



Tennessee Valley Authority, Post Office Box 2000, Soddy-Daisy, Tennessee 37379

J. L. Wilson  
Vice President, Sequoyah Nuclear Plant

October 18, 1991

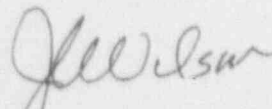
U.S. Nuclear Regulatory Commission  
ATTN: Document Control Desk  
Washington, D.C. 20555

Gentlemen:

TENNESSEE VALLEY AUTHORITY - SEQUOYAH NUCLEAR PLANT UNIT 1 - DOCKET  
NO. 50-327 - FACILITY OPERATING LICENSE DPR-77 - LICENSEE EVENT REPORT  
(LER) 50-327/91002, REVISION 1

The enclosed LER provides details concerning an administrative entry into Limiting Conditions for Operation (LCOs) 3.0.5 and 3.8.1.1 when the air pressure in one of the 2B-B diesel generator (D/G) air start accumulators dropped below 180 pounds per square inch gauge (used at the time of the event to determine operability), while the A train emergency gas treatment system was out of service. Subsequent testing and analysis concluded that the D/G was functional and therefore operable throughout the event. For this reason, the LCO 3.0.5 and 3.8.1.1 entries were not required, and this event did not constitute an operation prohibited by technical specifications. This LER is being revised to document that this is now considered a voluntary report and to provide additional information resulting from further investigation. The changes from TVA's original report are designated by vertical bars in the right hand margins.

Sincerely,

  
J. L. Wilson

Enclosure  
cc: See page 2

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U.S. Nuclear Regulatory Commission  
October 18, 1991

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### LICENSEE EVENT REPORT (LER)

FACILITY NAME (1) Sequoyah Nuclear Plant, Unit 1 DOCKET NUMBER (2) | PAGE (3) |  
0151010131217110F1017

TITLE (4) Voluntary Report of an Event Involving Lack of Response to an Annunciator warning of Decreasing Pressure in the Diesel Generator Air Start System

EVENT DAY (5)			LER NUMBER (6)			REPORT DATE (7)			OTHER FACILITIES INVOLVED (8)		
MONTH	DAY	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER		MONTH	DAY	YEAR	FACILITY NAMES	DOCKET NUMBER (5)	
01	21	91	2102	01		10	18	91	Sequoyah, Unit 2	0151010131218	

OPERATING MODE (9) | THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR 5: (Check one or more of the following) |

<input type="checkbox"/> (9)	<input type="checkbox"/> 20.402(b)	<input type="checkbox"/> 20.405(c)	<input type="checkbox"/> 50.73(a)(2)(iv)	<input type="checkbox"/> 73.71(b)
<input type="checkbox"/> POWER LEVEL (10)	<input type="checkbox"/> 20.405(a)(1)(i)	<input type="checkbox"/> 50.36(c)(1)	<input type="checkbox"/> 50.73(a)(2)(v)	<input type="checkbox"/> 73.71(c)
<input type="checkbox"/> (10)	<input type="checkbox"/> 20.405(a)(1)(ii)	<input type="checkbox"/> 50.36(c)(2)	<input type="checkbox"/> 50.73(a)(2)(vi)	<input checked="" type="checkbox"/> OTHER (Specify in Abstract below and in Text, NRC Form 366A)
	<input type="checkbox"/> 20.405(a)(1)(iii)	<input type="checkbox"/> 50.73(a)(2)(i)	<input type="checkbox"/> 50.73(a)(2)(vii)(A)	
	<input type="checkbox"/> 20.405(a)(1)(iv)	<input type="checkbox"/> 50.73(a)(2)(ii)	<input type="checkbox"/> 50.73(a)(2)(vii)(B)	
	<input type="checkbox"/> 20.405(a)(1)(v)	<input type="checkbox"/> 50.73(a)(2)(iii)	<input type="checkbox"/> 50.73(a)(2)(viii)	

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER
Melissa D. Meade, Compliance Licensing	615843-7765

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

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPROS	CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPROS
JA	615	FUS	US EBI	569	NO				

SUPPLEMENTAL REPORT EXPECTED (14) | EXPECTED SUBMISSION DATE (15) |

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

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

This LER is being revised to document that it is being submitted as a voluntary report. On January 24, 1991, at 0945 Eastern standard time (EST) with Units 1 and 2 in Mode 1, Limiting Conditions for Operation (LCOs) 3.0.5 and 3.8.1.1 were entered. The "A" train emergency gas treatment system (EGTS) was out of service for a filter test when it was discovered that the "B" train diesel generator (D/G) automatic air start system was below the 180 pounds per square inch gauge limit used at the time of the event to determine operability. The air compressor for the D/G starting air system was manually started and the air pressure reestablished. This event resulted from the failure of operational personnel to identify and respond to an annunciator in the main control room, warning of decreasing pressure in the air start system. Troubleshooting revealed the failure of the air compressor to automatically start was caused by a blown fuse (Type NON 10). The blown fuse was replaced and the normal automatic function of the system was restored. As a result of further testing and evaluation, the D/G was determined to have been operable in the as-found condition. Additionally, expectations relative to operator attentiveness to annunciators have been clearly conveyed and the level of awareness of the shift crews has been significantly raised.

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

DESCRIPTION OF EVENT

On January 24, 1991, at 0945 Eastern standard time (EST) with Units 1 and 2 operating in Mode 1 (100 percent power, 2,235 pounds per square inch gauge [psig], and 578 degrees Fahrenheit), Limiting Conditions for Operation (LCOs) 3.0.5 and 3.8.1.1 were administratively entered when both trains of the emergency gas treatment system (EGTS) (EIS Code BH) were conservatively declared inoperable. The "A" train EGTS had been removed from service at 1324 EST on January 23, 1991, for a filter test to be conducted in accordance with O-SI-SFT-065-001.A, "EGTS Filter Train." During the time A train was out of service, it was discovered that the 2B-P diesel generator (D/G) (EIS Code EK) automatic air start system (EIS Code LC) accumulator tank No. 1 contained less than 130 psig (used at the time of the event to determine operability). This limit was based on the starting pressure considered necessary to ensure capability for five D/G starts. The decreased pressure resulted in the 2B-8 D/G being considered inoperable and the "B" train EGTS being declared inoperable in accordance with LCO 3.0.5.

An auxiliary unit operator (AUO) in the D/G building heard an alarm and found a low air pressure alarm sounding. The AUO notified the Unit 2 reactor operator in the main control room (MCR) and received approval to manually start the compressor to recharge the tank. The AUO reported the No. 1 tank's pressure as 140 psig, and the No. 2 tank's pressure as 220 psig. The assistant shift operating supervisor (ASOS) checked the M26 vertical annunciator panel in the MCR and found the annunciator flashing. The air compressor is normally started automatically and recharges the air tank when the air pressure decreases to 250 psig. When the pressure decreases to 200 psig, the low air pressure annunciator window in the MCR is activated, and, in response, the operators in the MCR are expected to acknowledge the alarm and dispatch personnel to troubleshoot and correct the problem. It is intended that the annunciation would provide early notification of system degradation and, depending upon the nature and size of the leak, action could be taken before D/G operability is affected. However, before the AUO notified the operator in the MCR of the low pressure alarm, no audible or visual recognition of a low pressure annunciator had been noted by the MCR operators.

At the time of discovery, the size of the leak and the time of annunciator initiation were unknown. Based on testing and analysis conducted after the pressure in the accumulator was restored, TVA estimated that the annunciator initially alarmed at approximately 0800 and the accumulator dropped below 180 psig at approximately 0830. The AUO discovered the reduced air pressure at 0945, and the pressure was restored to greater than 250 psig at 1005.

Following notification by the AUO in the D/G building, the alarm was acknowledged and three ASOSs were dispatched to the diesel building to troubleshoot and correct the problem. LCOs 3.8.1.1 and 3.0.5 were entered in response to technical specifications (TSs) and operating instructions. The ASOSs discovered the failure of the compressor to function properly in automatic was because of a blown fuse (EIS Code FU) (Bussman Type NON 10) for the air dryer control circuit. The compressors when aligned in automatic will stop and will not restart with a control fuse blown. Following the replacement of the blown fuse, the compressors were determined to be functioning

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

properly. LCOs 3.0.5 and 3.8.1.1 were exited at 1005 EST, when the No. 1 tank pressure exceeded 180 psig (the tank was noted to be pressurized to greater than 250 psig at that time).

DESCRIPTION OF EVENT

On April 9 and April 10, testing and evaluation were conducted to better define the event duration and significance. The as-found condition was simulated and the D/G started and performed in accordance with TS SR 4.8.1.1.2 and requirements from accident analysis assumptions under these conditions. Therefore, D/G operability (ability to perform intended function) was maintained throughout the event. Additionally, analysis based on testing and operating experience concluded that sufficient capacity for five-start qualification was likely available in the as-found condition. For these reasons, the D/G has been shown to have been operable during this event and accordingly, this LER is now being submitted as a voluntary report.

CAUSE OF EVENT

The primary cause of the event was the MCR operator failing to identify, acknowledge, and respond to an annunciator warning of decreasing pressure in the D/G air start system. Subsequent evaluation determined the underlying cause of the inadequate performance was weaknesses in definition and enforcement of operating standards. The cause of the initiating event was a premature fuse failure resulting from excessive cycling of the air start system because of a high leak rate of the 2B-B D/G No. 1 air start system.

TVA could not determine why the on shift crew did not identify the annunciator. SQN operators are expected to promptly detect and respond to annunciators. The onshift crew at the time of this event did not perform at the level expected. A human performance enhancement system (HPES) evaluation was conducted and identified several potential contributing causes for why the operators did not identify the alarm and annunciation. The existing design of the D/G panel, alarms, and annunciators creates some impediments from a human factors standpoint, e.g., visual perception difficulty created by red background annunciators, audibility of the alarm between the common panel and horseshoe, automatic silencing of annunciators after a short time, and single alarms for multiple panels and conditions. Deficiencies in the panel design were previously identified during the Detailed Control Room Design Review (DCRDR) as Human Engineering Deficiencies (HEDs). These and other HED items and corrective actions required were submitted to the NRC in response to NRC NUREG-0737. Implementation of the annunciator upgrade project was originally scheduled for the Cycle 5 refueling outages, but had been accelerated for implementation during the Cycle 5 outages. Additionally, a large number of lit annunciators had existed in the MCR for a long period of time, which may have adversely affected cognizance and diligence. A work request sticker on an adjacent window was identified as potentially inhibiting the operator from seeing the annunciator, although this could not be conclusively determined. Another potential contributor identified at the time of the event was a high activity level in the MCR, which may have impacted either audibility or operator vigilance. Irrespective of these potential contributors, it is clearly the responsibility of the operators to maintain full cognizance of annunciators and alarms.



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ANALYSIS OF EVENT

This event was originally reported in accordance with 10 CFR 50.73(a)(2)(i)(B) as an operation prohibited by TSs. As a result of further testing and evaluation, TVA determined that the D/G remained operable during the event. Accordingly, this LER is being submitted as a voluntary report.

The D/Gs are the emergency power supply to the 6.9-kilovolt (kV) shutdown boards. The design basis, as described in the Updated Final Safety Analysis Report (UFSAR), Section 8.3.1, states that, upon a loss of voltage or degraded voltage on the 6.9-kV shutdown boards, the D/G must reach 850 revolutions per minute, 96.8 percent of nominal voltage, and be connected to the shutdown boards within 10 seconds. The accident analysis also requires the D/G to be supplying voltage to the shutdown boards within 10 seconds or the D/G is considered to be the assumed single failure. Additionally, TS SR 4.8.1.1.2 verifies that the D/G starts from ambient conditions and reaches rated speed and voltage within 10 seconds. The UFSAR, Section 9.5.6 describes the D/G starting system and states that the starting system is sized for an air storage capacity sufficient to crank the engine five times without recharging.

Although the 2B-B D/G was administratively declared inoperable as a result of the starting air system accumulator pressure being below 180 psig, subsequent testing confirmed that the D/G was available to perform its intended function and would comply with requirements to start and provide required output voltage within 10 seconds. Additionally, further analysis concluded that with manual intervention, there was likely adequate air capacity to crank the engine five times.

The design bases, as described in the Updated Final Safety Analysis Report, Section 6.2.3, for the EGTS are: (1) to keep the air pressure within each shield building annulus below atmospheric at all times in which the integrity of that particular containment is required and (2) to reduce the concentration of radioactive nuclides in the annulus air that is released to the environs during a loss of coolant accident (LOCA) in either reactor unit to levels sufficiently low to keep the site boundary dose rate below 10 CFR 100 guideline values. In this event, although the A train EGTS was technically inoperable because of the scheduled performance of a filter test being conducted on this train, the system was available to perform its design function throughout the period that the 2B-B D/G experienced low start air pressure provided operator action to suspend the test and return the system to service was taken. The B train EGTS was administratively declared inoperable because the Emergency Power Supply 2B-B D/G was declared inoperable. However, the D/G could have been started and B train EGTS would have been available to perform its designated function if it had been required. Accordingly, this event did not adversely effect the health and safety of the public.

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CORRECTIVE ACTION

The immediate corrective action was to manually start the air compressor and reestablish a minimum 180 psig pressure in the air accumulator tank. The MCR panel M26 annunciator window for low air start pressure for the 2B-B D/G was functionally tested and found to be operating properly. The audible horn in the MCR was also functionally tested and found to be operating properly. The current scheduled completion date for resolution of the panel HEDs previously described is during the Cycle 5 refueling outages.

Reinforcement of the operators' top priority was achieved by lengthy discussions with crews, and a memorandum was issued from the Operations Superintendent to all Operations personnel on February 28, 1991. The memorandum described the event leading to this specific occurrence and emphasized that knowing the status of the plant and promptly recognizing and responding to alarms are fundamental operator responsibilities that must be accepted and cannot be delegated. The memorandum stressed the shared responsibility of the entire control room crew for proper operations. Implementation of a refined "operator at the controls" concept to raise operator annunciator awareness and recognition was also introduced by the memorandum. The refinements largely involve designating a single operator at the controls for each unit to continually monitor and attend to the control panels and annunciators without attending to administrative functions. The control room operator is responsible for the remaining control room duties. These actions have clearly conveyed expectations relative to operator attentiveness to annunciators and have significantly raised the level of awareness of the shift crews.

Additionally, controls have been further strengthened to minimize distractions in the MCR. Barriers at MCR entrances have been constructed as part of control room upgrades, and restricted access is being enforced. The number of telephone calls to the MCR has been limited to those that truly require interface with the MCR operators. The changes have been conveyed to the plant staff by memorandum and discussion in shift turnover and plan-of-the-day meetings.

To address the broader concerns regarding weaknesses in operating standards, intensive management efforts are ongoing. These efforts include the evaluation and upgrade of published standards and communications of these standards, and are described in detail in TVA's response to Notice of Violation 91-04-01, dated June 12, 1991.

With regard to the annunciator system hardware, significant improvements have been achieved to date and efforts are ongoing and continuing to receive senior management attention. In addition, interim measures have been put in place until the overall upgrade project is implemented. These included raising the volume of the horn on the common annunciator panels and deleting the automatic silence alarm feature. As a result of efforts that were initiated in mid-1990 and expedited in the fall of 1990, the total number of lit MCR annunciators has been decreased from approximately 136 to 37; and work is continuing to further reduce this number. For example, modifications are being implemented to eliminate nuisance alarms caused by logic ties and setpoint changes. Aggressive pursuit of maintenance on components affecting annunciators is continuing.

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CORRECTIVE ACTION (Continued)

with success. An annunciator disablement program was established in October 1990 and has achieved significant progress in reducing the number of nuisance annunciators associated with conditions such as instrument malfunctions, related component maintenance, and abnormal system alignments. As a result of the efforts described above, failed power supplies and cards have recently been found to be causing erratic annunciator system performance, including annunciator horns alarming without flashing windows and flashing windows without alarming horns. These problems resulted from an annunciator with a weak circuit card alarming coincident with the power supply being at a negative peak on the alternating current (AC) sine wave. A temporary change has been instituted to filter the power supply to the system to dampen the AC peaks preventing degraded performance.

Troubleshooting identified a blown fuse (Type NON 10) as the cause of the air compressor failing to start automatically. The blown fuse and seven other Type NON 10 fuses in similar applications were replaced. The Bussman NON 10 fuse installed in the dryer circuit prevents compressor operation in automatic mode when blown or failed. Replacing the blown fuse and subsequent postmaintenance testing (PMT) reestablished the automatic function to the diesel air start system. A high leak rate had allowed the pressure to decrease to approximately 140 psig. Troubleshooting located and resolved the high leak rate in the air start system. The high leak rate was apparently caused by crud accumulation on the discharge check valve. A preventative maintenance (PM) instruction was written to routinely inspect and clean the D/G air start compressors discharge check valves on a periodic basis. Surveillance Instruction (SI) 166.36, "Diesel Starting Air Valve," was revised to require any leakage greater than approximately 0.5 psig per minute on the D/G air start system to be resolved in a timely manner. This should reduce the frequent cycling of the compressors and dryers and thus, decrease the fuse failure rate.

The blown fuse and seven other fuses were sent to the fuse vendor for analysis. The vendor's report states that the failure of the blown fuse was caused by overheating probably because of poor clip contact. However, review and inspection of the clips eliminated this as a possible cause. The frequent cycling is the only logical cause for the fuse to overheat and fail. This particular fuse incorporates a silver link with a tin slug called the "M-spot." Under normal conditions, the M-spot will heat up and form an alloy with a melting temperature lower than the tin or silver alone. This ensures that the fuse opens in the center of the link at the M-spot. As the link alloys, the effective current carrying capacity of the fuse becomes lower. Eventually, normal load current may cause the fuse to open; this is termed aging or degrading. These 10-amp fuses would handle the normal full load of this circuit, which is 8 amps. It also has an instantaneous rating to handle the simultaneous start of both air dryer fans; a total of approximately 39 amperes. The fuse failure appeared to be related to the heavy duty cycling on the fuses because of the compressors and dryers starting frequently. The frequent starting does not allow the fuse to cool down sufficiently. This particular fuse apparently failed when one compressor dryer started right after the other started. The No. 1 dryer was cycling approximately every 58 minutes running nine minutes while



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CORRECTIVE ACTION (Continued)

the No. 2 dryer was cycling approximately every 143 minutes running 25 minutes. TVA has evaluated the system to determine if a modification should be made to change the dryer circuit fuse to a dual element fuse with higher amperage ratings. The implementation of the associated design change was completed by July 31, 1991. Additionally, the setting of the D/G start air flow pressure alarm switch was reevaluated to further ensure adequate margin is given to allow operator response. Necessary changes to the setting were accomplished by April 22, 1991.

ADDITIONAL INFORMATION

A search of the LER and Nuclear Experience Review data base did not produce any previous or similar events.

COMMITMENTS

1. A PM instruction was written to periodically inspect and clean the D/G air start compressor check valves. This instruction was written by March 15, 1991.
2. SI-166.36 was revised by March 15, 1991, to require any D/G air start system leakage rate exceeding approximately 0.5 psig per minute to be resolved in a timely manner.
3. A letter from the Operations Superintendent to all licensed personnel detailing the lessons learned from this event and emphasizing the responsibility and necessary vigilance to ensure full and continuous cognizance of plant status was issued February 28, 1991.
4. The setting of the D/G start air flow pressure alarm switch will be evaluated to ensure adequate margin is given to allow operator response. Necessary changes to the setting were accomplished by April 22, 1991.
5. TVA is evaluating the system to determine if a modification should be made to change the dryer circuit fuse to a dual element time delay fuse with higher amperage ratings. The implementation was completed by July 31, 1991.

PL090204/1387h