



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

September 15, 2022

10 CFR 50.73

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

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

Subject: Licensee Event Report 50-327/2022-001-00, Failure of 1B-B Centrifugal Charging Pump Results in Condition Prohibited by Technical Specifications

The enclosed licensee event report provides details concerning the inoperability of the 1B-B Centrifugal Charging Pump affecting one train of the Emergency Core Cooling System (ECCS) for longer than allowed by technical specifications (TSs). During a telephone conversation at 1730 eastern daylight time on July 21, 2022, the NRC approved a verbal request from Sequoyah Nuclear Plant that a Notice of Enforcement Discretion be issued allowing continued operation for an additional 69 hours beyond the expiration of the TS Limiting Condition for Operation action statement. 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 unit's TSs.

There are no new 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,

Lovitt, Matthew
Robert

for

Thomas Marshall
Site Vice President
Sequoyah Nuclear Plant

Digitally signed by Lovitt, Matthew Robert
DN: c=us, o=Users, ou=Main,
ou=Remote Sites, ou=Users, ou=SQN,
cn=Lovitt, Matthew Robert,
email=mllovitt@nrc.gov
Reason: I am approving this document
Date: 2022.09.15 08:10:19 -0400

Enclosure: Licensee Event Report 50-327/2022-001-00
cc: NRC Regional Administrator – Region II
NRC Senior Resident Inspector – Sequoyah Nuclear Plant



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/>)

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, Library, and Information Collections Branch (T-6 A10M), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by e-mail to Infocollects.Resource@nrc.gov, and the OMB reviewer at: OMB Office of Information and Regulatory Affairs, (3150-0104), Attn: Desk all: oir_submission@omb.eop.gov. The NRC may not conduct or sponsor, and a person is not required to respond to, a collection of information unless the document requesting or requiring the collection displays a currently valid OMB control number.

1. Facility Name Sequoyah Nuclear Plant Unit 1	2. Docket Number 05000327	3. Page 1 OF 6
--	-------------------------------------	--------------------------

4. Title
Failure of 1B-B Centrifugal Charging Pump Results in 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
07	22	2022	2022	- 001-	00	09	15	2022	NA	05000
									NA	05000

9. Operating Mode 1	10. Power Level 100
-------------------------------	-------------------------------

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

10 CFR Part 20	<input type="checkbox"/> 20.2203(a)(2)(vi)	<input type="checkbox"/> 50.36(c)(2)	<input type="checkbox"/> 50.73(a)(2)(iv)(A)	<input type="checkbox"/> 50.73(a)(2)(x)
<input type="checkbox"/> 20.2201(b)	<input type="checkbox"/> 20.2203(a)(3)(i)	<input type="checkbox"/> 50.46(a)(3)(ii)	<input type="checkbox"/> 50.73(a)(2)(v)(A)	10 CFR Part 73
<input type="checkbox"/> 20.2201(d)	<input type="checkbox"/> 20.2203(a)(3)(ii)	<input type="checkbox"/> 50.69(g)	<input type="checkbox"/> 50.73(a)(2)(v)(B)	<input type="checkbox"/> 73.71(a)(4)
<input type="checkbox"/> 20.2203(a)(1)	<input type="checkbox"/> 20.2203(a)(4)	<input type="checkbox"/> 50.73(a)(2)(i)(A)	<input type="checkbox"/> 50.73(a)(2)(v)(C)	<input type="checkbox"/> 73.71(a)(5)
<input type="checkbox"/> 20.2203(a)(2)(i)	10 CFR Part 21	<input checked="" type="checkbox"/> 50.73(a)(2)(i)(B)	<input type="checkbox"/> 50.73(a)(2)(v)(D)	<input type="checkbox"/> 73.77(a)(1)(i)
<input type="checkbox"/> 20.2203(a)(2)(ii)	<input type="checkbox"/> 21.2(c)	<input type="checkbox"/> 50.73(a)(2)(i)(C)	<input type="checkbox"/> 50.73(a)(2)(vii)	<input type="checkbox"/> 73.77(a)(2)(i)
<input type="checkbox"/> 20.2203(a)(2)(iii)	10 CFR Part 50	<input type="checkbox"/> 50.73(a)(2)(ii)(A)	<input type="checkbox"/> 50.73(a)(2)(viii)(A)	<input type="checkbox"/> 73.77(a)(2)(ii)
<input type="checkbox"/> 20.2203(a)(2)(iv)	<input type="checkbox"/> 50.36(c)(1)(i)(A)	<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)(v)	<input type="checkbox"/> 50.36(c)(1)(ii)(A)	<input type="checkbox"/> 50.73(a)(2)(iii)	<input type="checkbox"/> 50.73(a)(2)(ix)(A)	

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

12. Licensee Contact for this LER

Licensee Contact Scott Bowman	Phone Number (Include Area Code) 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
X	CB	P	P025	Y	N/A	N/A	N/A	N/A	N/A

14. Supplemental Report Expected		15. Expected Submission Date	Month	Day	Year
<input checked="" type="checkbox"/> No	<input type="checkbox"/> 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)

At 2230 eastern daylight time (EDT) on July 18, 2022, operators declared the 1B-B Centrifugal Charging Pump (CCP) inoperable and entered Condition A of the Technical Specification (TS) Limiting Condition for Operation (LCO) 3.5.2 for one or more trains of the Emergency Core Cooling System inoperable. Enforcement discretion of TS LCO 3.5.2 was requested because the estimated time required to troubleshoot, repair, and test the 1B-B CCP would exceed the 72 hours allowed by Condition A. The request was granted for a period of 69 hours not to exceed a total time of 141 hours. At 1635 EDT on July 24, 2022, the 1B-B CCP was declared OPERABLE. Because the 1B-B CCP was inoperable for approximately 138 hours and the unit was not placed in MODE 3 within 78 hours, this constitutes an operation or condition prohibited by TSs.

Disassembly of the 1B-B CCP element showed severe wear on impellers 11 through 6 and less severe wear on impellers 5 through 1. The wear was on one side of the impellers. This is indicative of shaft bowing. Dye penetrant examination of the shaft showed a crack in the split ring keeper key groove at the 11th stage impeller. Pending completion of the destructive analysis, the most likely cause of the failure is low stress, high cycle fatigue. The 1B-B CCP element was replaced. Corrective actions include implementing preventative maintenance tasks to periodically replace CCP shafts. There were no actual safety consequences as a result of this event as the 1A-A CCP was started and available until the 1B-B CCP was OPERABLE.



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

(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/>)

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, Library, and Information Collections Branch (T-6 A10M), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by e-mail to Infocollects.Resource@nrc.gov, and the OMB reviewer at: OMB Office of Information and Regulatory Affairs, (3150-0104), Attn: Desk ail: oir_submission@omb.eop.gov. The NRC may not conduct or sponsor, and a person is not required to respond to, a collection of information unless the document requesting or requiring the collection displays a currently valid OMB control number.

1. FACILITY NAME	2. DOCKET NUMBER	3. LER NUMBER		
		YEAR	SEQUENTIAL NUMBER	REV NO.
Sequoyah Nuclear Plant Unit 1	05000-327	2022	- 001	- 00

NARRATIVE

I. Plant Operating Conditions Before the Event

At the time of the event, Sequoyah Nuclear Plant (SQN) Unit 1 was in Mode 1 at 100 percent rated thermal power.

II. Description of Event

A. Event Summary:

At 2130 eastern daylight time (EDT), on July 18, 2022, operators in the main control room (MCR) noticed that the pressurizer [EIS: PZR] level was slowly lowering with the downstream flow control valve near 100 percent open with the 1B-B Centrifugal Charging Pump (CCP) [EIS: CB] [EIS: P] in service. Thereafter, operators received an unexpected alarm for low flow to the reactor coolant pump (RCP) 1 [EIS: AB] seal. Seal injection flow was adjusted and the low flow alarm for RCP 1 cleared. Operators dispatched auxiliary unit operators (AUOs) to the field to validate MCR indications. Subsequently, operators received an alarm indicating a lowering pressurizer level with level indicating 54 percent and slowly lowering. Operators placed the 1A-A CCP in service and pressurizer level began to recover. At 2230 EDT, on July 18, 2022, operators declared the 1B-B CCP inoperable and entered Condition A of the Technical Specification (TS) Limiting Condition for Operation (LCO) 3.5.2 for one or more trains of the Emergency Core Cooling System (ECCS) inoperable.

TS LCO 3.5.2 Condition A has a 72-hour Completion Time (CT) to restore a train(s) to OPERABLE status. If the train is not restored to OPERABLE within 72 hours, the unit is required to be in MODE 3 within 6 hours and MODE 4 within 12 hours. Enforcement discretion of TS LCO 3.5.2 was requested because the estimated time required to troubleshoot, repair, and test the 1B-B CCP would exceed the 72 hours allowed by Condition A. The request was granted for a period of 69 hours not to exceed a total time of 141 hours.

At 1635 EDT on July 24, 2022, the 1B-B CCP was declared OPERABLE. Because the 1B-B CCP was inoperable for approximately 138 hours and the unit was not placed in MODE 3 within 78 hours, this constitutes an operation or condition prohibited by TSs and is therefore being reported in accordance with 10 CFR 50.73(a)(2)(i)(B).

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.



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

(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/>)

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, Library, and Information Collections Branch (T-6 A10M), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by e-mail to Infocollects.Resource@nrc.gov, and the OMB reviewer at: OMB Office of Information and Regulatory Affairs, (3150-0104), Attn: Desk ail: oir_submission@omb.eop.gov. The NRC may not conduct or sponsor, and a person is not required to respond to, a collection of information unless the document requesting or requiring the collection displays a currently valid OMB control number.

1. FACILITY NAME	2. DOCKET NUMBER	3. LER NUMBER		
		YEAR	SEQUENTIAL NUMBER	REV NO.
Sequoyah Nuclear Plant Unit 1	05000-327	2022	- 001	- 00

C. Dates and approximate times of occurrences:

Date/Time (EDT)	Description
07/18/22, 2130	An operator noted that pressurizer level was slowly lowering and the MCR received an unexpected annunciator for RCP 1 seal water flow low.
2220	The MCR received an unexpected annunciator for pressurizer level high-low.
2230	Operators declared the 1B-B CCP inoperable. Unit 1 entered TS LCO 3.5.2, Condition A. Subsequently, the 1A-A CCP was started, and pressurizer level began to return to program level.
07/21/22, 1730	Enforcement discretion of TS LCO 3.5.2 was requested, from NRC, because the estimated time required to troubleshoot, repair, and test the 1B-B CCP exceeded the CT. The request was granted for an additional 69 hours.
07/22/22, 0430	The unit was not placed in MODE 3 as required by TS LCO 3.5.2, Condition B.
07/24/22, 1635	The 1B-B CCP was declared OPERABLE. TS LCO 3.5.2 Condition A was exited.

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

The 1B-B CCP was manufactured by the Pacific Pump Company (now Flowserve), model 2.5 RLIIJ-11 stage horizontal pump.

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:

An operator noted that pressurizer level was slowly lowering and the MCR received an unexpected annunciator for RCP 1 seal water flow low. The MCR received an unexpected annunciator for pressurizer level high-low.

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

The most likely failure mode of the 1B-B CCP was low stress, high cycle fatigue.



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

(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/>)

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, Library, and Information Collections Branch (T-6 A10M), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by e-mail to Infocollects.Resource@nrc.gov, and the OMB reviewer at: OMB Office of Information and Regulatory Affairs, (3150-0104), Attn: Desk ail: oir_submission@omb.eop.gov. The NRC may not conduct or sponsor, and a person is not required to respond to, a collection of information unless the document requesting or requiring the collection displays a currently valid OMB control number.

1. FACILITY NAME	2. DOCKET NUMBER	3. LER NUMBER		
		YEAR	SEQUENTIAL NUMBER	REV NO.
Sequoyah Nuclear Plant Unit 1	05000-327	2022	- 001	- 00

H. Operator actions:

Operators declared the 1B-B CCP inoperable. The 1A-A CCP was started, and pressurizer level began to return to program level.

I. Automatically and manually initiated safety system responses:

The 1A-A CCP was manually started in response to the observed plant parameters.

III. Cause of the Event

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

Disassembly of the 1B-B CCP element showed severe wear on impellers 11 through 6 and less severe wear on impellers 5 through 1. The wear was on one side (180 degrees around the circumference) of the impellers. This is indicative of shaft bow. Dye penetrant examination of the shaft showed a crack in the split-ring keeper key groove at the 11th stage impeller. Pending completion of the destructive analysis, the most likely cause of the failure is low stress, high cycle fatigue.

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

There was no identified human performance related root cause.

IV. Analysis of the Event:

The function of the ECCS is to provide core cooling and negative reactivity to ensure that the reactor core is protected after any of the following accidents: loss of coolant accident (LOCA), coolant leakage greater than the capability of the normal charging system; rod ejection accident; loss of secondary coolant accident, including uncontrolled steam release or loss of feedwater; and a steam generator tube rupture. The addition of negative reactivity is designed primarily for the loss of secondary coolant accident where primary cooldown could add enough positive reactivity to achieve criticality and return to significant power.

The ECCS consists of three separate subsystems: centrifugal charging (high head), safety injection (SI) (intermediate head), and residual heat removal (RHR) (low head). The ECCS accumulators and the refueling water storage tank (RWST) are also part of the ECCS. The ECCS flow paths consist of piping, valves, heat exchangers, and pumps such that water from the RWST can be injected into the reactor coolant system (RCS) following the accidents described, above. The major components of each subsystem are the CCPs, the RHR pumps, the RHR heat exchangers, and the SI pumps. Each of the three subsystems consists of two 100% capacity trains that are interconnected and redundant such that either train is capable of supplying 100% of the flow required to mitigate the consequences of an accident.



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

(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/>)

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, Library, and Information Collections Branch (T-6 A10M), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by e-mail to Infocollects.Resource@nrc.gov, and the OMB reviewer at: OMB Office of Information and Regulatory Affairs, (3150-0104), Attn: Desk ail: oir_submission@omb.eop.gov. The NRC may not conduct or sponsor, and a person is not required to respond to, a collection of information unless the document requesting or requiring the collection displays a currently valid OMB control number.

1. FACILITY NAME	2. DOCKET NUMBER	3. LER NUMBER		
		YEAR	SEQUENTIAL NUMBER	REV NO.
Sequoyah Nuclear Plant Unit 1	05000-327	2022	- 001	- 00

A probabilistic risk assessment determined the incremental conditional core damage probability for SQN Unit 1 associated with an additional 5 days of unavailability of the 1B-B CCP was 2.15E-07. The incremental conditional large early release probability for SQN Unit 1 was 3.05E-09. These values were below acceptable thresholds and the enforcement discretion granted for an additional 69 hours was acceptable from a risk perspective.

V. Assessment of Safety Consequences

There were no actual safety consequences as a result of this event. The 1A-A CCP was started, and pressurizer level began to return to program level.

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

The 1A-A CCP was OPERABLE and placed in service.

- 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:

The 1B-B CCP was inoperable for approximately 138 hours.

VI. Corrective Actions

The event was entered into the Tennessee Valley Authority Corrective Action Program (CAP) under Condition Report 1790511.

- A. Immediate Corrective Actions:

The 1B-B CCP element was replaced, testing was completed, and the pump was returned to service.

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

Corrective actions include implementing preventative maintenance tasks to periodically replace CCP shafts.



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

(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/>)

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, Library, and Information Collections Branch (T-6 A10M), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by e-mail to Infocollects.Resource@nrc.gov, and the OMB reviewer at: OMB Office of Information and Regulatory Affairs, (3150-0104), Attn: Desk ail: oir_submission@omb.eop.gov. The NRC may not conduct or sponsor, and a person is not required to respond to, a collection of information unless the document requesting or requiring the collection displays a currently valid OMB control number.

1. FACILITY NAME	2. DOCKET NUMBER	3. LER NUMBER		
		YEAR	SEQUENTIAL NUMBER	REV NO.
Sequoyah Nuclear Plant Unit 1	05000-327	2022	- 001	- 00

VII. Previous Similar Events at the Same Site:
 There have been no previous similar events at SQN in the past three years.

VIII. Additional Information
 There is no additional information.

IX. Commitments:
 There are no commitments.