TVA

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J. L. Wilson
Vice President, Sequoyah Nuclear Plant

May 18, 1992

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

Gentlemen:

TENNESSEE VALLEY AUTHORITY - SEQUOYAH NUCLEAR PLANT UNIT 1 AND UNIT 2 - DOCKET NOS. 50-327 AND 50-328 - FACILITY OPERATING LICENSES DPR-77 AND DPR-79 - LICENSEE EVENT REPORT (LER) 50-327/92009

The enclosed LER provides details concerning a potential loss of auxiliary feedwater condition resulting from inadequate design interface for the anticipated transient without scram mitigating system-actuation circuitry. This condition is being reported in accordance with 10 CFR 50.73(a)(2)(i)(B) as an operation prohibited by technical specifications and in accordance with 10 CFR 50.73(a)(2)(ii)(B) as a condition outside the design basis of the plant.

Sincerely,

JLWilson

J. L. Wilson

Enclosure
cc: See page 2

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cc (Enclosure):

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NRC Form 366 (6-89) | U.S. NUCLEAR REGULATORY COMMISSION | Approved OMB No. 3150-0104 Expires 4/30/92

LICENSEE EVENT REPORT (LER)

FACILITY NAME (1): Sequoyah Nuclear Plant, Unit 1

DOCKET NUMBER (2): 0|5|0|0|0|3|2|7

PAGE (3): 1 OF 0|6

TITLE (4) Potential Loss of Auxiliary Feedwater Condition Resulting From Inadequate Design Interfaces for the Anticipated Transient Without Scram Mitigating System-Actuation Circuitry (AMSAC)

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)
									Sequoyah, Unit 2	0|5|0|0|0|3|2|8
0|4	1|6	9|2	9|2	0|0|9	0|0	0|5	1|8	9|2		0|5|0|0|0| |

OPERATING MODE (9): 4

POWER LEVEL (10): 0|0|0

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more of the following)(11)

__ 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)(1)(ii)	__ 50.36(c)(2)	__ 50.73(a)(2)(vii)	__ OTHER (Specify in Abstract below and in Text, NRC Form 366A)
__ 20.405(a)(1)(iii)	XX 50.73(a)(2)(i)	__ 50.73(a)(2)(viii)(A)	
__ 20.405(a)(1)(iv)	XX 50.73(a)(2)(ii)	__ 50.73(a)(2)(viii)(B)	
__ 20.405(a)(1)(v)	__ 50.73(a)(2)(iii)	__ 50.73(a)(2)(x)	

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER
J. W. Proffitt, Compliance Licensing	AREA CODE 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)

__ YES (If yes, complete EXPECTED SUBMISSION DATE) | X | NO

EXPECTED SUBMISSION DATE (15): MONTH | DAY | YEAR

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

On April 16, 1992, with both units shut down, it was determined that should the plant experience a transient-induced or spurious mitigating system-actuation circuitry signal and a subsequent loss of offsite power while operating above 40 percent reactor power, the motor-driven AFW pump circuit breakers would lock out; a loss of auxiliary feedwater could occur upon a failure of the turbine-driven AFW pump until the AMSAC signal timed out six minutes later. The cause of this condition was determined to be a lack of interdisciplinary design review in the development of the AMSAC design change. The AMSAC design was issued under a design control process that did not formally require interdisciplinary reviews. The current design control process requires interface reviews at various stages of the design. A design change was implemented to modify the AMSAC logic to ensure that the AFW pumps will function when required. The Sequoyah AMSAC design criteria will be revised to include electrical power requirements. This is considered to be an isolated event; however, a review of design changes (issued under the old design change process) associated with auxiliary power, which were not required to be implemented for restart from the extended outage, will be performed.

I. PLANT CONDITIONS

Unit 1 was in Mode 4 and Unit 2 was in a refueling outage in Mode 6.

II. DESCRIPTION OF EVENTS

A. On April 10, 1992, a problem evaluation report was initiated, which identified that the motor-driven auxiliary feedwater (AFW) (EIIS Code BA) pump circuit breaker (EIIS Code BKR) would oscillate open and closed if the associated handswitches were in the pull-to-lock position and an anticipated transient without a scram (ATWS) mitigating system-actuation circuitry (AMSAC) signal was present.

Upon further review of the identified condition by Nuclear Engineering (NE) and Operations, the problem evaluation report was revised on April 15, 1992, to indicate that should the plant experience a transient-induced or spurious AMSAC signal (e.g., low-low steam generator (SG) level in three of four SGs because of a secondary side transient) and then a loss of offsite power (loop) while operating above 40 percent reactor power, the motor-driven AFW pump circuit breakers would lock out.

The AFW pump design includes medium voltage breakers with an "antipumping" relay. This relay prevents breaker closure (i.e., locks out) if concurrent trip and close signals are present after one breaker operation (close/open). A "close permissive relay" is installed and prevents a concurrent trip and close signal to the breaker. The AMSAC signal closes the breaker and resets the close permissive relay. The undervoltage relays will trip the breaker and operate the close permissive relay, allowing breaker closure upon the next signal. However, the breaker requires approximately two seconds to recharg the closing springs before the next closure can occur. With the AMSAC signal maintained, the antipumping relay for the breaker will be energized, causing a lockout before the closing springs can recharge. The above condition will result in: (1) the presence of a maintained close signal since AMSAC is maintained until turbine impulse pressure reduces to a pressure of less than the corresponding 40 percent reactor power level value plus a 360-second time delay below 40 percent, and (2) the presence of a concurrent trip signal when the plant experiences a loss of offsite power. Therefore, when diesel generator loading is available (approximately 30 seconds for sequencing of AFW) the motor-driven AFW pump breakers will remain open (locked out) until the AMSAC signal times out six minutes later. In this scenario, no indication that the associated breakers are locked out is available.

LICENSEE EVENT REPORT (LER)
TEXT CONTINUATION

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Sequoyah Nuclear Plant, Unit 1	0 5 0 0 0 3 2 7	9 2	-- 0 0 9	-- 0 0	0 3 OF 0 6

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

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

None.

C. Date and Approximate Time of Major Occurrences

October 8, 1985	AMSAC design was issued.
May 23, 1990	AMSAC design was implemented on Unit 1.
November 8, 1990	AMSAC design was implemented on Unit 2.
Fall 1991	Operations training observed a potential problem with AFW in that the motor-driven AFW pumps would not restart after being placed in the pull-to-lock position. It was determined that the motor-driven AFW pumps would start after the AMSAC signal had cleared and reactor power level was less than 40 percent. Operations training discussed the findings with the AFW system engineer.
November 26, 1991	A problem evaluation report was initiated by the system engineer to document the potential problem, but was not processed. The cause for not processing the report could not be determined.
April 10, 1992	Another problem evaluation report was initiated by the system engineer to document the problem with the AMSAC circuitry.
April 15, 1992	The problem evaluation report was revised to reflect extent of condition determined from NE and Operations review.
April 16, 1992	It was concluded that the potential for loss of all AFW existed for specific scenarios and was reported to NRC.
April 20, 1992	A design change was implemented correcting the identified condition on Unit 1.
May 9, 1992	A design change was implemented correcting the identified condition on Unit 2.

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6) YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	PAGE (3)
Sequoyah Nuclear Plant, Unit 1	0 5 0 0 0 3 2 7	9 2	-- 0 0 9 --	0 0	0 4 OF 0 6

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

D. Other Systems or Secondary Functions Affected

None.

E. Method of Discovery

A potential problem was identified on the simulator with the AFW pump. The problem on the simulator occurred with an AMSAC signal present and the AFW pump placed in pull-to-lock and when subsequently placed in auto, the AFW pump would not restart. The pump could only be restarted on the simulator by going to stop and then releasing the handswitch to auto after the AMSAC signal had cleared (greater than six minutes and less than 40 percent power). This problem was discussed with the AFW system engineer who reviewed the problem. The conclusion reached was that the AFW circuit breaker would oscillate open/closed when the AFW pump handswitch was in pull-to-lock and receipt of an AMSAC signal. Further review and evaluation of the AMSAC, reactor protection system, LOOP, and diesel generator loading circuitry identified the subject condition.

F. Operator Actions

Not applicable - no operator actions were required.

G. Safety System Response

Not applicable - no safety system responses were required.

III. CAUSE OF EVENT

A. Immediate Cause

The immediate cause of this condition was the incorrect location of the AMSAC circuitry in the AFW pump circuitry.

B. Root Cause

The root cause of this condition was determined to be a lack of interdisciplinary design review in the development of the AMSAC design change. The AMSAC design was issued under a design control process that did not formally require interdisciplinary reviews. The design change review focused on instrumentation and controls and did not consider the effect of an inadvertent AMSAC actuation followed by a loss of offsite power. Instead, the design focused on the purpose of AMSAC, i.e., to provide a independent backup to the reactor protection system in the event of a failure. Thus, the focus was toward the failure of the reactor protection system as the event.

C. Contributing Factors

Contributing to this event was the fact that the AMSAC design criteria did not include electrical power requirements. The design criteria was developed by the NE section and was reviewed by the Electrical Instrumentation and Control sections and therefore also did not focus on the electrical power requirements.

IV. ANALYSIS OF EVENT

The AMSAC system is a non-safety-related, non-1E powered system that was designed to initiate auto-start signals for the AFW pumps in addition to the initiation of a main turbine trip, thereby, maintaining an reactor coolant system pressure of less than 3200 pounds per square inch gauge. If not blocked, the auto initiation signals are transmitted upon detection of 3/4 low-low steam generator water levels at a setpoint established at approximately 5 percent below the reactor protection system-generated signal. The signal blocking/permissive was designed to block arming of AMSAC until the plant reached or exceeded a reactor power level of approximately 40 percent. The system design also employed the use of time delay pick-up and drop-out relays. The primary function of the time delay relay was to mitigate operational transients and allow the RPS to generate the initial signals for AFW pump starts and turbine trip based on detection of 2/3 steam generator low water levels. The design established the time delay requirement of less than 30 seconds and with a dropout of approximately 360 seconds. The function of the dropout was to ensure AMSAC performed its function in the event of a turbine trip.

The consequences of this condition is a possible common-mode failure of both motor-driven AFW pumps to start under required conditions above 40 percent reactor power. The condition results from the maintained AMSAC start signal trying to close the breaker while a loss of offsite power signal is tripping the breaker open. The resulting action of the breaker antipumping device causes one cycle of the breaker followed by breaker lockout until the AMSAC close signal is removed.

For the described condition, i.e., an inadvertent AMSAC actuation, followed by a loss of offsite power with the units operating above 40 percent reactor power, AFW availability would not have been assured until the AMSAC signal times out six minutes later, assuming a coincident single failure of the turbine-driven AFW pump. However, the probability of this scenario (e.g., a transient-induced or spurious AMSAC signal, subsequent of loss of offsite power and single failure of the turbine-driven AFW pump) is considered low.

V. CORRECTIVE ACTIONS

A. Immediate Corrective Actions

TVA initiated and implemented a design change to modify the AMSAC logic to ensure that the AFW pumps will function when required.

B. Actions Taken to Prevent Recurrence

1. TVA will revise the SQN AMSAC design criteria to include electrical power requirements.

2. TVA considers this event to be isolated; however, a sample review of the design changes (issued under the old design change process) associated with auxiliary power, which were not required to be implemented for restart from the extended shutdown, will be performed.

3. Previous actions included a much improved design control process that requires interface reviews at various stages of the design.

VI. ADDITIONAL INFORMATION

A. Failed Components

None.

B. Previous Similar Events

A review of previous reportable occurrences identified a number of events associated with inadequate design or design control process problems. Previous actions include a much improved design control process that requires interface reviews at various stages of the design. Therefore, it is expected that the current design change process would identify this type deficiency.

VII. COMMITMENTS

1. TVA will revise the SQN AMSAC design criteria to include electrical power requirements by July 29, 1992.

2. TVA will review a sample of the design changes (issued under the old design change process) associated with auxiliary power that were not required to be implemented for restart from extended shutdown by July 29, 1992.