procedure No. 0-PI-SXX-061-001.0 "Ice Condenser Lower Plenum Floor Monitoring". This Instruction provides detailed steps for monitoring vertical movement of the ice condenser lower plenum floor to ensure lower inlet door operability.

8. **Please provide the following information for SQN based on the current PRA model:**

   A. **total core damage frequency (CDF) from internal events**
   B. **total CDF from external events (if modeled)**
   C. **percentage of CDF due to station blackout**
   D. **loss of offsite power frequency and basis**
   E. **probabilities of non-recovery of offsite AC power for various times in the model and basis for numbers used.**
   F. **probability of EDG/emergency AC bus recovery (if modeled) and the basis for the number(s)**

TVA RESPONSE

Based on Revision 01 of the Sequoyah Probabilistic Safety Analysis (PSA) model, the requested information has been established as follows.

A. The total CDF from internal events is 3.77E-05/yr.

B. The total CDF from external events has not been quantified. In the IPEEE (Individual Plant Examination for External Events) no vulnerabilities from external events were identified.

C. The percentage of CDF due to station blackout is 10.5%.

D. The loss of offsite power frequency is 0.0485/yr based on a Baysian update of generic industry data using site specific experience.

E. The probability of non-recovery from a loss of offsite AC power at 1 hour is 0.255. At 1 hour the steam generator secondary side inventory is depleted when no makeup is available. The probability of non-recovery at 1.7 hours is 0.604. At 1.7 hours core damage occurs when no secondary side makeup is available. The probability of non-recovery at 4 hours is 0.275. At 4 hours the station batteries are depleted. These non-recovery probabilities are based on the information in NUREG/CR-5032.

F. The probability of EDG/emergency AC bus recovery within 1.7 hours of 1/1 EDG is 0.39 and of 1/2 EDGs is 0.536. The probability of recovery within 4 hours of 1/1 EDG is 0.60 and of 1/2 EDGs is 0.80. The basis for these probabilities is a site specific EDG recovery model. This model is described in detail in Section 3.3.3.4.3.2 of the individual plant evaluation.

9. What are the normal and emergency power supplies for the ERCW (intake structure) sump pumps?

TVA RESPONSE

All of the sump pumps at the ERCW pumping station are powered from the various ERCW Motor Control Center (MCC) boards. The building basement sump pumps (not safety related) are powered from the MCC in their respective bays, the deck sump pump 1A is powered from the 1A ERCW 480v MCC, the deck sump pump 1B is powered from the 1B ERCW 480v MCC. All of the ERCW 480v MCC receive power from the 6.9 Kv Shutdown Boards, and are therefore Diesel backed. The deck sump pumps are safety related and remain loaded to the Diesel after blackout, the building basement sump pumps are non-safety related and are therefore load-stripped upon blackout.

ENCLOSURE 2
WATTS BAR NUCLEAR PLANT (WBN)
RESPONSES

1. **Please provide the WBN maintenance rule program (a)(2) performance criteria for the following systems:**

   A. Emergency Diesel Generators (EDGs)
   B. Turbine Driven Auxiliary Feedwater Pump
   C. Emergency 125 VDC Supply
   D. Emergency 120 VAC Supply
   E. Hydrogen Igniters
   F. Containment Air Return Fans
   G. Emergency Raw Cooling Water (ERCW)
   H. Ice Condenser

TVA RESPONSE

The maintenance rule program (a)(2) performance criteria for the systems listed above is as follows:

A. Emergency Diesel Generators

- Unavailability
  - No more than 2% for each DG averaged over a rolling 24 months (approximately 350 hours/24 months).
  - No more than 0.1% for the fuel oil transport support function for each EDG set averaged over a rolling 24 months (approximately 17 hours/24 months).
- Unreliability
  - No more than 1 failure of any of the fuel oil transfer pumps within a 24-month period.
  - Unreliability performance criteria for the EDG function is based on trigger values established as a result of 10CFR50.63. Nuclear Engineering established a target reliability of 97.5%. These trigger values are used as unreliability performance criteria for the Maintenance Rule as follows:

- 3 combined functional failures (FFs) (start demand and/or load run demand) out of 20 combined demands (all DGs combined)
- 4 combined FFs out of 50 combined demands (all DGs combined)
- 5 combined FFs out of 100 combined demands (all DGs combined)
- 4 FFs out of 25 demands (for each DG)

B. Turbine Driven Auxiliary Feedwater Pump

- Unavailability - No more than 2% per train or 350 hours/24 months based on a 24 month rolling average.

- Unreliability - No more than two FFs per train in a 24-month interval.

C. Emergency 125 VDC Supply

- Unavailability (Battery Board) - No unavailability of the boards are allowed during power operation (0 hours). Additionally, no unavailability is planned at other times. This does not include swapping the battery with the spare battery, which includes a momentary loss of backup power.

- Unreliability - No more than one FF of a vital battery or vital battery board per 24 month period.

D. Emergency 120 VAC Supply

- Unavailability - No more than 0.274% or 48 hours/inverter/24 months interval. The inverters are not required available during certain pre-analyzed conditions during outages.

- Unreliability - No more than one FF per channel per 24-month interval.

E. Hydrogen Igniters

- Unavailability - No more than 7 days (168 hours) during a 24 month period (Modes 1 & 2). The system will be considered unavailable during periods in which there are no functional igniters in one or more of the 34 zones.

- Unreliability - No more than one FF within a 24-month interval. Functional failure is defined as any failure or combination thereof that results in the loss of ignition capability in any of the 34 zones.

- Supplemental component level performance criteria is no more than three igniter failures in a 24-month interval.

F. Containment Air Return Fans

- Unavailability - No more than 1% per train per 24-months (approximately 175 hrs/train/24-months) reporting period.

- Unreliability - No more than one FF per train per 24-month interval. Functional failure is defined as a failure of the fans to start or operate as required.

G. Emergency Raw Cooling Water (ERCW)

- Unavailability - The train unavailability performance criteria for modes 5 and 6 is 1.4% (approximately 245 hours/24-months). Risk considerations preclude the elective removal of either ERCW train from service during power operation. However, routine pump surveillance testing involves cross-tying of the trains for brief periods. The test instructions have been reviewed against the requirements for operator recovery from planned maintenance. It was determined that cross-tying of trains for performance of the pump test does not require maintenance rule unavailability.

- Unreliability -

  - Train Level - No FFs per train within a 24-month interval.

  - Component level - No more than three component failures within a 24-month interval (ERCW pumps, strainers, and traveling water screens).

H. Ice Condenser

- Unavailability - No unplanned capability loss attributable to the ice condenser is permitted in a rolling 24-month interval.

- Unreliability -

  - No FF due to loss of the minimum required flow path through the ice bed within an operating cycle.

  - No FFs within an operating cycle where the minimum total ice mass is found to be less than that specified by the Technical Specification, and

  - No instances within an operating cycle in which the average boron concentration or pH of the sample is found to be less than that specified by the Technical Specification

- Condition

  - Not more than one failure to maintain the mean ice bed temperature below 27°F is permitted within a 24 month interval.

2. Are any of the above systems currently in maintenance rule program (a)(1) status and if so why?

TVA RESPONSE

The Auxiliary Feedwater (AFW) system is in (a)(1) status. However, this is due to a start logic issue on the motor driven AFW pumps which has since been resolved. At this time, this equipment is being monitored for removal from (a)(1) status which is projected for 4^{th} quarter FY03. The Turbine Driven AFW Pump is not in (a)(1) status.

3. **How many EDG failures (failure-to-start and failure-to-run) have occurred in the previous 100 starts for each of the EDGs?**

TVA RESPONSE

As of June 30, 2002, the number of EDG valid failures which have been recorded for the last 100 starts are as follows:

Generator	Number of Failures
DG 1A-A:	1
DG 1B-B:	0
DG 2A-A:	1
DG 2B-B:	0

4. **Are any of the above EDG failures a common-mode failure of the WBN EDGs (i.e., were the other EDGs actually unavailable because the root cause of the failed EDG also actually affected the other EDGs)?**

TVA RESPONSE

None of the EDG failures listed in Item 3 resulted from a common-mode failure.

5. **Do all reactor coolant pumps (RCPs) at WBN have the newer style high-temperature O-ring seals? If not, how many do not and on which unit? For those RCPs that do not have the new O-ring design, what is the schedule to replace them?**

TVA RESPONSE

All Watts Bar RCPs currently have the high temperature O-ring seals installed.

6. **Does WBN conduct Severe Accident Management Guidelines drills and if so how often?**

TVA RESPONSE

Severe Accident Management Guidelines (SAMG) training for WBN emergency preparedness teams normally consists of classroom instruction and a table top drill and are conducted annually with the teams being trained based on a four year rotation.

7. **How many failures of the ice condenser lower inlet doors have occurred during the previous two operating cycles (i.e. did not meet technical specifications surveillance requirements)? Are any of these failures attributed to floor upheaval/buckling causing door binding? Does Tennessee Valley Authority continue to monitor ice condenser floor growth from cycle-to-cycle?**

TVA RESPONSE

Surveillance instructions performed during the 3rd and 4th refueling outages were reviewed. Both of these performances were successfully completed with no doors failing their Technical specifications requirements.

No lower inlet door surveillance requirement failures during the specified time period were due to floor upheaval/buckling.

WBN performs a maintenance instruction 1-STRU-661-5000, "Ice Condenser Wear Slab Floor Inspection," each refueling outage which monitors floor growth to ensure that any floor movement does not impair the opening of the lower inlet doors and prevent them from fulfilling their accident function.

8. **Please provide the following information for WBN based on the current PRA model for each plant:**

   A. total core damage frequency (CDF) from internal events
   B. total CDF from external events (if modeled)
   C. percentage of CDF due to station blackout
   D. loss of offsite power frequency and basis
   E. probabilities of non-recovery of offsite AC power for various times in the model and basis for numbers used.

F. probability of EDG/emergency AC bus recovery (if modeled) and the basis for the number(s)

TVA RESPONSE

Based on Revision 2A of the Watts Bar Probabilistic Safety Analysis (PSA) model, the requested information has been established as follows:

A. The total CDF from internal events of 4.48E-5/yr.

B. The CDF from external events is not currently modeled in the WBN-PSA. In the IPEEE (Individual Plant Examination for External Events) no vulnerabilities from external events were identified.

C. WBN has not calculated the percentage of CDF due to Station Blackout, we do calculate the percentage of CDF due to Loss of Offsite Power (LOOP) which is 14% of the CDF.

D. The loss of offsite power frequency is 0.0259/yr based on a Baysian update of a generic industry data using site specific experience. Specifically, WBN has experienced no LOOP.

E. The non-recovery of the 161-kv Grid for WBN has a mean value of 0.255. Offsite power can also be restored to the WBN systems through the Unit 2 500-KV grid. The non-recovery of the Unit 2 500-KV grid has a mean value of 0.205.

   A Monte Carlo simulation is used in the electric power recovery analysis at WBN. This recovery analysis for the WBN PSA model is an integrated, time dependent model that looks at several parameters and conditions. These parameters include the recovery of offsite power, the recovery of one or two diesels, and the availability of auxiliary feedwater for heat removal. The result of the recovery analysis is a recovery factor that is the ratio of two conditional frequencies, given a LOOP initiating event: the conditional frequency of the loss of onsite power in a mission time of 24 hours and the failure to restore onsite or offsite power before core damage occurs, and the conditional frequency of onsite power failure in a 24 hour period without recovery. Factors that influence the time available to restore AC power include the availability of 125V DC power (i.e., battery lifetime) and the length of time to core damage due to pump seal leakage or power-operated relief valve (PORV) discharge following a loss of all onsite AC power.

The time to recover off-site power at nuclear power plants has been documented in NUREG/CR-5032, "Modeling Time to Recovery of Loss of Off-site Power at Nuclear Power Plants." The Model for Group I2 in this NUREG was chosen as best representing WBN and was used in the WBN recovery analysis.

F. As described above, a Monte Carlo simulation (PLG STADIC program is used in the electric power recovery (offsite and DG) analysis at WBN.

Some of the assumptions used in this time dependent model are:

- The diesels generators are assumed to be unrecoverable after the depletion of the DC batteries

- The turbine-driven AFW pump is also assumed to be unavailable after DC control power is lost

Examples of the non-recovery factors used for various conditions is provided in the following table:

Case	Number Of Unit 1 Diesel Generators Available For Recovery	Unit 1 Dgs Known To Initially Be In Maintenance	Auxiliary Feedwater Available	Operators Cooldown And Depressurize RCS	Number Of Recoverable Unit 1 Plus Unit 2 Diesel Generators	Probability Of Onsite Power Failure And Offsite Nonrecovery	Diesel Generator Unavailability	Sequence Recovery Factor
1	2	Unknown	Yes	No	2	1.17525-4	8.30762-3	5.5072-2
2	2	Unknown	Yes	Yes	2	8.73629-5	8.30762-3	4.09382-2
3	2	Unknown	No	N/A	2	6.21547-4	8.30762-3	0.291257
4	1	Unknown	Yes	No	1	9.14894-4	6.48421-2	5.4847-2
5	1	Unknown	Yes	Yes	1	6.75282-4	6.48421-2	4.04825-2
6	1	Unknown	No	N/A	1	4.95071-3	6.48421-2	0.29679
7	0	Unknown	Yes	No	0	3.7518-2	1.0	0.14712
8	0	Unknown	Yes	Yes	0	2.6999-2	1.0	0.105879
9	0	Unknown	No	N/A	0	0.159522	1.0	0.625577

9. **What are the normal and emergency power supplies for the ERCW (intake structure) sump pumps?**

TVA RESPONSE

There are two sump pumps per ERCW Strainer Room. The normal power supplies for the pumps in ERCW Strainer Room A are from the safety-related Control & Auxiliary Building Vent Board 1A1-A and 2A1-A (respectively). The normal power supplies for the pumps in ERCW Strainer Room B are from the safety-related Control & Auxiliary Building Vent Board 1B1-B and 2B1-B (respectively).

These boards receive diesel power; however, these pumps are load shed from their respective board in the event of Loss of Offsite Power.