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Robert A. Fenech
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December 13, 1993

U.S. Nuclear Regulatory Commission
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Gentlemen:

TENNESSEE VALLEY AUTHORITY - SEQUOYAH NUCLEAR PLANT UNITS 1 AND 2- DOCKET NOS. 50-327 AND 50-328 - FACILITY OPERATING LICENSES DPR-77 AND DPR-79 - LICENSEE EVENT REPORT (LER) 50-327/93029

The enclosed LER provides details concerning inoperable check valves in the component cooling system as a result of a build-up of corrosion products between valve components.

This event is being reported in accordance with 10 CFR 50.73(a)(2)(ii) as a condition outside the design basis.

Sincerely,

Robert A. Fenech

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Enclosure
cc: See page 2

210119

IE22

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NRC Form 366 (5-92) | U.S. NUCLEAR REGULATORY COMMISSION | Approved OMB No. 3150-0104 Expires 5/31/95

LICENSEE EVENT REPORT (LER)

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
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TITLE (4)

Inoperable Check Valves in the Component Cooling System as a Result of a Build-up of Corrosion Products Between Valve Components.

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

OPERATING MODE (9)	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)	
POWER LEVEL (10) 0 0	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)	
5	20.405(a)(1)(iii)	50.73(a)(2)(i)	50.73(a)(2)(viii)(A)		
	20.405(a)(1)(iv)	X 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)
J. Bajraszewski, Compliance Licensing	6 1 5 8 4 3 - 7 7 4 9

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
X	C C	I S V	D 2 4 3	Y					
B	C C	I S V	D 2 4 3	Y					

SUPPLEMENTAL REPORT EXPECTED (14)		EXPECTED SUBMISSION DATE (15)	MONTH	DAY	YEAR
YES (If yes, complete EXPECTED SUBMISSION DATE)	X NO				

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

On November 16, 1993, with Unit 1 in Mode 5 (cold shutdown) and Unit 2 in power operation at approximately 100 percent power, it was determined that both units were outside their design basis as a result of eight inoperable check valves in the Unit 1 component cooling system piping upstream of the reactor coolant pump thermal barrier heat exchangers. The Unit 1 condition was discovered by radiographic inspections of the check valves. The inspections indicated that seven of eight check valves were stuck in the open position. The eighth Unit 1 valve was found to be improperly assembled. Subsequent inspection of corresponding Unit 2 check valves identified seven valves that were stuck in the open position. The cause of the condition was oxide wedging (iron oxide corrosion product buildup) between valve components (piston and bonnet). The Unit 2 valves were cleaned, reassembled, and returned to service. The carbon steel bonnets on the Unit 1 valves will be replaced with stainless steel. A Unit 2 action plan will be developed and implemented during the upcoming refueling outage to ensure check-valve operability or to replace the Unit 2 carbon steel bonnets with stainless steel.

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

I. PLANT CONDITIONS

Unit 1 was in Mode 5 (cold shutdown); Unit 2 was in power operation at approximately 100 percent.

II. DESCRIPTION OF EVENT

A. Event

On November 16, 1993, at 0913 Eastern standard time (EST), it was determined that both units were outside their design basis as a result of eight inoperable check valves (EIIS Code ISV) in the Unit 1 component cooling system (CCS) (EIIS Code CC) piping supplying the reactor coolant pump thermal barrier heat exchangers (EIIS Code AB). These check valves are installed in pairs (two check valves in series) upstream of each of the four heat exchangers. The Unit 1 condition was discovered by radiographic inspections of the check valves. From the inspections, seven of eight check valves were stuck in the open position, that is, the pistons were stuck inside the machined valve bonnet guide sleeves. Inspection of the valve bodies revealed only slight surface corrosion. No damage or excessive wear of the seating surface was found. The eighth Unit 1 valve was found to be improperly assembled (the piston was installed upside down). The Unit 2 determination was based on system configuration similarities and a high probability that the same condition would exist on Unit 2. Subsequent inspection on the Unit 2 valves identified seven valves stuck in the open position.

B. Inoperable Structures, Components, or Systems That Contributed to the Event

None.

C. Dates and Approximate Times of Major Occurrences

September 15, 1993 — SQN completed the generic review of a Watts Bar Nuclear Plant condition adverse to quality (CAQ) document. The CAQ document addressed the over-pressurization of low pressure component cooling piping as a result of a thermal barrier heat exchanger tube rupture. An NRC inspector questioned the leak tightness of the check valves upstream of the heat exchangers.

October 8, 1993 — Work requests were issued for inspection of the component cooling check valves upstream of the thermal barrier heat exchanger on each unit. The work requests were scheduled to be performed during the Cycle 6 refueling outage on each unit.

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November 13, 1993 — Radiographic inspections were performed on the Unit 1 check valves. Seven of eight were found in the open position with no system flow. The eighth valve was found to be improperly assembled.

November 14, 1993 — A CAQ document was issued based on the results of the Unit 1 valve inspection. Operability determination and Unit 2 impact evaluation were initiated.

November 16, 1993 at 0913 EST — The degraded condition was determined to be outside the design basis. The shutdown of Unit 2 was initiated because of the high probability that a similar condition existed on Unit 2.

November 18, 1993 — Disassembly and inspection of the Unit 2 check valves identified seven of eight valves stuck in the open position. The piston of the eighth valve was not stuck and was installed correctly.

D. Other Systems or Secondary Functions Affected

None.

E. Method of Discovery

The condition was discovered as a result of radiographic inspections of the Unit 1 check valves.

F. Operator Actions

Upon determination that the condition was outside the design basis, operators initiated power reduction and the shutdown of Unit 2.

G. Safety System Response

No safety system responses were required.

III. CAUSE OF EVENT

A. Immediate Cause

The immediate cause of the condition is a result of inoperable check valves, in the component cooling system, upstream of the reactor coolant pump thermal barrier heat exchangers.

B. Root Cause

The root cause for the valves being stuck in the open position is oxide wedging (iron oxide corrosion product build-up) between valve components (piston and bonnet). There is continuous flow through the valves during operation; consequently, the valves are in the open position for extended periods of time. In this condition, the stainless steel piston is inside the machined carbon steel valve bonnet guide sleeve. As iron oxide corrosion products formed between the components (on the bonnet guide sleeve surface), the piston became wedged in the valve bonnet, in the fully open position.

The valve that was found to be incorrectly assembled was supplied from the manufacturer in that condition.

C. Contributing Factors

A contributing factor to the oxidation and corrosion product build-up was less than adequate water chemistry in the CCS system during previous plant operation (1985 through 1987). The poor water chemistry was a result of component cooling heat exchanger tube leakage that introduced untreated river water from the essential raw cooling water (ERCW) system. Water chemistry was improved in late 1987 when inleakage was minimized by reducing the pressure differential between the component cooling and ERCW systems. Water chemistry was further improved by the replacement of the component cooling tube heat exchangers between May 1989 and November 1991 as inleakage of ERCW was eliminated. Since the elimination of ERCW inleakage, good water chemistry has been maintained. Oxide corrosion product build-up on another check valve in the CCS was determined to be minimal over a 10-month operating period through a visual inspection.

IV. ANALYSIS OF EVENT

Operability of the CCS ensures that sufficient cooling capacity is available for the continued operation of safety-related equipment during normal and accident conditions. Operability of the check valves upstream of the reactor coolant pump thermal barrier heat exchanger is required to prevent over-pressurization of the CCS because of postulated heat exchanger failure. In the event of a heat exchanger tube rupture, the leak would result in CCS supply and return flow mismatch and the closure of containment isolation valves. If the check valves are stuck in the open position, the containment isolation would result in exposure of the low pressure containment isolation inboard check valve to reactor coolant pressure. This containment isolation valve is periodically tested to assure leak tightness. Evaluation of the low pressure piping and valves indicates that the system will withstand the higher pressure without gross failure. Some leakage may occur from

valve packing and gaskets. This would limit the postulated event and maintain any outleakage inside containment. In the event of a rupture of the thermal barrier heat exchanger, the reactor could be shut down and maintained shut down with offsite dose exposure within 10 CFR 100 limits. Therefore, there were no adverse consequences to the health and safety of plant personnel or the general public as a result of this event.

V. CORRECTIVE ACTION

A. Immediate Corrective Action

The immediate corrective action for the Unit 2 valves was to disassemble the valves, clean or repair the pistons and bonnets, and establish acceptability for return to service for the six months remaining in the fuel cycle. The Unit 1 valves were disassembled and cleaned. New stainless steel bonnets are being procured from the valve manufacturer for installation in the Unit 1 valves.

B. Corrective Action to Prevent Recurrence

Piston check valves in the CCS and check valves and relief valves on other systems were evaluated for malfunction as a result of corrosion build-up. These valves were found to be either sufficiently cycled by system operation, tested to ensure proper operation, or installed in stainless steel piping systems that are not susceptible to corrosion build-up.

The site Corrective Action Program is tracking the actions for development and implementation of a long-term permanent resolution to ensure the operability of the check valves.

A Unit 2 action plan will be developed and implemented to ensure check-valve operability, or the Unit 2 carbon steel bonnets will be replaced with stainless steel.

VI. ADDITIONAL INFORMATION

A. Failed Components

The failed components are Dresser Industrial Valve and Instrument Division sealed cap piston check valves, Type 7440, with a carbon steel (ASTM A105 Grade 2) body for 1 1/2-inch piping and a stainless steel (AISI Type 410) piston.

B. Previous Similar Events

None.

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VII. COMMITMENTS

1. The carbon steel check valve bonnets of the eight Unit 1 check valves upstream of the thermal barrier heat exchangers will be replaced with stainless steel bonnets before restart from the Unit 1 Cycle 6 refueling outage.

2. A Unit 2 action plan will be developed and implemented to ensure check-valve operability, or the Unit 2 carbon steel bonnets will be replaced with stainless steel, before restart from the Unit 2 Cycle 6 refueling outage.