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

August 22, 2014

10 CFR 50.73

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

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

Subject: **Licensee Event Report 50-328/2014-002-00, "Containment Vacuum Relief Valve Inoperable Resulting in a Condition Prohibited by Technical Specifications"**

The enclosed Licensee Event Report provides details concerning a failure of a containment vacuum relief valve to close. This report is being submitted in accordance with 10 CFR 50.73(a)(2)(i)(B), as an event or condition that is prohibited by technical specifications.

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

Respectfully,

John T. Carlin
Site Vice President
Sequoyah Nuclear Plant

Enclosure: Licensee Event Report 50-328/2014-002
cc: NRC Regional Administrator – Region II
NRC Senior Resident Inspector – Sequoyah Nuclear Plant

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NRC FORM 366 (02-2014) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB: NO. 3150-0104 EXPIRES: 01/31/2017

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 and Information Collections Branch (T-5 F53), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to Infocollects.Resource@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.

LICENSEE EVENT REPORT (LER)

(See Page 2 for required number of digits/characters for each block)

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4. TITLE

Containment Vacuum Relief Valve Inoperable Resulting in a Condition Prohibited by Technical Specifications

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
06	24	14	2014	- 002	- 00	08	22	2014	FACILITY NAME	DOCKET NUMBER

9. OPERATING MODE	11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: *(Check all that apply)*			
1	☐ 20.2201(b)	☐ 20.2203(a)(3)(i)	☐ 50.73(a)(2)(i)(C)	☐ 50.73(a)(2)(vii)
	☐ 20.2201(d)	☐ 20.2203(a)(3)(ii)	☐ 50.73(a)(2)(ii)(A)	☐ 50.73(a)(2)(viii)(A)
	☐ 20.2203(a)(1)	☐ 20.2203(a)(4)	☐ 50.73(a)(2)(ii)(B)	☐ 50.73(a)(2)(viii)(B)
	☐ 20.2203(a)(2)(i)	☐ 50.36(c)(1)(i)(A)	☐ 50.73(a)(2)(iii)	☐ 50.73(a)(2)(ix)(A)
10. POWER LEVEL	☐ 20.2203(a)(2)(ii)	☐ 50.36(c)(1)(ii)(A)	☐ 50.73(a)(2)(iv)(A)	☐ 50.73(a)(2)(x)
	☐ 20.2203(a)(2)(iii)	☐ 50.36(c)(2)	☐ 50.73(a)(2)(v)(A)	☐ 73.71(a)(4)
100	☐ 20.2203(a)(2)(iv)	☐ 50.46(a)(3)(ii)	☐ 50.73(a)(2)(v)(B)	☐ 73.71(a)(5)
	☐ 20.2203(a)(2)(v)	☐ 50.73(a)(2)(i)(A)	☐ 50.73(a)(2)(v)(C)	☐ OTHER
	☐ 20.2203(a)(2)(vi)	☒ 50.73(a)(2)(i)(B)	☐ 50.73(a)(2)(v)(D)	Specify in Abstract below or in NRC Form 366A

12. LICENSEE CONTACT FOR THIS LER

LICENSEE CONTACT	TELEPHONE NUMBER *(Include Area Code)*
Zachary T. Kitts	(423) 843-7018

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
A	BF	RV	A415	Y					

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

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

On June 24, 2014, at 2315 Eastern Daylight Time (EDT) nightshift Operations personnel identified the containment vacuum relief valve, 2-VLV-30-573, was not in its normally closed position. Operations personnel declared the containment vacuum relief valve inoperable and entered into actions of Technical Specifications (TSs) Limiting Condition for Operation (LCO) 3.6.3, "Containment Isolation Valves" and TS LCO 3.6.6, "Vacuum Relief Lines." On June 25, 2014, at 0311 EDT, Operations personnel declared the containment isolation function of the vacuum relief valve operable with the valve closed. The containment vacuum relief valve had actuated and failed to reseat during containment venting that completed at 1647 EDT on June 24. This resulted in a containment isolation valve being inoperable for longer than permitted by TS LCO 3.6.3, and therefore a condition prohibited by TSs. The causes of this event included failure of Maintenance craft personnel to follow procedures and inadequate operating instruction for identification of relief valve position. Corrective actions include additional training for Maintenance craft personnel and a procedure revision for valve position validation.

NARRATIVE

I. Plant Operating Conditions Before the Event

At the time of the event, Sequoyah Nuclear Plant (SQN) Unit 2 was operating at 100 percent reactor thermal power.

II. Description of Events

A. Event:

On June 24, 2014, at 2315 Eastern Daylight Time (EDT) nightshift Operations personnel identified the containment vacuum relief valve [EIIS Code RV], 2-VLV-30-573, was not in its normally closed position. Operations personnel declared the containment vacuum relief valve inoperable and applied Action a. of Technical Specifications (TSs) Limiting Condition for Operation (LCO) 3.6.3, "Containment Isolation Valves" and the action associated with TS LCO 3.6.6, "Vacuum Relief Lines." On June 25, 2014, at 0311 EDT Operations personnel declared the containment isolation function of the vacuum relief valve operable: as the valve disc had been reset, its position indication showed closed, and containment pressure was increasing. Operations personnel exited TS LCO 3.6.3 Action a. as the isolation function of the containment vacuum relief valve was met; however, remained in TS LCO 3.6.6 for additional evaluation of the relief function. Additional maintenance was performed on the containment vacuum relief valve allowing Unit 2 to exit TS LCO 3.6.6 on June 26, 2014, at 0026 EDT.

Prior to determining the containment vacuum relief valve was inoperable, dayshift Operations personnel had started and completed a containment vent for pressure reduction at 1600 and 1647 EDT, respectfully on June 24, 2014, using operating instruction, 0-SO-30-8, "Containment Pressure Control." Based on the timing of this activity, it was determined that the containment vacuum relief valve had actuated during the containment vent and had failed to reseat. Nightshift Operations personnel around 2125 EDT identified an open indication of the containment vacuum relief valve but, considered the valve position indicator to be faulty on the basis of other position indicators showing a closed valve. The actual condition of the containment vacuum relief valve was not identified by Operations personnel until 2315 EDT. This resulted in a containment isolation valve [EIIS code ISV] being inoperable for longer than permitted by TS LCO 3.6.3, and therefore a condition prohibited by TSs.

NARRATIVE

During maintenance activity on the inoperable containment vacuum relief valve, the valve hinge mechanism was found dislocated, not allowing the valve disc to reseat. This was corrected, allowing the valve disc to reseat. During additional maintenance of the containment vacuum relief valve, it was determined that the locking wire was not installed on the spring tension bolts of its hinge mechanism. This allowed the bolts to loosen and the spring closure force to decrease. It is believed that the reduced spring force and the sudden pressure difference created during the containment vent resulted in disarticulation of the hinge mechanism and the resulting failure to reseat. It could not be determined when previous valve maintenance failed to install the locking wire.

TS LCO 3.6.3 Action a. - With one or more penetration flow paths with one containment isolation valve inoperable . . . isolate the affected penetration within 4 hours by use of at least one closed and deactivated automatic valve, closed manual valve, blind flange, or check valve## with flow through the valve secured; . . .

##3. A check valve with flow through the valve secured is only applicable to penetration flow paths with two containment isolation valves.

TS LCO 3.6.6 Action - With one primary containment vacuum relief valve inoperable, restore the line to OPERABLE status within 72 hours or be in at least HOT STANDBY within the next 6 hours and in COLD SHUTDOWN within the following 30 hours.

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

There are four position indicators for the vacuum relief valve. There are three indicators that illuminate when the valve is closed and one that illuminates only when the valve is full open. Nightshift Operations personnel identified one of the three containment vacuum relief valve closed position indicators [EIIS Code ZI] in the main control room (MCR) was not illuminated. The open position was also not illuminated. These indicators presented to Operations personnel that the valve was closed. The MCR indication for containment vacuum relief valve led the Operations personnel to believe the valve was closed and there to be an indicator light socket [EIIS Code LF] or zone switch [EIIS Code ZIS] problem.

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NARRATIVE

C. Dates and approximate times of occurrences:

Dates and Times	Description
Unknown	Containment Vacuum Relief Valve spring tension bolts' locking wire for the hinge mechanism not installed.
May 21 to 30, 2014	During the Unit 2 refueling outage, maintenance activities and post maintenance testing were performed on the containment vacuum relief valve. As left test acceptance criteria was met for valve closure force.
June 24, between 1600 to 1647 EDT	Operations personnel performed containment vent. Containment vacuum relief valve did not reseat becoming inoperable.
June 24, at 2125 EDT	Operations personnel identified MCR position indicator for containment vacuum relief valve as faulty and entered the issue into the corrective action program.
June 24 at 2315 EDT	Operations personnel determined the containment vacuum relief valve was inoperable and entered into TS LCO 3.6.3 Action a.
June 25 at 0247 EDT	TS LCO 3.6.3 Action g. required Unit 2 be in Hot Standby as Action a. was not met based on the containment vacuum relief valve being inoperable after venting.
June 25 at 0311 EDT	Operations personnel exit TS LCO 3.6.3, Action a.

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

1. Containment Vacuum Relief Valve
   Manufacturer: Anderson-Greenwood and Company
   Model Number: CV1-L
   Size: 24 inch

E. Other systems or secondary functions affected:

No other components were affected by this event.

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

Nightshift Operations personnel identified that the containment pressure had not risen since assuming shift, and determined the containment vacuum relief valve was not fully closed.

G. The failure mode, mechanism, and effect of each failed component, if known:

The containment vacuum relief valve was found with its valve disc displaced from the valve seat. Corrective maintenance was necessary to allow the valve disc to reseat. This failure condition allowed the valve to perform its containment vacuum relief function to some extent but, did not allow for containment closure.

H. Operator actions:

Operations personnel upon determining the containment vacuum relief valve was not fully closed, declared the valve inoperable and entered into appropriate TSs actions.

I. Automatically and manually initiated safety system responses:

During the event, plant conditions did not require automatic or manual initiation of a safety system response. Operations personnel manually isolated the containment relief path by closing its redundant containment isolation valve.

III. Cause of the event

A. The cause of each component or system failure or personnel error, if known:

1. Maintenance workers did not use the specified drawing to disassemble the containment vacuum relief valve. The drawing used did not show locking wire on the spring tension bolts. As a result, maintenance workers did not recognize locking wire was missing because the vacuum relief valve had not been properly assembled at some time prior to May 2014. Furthermore, the work procedures for reassembling the valve did not specify an accurate drawing. As such, appropriate installation of locking wire was not performed

on the containment vacuum relief valve spring tension bolts assuring position retention.

2. The ruled based guidance necessary to reestablish containment integrity after a containment vent does not support the operator fundamentals. A review of operating instruction, 0-SO-30-8, determined that containment vacuum relief valve position is not verified following containment pressure relief activities, nor was guidance provided to check for expected containment pressure conditions.

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

1. TVA Mechanical Maintenance Department Craft personnel conducted the May 2014 maintenance activities on the containment vacuum relief valve. The Dayshift and Nightshift Maintenance craft personnel had not previously performed maintenance activities on this type of relief valve and the activity was conducted over several shifts. The maintenance work procedure specified several different drawings of similar valves. Two of the seven drawings showed two locations for locking wire on valve components: the spring tension bolts, and a disc and arm assembly. The maintenance work procedure for disassembling the valve referred to a specific drawing that showed locking wire only on the spring tension bolts, yet the craft personnel did not use this particular drawing. While reassembling the valve, craft personnel believed the locking wire on the disc and arm assembly was the locking wire referred to in the reassembling portion of the maintenance work procedure.

2. Detailed guidance in the operating instruction was not determined to be a human performance related cause event.

IV. Analysis of the event:

The primary containment vessel is fitted with a vacuum relief (VR) system [EIIS code BF]. The purpose of the VR system is to protect the vessel from an excessive external force. It is a self-activated system that limits external pressure on the vessel in the event of maloperation or inadvertent operation of systems that result in additional external forces on the containment vessel. Those limiting external forces are created by: inadvertent containment spray [EIIS code BE] actuation, inadvertent containment air return system [EIIS code BK] operation and simultaneous occurrence of both. The VR system consists of 3 containment relief pathways each containing a normally closed self-

actuated vacuum relief valve and position indication. In series with the vacuum relief valve is a normally open pneumatically operated containment isolation valve with necessary instrumentation and controls. The containment vessel VR system assures that the external pressure differential on the containment vessel does not exceed the design external pressure of 0.5 pounds per square inch delta (psid.) When an external pressure exceeds a relief valve actuation force it opens allowing air flow from the annulus space through the VR pathway into the containment vessel. Additional details may be found in Section 6.2.6, "Vacuum Relief System," of the Updated Final Safety Analysis Report (UFSAR).

The containment relief pathway's pneumatically operated containment isolation valve closes when containment pressure with respect to annulus pressure reaches a instrument set point of 1.5 psid. A high pressure signal is developed from either of two sets of instrument sensors and is completely independent of the other containment isolation signals. This valve, in the affected pathway, remained operable and was manually closed by Operations personnel to determine if the containment vacuum relief valve was in fact open. After determining the containment vacuum relief valve was open, the isolation valve was closed.

With the one containment vacuum relief valve in a failed open position, increasing development of containment pressure relative to annulus pressure could have hindered set point actuation for the relief pathway isolation valve. This could have a negative impact for accident events that require containment isolation for mitigation of consequences. Nevertheless, during the time of the inoperable containment vacuum relief valve, there were no actual safety significant consequences as a result of this event. No event occurred that required the use of the vacuum relief pathway containment isolation valve.

TVA developed a probabilistic risk assessment considering the duration of the event. The failure of the containment vacuum relief valve represented a large hole in containment. As such, this penetration size is considered in the level 2 analysis for all core damage sequences resulting in a large early release. The assessment determined the increase in large early release frequency was less than 1.98E-08 per year for the event conditions.

V. Assessment of Safety Consequences

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

Analysis for excessive external forces where the relief function of the

containment vacuum relief is necessary, assumes one vacuum relief valve fails to open. Mitigation of these forces is met with the other two operable containment vacuum relief valves. For events requiring isolation, the containment vacuum pathway containment isolation valve remained operable and available during this event.

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:

Unit 2 was operating in Mode 1 during this event.

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:

This event did not result in a train of a safety system being inoperable. The function of the vacuum relief system was met with two valves remaining operable and the affected valve providing some amount of relief in its failed state. The containment vacuum pathway containment isolation valves remained operable and available during this event.

VI. Corrective Actions

Corrective Actions are being managed by TVA's Corrective Action Program under PER 902721.

A. Immediate Corrective Actions:

1. Operations personnel entered into the TS LCO actions and isolated the penetration until the containment vacuum relief valve was restored for containment isolation.

2. Corrective maintenance was performed on the containment vacuum relief valve to adjust the spring tension bolts and install the associated locking wire.

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

1. A maintenance case study is being developed for inclusion into maintenance training.

2. The operating instruction is being revised to provide validation of containment vacuum relief valve position.

VII. Additional Information

A. Previous similar events at the same plant:

A review of previous reportable events for the past 3 years was performed and identified LERs 1-2013-004R01, 1-2014-001, 1-2014-002, and 2-2014-001 as similar. LER 1-2013-004R1 involved a failure to maintain containment integrity during fuel movements as the result of ineffective procedures for controlling containment penetrations. LER 1-2014-001 involved a failure to perform a TS surveillance requirement on safety injection system equipment. The cause was identified as an omission of the surveillance instruction to have ever included the required test. LER 1-2014-002 involved a failure to provide appropriate administrative controls (i.e., inadequate procedure,) for some containment penetration during fuel movements. LER 2-2014-001 involved a failure to align radiation monitors to the correct containment purge air exhaust train as the result of procedure adherence.

B. Additional Information:

None.

C. Safety System Functional Failure Consideration:

This event did not result in a safety system functional failure.

D. Scrams with Complications Consideration:

This event did not result in an unplanned scram with complications.

VIII. Commitments:

None.