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NOV 13 1990

U.S. Nuclear Regulatory Commission
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Gentlemen:

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

SEQUOYAH NUCLEAR PLANT (SQN) UNIT 2 - DOCKET NO. 50-328 - FACILITY OPERATING LICENSE - DPR 79 - SPECIAL REPORT 90-17 - 10 CFR 50, APPENDIX R

The enclosed special report provides details concerning noncompliance with the requirement of License Condition 2.C.13.c of the Unit 2 Facility Operating License. This issue was initially reported by telephone notification at 1111 Eastern standard time on October 28, 1990, and was confirmed by facsimile dated October 29, 1990. The condition is applicable to both Units 1 and 2. This report is being made in accordance with Unit 2 License Condition 2.H.

If you have any questions concerning this submittal, please telephone M. A. Cooper at (615) 843-6422.

Very truly yours,

TENNESSEE VALLEY AUTHORITY

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Enclosure
cc: See page 2

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U.S. Nuclear Regulatory Commission

NOV 13 1990

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ENCLOSURE
SEQUOYAH NUCLEAR PLANT (SQN) UNIT 2
SPECIAL REPORT 90-17

DESCRIPTION OF CONDITION

At approximately 1200 Eastern daylight time (EDT) on October 27, 1990, with Unit 1 in Mode 1 at 100 percent power and Unit 2 in Mode 5 shutdown for the Cycle 4 refueling outage, a noncompliance with the requirement of Unit 2 License Condition 2.C.13.c was confirmed. The noncompliance affects both Units 1 and 2. Unit 2 License Condition 2.C.13.c requires TVA to comply with specified parts of Section III of 10 CFR 50, Appendix R. Section III.G.1.a of Appendix R requires that one train of systems necessary to achieve and maintain hot shutdown conditions from either the main control room (MCR) or auxiliary control room (ACR) remain free from fire damage. However, it was discovered that seven ACR instrument loops required for remote shutdown capability are powered from an MCR power source. Thus, an MCR fire could disable the affected instrumentation in both the MCR and ACR. The seven affected ACR instrumentation loops are:

Indication	Description
TI-68-1C	Loop 1 reactor coolant hot leg temperature
TI-68-24C	Loop 2 reactor coolant hot leg temperature
TI-68-43C	Loop 3 reactor coolant hot leg temperature
TI-68-65C	Loop 4 reactor coolant hot leg temperature
FI-62-137C	Emergency boration flow to charging pump suction
TI-74-38C	Residual heat removal heat exchanger "A" outlet temperature
TI-74-40C	Residual heat removal heat exchanger "B" outlet temperature

Unit 1 TI-68-1C had failed high on October 24, 1990. Unit 1 entered Limiting Condition for Operation (LCO) 3.3.3.5 (remote shutdown instrumentation) for TI-68-1C at 2136 EDT. The noncompliance with 10 CFR 50 Appendix R was identified while preparing to replace Unit 1 TI-68-1C. When the noncompliance was confirmed, the affected instruments were declared inoperable, and Unit 1 entered LCO 3.3.3.5 at 1111 EDT on October 27, 1990, for the other six instruments listed above. LCO 3.3.3.5 has a seven-day action requirement. (LCO 3.3.3.5 applies in Modes 1-3; Unit 2 was in Mode 5.)

The noncompliance was reported by telephone at 1111 Eastern standard time (EST) on October 28, 1990, to the NRC Operations Center and confirmed by facsimile dated October 29, 1990, in accordance with Unit 2 License Condition 2.H. This special report is being submitted in accordance with the same license condition.

CAUSE OF CONDITION

The root cause of this condition has been attributed to a personnel error in the original design in that the design did not meet the requirement of independence from the control building for remote shutdown instruments as discussed in Section 7.4.1 of the SQN Updated Final Safety Analysis Report (UFSAR). The design requirements established for the equipment were in compliance with Appendix R, but the final system design was not.

Evaluations to ensure compliance with Appendix R protection requirements at SQN were conducted in 1984 and 1985. During this timeframe, the Appendix R circuits were walked down to identify any interactions. For instruments contained in the ACR, the program ensured that each transfer switch isolated the required circuit. Instruments identified with a "C" suffix, i.e., those located in the ACR, were assumed to be isolated from the MCR because of the associated design requirement and were not reviewed for compliance with the design requirement. The only other assumption made at the time was that the cables were routed as stated in the Computer Cable Routing System.

As a result of the discovery of the condition described in this report, a review was made of the complete list of ACR instrument loops required for remote shutdown contained in Appendix E of TVA calculation SQN-SQS4-127. This review did not result in the identification of any interactions other than the seven subject instruments. Therefore, it is concluded that the interactions for the seven subject instruments are isolated cases.

ANALYSIS OF CONDITION

This condition is being reported in accordance with the requirements of Unit 2 License Condition 2.H as a noncompliance with the requirements of Appendix R of 10 CFR 50. The potential consequence of a postulated MCR fire could have been the loss of both MCR and ACR indication of the seven listed instruments. However, the loss of all seven of the subject instruments would still leave operators with sufficient information to establish and maintain hot standby conditions.

Upon a decision to abandon the MCR because of a fire, the operators would follow Abnormal Operating Instruction (AOI)-27, "Main Control Room Abandonment," in order to maintain control of the plant. The following discussions evaluate the loss of the subject ACR indications because of a loss of power.

Loss of Emergency Boration Flow Indication

In AOI-27, the operator is instructed to borate the reactor coolant system (RCS) to a cold shutdown, xenon-free concentration of $\geq$ 1 percent delta k/k. The operator uses boron tables to calculate the required amount of boron needed to achieve this shutdown margin for a set of predefined conditions (i.e., RCS temperature < 140 degrees Farenheit [F] and no xenon). When the operator would attempt to borate, he would be unable to establish any flow rate on the local indicator because of the loss of power to the flow loop. The unit operator would then direct the local auxiliary unit operator (AUO) to manually open the boration valve and establish a boration flow path. Since there would be no indication of the actual boration flow rate, the operator would use caution

and proceed slowly in ensuring shutdown margin. The operator would have calculated a predetermined amount (gallons) of 20,000-parts per million (ppm) boron solution to be added through the boration valve. The operator would also proceed slowly by injecting boron in small intervals and following up each injection with an RCS grab sample analysis by Chemistry to determine the actual concentration of the boron in the RCS. In addition, the ACR source range nuclear instrumentation is available to monitor the effects of boron injection.

Loss of RCS Hot Leg Temperature Indication

This temperature indication has several functions upon abandonment of the MCR. These are: (1) verifying natural circulation; (2) determining shutdown margin; (3) identifying an RCS overcooling transient and determining RCS cooldown rate; and (4) ensuring RCS subcooling margin. Upon loss of this indication, the operator would still have sufficient information to perform all the functions identified above. A discussion of each function follows.

Natural Circulation Verification

In a letter to NRC dated December 18, 1984, TVA committed to NRC that natural circulation verification in the ACR would be provided by utilizing the difference between the RCS T(hot) and the steam generator (SG) pressure. The SG saturated conditions will provide a corresponding T(cold) temperature by using the SG pressure. Even though T(hot) is not available in the subject scenario, plant personnel would have a reliable method of verifying natural circulation by the following:

(1) Auxiliary feedwater (AFW) demand continues or increases.

(2) SG water level remains relatively constant.

(3) RCS pressurizer pressure remains constant.

A consistent AFW demand and steady SG level indicate steam is being produced and dumped through the SG atmospheric relief valve. Heat removal from the RCS will have a direct impact on maintaining or decreasing the pressurizer pressure. Therefore, the above parameters provide assurance that heat is being removed from the RCS by natural circulation.

A loss of natural circulation would be detectable in an SG if there was no evidence of steaming. The following conditions would exist if this event occurred:

(1) AFW demand would slow down and eventually stop.

(2) SG water level would remain constant or gradually increase.

(3) RCS pressurizer pressure would gradually increase.

The above parameters are verifiable in the ACR. Therefore, the subject scenario will not prevent plant personnel from verifying natural circulation.

Determination of Shutdown Margin

Means of achieving and maintaining shutdown margin are provided in normal and emergency procedures to comply with Technical Specification 3/4.1, "Reactivity Control." Adequate instrumentation and controls are provided in the ACR and 6.9-kilovolt shutdown board room to accomplish this objective. AOI-27 describes the action necessary to implement this objective. The following features are provided to ensure boration control is achievable during normal, accident, or emergency conditions.

The boron injection system ensures that negative reactivity control is available during each mode of facility operation. The components required to perform this function include: (1) borated water sources, (2) charging pumps, (3) separate flow paths, (4) boric acid transfer pumps, (5) associated heat tracing systems, and (6) an emergency power supply from operable diesel generators.

With the RCS average temperature above 200°F, a minimum of two separate and redundant boron injection systems are provided to ensure single functional capability in the event an assumed failure renders one of the systems inoperable. The boration capability of either flow path is sufficient to provide a shutdown margin from expected operating conditions of 1.6 percent delta k/k after xenon decay and cooldown to 200°F. The maximum expected boration capability requirement occurs at EOL from full power equilibrium xenon conditions and requires 6,042 gallons of 20,000-ppm borated water from the boric acid storage tanks or 82,082 gallons of 2,500-ppm borated water from the refueling water storage tank.

With the RCS temperature below 200°F, one injection system is acceptable without single failure consideration on the basis of the stable reactivity condition of the reactor and the additional restrictions prohibiting core alterations and positive reactivity change in the event the single injection system becomes inoperable.

Shutdown margin verification may be achieved by taking RCS grab samples and performing a chemical analysis to determine the actual boron concentration in the RCS.

Identification of an RCS Overcooling Transient and Determination of RCS Cooldown Rate

The operator has indications available for immediate identification of an RCS overcooling transient. Since the temperature rise across the core is small once the rods are inserted, RCS T(cold) based upon steam generator temperature (with a calculation based upon SG pressure and the SG at saturated conditions) could be used to quickly determine an approximate RCS temperature. Additionally on the primary side, he would have pressurizer pressure and level available in the ACR. Source range nuclear instrumentation is available and the rate could start increasing during this transient. SG pressures and levels and AFW flow would be available (SG pressures could be decreasing and AFW flow could be increasing). These indications would be sufficient to identify the transient, and AUOs could be dispatched to locate and mitigate the source of the transient.

Ensuring RCS Subcooling Margin

Since the temperature rise across the core is small once the rods are inserted, RCS T(cold) based upon steam generator temperature (with a calculation based upon SG pressure and the SG at saturated conditions) could be used to quickly determine an approximate RCS temperature. The SG saturated conditions will provide a corresponding T(cold) temperature by using the SG pressure. Pressurizer pressure would then be used to determine the RCS saturation temperature. These two temperatures would then be used to determine subcooling margin.

Loss of RHR Heat Exchanger Outlet Temperature Indication

These indications are not needed in hot standby conditions. They only affect long-term cooldown and are not needed until the plant is taken to hot shutdown conditions (<350°F). At that time, an AUO can be dispatched locally at the RHR heat exchanger to monitor available local indicators (TI-74-15 and -27).

CONCLUSION

The preceding discussions show that even if a control building fire had caused the loss of all seven of the subject instruments, the impact on the ability to bring the plant to hot standby and maintain it at hot standby would have been minimal. Additionally, the equipment required to establish a shutdown path would have been unaffected. Thus, it can be concluded that the subject condition did not result in adverse effects on the health and safety of the public or plant personnel.

CORRECTIVE ACTIONS

Instrument 1-TI-68-1C was returned to service at 0056 EST on October 31, 1990, after another instrument was substituted for it in the ACR as a temporary alteration. The substitute instrument and its power supply are independent of the control building. The temporary alteration will remain in effect until 1-TI-68-1C is repaired or replaced during the Unit 1 Cycle 5 refueling outage. The LCO 3.3.3.5 entry made October 24, 1990, on this instrument was exited at that time. The LCO 3.3.3.5 entry made October 27, 1990, for the other six Unit 1 instruments remained in effect.

As soon as the scope of the problem was identified, engineering and design work was initiated to prepare Design Change Notices (DCNs) M05862A and M05866A for Unit 1 and Unit 2 respectively to implement corrective action. Both DCNs were issued at approximately 0400 EST on October 31, 1990. The corrective actions provided by the above DCNs are as follows.

(1) Reassignment of power supplies for the seven involved instrument loops and other nondivisional associated instrument loops (shared power supplies) to the 120-volt (V), alternating-current (ac) Vital Instrument Power Boards 1-IV and 2-IV located in the auxiliary building on elevation 734.0.

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(2) Reconfiguration of the instrument power supply cable routes (three cables per unit) in such a way to retain the existing auxiliary building and reactor building portions of the cable routes and the abandoning of the control building portions. Cables were identified and cut at the control/auxiliary building walls (Q-line) and pulled back from the control building side of the cable tray penetration and terminated in new junction boxes and routed in new conduit to the 120-V ac vital instrument boards. This reroute is totally external of the control building.

The modifications to implement the subject DCN on Unit 1 were completed late on October 31, 1990. Unit 1 exited LCO 3.3.3.5 for the remaining six instruments at 0907 EST on November 1, 1990. The modifications on Unit 2 were completed on November 2, 1990.

An internal TVA corporate quality assurance audit is currently being conducted at SQN (November 5-16, 1990). The purpose of this audit is to review the Appendix R and fire protection programs at SQN to determine if there are any programmatic problems. The results of this audit will be reviewed and any appropriate corrective actions identified will be implemented.