TENNESSEE VALLEY AUTHORITY

Sequoyah Nuclear Plant, Post Office Box 2000, Soddy Daisy, Tennessee 37384

January 06, 2022

10 CFR 50.73

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

Sequoyah Nuclear Plant, Unit 2
Renewed Facility Operating License No. DPR-79
NRC Docket No. 50-328

Subject: **Licensee Event Report 50-328/2021-002-00, Turbine Trip Function Inoperable Due to Slow to Close Turbine Throttle Valve**

The enclosed licensee event report provides details concerning a slow to close turbine throttle valve that impacted the turbine trip function's response time to trip. This report is being submitted in accordance with 10 CFR 50.73(a)(2)(i)(B), as any operation or condition which was prohibited by the plant's Technical Specifications and in accordance with 10 CFR 50.73(a)(2)(v), as an event or condition that could have prevented the fulfillment of a safety function of structures or systems that are needed to: (D) mitigate the consequences of an accident.

There are no regulatory commitments contained in this letter. Should you have any questions concerning this submittal, please contact Mr. Jeffrey Sowa, Site Licensing Manager, at (423) 843-8129.

Respectfully,

Marshall, Thomas B. Digitally signed by Marshall, Thomas B. Date: 2022.01.06 10:32:39 -05'00'

Thomas Marshall
Site Vice President
Sequoyah Nuclear Plant

Enclosure: Licensee Event Report 50-328/2021-002-00
cc: NRC Regional Administrator – Region II
NRC Senior Resident Inspector – Sequoyah Nuclear Plant

NRC FORM 366 (08-2020) | U.S. NUCLEAR REGULATORY COMMISSION | APPROVED BY OMB: NO. 3150-0104 | EXPIRES: 08/31/2023

LICENSEE EVENT REPORT (LER)

(See Page 3 for required number of digits/characters for each block)

(See NUREG-1022, R.3 for instruction and guidance for completing this form https://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1022/r3/)

1. Facility Name	2. Docket Number	3. Page
Sequoyah Nuclear Plant Unit 2	05000328	1 OF 6

4. Title

Turbine Trip Function Inoperable Due to Slow to Close Turbine Throttle Valve

5. Event Date			6. LER Number			7. Report Date			8. Other Facilities Involved	
Month	Day	Year	Year	Sequential Number	Rev No.	Month	Day	Year	Facility Name	Docket Number
									NA	05000
11	08	2021	2021	- 002 -	00	01	06	2022	Facility Name: NA	Docket Number: 05000

9. Operating Mode	10. Power Level
1	15

11. This Report is Submitted Pursuant to the Requirements of 10 CFR §: *(Check all that apply)*

10 CFR Part 20	☐ 20.2203(a)(2)(vi)	☐ 50.36(c)(2)	☐ 50.73(a)(2)(iv)(A)	☐ 50.73(a)(2)(x)
☐ 20.2201(b)	☐ 20.2203(a)(3)(i)	☐ 50.46(a)(3)(ii)	☐ 50.73(a)(2)(v)(A)	**10 CFR Part 73**
☐ 20.2201(d)	☐ 20.2203(a)(3)(ii)	☐ 50.69(g)	☐ 50.73(a)(2)(v)(B)	☐ 73.71(a)(4)
☐ 20.2203(a)(1)	☐ 20.2203(a)(4)	☐ 50.73(a)(2)(i)(A)	☐ 50.73(a)(2)(v)(C)	☐ 73.71(a)(5)
☐ 20.2203(a)(2)(i)	**10 CFR Part 21**	☒ **50.73(a)(2)(i)(B)**	☒ **50.73(a)(2)(v)(D)**	☐ 73.77(a)(1)(i)
☐ 20.2203(a)(2)(ii)	☐ 21.2(c)	☐ 50.73(a)(2)(i)(C)	☐ 50.73(a)(2)(vii)	☐ 73.77(a)(2)(i)
☐ 20.2203(a)(2)(iii)	**10 CFR Part 50**	☐ 50.73(a)(2)(ii)(A)	☐ 50.73(a)(2)(viii)(A)	☐ 73.77(a)(2)(ii)
☐ 20.2203(a)(2)(iv)	☐ 50.36(c)(1)(i)(A)	☐ 50.73(a)(2)(ii)(B)	☐ 50.73(a)(2)(viii)(B)	
☐ 20.2203(a)(2)(v)	☐ 50.36(c)(1)(ii)(A)	☐ 50.73(a)(2)(iii)	☐ 50.73(a)(2)(ix)(A)	

☐ **Other** (Specify here, in Abstract, or in NRC 366A).

12. Licensee Contact for this LER

Licensee Contact	Phone Number (Include Area Code)
Scott Bowman	423.843.6910

13. Complete One Line for each Component Failure Described in this Report

Cause	System	Component	Manufacturer	Reportable To IRIS	Cause	System	Component	Manufacturer	Reportable To IRIS
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

14. Supplemental Report Expected		15. Expected Submission Date	Month	Day	Year
☒ No	☐ **Yes** (If yes, complete 15. Expected Submission Date)		N/A	N/A	N/A

16. Abstract (Limit to 1560 spaces, i.e., approximately 15 single-spaced typewritten lines)

On October 28, 2021, Main Steam Throttle Valve 1 (TV-1), associated with the high-pressure turbine and turbine trip function, was replaced during the Unit 2 refueling outage. On November 5, Surveillance Requirement 3.3.2.9 was successfully completed for the Turbine Trip function. On November 8, at 2115 eastern standard time (EST), during turbine overspeed trip testing, it was identified that TV-1 took longer than expected to close on the overspeed trip signal. In response, station personnel developed a support/refute matrix that included validating installation of an orifice block vice a flushing block in TV-1. This led to the discovery that TV-1 was installed with the incorrect block. The flushing block was replaced with the correct orifice block. On November 9, at 0700, SR 3.3.2.9 was successfully completed restoring the valve to operable status.

The cause of the event was the failure to follow procedural requirements regarding a quality critical maintenance (QCM) step. The maintenance procedure addressing quality critical maintenance requires that supervision/oversight must be present in the field during the execution of steps requiring additional oversight. Contrary to this requirement, The TVA QCM signee performed the step in an independent verification role vice providing oversight and witnessing the installation of the correct orifice plate. Corrective actions included providing a briefing for Outage Services personnel regarding oversight responsibilities associated with QCM steps and revising the vendor's procedure "Critical Step" with photos and guidance to visually confirm and photograph blocks when installing.

1. FACILITY NAME	2. DOCKET NUMBER	3. LER NUMBER		
		YEAR	SEQUENTIAL NUMBER	REV NO.
Sequoyah Nuclear Plant Unit 2	05000-328	2021	- 002	- 00

NARRATIVE

I. Plant Operating Conditions Before the Event

At the time of the event, Sequoyah Nuclear Plant (SQN) Unit 2 was in Mode 1 at approximately 15 percent rated thermal power.

II. Description of Event

A. Event Summary:

On October 28, 2021, Main Steam [EIIS: SB] Throttle Valve-1 (TV-1) [EIIS: SCV], associated with the high-pressure turbine [EIIS: TRB] and turbine trip [EIIS: JJ] function, was replaced during the Unit 2 refueling outage. On November 5, Surveillance Requirement 3.3.2.9 (Verify ESFAS [Engineered Safety Feature Actuation System] RESPONSE TIMES are within limit) was successfully completed for the Turbine Trip function.

On November 8, at 2115 eastern standard time (EST), during turbine overspeed trip testing, it was identified that TV-1 took longer than expected to close on the overspeed trip signal. During subsequent testing, TV-1 continued to close slower than expected. In response, station personnel developed a support/refute matrix that included validating installation of an orifice block vice a flushing block in TV-1. This led to the discovery that TV-1 was installed with the incorrect block. The flushing block was replaced with the correct orifice block.

On November 9, at 0700, SR 3.3.2.9 was successfully completed restoring the valve to operable status. At 0745 a partial performance of turbine overspeed testing confirmed TV-1 was functioning as required.

During the Unit 2 refueling outage, TV-1 was one of several turbine control system valves replaced. Valves received from the vendor typically arrive with flushing blocks installed and are clearly labeled as such. Two of the replacement valves were received with labeled flushing blocks attached. TV-1 was received from the vendor without a labeled flushing block that appeared to be and was assumed to be the required orifice block for the valve. Total reliance was placed on the vendor method for labeling flushing blocks.

The delta in closing times between the November 5th ESFAS testing and the November 8th turbine overspeed testing is most probably the result of different system alignments during the tests. During the performance of ESFAS testing, the four main steam throttle valves are manipulated with the governor valves remaining closed and isolated from the Electrohydraulic Control (EHC) System. Whereas, during the performance of turbine overspeed trip testing, all the throttle valves and governor valves are manipulated. It is possible that additional flow in the EHC trip header, due to flow from the additional valves, could cause increased backpressure on the throttle drain to the trip header. With the flushing block installed on TV-1 rather than the required orifice, it is possible the backpressure on TV-1 could reduce the effectiveness of draining EH fluid to the trip header. This reduced flow would in turn slow the response of TV-1 to close. A condition report (CR) was initiated to evaluate if the system

alignment for surveillance testing and turbine overspeed testing should be similar.

A past operability evaluation (POE) determined TV-1 was inoperable from Mode 3 entry on November 5, 2021, at 0519 until November 9, 2021, at 0700, when turbine trip response time testing was completed with acceptance criteria met. Therefore, this event is reportable per 10 CFR 50.73(a)(2)(i)(B) as any operation or condition which was prohibited by the plant's technical specifications. Additionally, the POE determined the turbine trip function requires four out of four throttle valves to close, and with TV-1 inoperable, the turbine trip function would not have been performed within the required 2.5 seconds (per the Final Safety Analysis Report (FSAR)). This constitutes an event or condition that could have prevented the fulfillment of a safety function necessary to mitigate the consequences of an accident, which is reportable under 10 CFR 50.73(a)(2)(v)(D).

B. Status of structures, components, or systems that were inoperable at the start of the event and contributed to the event:

No inoperable structures, components, or systems contributed to this event.

C. Dates and approximate times of occurrences:

Date/Time (EST)	Description
10/28/21	TV-1 installed during outage.
11/05/21, 0519	Unit 2 entered Mode 3 which required TV-1 to be operable; however, it was not.
1039	Turbine trip response time testing was completed with acceptance criteria met.
11/07/21, 0601	Unit 2 entered Mode 2 with TV-1 inoperable.
2253	Unit 2 entered Mode 1 with TV-1 inoperable.
11/08/21, 2115	CR 1734714 was initiated documenting the slow response of TV-1 observed during main turbine overspeed trip testing.
11/09/21, 0342	Mechanical Maintenance technicians found a flushing block installed in TV-1 and replaced it with the correct orifice block.
0700	Turbine trip response time testing was completed with acceptance criteria met.
0745	Main turbine overspeed trip testing was performed with acceptance criteria met.

D. Manufacturer and model number of each component that failed during the event:

There was no component that failed during the event.

E. Other systems or secondary functions affected:

There were no other systems or secondary functions affected by this event.

F. Method of discovery of each component or system failure or procedural error:

Station personnel developed a support/refute matrix that included validating installation of the orifice block vice the flushing block in TV-1. This led to the discovery that TV-1 was installed with the incorrect block.

G. Failure mode, mechanism, and effect of each failed component:

There was no component that failed during the event.

H. Operator actions:

Operators initiated CR 1734714 for TV-1 due to its slow closure time during main turbine overspeed trip testing.

I. Automatically and manually initiated safety system responses:

None.

III. Cause of the Event

A. Cause of each component or system failure or personnel error:

The human performance factor related to this event was associated with supervision and oversight. The oversight requirement was to witness a step being performed vice verifying a step was performed.

B. Cause(s) and circumstances for each human performance related root cause:

The cause of the event was the failure to follow procedural requirements regarding a quality critical maintenance (QCM) step. The maintenance procedure addressing quality critical maintenance requires that supervision/oversight must be present in the field during the execution of steps requiring additional oversight. Contrary to this requirement, The TVA QCM signee performed the step in an independent verification role vice providing oversight and witnessing the installation of the correct orifice plate.

The individual responsible for QCM oversight during the TV-1 valve replacement was a non-licensed, TVA employee in the Components Maintenance Optimization group. There were no schedule or situational pressures present.

IV. Analysis of the Event:

The primary functions of the Turbine Trip and Feedwater Isolation signals are to prevent damage to the turbine due to water in the steam lines, and to stop the excessive flow of feedwater into the steam generators (SGs). These Functions are necessary to mitigate the effects of a high-water level in the SGs, which could result in carryover of water into the steam lines and excessive cooldown of the primary system. Turbine Trip and Feedwater Isolation functions must be operable in Modes 1, 2, and 3 except when all main feedwater (MFW) isolation valves (MFIVs), MFW regulation valves (MFRVs), and associated MFRV bypass valves are closed or isolated by a closed manual valve when the MFW System is in operation and the turbine generator may be in operation. Turbine Trip and Feedwater Isolation is also initiated by all Functions that initiate a Safety Injection (SI) signal.

Turbine trip is a required part of ESFAS as outlined in TS 3.3.2. The response time testing requirement for turbine trip is 2.5 seconds per the FSAR. TS 3.3.2 requires that the throttle valves close in 1.1 seconds (SR 3.3.2.9) so that, when combined with the other trip logic in a turbine trip signal, the overall response time testing requirement is met. The turbine trip function requires four-out-of-four throttle valves to close.

While the turbine was latched, the main turbine governor valves were available to remove steam flow from the main turbine. These valves function as a series valve to the throttle valves and receive the same trip signal that is supplied to the throttle valves. These valves are not response time tested, but at the time of this event, were all functioning correctly which includes tripping closed in a similar time to the throttle valve's design time. Additionally, there was no challenge with the Feedwater Isolation function or MSIVs. With the MSIVs available, the capability existed to mitigate a cooldown event by isolating all steam supplied from the reactor to the secondary plant.

V. Assessment of Safety Consequences

There were no actual safety consequences because of this event. With TV-1 inoperable, there were additional methods to stop steam flow to the main turbine. One is by closure of the main turbine governor valves, and another, is closure of the MSIVs. In the event a turbine overspeed event occurred and turbine “missiles” released, the projected paths would not have been expected to damage the main control room or key safety related systems. A probabilistic risk assessment determined that increase to risk for Core Damage Frequency or Large Early Release Frequency is very small.

A. Availability of systems or components that could have performed the same function as the components and systems that failed during the event:

With TV-1 inoperable, there were additional methods to stop steam flow to the main turbine, closure of the main turbine governor valves, and another, closure of the MSIVs.

B. For events that occurred when the reactor was shut down, availability of systems or components needed to shutdown the reactor and maintain safe shutdown conditions, remove residual heat, control the release of radioactive material, or mitigate the consequences of an accident:

The event did not occur when the reactor was shut down.

C. For failure that rendered a train of a safety system inoperable, an estimate of the elapsed time from discovery of the failure until the train was returned to service:

Operators documented the slow closure of TV-1 on November 8 at 2115. The valve was returned to operable status on November 9 at 0700. The elapsed time was 9 hours 45 minutes.

VI. Corrective Actions

The event was entered into the Tennessee Valley Authority Corrective Action Program (CAP) under CRs 1734714 and 1734963.

A. Immediate Corrective Actions:

An extent of condition was performed for additional valves replaced during the Unit 2 refueling outage. Performed reaffirmation with personnel involved that QCM witness roles are for providing additional oversight of the performance of an evolution. It is not a concurrent or independent verification process.

B. Corrective Actions to Prevent Recurrence or to reduce probability of similar events occurring in the future:

Corrective actions included providing a briefing for Outage Services personnel regarding oversight responsibilities associated with QCM steps and revising the vendor's procedure "Critical Step" with photos and guidance to visually confirm and photograph blocks when installing.

VII. Previous Similar Events at the Same Site:

There were no previous similar events at SQN occurring within the last three years.

VIII. Additional Information

There is no additional information.

IX. Commitments:

There are no commitments.