TVA

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J. L. Wilson
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March 2, 1992

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
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Gentlemen:

TENNESSEE VALLEY AUTHORITY - SEQUOYAH NUCLEAR PLANT UNIT 1 - DOCKET NO. 50-327 - FACILITY OPERATING LICENSE DPR-77 - LICENSEE EVENT REPORT (LER) 50-327/91009, REVISION 1

The enclosed LER has been revised to provide additional details concerning the cause of the auxiliary building fire suppression water system's reduction in performance and the corrective actions taken that were necessary to return the system to its original configuration and operable status. The inoperability of the auxiliary building fire suppression water system was initially reported on June 5, 1991, in accordance with 10 CFR 50.73(a)(2)(i)(B) as an operation prohibited by technical specifications.

Revisions to the LER are annotated by vertical bars in the right-hand margin.

Sincerely,

J.L. Wilson

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)

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

TITLE (4) Operation with Inoperable Auxiliary Building Fire Suppression System Because of Inadequate Test Performance and Review

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 5	0 6	9 1	9 1	0 0 9	0 1	0 3	0 2	9 2		0|5|0|0|0| |

OPERATING MODE (9): 1

POWER LEVEL (10): 1 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)	__ 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	
	AREA CODE	
C. H. Whittemore, Compliance Licensing	6 1 5	8 4 3 - 7 2 1 0

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
X YES (If yes, complete EXPECTED SUBMISSION DATE)	__ NO		0 7	1 9	9 1

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

This LER provides details concerning the cause of the auxiliary building sprinkler system's reduced performance and also to report the corrective actions taken to return the system to operable status. On May 6, 1991, at 1600 EDT, with Units 1 and 2 operating in Mode 1, LCO 3.7.11.1 was entered when the fire suppression system for the auxiliary building was declared inoperable. The surveillance test that demonstrates the operability of the system was performed on April 2, 1991. On May 6, 1991, the fire protection engineer determined that the test data did not satisfy the acceptance criteria. The test was invalidated, the system was declared inoperable, and LCO 3.7.11.1 was entered. Inadequate managerial supervision had resulted in a test director being assigned to conduct this test in April who had not been properly trained. The test director had incorrectly considered the test acceptable. Following system adjustments and testing, the existing system was considered acceptable to serve as the backup fire suppression system in accordance with Action Statement (b)(1) for LCO 3.7.11.1. The cause of the reduction in system performance has been determined to be internal piping corrosion deposits, incrustation, and a buildup of river sediment. The fire protection system was restored to operable status on December 30, 1991.

DESCRIPTION OF EVENT

On May 6, 1991, at 1600 Eastern daylight time (EDT), with Units 1 and 2 operating in Mode 1 at 100 percent power, SQN Technical Specification (TS) Limiting Condition for Operation (LCO) 3.7.11.1 was entered when the fire suppression water system (EIIS Code KP) for the auxiliary building was declared inoperable.

SQN TS Surveillance Requirement (SR) 4.7.11.1 requires the fire suppression water system to be demonstrated operable at least once every three years by performing a flow test of the system in accordance with Chapter 5, Section 11, of the "Fire Protection Handbook," 14th Edition, published by the National Fire Protection Association. SQN implements this requirement annually for the auxiliary building fire suppression system by performance of Surveillance Instruction (SI) 0-SI-SFT-026-002.0, "Auxiliary Building System Hydraulic Performance Verification." 0-SI-SFT-026-002.0 provides the detailed instructions to determine the hydraulic performance of the auxiliary building high pressure fire protection system. This test measures static pressure, residual pressure, and velocity pressure when a flow is imposed on selected auxiliary building hose stations (a total of nine test configurations are evaluated). The first five configurations are used to collect data for trending purposes to determine system degradation. The last four test configurations are used to obtain data that is compared with acceptance criteria to demonstrate operability of the system.

This test was performed by the Fire Protection Unit (FPU) on April 2, 1991, and the system was declared operable. This was based on the fact that the test director and his management considered the test completed without any deficiencies and with the acceptance criteria met. Site procedure SI-1, "Surveillance Program," requires that TS surveillance package reviews be completed within 10 calendar days of test completion. However, review of the subject performance package in the FPU was not complete until April 12, 1991. The test was then carried to the SRO for review and then delivered to the fire protection engineer on April 15, 1991. On May 6, 1991, the fire protection engineer, while reviewing the test package, discovered that the test method and data did not satisfy the acceptance criteria, i.e., the pressure maintained by the pressure control valve downstream of the pumps was below that required for proper conduct of the test and test data was improperly plotted, incorrectly indicating acceptable results. The test was invalidated, the system declared inoperable, and LCO 3.7.11.1 was entered at 1600 EDT for Units 1 and 2. Although the water suppression system was declared inoperable, the fire pumps were operable, the flow paths were intact, and two additional pumps were also available. It was noted during review that, throughout the test, the reference pressure measured at hydrant 0-26-883 was approximately 10 psig below the minimum required value of 120 psig. Therefore, the main pressure control valve for the suppression system (0-PCV-26-15) was adjusted to 143 psig to increase the reference pressure to approximately 130 psig. Following this adjustment, Test No. 6 of 0-SI-SFT-026-002.0 was successfully performed, which isolates the Unit 2 dedicated eight-inch feed to the auxiliary building loop header. Subsequent to this, however, Test No. 7, which isolates one of the turbine building feeds to the auxiliary building loop, was performed with marginally unsatisfactory results.

DESCRIPTION OF EVENT (Continued)

As a result of this second test, a reduction in actual system performance was confirmed. The decision was made by the Operations Superintendent to utilize the installed fire suppression system as the backup system required by the TSs. The decision considered that actions had been taken to raise system pressure (beyond the previous April test condition) as previously described, testing for one test lineup had met the acceptance criteria, and testing for the second lineup had not met acceptance criteria but by only a small amount. At that point, it was postulated that leakage past boundary valves or increased system resistance, e.g., blockage, could be causing the weak performance. However, the reduction in capability was not considered large, the pumps were determined to be performing properly, the system was intact, and additional pumps were available; therefore it was considered to be an adequate backup suppression system while troubleshooting and testing continued. Subsequently, after strainer cleaning and walkdowns to identify possible leakage paths, further testing confirmed continued performance weaknesses.

As an interim measure, system pressure was further increased and testing under all required configurations fully met test acceptance criteria. The existing system under this configuration continues to be used as the backup suppression system while investigation into the performance reduction continues.

In March 1989 the responsibility for performance of this SI was transferred from Operations to the FPU. The 1989 performance was completed by FPU personnel with the fire protection system engineer serving as the test director. In 1990, the Operations' Section XI test group served as the test director. In 1991, the SI was performed by FPU personnel with a FPU individual serving as test director. The basis for the test director's assignment from outside the FPU, i.e., for 1989 and 1990 SI performances, could not be determined. Only qualified personnel should be assigned the duty of test director. The FPU maintains qualification cards for ready-reference to indicate those individuals that have been trained and qualified for specific SIs. However, in the reorganization of 1989, the management controls for the test director assignment to ensure only qualified personnel were assigned as test directors, were not communicated to or assumed by the FPU foremen. Consequently, on April 2, 1991, the FPU foreman assigned a fire operator as test director for 0-SI-SFT-026-002.0, although training and qualification had not been provided.

The criteria in the SI are twofold. The first requirement is to maintain system reference pressure between 120 and 140 pounds per square inch gauge (psig) throughout data collection. The system pressure was below this range during the April 2, 1991, performance. A note in the acceptance criteria section of the SI states that this acceptance criteria only applies to test six through nine. The test director failed to recognize in tests six through nine that the pressure was outside the acceptance criteria and did not stop to evaluate the discrepancy as required by administrative procedure, Site Standard Practice (SSP) 8.1, "Conduct of Testing."

DESCRIPTION OF EVENT (Continued)

SSP-8.1 provides guidelines to ensure that personnel involved with the test activities are knowledgeable of their duties and responsibilities and that test data including deficiencies are documented. SSP-8.1 also provides guidelines to ensure that test activities are performed by qualified individuals. SSP-8.1 also contains explicit notification requirements for the test director to notify the SOS "if the test acceptance criteria is not met based on a test deficiency discovered during the performance of any activity." This requirement was not met when pressures were recorded and verified to be less than 120 psig.

The SI also requires that graphical plots be made of the data points to verify hydraulic performance. While the SI contains reasonably explicit instruction, the test director was confused over how to plot the data. He discussed the problem with a representative of the Technical Support Group who offered to assist. The test director, believing he understood the method, plotted the data. The hydraulic performance line was incorrectly plotted such that the data points, which were required to fall above the line drawn, were incorrectly deemed to be acceptable.

The fire protection unit foreman that assigned the individual the duties of test director was also unfamiliar with the test and subsequently failed to perform an adequate review of the completed test package by verifying the acceptance criteria had been met. His review was a cursory review to ensure that data blocks and signatures were completed.

The completed package was forwarded to the fire protection engineer. On May 6, 1991, the fire protection engineer reviewed the data package and concluded that the test was unacceptable based on the fact that the system pressure for the test had not been satisfied and that the test acceptance criteria was not met. The fire protection engineer notified the shift operations supervisor (SOS), and LCO 3.7.11.1 was entered at 1600 hours. Appropriate actions were taken to establish a backup fire suppression system as described above.

To restore the system to TS operability, a temporary alteration was made to the high pressure fire protection system. The temporary alteration involved raising the system pressure from its normal setting of 135 psig to 147 psig. This increase in system pressure permitted the hydraulic test to be performed successfully. To restore the system to its original operating pressure and configuration, the system was inspected and discrepancies corrected. In addition, procedures were revised and enhanced to better trend performance and verify operability. After all the corrective action was in place, the pressure control valve was restored to its original value of 135 psig, testing was satisfactorily performed, and the temporary alteration was terminated. System operability was restored in its original configuration on December 30, 1991.

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

CAUSE OF EVENT

The cause of the reduction in system performance has been determined to be a buildup of river sediment compounded by the normal internal corrosions expected of carbon steel pipe subjected to river water. The river sediment buildup in the piping system was not controlled appropriately because of inadequate procedures. The instructions specifying flushing criteria did not require a sufficient flow rate as recommended by the National Fire Protection Association standard for fire mains nor did the instructions require all flow paths to be subjected periodically to a flushing activity. The procedures implemented technical specifications; however, they were not explicit enough to effectively control the sediment buildup over a long period of time.

Additionally, some blockage of the auxiliary building fire suppression system strainers was noted; however, subsequent testing revealed that this anomaly did not significantly effect the system's performance any more than it had already been degraded.

The cause of the surveillance test having been initially accepted was lack of supervisory oversight of daily activities and communication of expectations and responsibilities. This was a direct result of the reorganization in 1989, which reassigned direct supervisory management over the FPU. Direct supervisory management over the FPU was not assumed following the reorganization. The FPU foremen were not directed and did not assume the responsibilities and management control over the test director qualification process. Before the reorganization, the FPU manager had always made the test director assignment based on the knowledge of the training program for test directors. The FPU foreman did not ensure that the individual assigned as test director was qualified and trained on this test as required by SSP-8.1. The foreman was not knowledgeable of these requirements and had not been given clear supervisory direction. The individual conducted the test improperly and interpreted the instructions incorrectly. The test should have been stopped when the acceptance criteria pressure, as indicated in the test, was not satisfied. This may have resulted from lack of training combined with confusion resulting from the procedure format. After the test was completed, the FPU foreman reviewed the test package and did not identify the inadequate test pressures as a deficiency. His review was a cursory review to ensure that data blocks and signatures were completed. A contributing cause is that SI-1 "Surveillance Program," is unclear regarding responsibility for review of completed instructions.

The cause for the delay in reviewing the subject SI once it was completed was twofold. First the FPU reviewer rotated offshift for seven days and second, competing priorities in the Technical Support Group allowed the SI to remain unreviewed for approximately three weeks.

ANALYSIS OF EVENT

This event is being reported in accordance with 10 CFR 50.73(a)(2)(i)(B) as an operation prohibited by TSs. The fire protection system is described in the Updated Final Safety Analysis Report, Section 9.5.1. The fire protection system is designed to provide a reliable source of water or other fire fighting agent to the fire suppression system throughout the plant. An automatic fire detection system is installed in various areas of the plant to provide rapid notification of a fire to the main control room and to initiate automatic suppression when required. The auxiliary building fire suppression water system provides fire protection in plant areas where a fire could affect the ability to achieve and maintain safe plant shutdown.

The results of the April 2, 1991, performance of the SI would indicate that the auxiliary building fire suppression system was significantly degraded (i.e., approximately 85 percent) at the time of the test. Two factors exist to refute this assumption. Primarily, the test conducted subsequent to adjustment of the PCV from approximately 125 psig to 143 psig (Test No. 6) met the acceptance criteria and, in fact, resulted in an improvement of approximately 78 psig extrapolated to the design flow of 1320 gpm. It is highly unlikely that an improvement of this magnitude would have resulted from the 18 psig increase in the controlling pressure of the PCV. Additionally, interviews with the individuals who conducted the April 12, 1991, test revealed that the data was obtained immediately after aligning the system to the specified test configuration. Subsequent testing has revealed that the system PCV is relatively slow-acting and requires several minutes to reestablish system pressure after flow is initiated for any given test. A nominal waiting period of approximately five minutes during troubleshooting activities has resulted in a significant increase in the residual pressure reading used to determine acceptability. With these factors in mind, analysis indicates that the actual system degradation at the time of April 2, 1991, SI performance was approximately 20 to 30 percent. This value is extremely difficult to quantify because of the variable increase in the residual pressure as a function of time to reach equilibrium conditions and the unknown absolute value for the PCV in the as-found conditions on May 6, 1991. Variations in the data obtained by the SI during troubleshooting as a function of PCV setpoint would indicate a degradation value at approximately 20 to 30 percent during the period after April 2, 1991. Therefore, the safety significance of the event is not of the magnitude that would be indicated by the results of the April 2, 1991, performance of the SI.

Although the auxiliary building fire suppression water flowrate and pressure did not meet the established acceptance criteria, suppression was still considered adequate to enable both units to reach and maintain safe shutdown. This conclusion is based on an engineering assessment of the most probable fire situation in the area of highest demand. While fire protection code requirements assume demand from actuation of all

affected area sprinkler heads, it is considered more probable, based on engineering judgment that only ten sprinkler heads would in fact actuate for the assumed 20 foot fire. Maximum flow from ten sprinkler heads in the area of highest demand results in a flow requirement of 396 gpm. Actual data from the April 2, 1991, performance indicates that a minimum of 433 gpm was available with the most limiting header alignment tested. Thus, given the fact that flow would have been available and that equipment/cables for safe shutdown are separated to the greatest extent possible, there is reasonable assurance that any fire in the auxiliary building would not have prevented either unit from achieving and maintaining safe shutdown. Accordingly, this condition did not constitute a threat to the plant personnel or public.

CORRECTIVE ACTION

The immediate corrective action upon determining the test was invalid, was to declare the system inoperable and enter LCO 3.7.11.1 at 1600 EDT on May 6, 1991. Actions were taken to establish a backup fire suppression system within 24 hours. The fire pumps were operable and flow paths intact, the test demonstrating operability was marginally inadequate. It was noted during review that, throughout the test, the reference pressure measured at hydrant 0-26-883 was approximately 10 psig below the minimum required value of 120 psig. Therefore, the main pressure control valve for the suppression system (0-PCV-26-15) was adjusted to 143 psig to increase the reference pressure to approximately 130 psig. Following this adjustment, Test No. 5 of 0-SI-SFT-026-002.0 was successfully performed, which isolates the Unit 2 dedicated eight-inch feed to the auxiliary building loop header. Subsequent to this, however, Test No. 7, which isolates one of the turbine building feeds to the auxiliary building loop, was performed with marginally unsatisfactory results. As previously described, the existing fire protection system was established as the backup fire protection system. Work Request (WR) C015208 was initiated to troubleshoot and correct identified problems. This has resulted in pressure control valves being calibrated, strainers replaced, several suspected points of leakage or blockage eliminated, and other points are being monitored.

As an interim measure, a FPU supervisor position has been established and filled. The FPU supervisor is providing increased management and supervision over FPU daily activities. The FPU supervisor has reviewed and discussed this event with the FPU, stressing expectations and responsibilities regarding work practices. This was accomplished May 22, 1991. Additionally, retraining of the FPU personnel on the requirements of SSP 8.1 was accomplished on May 28, 1991. Broader improvements in overall conduct of the fire protection program are being initiated as a result of a fire protection program improvement task force that is addressing such areas as organization and responsibilities, training, and procedures.

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

A detailed discussion with the interim FPU supervisor, the FPU foreman, test director, and Plant Manager was conducted to reinforce the responsibilities of each individual with respect to performance of a test and their role in review of test packages.

The SI, 0-SI-SFT-026-002.0, will be revised to more clearly indicate the acceptance criteria to be met.

As a result of this event and several other indications, it has been concluded that additional training is needed to ensure proper understanding of requirements for conduct of testing. Test directors are to be retrained and the selection and qualification of test directors will be ultimately controlled by a senior plant management position. This is intended to ensure that an adequate level of experience for each individual evolution is maintained during the performance and during review of test results to obtain a thorough and accurate finished product of plant SIs.

SI-1 has been revised to clearly define responsibilities for the technical review of completed test packages.

The SQN Plant Manager has recently restructured and refocused the daily Plan of the Day meeting with significant emphasis on Surveillance Instruction performance. This includes both timely surveillance performance and review cycle completion.

The pressure control valves have been adjusted and calibrated, and strainers have been cleaned or replaced. The fire protection lines have been cleaned utilizing an industrial-type internal pipeline scrubber process. The yard piping is not considered safety-related; however, a portion of this piping has also been cleaned utilizing the scrubber process.

Procedures used to verify operability of systems and provide trending data will be revised to ensure appropriate flow rates are specified to properly flush piping to control river water sediment. Also, procedures will be revised to ensure piping in remote loops will be periodically subjected to flushing activities. Trending of test data will be used to identify areas of deterioration and adverse trends. These corrective actions were described in the Fire Protection Improvement Plan submitted to NRC.

COMMITMENTS

1. The SI, 0-SI-SFT-026-002.0, will be revised to clearly indicate the acceptance criteria to be met. (This commitment has been superseded by corrective actions detailed in the Fire Protection Improvement Plan submitted to NRC by letter dated October 4, 1991.)

LICENSEE EVENT REPORT (LER)
TEXT CONTINUATION

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

ADDITIONAL INFORMATION

A working meeting between TVA and NRC was held on August 19, 1991, at SQN to discuss the problems TVA had identified relative to the SQN Fire Protection Program. During the meeting TVA described consolidation of various improvement initiatives into an overall Fire Protection Improvement Plan. NRC residents will be periodically informed of the program status. The details of the Fire Protection Improvement Plan were submitted to NRC on October 4, 1991.

P1090204/1452