



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

October 24, 1994

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

Gentlemen:

TENNESSEE VALLEY AUTHORITY - SEQUOYAH NUCLEAR PLANT UNIT 2 - DOCKET  
NO. 50-328 - FACILITY OPERATING LICENSE DPR-79 - LICENSEE EVENT REPORT  
(LER) 50-328/94007

The enclosed LER provides details concerning the inoperability of a centrifugal charging pump. This event is being reported in accordance with 10 CFR 50.73(a)(2)(i)(B) as an operation prohibited by technical specifications and 10 CFR 50.73(a)(2)(ii)(B) as a condition that was outside the design basis of the plant.

Sincerely,

O. J. Zeringue  
Acting Site Vice President

Enclosure  
cc: See page 2

010020

9411010364 941024  
PDR ADOCK 05000328  
S PDR

LE22  
11

U.S. Nuclear Regulatory Commission

Page 2

October 24, 1994

cc (Enclosure):

INPO Records Center  
Institute of Nuclear Power Operations  
700 Galleria Parkway  
Atlanta, Georgia 30339-5957

Mr. D. E. LaBarge, Project Manager  
U.S. Nuclear Regulatory Commission  
One White Flint, North  
11555 Rockville Pike  
Rockville, Maryland 20852-2739

NRC Resident Inspector  
Sequoyah Nuclear Plant  
2600 Igou Ferry Road  
Soddy-Daisy, Tennessee 37379-3624

Regional Administrator  
U.S. Nuclear Regulatory Commission  
Region II  
101 Marietta Street, NW, Suite 2900  
Atlanta, Georgia 30323-2711

## LICENSEE EVENT REPORT (LER)

FACILITY NAME (1) Sequoyah Nuclear Plant (SON), Unit 2										DOCKET NUMBER (2)   PAGE (3) 050003   2   8   1   0   0   6									
TITLE (4) Centrifugal Charging Pump (CCP) Total Flow Rate Exceeded the Technical Specification (TS) Upper Limit Resulting in the Pump Being Inoperable																			
EVENT DAY (5)				LER NUMBER (6)				REPORT DATE (7)				OTHER FACILITIES INVOLVED (8)							
				SEQUENTIAL   REVISION								FACILITY NAMES				DOCKET NUMBER(S)			
MONTH   DAY   YEAR   YEAR				NUMBER   NUMBER				MONTH   DAY   YEAR								050003			
0   9   2   3   9   4   9   4				0   0   7   0   0   1   0   2   4   9   4								050003							
OPERATING MODE (9)		THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR 5: (Check one or more of the following)(11)																	
6		20.402(b)   20.405(c)   50.73(a)(2)(iv)   73.71(b)																	
POWER		20.405(a)(1)(i)   50.36(c)(1)   50.73(a)(2)(v)   73.71(c)																	
LEVEL		20.405(a)(1)(ii)   50.36(c)(2)   50.73(a)(2)(vii)   OTHER (Specify in																	
(10)   0   0   0		20.405(a)(1)(iii)   XX   50.73(a)(2)(i)   50.73(a)(2)(viii)(A)   Abstract below and in																	
		20.405(a)(1)(iv)   XX   50.73(a)(2)(ii)   50.73(a)(2)(viii)(B)   Text, NRC Form 366A)																	
		20.405(a)(1)(v)   50.73(a)(2)(iii)   50.73(a)(2)(x)																	
LICENSEE CONTACT FOR THIS LER (12)																			
NAME										TELEPHONE NUMBER									
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		CAUSE   SYSTEM   COMPONENT   MANUFACTURER		REPORTABLE													
		TO NPRDS				TO NPRDS													
SUPPLEMENTAL REPORT EXPECTED (14)										EXPECTED   MONTH   DAY   YEAR									
YES (If yes, complete EXPECTED SUBMISSION DATE)   X   NO										SUBMISSION									
										DATE (15)									
ABSTRACT (Limit to 1400 spaces, i.e., approximately fifteen single-space typewritten lines) (16)																			

On September 23, 1994, it was determined that the 2B-B CCP total flow rate exceeded the TS limit of 555 gallons per minute (GPM). During the performance of a surveillance instruction (SI), total flow was measured at approximately 566.5 GPM. A subsequent review determined that the condition existed since January 10, 1994, resulting in the 2B-B CCP being technically inoperable for approximately six months (January 10 through July 5, 1994). During this period of time, the 2A-A CCP was out of service for short periods of time on six occasions, resulting in Unit 2 being outside the design basis. On January 5, 1994, the 2B-B CCP motor tripped on timed motor over-current. Component inspection determined that the pump shaft broke and that the rotating element required replacement. An evaluation performed on a spare rotating element determined that the spare rotating element was suitable for replacement. The spare rotating element was installed, and the CCP was tested under miniflow conditions and was placed in service. However, with the replacement rotating element, the total flow delivered was greater than the TS upper limit. The condition was caused by an incorrect evaluation of the performance of the spare rotating element in that the actual pump performance was higher than estimated in the evaluation. The SI was completed, and both CCPs were left within TS limits.

## LICENSEE EVENT REPORT (LER)

## TEXT CONTINUATION

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6)						PAGE (3)		
		YEAR	NUMBER	NUMBER	NUMBER	NUMBER	NUMBER			
Sequoyah Nuclear Plant (SQN), Unit 2		1994	007	000	000	000	000	2	0	6

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

## I. PLANT CONDITIONS

Unit 2 was in Mode 6, refueling.

## II. DESCRIPTION OF EVENT

A. Event

On September 23, 1994, it was determined that the 2B-B centrifugal charging pump (CCP) (EIIIS Code CB) total flow rate exceeded the technical specification (TS) limit of 555 gallons per minute (GPM). During the performance of a surveillance instruction (SI) for charging pump injection flow testing, total flow was measured at approximately 566.5 GPM. A subsequent review determined that the condition existed since January 10, 1994, resulting in the 2B-B CCP being technically inoperable for approximately six months (January 10 through July 5, 1994). During this period of time, the 2A-A CCP was out of service for short periods of time on six occasions, resulting in the unit being outside design basis. On January 5, 1994, the 2B-B CCP motor tripped on timed motor over-current, and the pump was subsequently disassembled. Component inspection determined that the pump shaft broke at the balance drum locknut and that the rotating element required replacement. An evaluation was performed for the use of a spare rotating element. The evaluation determined that the spare rotating element was suitable for replacement based on very similar performance characteristics. The pump flow curves supplied by the manufacturer indicated very similar expected performance between the rotating element being replaced, the spare rotating element, and the rotating element installed in the 2A-A CCP. Flow testing performed during the Unit 2 Cycle 5 (U2C5) refueling outage (RFO) indicated that the total flow rate was approximately 538.2 GPM, approximately 16.8 GPM less than the TS limit. The evaluation noted that system configuration had not changed; therefore, there would not be a change in system fluid resistance. It was estimated that the spare rotating element could provide an increased flow rate of approximately 4 GPM, resulting in a total flow rate less than the TS limit. The spare rotating element was installed, and the CCP was tested under miniflow conditions and placed in service. However, with the replacement rotating element, the total flow delivered was greater than the TS upper limit.

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

None.

C. Dates and Approximate Times of Major Occurrences

March 24, 1992

During the U2C5 RFO, the 2B-B CCP was found to have a total flow of approximately 538.2 GPM.

**LICENSEE EVENT REPORT (LER)**  
TEXT CONTINUATION

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6)										PAGE (3)									
Sequoyah Nuclear Plant (SQN), Unit 2				SEQUENTIAL				REVISION													
		YEAR		NUMBER				NUMBER													
		0	5	0	0	0	3	1	2	8	9	4	--	0	0	7	--	0	0	0	3

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

January 5, 1994 The 2B-B CCP motor tripped on timed overcurrent. A subsequent equipment inspection identified a failed pump shaft.

January 10, 1994 A spare rotating element was evaluated, installed, postmaintenance testing (ASME Section XI pump test) was completed, and the 2B-B CCP was returned to service.

January 14, 1994 through July 5, 1994 The 2A-A CCP was out of service for short periods of time on six different days to facilitate surveillance testing (total time of approximately 5 hours-27 minutes), preventative maintenance (total time of approximately 6 hours-40 minutes), and corrective maintenance (total time of approximately 4 hours-22 minutes).

February 2, 1994 A postmaintenance testing suitability evaluation was docketed with NRC, providing the technical basis for not performing a system full-flow test. The evaluation was based on the very similar performance characteristics between the spare rotating assembly and both the 2B-B and 2A-A CCP rotating assemblies.

July 5, 1994 at 2356 Eastern daylight time Unit 2 entered Mode 4, hot shutdown, in preparation for refueling.

September 13, 1994 An SI for charging pump injection flow was performed. A Unit 2 CCP flow balance was performed, and both CCPs were left within TS limits. Test data indicated that the 2B-B CCP total flow (run-out) may have exceeded the TS limit. A condition adverse to quality document was initiated to evaluate the condition.

September 23, 1994 A review of test methodology, instruments, and data determined that TS Surveillance Requirement 4.5.2.h.2.b for CCP total pump flow was exceeded.

D. Other Systems or Secondary Functions Affected

None.

LICENSEE EVENT REPORT (LER)

TEXT CONTINUATION

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6)										PAGE (3)			
Sequoyah Nuclear Plant (SQN), Unit 2			SEQUENTIAL				REVISION								
		YEAR	NUMBER				NUMBER								
	0500032894	007	0004	OF	06										

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

E. Method of Discovery

The condition was discovered during the performance of an SI for charging pump injection flow testing. This SI is performed each outage to ensure compliance with TS flow and pump-balance requirements. After a review of the SI, it was determined that the total flow rate exceeded the TS limit, resulting in the 2B-B CCP being technically inoperable for a period of approximately six months.

Operator Actions

None - No operator actions were required.

G. Safety System Response

None - No safety system responses were required.

III. CAUSE OF EVENT

A. Immediate Cause

The immediate cause of the condition was that the total run-out flow rate for the 2B-B CCP exceeded the TS limit, resulting in the equipment being technically inoperable.

B. Root Cause

The root cause for the condition was an incorrect evaluation of the spare rotating element. A review of the condition determined that the evaluation estimated a performance increase of approximately 4 GPM. The actual gain as determined by subsequent flow testing was approximately 28.3 GPM. The evaluation of the spare rotating element was based on industry experience; manufacturer test data of the 2A-A, 2B-B, and the spare rotating elements; and data from the previous flow balance testing. An ongoing review of the evaluation has not determined why the pump performance was greater than expected.

C. Contributing Factors

None.



## LICENSEE EVENT REPORT (LER)

## TEXT CONTINUATION

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6)			PAGE (3)		
		SEQUENTIAL	REVISION				
Sequoyah Nuclear Plant (SQN), Unit 2		YEAR	NUMBER	NUMBER			
		05001031218194	--007	--00050F	0	6	

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

## IV. ANALYSIS OF EVENT

The operability of two independent emergency core cooling system (ECCS) subsystems ensures that sufficient emergency core cooling will be available in the unlikely event of a loss of coolant accident (LOCA). The ECCS limits the peak cladding temperature (PCT) within acceptable limits and provides long-term core cooling capability during accident recovery.

An evaluation of this condition was performed. The evaluation reviewed impact to the safety analysis for flow rated above the TS limit, equipment failure during the accident injection phase, and impact during the postaccident recirculation phase. It was determined that the measured total flow rate is bounded by the current maximum safeguards flows of record; therefore, the as-found condition did not adversely impact the safety analysis. Based on vendor run-out testing and tests performed at other utilities, it was determined that the 2B-B CCP would have successfully operated for the duration of the injection phase, and PCT limits would have been maintained in the unlikely event of an accident condition. Analysis of the recirculation phase for a small-break LOCA determined that the CCP would not reach the run-out flow rate because of elevated reactor coolant system pressures. Therefore, the as-found condition of the 2B-B CCP would not have resulted in equipment failure, and PCT limits would have been maintained. The evaluation of a large-break LOCA determined that the fuel rod cladding heat-up transient terminates well before the switchover to the recirculation phase with no impact to the calculated PCT. During post-LOCA long-term core cooling, it is assumed that the pump would be inoperable. This is based on the lack of test data, in the run-out condition found on the 2B-B CCP, for extended periods of time with low reactor coolant system pressures. However, the condition could be mitigated by use of the other ECCS subsystems that were available, such as the residual heat removal pumps. These pumps were operable and fully capable of providing continuous flow in the long-term postaccident scenario.

Additionally, the condition of the 2B-B CCP being operated for approximately 15 minutes at a total flow (run-out) rate of 566.5 GPM was reviewed. The rotating element impellers being used in this pump are of a sand cast type with a run-out limit of 580 GPM for up to 15 minutes. Based on this information, the condition experienced by the equipment did not result in pump degradation.

Therefore, the condition did not adversely affect the health and safety of plant personnel or the general public.

## V. CORRECTIVE ACTION

A. Immediate Corrective Action

The flow balance of the CCPs was completed, and the 2B-B CCP was left within the TS limit.

**LICENSEE EVENT REPORT (LER)**  
TEXT CONTINUATION

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6)										PAGE (3)			
Sequoyah Nuclear Plant (SQN), Unit 2															

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

**B. Corrective Action to Prevent Recurrence**

The previously-performed evaluation associated with the spare CCP rotating element is being reviewed to determine the appropriate actions to prevent recurrence.

**VI. ADDITIONAL INFORMATION**

**A. Failed Components**

None.

**B. Previous Similar Events**

None.

**VII. COMMITMENTS**

Complete the review of the previously-performed evaluation associated with the spare CCP rotating element and identify the appropriate action to prevent recurrence by January 27, 1995.