



Tennessee Valley Authority, Post Office Box 2000, Soddy Daisy, Tennessee 37384-2000

August 24, 2011

10 CFR 50.73

ATTN: Document Control Desk  
U.S. Nuclear Regulatory Commission  
Washington, D.C. 20555-0001

Sequoyah Nuclear Plant, Unit 1  
Facility Operating License No. DPR-77  
NRC Docket Nos. 50-327

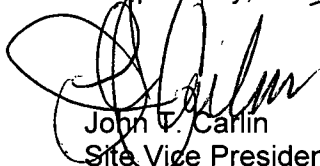
**Subject: License Event Report 327/2011-003, "Unit 1 Reactor Trip As a Result of Turbine Control Card Failure"**

The enclosed licensee event report provides details concerning an automatic reactor trip and automatic engineered safety feature actuation of auxiliary feedwater following the failure of a turbine control analog electro-hydraulic signal conditioning card. The Tennessee Valley Authority (TVA) is submitting this report in accordance with 10 CFR 50.73 (a)(2)(iv)(A), a condition that resulted in automatic actuation of the reactor protection system.

The cause of the event is still under investigation; therefore, a supplement of this event report is forthcoming.

There are no regulatory commitments contained in this letter. Should you have any questions concerning this submittal, please contact G. M. Cook, Sequoyah Site Licensing Manager, at (423) 843-7170.

Respectfully,

  
John V. Carlin  
Site Vice President  
Sequoyah Nuclear Plant

Enclosure: Licensee Event Report - Unit 1 Reactor Trip As a Result of Turbine Control Card Failure

cc: NRC Regional Administrator – Region II  
NRC Senior Resident Inspector – Sequoyah Nuclear Plant

IE 22  
NRR

**LICENSEE EVENT REPORT (LER)**(See reverse for required number of  
digits/characters for each block)

Estimated burden per response to comply with this mandatory collection request: 80 hours. Reported lessons learned are incorporated into the licensing process and fed back to industry. Send comments regarding burden estimate to the FOIA/Privacy Section (T-5 F52), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to [infocollects.resources@nrc.gov](mailto:infocollects.resources@nrc.gov), and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-10202, (3150-0104), Office of Management and Budget, Washington, DC 20503. If a means used to impose an information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

**1. FACILITY NAME**

Sequoyah Nuclear Plant Unit 1

**2. DOCKET NUMBER**

05000327

**3. PAGE**

1 OF 6

**4. TITLE:**

Unit 1 Reactor Trip As a Result of Turbine Control Card Failure

**5. EVENT DATE**

MONTH	DAY	YEAR
06	26	2011

**6. LER NUMBER**

YEAR	SEQUENTIAL NUMBER	REV NO.
2011	003	00

**7. REPORT DATE**

MONTH	DAY	YEAR
08	24	2011

**8. OTHER FACILITIES INVOLVED**

FACILITY NAME	DOCKET NUMBER
FACILITY NAME	DOCKET NUMBER

**9. OPERATING MODE**

1

**10. POWER LEVEL**

100

**11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check all that apply)**

- |   |   |  |  |
|---|---|--|--|
| <input type="checkbox"/> 20.2201(b)         | <input type="checkbox"/> 20.2203(a)(3)(i)   | <input type="checkbox"/> 50.73(a)(2)(i)(C)             | <input type="checkbox"/> 50.73(a)(2)(vii)        |
| <input type="checkbox"/> 20.2201(d)         | <input type="checkbox"/> 20.2203(a)(3)(ii)  | <input type="checkbox"/> 50.73(a)(2)(ii)(A)            | <input type="checkbox"/> 50.73(a)(2)(viii)(A)    |
| <input type="checkbox"/> 20.2203(a)(1)      | <input type="checkbox"/> 20.2203(a)(4)      | <input type="checkbox"/> 50.73(a)(2)(ii)(B)            | <input type="checkbox"/> 50.73(a)(2)(viii)(B)    |
| <input type="checkbox"/> 20.2203(a)(2)(i)   | <input type="checkbox"/> 50.36(c)(1)(i)(A)  | <input type="checkbox"/> 50.73(a)(2)(iii)              | <input type="checkbox"/> 50.73(a)(2)(ix)(A)      |
| <input type="checkbox"/> 20.2203(a)(2)(ii)  | <input type="checkbox"/> 50.36(c)(1)(ii)(A) | <input checked="" type="checkbox"/> 50.73(a)(2)(iv)(A) | <input type="checkbox"/> 50.73(a)(2)(x)          |
| <input type="checkbox"/> 20.2203(a)(2)(iii) | <input type="checkbox"/> 50.36(c)(2)        | <input type="checkbox"/> 50.73(a)(2)(v)(A)             | <input type="checkbox"/> 73.71(a)(4)             |
| <input type="checkbox"/> 20.2203(a)(2)(iv)  | <input type="checkbox"/> 50.46(a)(3)(ii)    | <input type="checkbox"/> 50.73(a)(2)(v)(B)             | <input type="checkbox"/> 73.71(a)(5)             |
| <input type="checkbox"/> 20.2203(a)(2)(v)   | <input type="checkbox"/> 50.73(a)(2)(i)(A)  | <input type="checkbox"/> 50.73(a)(2)(v)(C)             | <input type="checkbox"/> OTHER                   |
| <input type="checkbox"/> 20.2203(a)(2)(vi)  | <input type="checkbox"/> 50.73(a)(2)(i)(B)  | <input type="checkbox"/> 50.73(a)(2)(v)(D)             | Specify in Abstract below<br>or in NRC Form 366A |

**12. LICENSEE CONTACT FOR THIS LER**

FACILITY NAME

SQN - Donald Sutton

TELEPHONE NUMBER (Include Area Code)

(423) 843-6539

**13. COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT**

CAUSE	SYSTEM	COMPONENT	MANU- FACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANU- FACTURER	REPORTABLE TO EPIX
X	JJ	ECBD	W	Y					

**14. SUPPLEMENTAL REPORT EXPECTED**☒ YES (If yes, complete 15. EXPECTED SUBMISSION DATE) ☐ NO**15. EXPECTED  
SUBMISSION  
DATE**

MONTH	DAY	YEAR
09	30	2011

ABSTRACT (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines)

On June 26, 2011, at 1615 Daylight Saving Time (DST), Sequoyah Nuclear Plant (SQN) Unit 1 received an automatic reactor trip as a result of the failure of a turbine control analog electro-hydraulic (AEH) signal conditioning card. The card failure created an indication that the main turbine had tripped (auto stop latch signal) resulting in the governor and throttle valves closing. When the throttle valves closed, an automatic reactor trip was received from the turbine trip at greater than 50 percent rated thermal power. An immediate corrective action was to replace the failed AEH signal conditioning card. The root cause of this event is being evaluated and will be provided in the supplement to this LER.

U.S. NUCLEAR REGULATORY COMMISSION  
**LICENSEE EVENT REPORT (LER)**  
**CONTINUATION SHEET**

1. FACILITY NAME	2. DOCKET	6. LER NUMBER			3. PAGE
Sequoyah Nuclear Plant Unit 1	05000327	YEAR	SEQUENTIAL NUMBER	REV NO.	2 OF 6
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**NARRATIVE****I. PLANT CONDITION(S)**

At the time of the event, Sequoyah Nuclear Plant (SQN) Unit 1 was operating at approximately 100 percent rated thermal power with the turbine control system in normal operation.

**II. DESCRIPTION OF EVENT****A. Event:**

On June 26, 2011, at 1615 Daylight Saving Time (DST), SQN Unit 1 automatically tripped as a result of the failure of a turbine control analog electro-hydraulic (AEH) signal conditioning card [EIS Code JJ]. Failure of the card created an indication that the turbine had tripped and resulted in the governor and throttle valves [EIS Code TA] closing. Prior to the reactor trip, reactor power was at approximately 100 percent. Following the reactor trip, the steam dump [EIS Code SG] system functioned initially as expected (all valves opened). Subsequently, the steam dump system was manually turned off because three of the valves did not close when expected. As a consequence, decay heat removal was via the steam generator atmospheric relief valves.

The Tennessee Valley Authority is submitting this report in accordance with 10 CFR 50.73 (a)(2)(iv)(A), a condition that resulted in automatic actuation of the reactor protection system.

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

None.

**C. Dates and Approximate Times of Major Occurrences:**

Date	Description
June 26, 2011 at 1615:26 DST	Turbine governor valves start closing due to the signal conditioning card failure.
June 26, 2011 at 1615:29 DST	Control rods begin stepping in as a result of the turbine load reduction.
June 26, 2011 at 1615:36 EDT	Operators misdiagnose reason for control rod insertion and incorrectly place control rods in manual.
June 26, 2011 at 1615:47 DST	All four turbine throttle valves closed. Automatic reactor trip occurs due to turbine trip above 50 percent rated thermal power. Operations entered Emergency Procedure E-0 "Reactor Trip or Safety Injection".

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**NARRATIVE**

June 26, 2011  
at 1625:50 DST

Three steam dump valves did not close as expected following the trip. Operators turn steam dump control off in accordance with Emergency Subprocedure ES-0.1 "Reactor Trip Response," a subprocedure of procedure E-0. Decay heat removal via the steam generator atmospheric relief valves was used in accordance with Emergency Subprocedure ES-0.1.

**D. Other Systems or Secondary Functions Affected:**

No other systems or secondary functions were affected by this event.

**E. Method of Discovery:**

Control room alarms alert operators to the start of the event.

**F. Operator Actions:**

At the time of the turbine load rejection, control bank D rods automatically inserted 10 steps over 7 seconds from an initial rod height of 220 steps withdrawn. The reactor operator misdiagnosed the reason for the insertion and incorrectly placed the control rods in manual; the reactor tripped approximately 12 seconds later with all rods fully inserting. Had the rods remained in automatic, rod height of control bank D would have been approximately 198 steps withdrawn at the time of the reactor trip. The difference in reactivity worth from the actual versus projected rod height of control bank D is not significant and is bounded by the accident analysis that assumes the control rod of highest worth remains fully withdrawn. The operator's actions of placing the rods in manual was not in compliance with plant procedures and did not meet expectations set by Operations Management or Training. Once the reactor tripped, Operations entered emergency operations procedure E-0 "Reactor Trip or Safety Injection," as required by procedure. The steam dump system initially functioned as expected (all valves opened); afterwards, Operations manually turned off the steam dump system because three of the valves did not close when expected.

**G. Safety System Responses:**

The plant responded as expected for the conditions of the reactor trip.

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## NARRATIVE

## III. CAUSE OF THE EVENT

## A. Immediate Cause:

The immediate cause of the reactor trip was a turbine trip above 50 percent rated thermal power due to a failed turbine control AEH card.

## B. Root Cause:

The root cause of this event is being evaluated and will be provided in the supplement to this LER.

## IV. ANALYSIS OF THE EVENT

SQN Unit 1 was operating in Mode 1 at approximately 100 percent rated thermal power. At 1615 DST, the reactor automatically tripped following a turbine trip from greater than 50 percent rated thermal power (P-9 interlock). Prior to the event, reactor coolant system (RCS) pressure was approximately 2234 pounds per square inch gauge (psig). Following the turbine control card failure, the turbine valves closed and the turbine load reduction caused a rise in RCS temperature. This caused RCS volume to increase with a corresponding increase in RCS pressure. RCS pressure increased above 2335 psig, the setpoint of the pressurizer power operated relief valves (PORVs), before the reactor trip. Both PORVs opened briefly (approximately 3 seconds); approximately 7 seconds later, one PORV re-opened. Both PORVs reclosed at the proper pressure. Because of the turbine load reduction, RCS average temperature increased to approximately 586 degrees Fahrenheit, which is 3 degrees Fahrenheit above the Technical Specification (TS) 3.2.5 limit of 583 degrees Fahrenheit. The TS 3.2.5, Departure from Nucleate Boiling (DNB) Parameters, action statement requires that the parameter be restored to a value within its limits within 2 hours or reduce THERMAL POWER to less than 5 percent of RATED THERMAL POWER within the next 4 hours. The TS 3.2.5 limit for average temperature was exceeded for a period of approximately 7 seconds which is well within the TS 3.2.5 action statement requirement. Following the reactor trip, average temperature rapidly decreased as a result of loss of nuclear heat generation to approximately 545 degrees Fahrenheit, then increased to its no-load value of 547 degrees Fahrenheit. Following the trip, all safety related equipment operated as designed. The auxiliary feedwater system automatically actuated as expected on loss of the main feedwater pumps. The main feedwater pumps were available for recovery using approved plant procedures following the scram. Initially, the steam dump system functioned as expected (all valves opened). Subsequently, the steam dump system was manually turned off because three of the valves did not close when expected. As a consequence, decay heat removal was provided via the atmospheric relief valves.

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**NARRATIVE**

**V. ASSESSMENT OF SAFETY CONSEQUENCES**

As discussed in the above "Analysis of The Event," following the trip, all safety related equipment operated as designed, the auxiliary feedwater system actuated as expected and decay heat removal was provided using the atmospheric relief valves. In addition, the DNB parameter for average temperature momentarily increased to above the TS 3.2.5 limit to 586 degrees Fahrenheit. However, the parameter was restored to within the TS 3.2.5 limit well within the allowance of the associated action statement and all other DNB parameters remained within limits during this event. As a result, this event did not adversely affect the health and safety of plant personnel or the general public.

**VI. CORRECTIVE ACTIONS**

**A. Immediate Corrective Actions:**

The immediate corrective action was to replace the failed AEH signal conditioning card.

**B. Corrective Actions to Prevent Recurrence:**

The corrective actions are being managed through the SQN Corrective Action Program.

Corrective actions to prevent recurrence are being developed to address the root cause and will be provided in the supplement to this LER.

**VII. ADDITIONAL INFORMATION**

**A. Failed Components:**

The failed component was a Westinghouse AEH signal conditioning card.

**B. Previous LERs on Similar Events:**

A review of previous reportable events for the past three years did not identify any previous similar events.

**C. Additional Information:**

None.

**D. Safety System Functional Failure:**

This event did not result in a safety system functional failure in accordance with 10 CFR 50.73(a)(2)(v).

**LICENSEE EVENT REPORT (LER)** U.S. NUCLEAR REGULATORY COMMISSION  
**CONTINUATION SHEET**

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**NARRATIVE**

**E. Unplanned Scram with Complications:**

This event did not result in an unplanned scram with complications. The main feedwater pumps were available for recovery using approved plant procedures following the scram. Although the steam dump system valves opened as expected, the steam dump system was later turned off because three of the valves did not close when expected. The atmospheric relief valves were available and were subsequently used for decay heat removal.

**VIII. COMMITMENTS**

None.