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J. L. Wilson
Vice President, Sequoyah Nuclear Plant

January 13, 1992

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

Gentlemen:

TENNESSEE VALLEY AUTHORITY - SEQUOYAH NUCLEAR PLANT UNIT 1 - DOCKET NO. 50-327 - FACILITY OPERATING LICENSE DPR-77 - LICENSEE EVENT REPORT (LER) 50-327/91025

The enclosed LER provides details concerning the inoperability of the Unit 1 main steam isolation valves. This event is being reported in accordance with 10 CFR 50.73(a)(2)(i)(B) as an operation prohibited by Technical Specifications and 10 CFR 50.73(a)(2)(ii)(B) as a condition that was outside the design basis of the plant.

Sincerely,

J. L. Wilson

Enclosure
cc: See page 2

IE22
1/1

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LICENSEE EVENT REPORT (LER)

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TITLE (4) Main steam isolation valves inoperable because jumpers had not been removed following maintenance

EVENT DAY (5)			LER NUMBER (6)		REPORT DATE (7)			OTHER FACILITIES INVOLVED (8)	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	MONTH	DAY	YEAR	FACILITY NAMES	DOCKET NUMBER(S)
1 2	1 4	9 1	9 1	0 2 5	0 0	0 1	1 3	9 2		0 5 0 0 0

OPERATING MODE (9)	3	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more of the following)(11)					
POWER LEVEL (10)	0 0 0	20.402(b)		20.405(c)		50.73(a)(2)(iv)		73.71(b)	
		20.405(a)(1)(i)		50.36(c)(1)		50.73(a)(2)(v)		73.71(c)	
		20.405(a)(,ii)		50.36(c)(2)		50.73(a)(2)(vii)		OTHER (Specify in	
		20.405(a)(1)(iii)	XX	50.73(a)(2)(i)		50.73(a)(2)(viii)(A)		Abstract below and in	
		20.405(a)(1)(iv)	XX	50.73(a)(2)(ii)		50.73(a)(2)(viii)(B)		Text, NRC Form 366A)	
		20.405(a)(1)(v)		50.73(a)(2)(iii)		50.73(a)(2)(x)			

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER (AREA CODE)
J. W. Proffitt, Compliance Licensing	6 1 5 8 4 3 - 6 6 5 1

COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS	CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS

SUPPLEMENTAL REPORT EXPECTED (14)		EXPECTED SUBMISSION DATE (15)	MONTH	DAY	YEAR
YES (If yes, complete EXPECTED SUBMISSION DATE)	X NO				

ABSTRACT (Limit to 1400 spaces, i.e., approximately fifteen single-space typewritten lines) (16)

During the performance of a special test of the main steam isolation valves (MSIVs) on December 14, 1991, jumpers were discovered on the A train closure circuitry that had not been removed following outage maintenance activities. The jumpers would prevent manual or automatic closure of the MSIVs from the A train circuitry or protective signals. The MSIVs were declared inoperable, and the appropriate Limiting Conditions for Operations (LCOs) were entered. The jumpers were removed and the valves were subsequently stroke-time tested successfully. The Loop 4 valve was adjusted, retested, and declared operable. The other valves were tested successfully. Jumpers had been removed from the B train circuitry following outage maintenance activities. Jumpers were not removed from the A train circuitry because personnel did not properly use and follow procedures. Maintenance personnel will be briefed on the requirements and importance of prejob briefings, following procedures, and having work instruction in the field. Contributing causes were also identified and are being addressed.

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TEXT (If more space is required, use additional NRC Form 366A's) (17)

I. PLANT CONDITION

Unit 1 was operating in Mode 3, hot standby, with reactor coolant system (RCS) temperature at 545 degrees Fahrenheit and RCS pressure at 2235 pounds per square inch gauge.

II. DESCRIPTION OF EVENT

A. On December 14, 1991, it was determined that the Unit 1 main steam isolation valves (MSIVs) (EIIS Code SB) were inoperable. NRC was notified in accordance with 10 CFR 50.72(b)(2)(i).

During the Unit 1 Cycle 5 refueling outage (U1C5 RFO), all four MSIVs had their valve stem packing replaced with a new packing configuration to enhance packing performance. Electrical jumpers were installed on each A and B train actuation circuit for each MSIV (eight jumpers total) to open the MSIVs for the packing activity. The activity could not be performed with the valves closed because of physical obstruction. On November 16, 1991, after the valves had been repacked, two electricians, who were temporary outage staff augmentation personnel, were directed to support mechanical maintenance personnel by removing the jumpers so the MSIVs could be stroked. A brief discussion of the job task was held with the electrical maintenance foreman and the two electricians before going to the field. The work document was not taken to the work location. One electrician located the B train local junction boxes, removed two jumpers from each B train junction box (one junction box in the east valve vault and one junction box in the west valve vault), verified each MSIV stroked when the jumpers were removed, and obtained verification from the other electrician that the four jumpers were removed. Neither electrician was aware four more jumpers were installed on the A train circuits. After removing the four B train jumpers, the electricians returned to the maintenance shop and signed the work document indicating the required configuration changes were completed. Both electricians failed to read and recognize that the work instruction and configuration log listed four junction boxes and eight jumpers under the installation section. They each signed the work instruction step and configuration log, one as performer and one as verifier, that the jumpers had been removed.

The post maintenance test (PMT) for the repacking task was performed in Mode 5 and the five-second acceptance criteria was not met as required by Technical Specification 3.7.1.5, "Main Steam Line Isolation Valves." Stroke times were significantly slower than the expected 3.5 seconds based on previous test results. Troubleshooting focused on the new packing configuration as the problem. After discussions with the vendor, packing adjustment, packing replacement, exhaust vent path adjustments and stem lubrication, the PMT acceptance criteria for stroke time was met (with stroke times of four and one half to five seconds) and the valves declared operable.

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On December 11, 1991, shortly after Mode 3 was entered, a problem evaluation report was presented to management, which indicated that the MSIV PMT was potentially inadequate in that it did not perform single train vent path testing to verify valve stroke time. This concern resulted from a review of test methodology and the recent PMT stroke time data. Testing with a single train vent path would be expected to add additional time (approximately one second) to dual train test results. Resultant single train valve stroke times when added to the time for the electronics response could result in exceeding the overall single train response time (seven seconds) required by Technical Specification 3.3.2.1., "Engineered Safety Feature Actuation System Instrumentation." A review of the Unit 2 stroke time data indicated sufficient margin and Unit 1 data indicated a close margin; a Unit 1 confirmatory test was determined to be prudent. A special test instruction (STI) had to be written to perform the single train vent path testing of each MSIV; individual train valve handswitces do not exist. During performance of this special test on December 14, 1991, the MSIVs would not stroke using an A train transfer switch in the backup control room.

The same electrician who had lifted the B train jumpers was assigned to troubleshoot the problem. Upon opening the A train junction boxes he discovered that jumpers were installed. He immediately notified his supervisor of the discovery of the jumpers and that it was possible these jumpers were left from the earlier activity. LCO 3.0.3 was entered on Unit 1 at 2239 Eastern standard time (EST) because the A train solid state protection system (SSPS) actuation of the MSIVs was precluded by the jumpers. The jumpers were removed, testing was performed, and LCO 3.0.3 exited at 0009 EST December 15, 1991. The Loop 4 MSIV did not initially pass the stroke time test criteria because of a limit switch problem. Therefore, the limit switch was adjusted, the PMT was completed, and the valve was subsequently declared operable. LCO 3.7.1.5 was exited at 0120 EST.

B. Inoperable Structures, Components, or Systems that Contributed to the Event

None.

C. Dates and Approximate Times of Major Occurrences

1. October 28, 1991 — Work Order (WO) 90-27948-46 was approved to change the packing of the Unit 2 MSIV. (Unit 1 was in Mode 6, refueling.)

2. November 13, 1991 — WO 90-27948-46 was replanned to open the MSIVs locally by installing electrical jumpers in the circuit.

3. November 14, 1991, at 2000 EST — Unit 1 entered Mode 5, cold shutdown.

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4. November 14, 1991 — Work began on WO 90-27948-46. Eight jumpers were installed; one in each MSIV A and B train circuit.

5. November 16, 1991 — The four B train jumpers were removed, and the valves were stroked. The WO was signed as completed.

6. December 6, 1991 — The PMT was performed to verify the MSIV valve stroke time in accordance with Technical Specification 3.7.1.5.

   Final stroke times were greater than those experienced in the past--close to five seconds.

7. December 11, 1991, at 1046 EST — Unit 1 entered Mode 3, hot standby.

8. December 11, 1991 — Shortly after the unit entered Mode 3, a problem evaluation report (PER) was presented to management.

   Units 1 and 2 data were evaluated. The decision was made for additional testing on Unit 1.

9. December 14, 1991 — A special test was performed and showed that the B train transfer switches resulted in valve closure, but the A train transfer switches did not result in closure of the valves.

   The electrician discovered that the jumpers were installed and immediately notified his supervisor.

10. December 14, 1991, at 2239 EST — Operations was notified; all four MSIVs were declared inoperable. Action statements for LCOs 3.7.1.5 and 3.0.3 were entered.

11. December 15, 1991, at 0002 EST — The jumpers were removed, and testing was completed. LCO 3.0.3 was exited.

12. December 15, 1991, at 0120 EST. — LCO 3.7.1.5 was exited for Loop 4.

D. Other Systems or Secondary Functions Affected

None.

E. Method of Discovery

From review of the PER concerning stroke testing methodology and recent MSIV test performance, additional testing of the MSIVs was performed. As a result of the testing, the existence of the jumpers was identified.

F. Operator Actions

Upon notification of the jumpers being installed on the MSIVs, Operations declared all four MSIVs inoperable, and LCOs 3.7.1.5 and 3.0.3 were entered.

G. Safety System Responses

None.

III. CAUSE OF THE EVENT

A. Immediate Cause

The immediate cause of this event was that the jumpers associated with the MSIV A train circuitry were not removed following maintenance activities.

B. Root Cause

The root cause of this event was that the craft personnel did not follow procedures. Craft personnel did not ensure that the work document was in the field as required by procedure, the electricians did not follow the work order to remove all eight jumpers, the electricians did not carefully read the work document before signing the action, and the electricians incorrectly signed the work document indicating all jumpers had been removed.

C. Contributing Factors

A combination of weaknesses in the controls for the use of temporary personnel and weaknesses in work processes and implementation by permanent personnel contributes to this event. The dual train feature of the MSIVs and Section XI testing was not recognized in assignment of the PMT and verification. Specific examples of these contributing weaknesses are described below.

The electricians involved in this job were not familiar with plant verification requirements and did not carefully read documents prior to signing.

The craft general foremen did not ensure that the electricians, who were temporary personnel, were fully briefed on the scope of their work activities and expectations for work performance in the field, e.g., careful review of work documents and use in the field.

The maintenance planner did not specify the verification type in the work order for jumper removal. The PMT specified for the packing activity was inadequate to detect the presence of jumpers and the verification type in the configuration log was inappropriate, given the PMT limitations.

The work order did not provide detailed information for jumper removal. In addition, the train A and B jumpers were listed as one entry for each MSIV on the configuration log.

IV. ANALYSIS OF THE EVENT

The presence of the jumpers prevented manual or automatic closure of the MSIVs from the A train circuitry or protection signals. The design bases of the plant described in the FSAR and the Technical Specifications state that the plant has been designed for the uncontrolled blowdown of only one steam generator. If a break were to occur in the steam line downstream of the main steam isolation valve and the Train B SSPS were to fail, a four steam generator blowdown would occur until manual action was taken to isolate the MSIVs. Additionally, for breaks upstream of the MSIVs safety grade isolation of the intact generators would not be assured. The SQN technical specifications do not require that the MSIVs be operational in modes 4 or 5. Thus, operation in mode 1, 2, or 3 with the Train A main steam isolation logic disabled results in being outside the design basis of the plant.

During the time that SQN operated in Mode 3 with the jumpers in place, the RCS was borated to greater than 1800 ppm. This boron concentration assures that the reactor would not have gone critical during an overcooling event (i.e., following a main steam line break [MSLB] discussed below). Thus, the fuel limits would have been met for a MSLB even if none of the MSIVs closed. This evaluation showed that temperatures and pressures in plant structures for design

or equipment qualification would not be exceeded if the MSIVs did not close. On this basis, it is concluded that for the operational conditions under which the jumpers were in place a main steam line break would have had no effect on the health and safety of the public.

For operation in modes 1, 2, or 3 (unborated) a break upstream of the MSIVs does not result in a blowdown that exceeds the blowdown in the FSAR analysis. This evaluation takes credit for non-safety grade isolation of the intact steam generators from the turbine. For breaks less than 1.5 ft^2 downstream of the MSIVs, the FSAR analyses are bounding. For a large break downstream of the MSIV it is concluded, on the basis of the conservatisms and margin to DNB in the FSAR and an RCS cooldown scoping analysis, that DNB would not occur for a blowdown of all four steam generators. This conclusion is based on a design basis evaluation of Mode 3 (actual condition) events and realistic response modeling for potential power operation. A single failure that prevents closure of the MSIVs does not change the containment pressure or temperature response due to isolation of the intact steam generators from the break by the safety related main steam line check valve. The impact of four steam generators blowing down in the main steam valve vaults was evaluated and it was concluded that the EQ temperature evaluations and the design pressure studies were still valid.

In addition to the above discussion, the MSIVs could also be manually closed upon detection of the event. Multiple indications and parameters that are normally monitored would identify both the event and failure of the MSIVs to close. Accordingly, prompt operator action to terminate the scenario can be reasonably assumed.

The steam generator tube rupture event was also reviewed. Leaving the MSIVs open to allow blowdown to the condenser is preferred to venting through the atmospheric dump valves. Again, the MSIVs could be manually closed if required. Thus, it was concluded that the steam generator tube rupture evaluations were not affected by this event.

It is concluded that the presence of the jumpers in the A train main steam isolation circuit did not represent a significant risk to the plant or the public.

V. CORRECTIVE ACTIONS

1. A preliminary investigation was performed to address three areas of concern before Unit 1 criticality:

   A. The potential generic implications on the PMT program for dual trained devices.

   B. The potential generic implications on safety-related work performed by or supported by Electrical Maintenance.

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C. Recurrence control to prevent future incidents of inadequate maintenance configuration control.

Results of this investigation were reviewed by senior TVA management and by the Plant Operations Review Committee on December 16, 1991, before taking the unit critical. Briefings were conducted with oncoming maintenance shifts on this event, which provided explicit direction related to making signoffs in work documents after the fact, the importance of second-party and independent verification, and the ramifications for failure to meet these job requirements.

2. Appropriate disciplinary action is being taken for the individuals involved with this event.

3. Maintenance personnel will be further briefed on the requirement and the importance of having work instructions in hand and working them step-by-step in the field. The briefing will address the importance of pre-job briefings by the foreman of any craft performing work, regardless of who has the work order package. The briefing will also emphasize the importance of the accuracy of verification and the clarity of the configuration change log (i.e., uniquely identifying each item to change/restore).

4. Appropriate plant procedures will be revised to identify dual train actuated components to ensure PMT specified in work documents adequately address these components.

5. The administrative instruction governing verification will be enhanced to include qualification requirements for verification performers.

6. Staff augmentation personnel controls and work processes will be strengthened.

7. Additional guidance will be provided to planners to ensure appropriate detail is provided in work documents.

LICENSEE EVENT REPORT (LER)

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VI. ADDITIONAL INFORMATION

Several previous reportable events were identified that contained causes or contributing factors similar to those noted in the investigation of this event. The following were identified as being similar: LERs 50-327/91005, 50-327/91009, 50-327/91011, 50-327/91017, 50-328/91003, 50-328/91004, and Special Report 91-01. Though similarities do exist in these events, differences in circumstances and causes led to corrective actions focused on the specific event that did not prevent this current event.

A symptomatic review of this and recent events involving inappropriate personnel actions indicate a continuing lack of formality with regard to performance of some activities. Actions previously taken were intended to ensure that expectations were clearly conveyed, understood, and concurred with by working level personnel and were to be enforced by line supervision and middle level management. Although these actions have helped to reduce the number of events, the need for continued reinforcement of expectations to line supervisors is evidenced.

This event and other events are additionally being evaluated on a broader basis relative to managing and controlling temporary (staff augmentation) personnel, dissemination of expectations and performance of permanent TVA employees in supervising temporary personnel, and the extent of controls provided by site work processes. Improvements associated with temporary personnel training and responsibilities, permanent employee supervision responsibilities, and work process enhancements are being developed and implemented as part of this evaluation.

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VII. COMMITMENTS

1. Maintenance personnel will be briefed on the requirement and the importance of having work instructions in hand and working them step-by-step in the field. The briefing will address the importance of pre-job briefings by the foreman of any craft performing work, regardless of who has responsibility for the work order package. The briefing will also emphasize the importance of the accuracy of verification and the clarity of the configuration change log (i.e., uniquely identifying each item to change/restore). This item is ongoing and will be completed by February 3, 1992.

2. The administrative instruction governing verification will be revised to include the qualification requirements for verification performers. This action will be completed by February 21, 1992.

3. Appropriate plant procedures will be revised by April 7, 1992, to identify dual train actuated components to ensure PMT specified in work documents adequately address these components.

4. Staff augmentation personnel controls and work processes will be strengthened by March 6, 1992.

5. Additional guidance will be provided to planners to ensure appropriate detail is provided in work documents by March 6, 1992.

PL090204/1595