



Tennessee Valley Authority, Post Office Box 2000, Spring City, Tennessee 37381

January 30, 2018

10 CFR 50.73

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

Watts Bar Nuclear Plant, Units 1 and 2  
Facility Operating License Nos. NPF-90 and NPF-96  
NRC Docket Nos. 50-390 and 50-391

Subject: **Licensee Event Report 390/2017-012-01, Error in Plant Emergency Procedures Leads to a Condition Prohibited by the Technical Specifications**

This submittal provides Licensee Event Report (LER) 390/2017-012-01. This LER provides details concerning a condition where a procedure error related to use of the Essential Raw Cooling Water crosstie resulted in a condition prohibited by the Technical Specifications (TS). This condition is being reported as a condition prohibited by TS in accordance with 10 CFR 50.73(a)(2)(i)(B). This supplement addresses the cause and corrective actions for this event.

There are no regulatory commitments contained in this letter. Please direct any questions concerning this matter to Kim Hulvey, WBN Licensing Manager, at (423) 365-7720.

Respectfully,

A handwritten signature in blue ink, appearing to read "Paul Simmons", is written over the word "Respectfully,".

Paul Simmons  
Site Vice President  
Watts Bar Nuclear Plant

Enclosure  
cc: See Page 2

U.S. Nuclear Regulatory Commission  
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January 30, 2018

cc (Enclosure):

NRC Regional Administrator - Region II  
NRC Senior Resident Inspector - Watts Bar Nuclear Plant



## LICENSEE EVENT REPORT (LER)

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 Information Services Branch (T-2 F43), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by 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.

## 1. FACILITY NAME

Watts Bar Nuclear Plant, Unit 1

## 2. DOCKET NUMBER

05000390

## 3. PAGE

1 OF 7

## 4. TITLE

Error in Plant Emergency Procedures Leads to a Condition Prohibited by the Technical Specifications

## 5. EVENT DATE

MONTH	DAY	YEAR
08	23	2017

## 6. LER NUMBER

YEAR	SEQUENTIAL NUMBER	REV NO.
2017	012	01

## 7. REPORT DATE

MONTH	DAY	YEAR
01	30	2018

## 8. OTHER FACILITIES INVOLVED

FACILITY NAME	DOCKET NUMBER
Watts Bar Nuclear Plant, Unit 2	05000391
FACILITY NAME	DOCKET NUMBER

## 9. OPERATING MODE

## 11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check all that apply)

1

<input type="checkbox"/> 20.2201(b)	<input type="checkbox"/> 20.2203(a)(3)(i)	<input type="checkbox"/> 50.73(a)(2)(ii)(A)	<input type="checkbox"/> 50.73(a)(2)(viii)(A)
<input type="checkbox"/> 20.2201(d)	<input type="checkbox"/> 20.2203(a)(3)(ii)	<input type="checkbox"/> 50.73(a)(2)(ii)(B)	<input type="checkbox"/> 50.73(a)(2)(viii)(B)
<input type="checkbox"/> 20.2203(a)(1)	<input type="checkbox"/> 20.2203(a)(4)	<input type="checkbox"/> 50.73(a)(2)(iii)	<input type="checkbox"/> 50.73(a)(2)(ix)(A)
<input type="checkbox"/> 20.2203(a)(2)(i)	<input type="checkbox"/> 50.36(c)(1)(i)(A)	<input type="checkbox"/> 50.73(a)(2)(iv)(A)	<input type="checkbox"/> 50.73(a)(2)(x)

## 10. POWER LEVEL

100

<input type="checkbox"/> 20.2203(a)(2)(ii)	<input type="checkbox"/> 50.36(c)(1)(ii)(A)	<input type="checkbox"/> 50.73(a)(2)(v)(A)	<input type="checkbox"/> 73.71(a)(4)
<input type="checkbox"/> 20.2203(a)(2)(iii)	<input type="checkbox"/> 50.36(c)(2)	<input type="checkbox"/> 50.73(a)(2)(v)(B)	<input type="checkbox"/> 73.71(a)(5)
<input type="checkbox"/> 20.2203(a)(2)(iv)	<input type="checkbox"/> 50.46(a)(3)(ii)	<input type="checkbox"/> 50.73(a)(2)(v)(C)	<input type="checkbox"/> 73.77(a)(1)
<input type="checkbox"/> 20.2203(a)(2)(v)	<input type="checkbox"/> 50.73(a)(2)(i)(A)	<input type="checkbox"/> 50.73(a)(2)(v)(D)	<input type="checkbox"/> 73.77(a)(2)(i)
<input type="checkbox"/> 20.2203(a)(2)(vi)	<input checked="" type="checkbox"/> 50.73(a)(2)(i)(B)	<input type="checkbox"/> 50.73(a)(2)(vii)	<input type="checkbox"/> 73.77(a)(2)(ii)
	<input type="checkbox"/> 50.73(a)(2)(i)(C)	<input type="checkbox"/> OTHER	Specify in Abstract below or in NRC Form 366A

## 12. LICENSEE CONTACT FOR THIS LER

## LICENSEE CONTACT

Dean Baker, Licensing Engineer

## TELEPHONE NUMBER (Include Area Code)

423-452-4589

## 13. COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO EPIX

## 14. SUPPLEMENTAL REPORT EXPECTED

☐ YES (If yes, complete 15. EXPECTED SUBMISSION DATE) ☒ NO

## 15. EXPECTED SUBMISSION DATE

MONTH	DAY	YEAR

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

On August 23, 2017, Watts Bar Nuclear Plant (WBN) identified that procedures 1-E-1 and 2-E-1, Loss of Reactor or Secondary Coolant, contained steps to manually open 1-FCV-67-458 in the event of a Train A or B power failure. Opening 1-FCV-67-458 would result in the crosstie of Essential Raw Cooling Water (ERCW) Headers 2A and 1B, which would lead to providing flow to equipment not operating due to the loss of a train of power. On October 6, 2017, it was determined that for certain time periods, if a design basis accident had occurred on Unit 2 with a loss of offsite power concurrent with a train failure and with 1-FCV-67-458 opened, inadequate ERCW flow would have been available to remove decay heat after transfer to cold leg recirculation. This condition only affected operability of ERCW Train A. This is reportable as a condition prohibited by Technical Specification 3.7.8.

The issue associated with this incorrect procedural step to cross-tie the ERCW trains in 1-E-1 and 2-E-1 was addressed as part of actions to resolve an ERCW design and procedure issue documented in Licensee Event Report (LER) 390-2017-009. This report, while related, identifies an issue that was not addressed in the prior LER. The cause was determined to be the incorrect application of a cross tie requirement associated with 10 CFR 50 Appendix R. Corrective action will be to include engineering in the review of procedures affected by complex design changes.



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

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1. FACILITY NAME	2. DOCKET NUMBER	3. LER NUMBER		
Watts Bar Nuclear Plant, Unit 1	05000390	YEAR	SEQUENTIAL NUMBER	REV NO.
		2017	- 012	- 01

**NARRATIVE****I. PLANT OPERATING CONDITIONS BEFORE THE EVENT**

Watts Bar Nuclear Plant (WBN) Unit 1 was at 100 percent rated thermal power (RTP). WBN Unit 2 was also in Mode 1 at 100 percent power.

**II. DESCRIPTION OF EVENT****A. Event Summary**

On August 23, 2017, WBN identified that procedures 1-E-1 and 2-E-1, Loss of Reactor or Secondary Coolant, contained steps to manually open 1-FCV-67-458 {EIS:FCV} in the event of a Train A or Train B power failure. Opening 1-FCV-67-458 would result in the crosstie of Essential Raw Cooling Water (ERCW) {EIS:BI} Headers 2A and 1B, which would lead to providing flow to equipment not operating due to the loss of a train of power. On October 6, 2017, it was determined that for certain time periods, if a design basis accident had occurred on Unit 2 with a loss of offsite power concurrent with a train failure and with 1-FCV-67-458 opened, inadequate ERCW flow would have been available to remove decay heat after transfer to cold leg recirculation. This condition only affected operability of ERCW Train A.

The issue associated with this incorrect procedural step to cross-tie the ERCW trains in 1-E-1 and 2-E-1 was addressed as part of actions to resolve an ERCW design and procedure issue documented in Licensee Event Report (LER) 390-2017-009. This report, while related, identifies an issue that was not addressed in the prior LER.

This event is being reported to the Nuclear Regulatory Commission (NRC) under 10 CFR 50.73(a)(2)(i)(B) as a condition prohibited by Technical Specifications.

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

No inoperable equipment contributed to this event.

**C. Dates and Approximate Times of Occurrences**

Date	Event
10/20/15	WBN Unit 1 receives license Amendment 104 to revise the Technical Specifications (TS) for CCS and ERCW to support Dual Unit Operation.
10/22/15	WBN Unit 2 receives operating license
10/08/15	Procedure 2-E-1, Loss of Reactor or Secondary Coolant, Rev. 0 issued including steps to open 1-ISV-67-458, ERCW Cross tie.
12/28/15	Procedure 1-E-1, Rev. 7 issued including steps to open 1-ISV-67-458, ERCW Cross tie.
5/23/16	WBN Unit 2 is critical for the first time
7/12/17	Condition Report (CR) 1316395 is generated to document ERCW design issue.
7/14/17	Procedures 1-E-0 and 2-E-0, are revised to address proper position of ERCW outlet valves from the CCS heat exchangers. Additionally, procedures 1-E-1 and 2-E-1 are revised to remove action to cross tie ERCW headers.

**LICENSEE EVENT REPORT (LER)  
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**1. FACILITY NAME**

Watts Bar Nuclear Plant, Unit 1

**2. DOCKET NUMBER**

05000390

**3. LER NUMBER**

YEAR

2017

SEQUENTIAL  
NUMBER

- 012

REV  
NO.

- 01

**NARRATIVE**

Date	Event
8/23/17	CR 1331422 generated to document concern that step to cross tie ERCW headers had been removed without evaluating impact on past operability.
10/6/17	Past Operability Evaluation (POE) for CR 1331422 determines that opening ERCW cross tie would have resulted in inoperability of Train A for 18.9 days between March 19, 2017 and April 25, 2017.

**D. Manufacturer and Model Number of Components that Failed During the Event**

There were no failed components that contributed to this event.

**E. Other Systems or Secondary Functions Affected**

No other systems or secondary functions were affected.

**F. Method of discovery of each Component or System Failure or Procedural Error**

The issue was identified as concern subsequent to it being corrected. A past operability evaluation performed after the condition was identified determined the condition to be reportable.

**G. Failure Mode and Effect of Each Failed Component**

No actual equipment failures occurred during this event.

**H. Operator Actions**

No actual event was ongoing related to this report.

**I. Automatically and Manually Initiated Safety System Responses**

Not applicable.

**III. CAUSE OF THE EVENT****A. The cause of each component or system failure or personnel error, if known.**

Procedure writers incorrectly applied the 1-ISV-67-458 position requirements for a 10 CFR 50 Appendix R concern to the requirements for starting the third ERCW pump.

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

Procedure writers incorrectly applied the 1-ISV-67-458 position requirements for a 10 CFR 50 Appendix R concern to the requirements for starting the third ERCW pump. This is a knowledge based error by the procedure writers due to the complexity of the procedure changes.

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**NARRATIVE****IV. ANALYSIS OF THE EVENT**

The WBN plant is provided with a common ERCW system serving both units (see Figure). Eight ERCW pumps are provided, with two pumps aligned to each 6.9 kV Shutdown Board (SDBD) and aligned to two ERCW trains A and B. The ERCW system supplies cooling water to the Component Cooling Water System (CCS) heat exchangers, the containment spray heat exchangers, the emergency diesel generators, containment coolers, and various other system loads.

The CCS is an intermediate cooling loop cooled by the ERCW system. Three CCS heat exchangers serve both units aligned into two trains. CCS heat exchangers A and B serve Train A for Units 1 and 2, respectively, and CCS heat exchanger C serves Train B for both units. The CCS heat exchangers provide heat removal for the Residual Heat Removal (RHR) heat exchangers, the Spent Fuel Pool heat exchangers, the Chemical and Volume Control System (CVCS), various pump coolers, and various other loads. ERCW flow to the CCS heat exchangers is controlled using the discharge flow control valves to each heat exchanger with a pair of valves, one which is normally throttled during normal conditions and the other normally closed and used during accident conditions which can be positioned to one of three (A, B, Open) preset opening positions.

The limiting design for both the ERCW and CCS systems is a normal shutdown on one unit with a design basis Loss of Coolant Accident (LOCA) on the other unit. The operation of the RHR system on the unit in shutdown and the transition to cold leg recirculation heat load on the RHR heat exchanger(s) for the LOCA unit represent the maximum heat load that is applied to the CCS system.

During normal operation, ERCW flow is modulated to the CCS heat exchangers to allow the CCS temperature to be maintained in an optimal operating band. Because heat loads during normal operation are low, ERCW flow would be maintained at flows lower than during an accident to allow for optimal CCS system operation.

In LER 390-2017-009, WBN reported several issues associated with the ERCW system, the most significant being that for an accident on Unit 2, no provisions existed in the Emergency Operating Instructions (EOIs) for adjusting ERCW flows to the Train A CCS heat exchangers by opening the ERCW to the CCS heat exchanger discharge control valves to one of the desired pre-set opening positions to support accident operation (minimum analysis required ERCW flow of 3500 gpm). These valve position adjustments should have been performed in procedure 2-E-0, Reactor Trip or Safety Injection. Without repositioning these valves in advance of switchover to recirculation, unacceptably high temperature in the CCS Train A system for both units may occur following transfer to recirculation post LOCA. The required valve repositioning steps were also incorrect in 1-E-0 for Unit 1, but the procedure did support an alignment yielding adequate flow for Unit 1 and Unit 2.

A separate issue was identified in Condition Report (CR) 1331422 that is the subject of this report where incorrect change to procedures 1-E-1 and 2-E-1, Loss of Reactor or Secondary Coolant, were made prior to Unit 2 initial operation. Steps were added to both procedures where, for a LOCA concurrent with a loss of offsite power and a train failure while the other unit was on RHR cooling, an ERCW supply side cross connect between the A and B trains would be open. This erroneous change had the potential to reduce ERCW flow to the functioning train.

A detailed engineering review of the positions of the ERCW discharge valves from the CCS heat exchangers was performed from the time period of the introduction of the 1-E-1 procedure error until

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Watts Bar Nuclear Plant, Unit 1	05000390	YEAR	SEQUENTIAL NUMBER	REV NO.
		2017	- 012	- 01

**NARRATIVE**

correction of this issue via EOI revisions as part of the evaluation of LER 390-2017-009. This review was used as a basis to document the impact of considering a LOCA with a train failure to address the impact of opening the ERCW supply side cross connect of system safety function.

The review performed for LER 390-2017-009 determined that inadequate ERCW flow would have been present for approximately 0.252 years for a large break LOCA on Unit 2. The review of the open cross tie issue identified a total of 18.9 days of inoperability on Unit 2 Train A. Of the 18.9 days, 7.8 days were already deemed inoperable by the review performed for LER 390-2017-009.

**V. ASSESSMENT OF SAFETY CONSEQUENCES**

As described in the previous section, the ERCW system Train A was not able to perform its safety function for a design basis accident on Unit 2 for about 18.9 days associated with the ERCW cross tie valve being opened in the event of a LOCA with a train failure. A probabilistic risk assessment (PRA) performed determined that the increase in core damage frequency (CDF) for this issue, when coupled with the issue described in LER 390-2017-009, to be less than  $1E-7$ .

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

Train B ERCW was able to perform its safety function for a design basis accident on Unit 2 related to this issue for the periods where Train A was inoperable.

- 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

Not applicable.

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

This issue was corrected during the resolution of the ERCW design issue reported in LER 390-2017-009.

**VI. CORRECTIVE ACTIONS**

This event was entered into the Tennessee Valley Authority (TVA) Corrective Action Program and is being tracked under Condition Report (CR) 1331422.

- A. Immediate Corrective Actions

The issue identified was already corrected when it was identified.

- B. Corrective Actions to Prevent Recurrence or to Reduce Probability of Similar Events Occurring in the Future

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**NARRATIVE**

For design changes involving significant procedure changes, engineering will be specified as a reviewing organization on the procedure changes developed to insure correct implementation.

**VII. PREVIOUS SIMILAR EVENTS AT THE SAME SITE**

LER 390/2017-009 reported an unanalyzed condition that showed adequate ERCW flow may not be available during dual unit limiting design basis conditions of one unit in Hot Shutdown on RHR cooling when the other unit experiences a LOCA during specific single failure events due to a design error. Due to procedural errors, the analysis showed during a Unit 1 LOCA, Unit 1 received adequate flow when following existing procedural guidance. During a Unit 2 LOCA, however, procedural guidance was not adequate to ensure the proper system alignment to establish correct ERCW to CCS Heat Exchanger A and B flow rates for either unit's cool down requirements, due to procedure errors. The cause of this event was human performance related to both a knowledge of personnel associated with the design and a failure by procedure preparers to properly capture configuration changes specified in a plant design change when WBN went to dual unit operation.

LER 390/2016-004 reported an unanalyzed condition where the Unit 1 Fire Protection Report (FPR) analysis for 10 CFR 50, Appendix R contained a non-conservative time for isolation of the Volume Control Tank (VCT) following a postulated fire in room 737.0-A1A. Multiple fire-induced failures were postulated to result in a loss of suction to the Centrifugal Charging Pumps (CCPs), which could cause Reactor Coolant Pump seal damage and loss of Reactor Coolant System inventory. Fire modeling subsequently determined that for any credible combination of failures or equipment spurious operation that the CCPs would remain operable. This issue was determined to be the result of a latent engineering error associated with the original Appendix R analysis performed for Unit 1.

**VIII. ADDITIONAL INFORMATION**

None.

**IX. COMMITMENTS**

None.



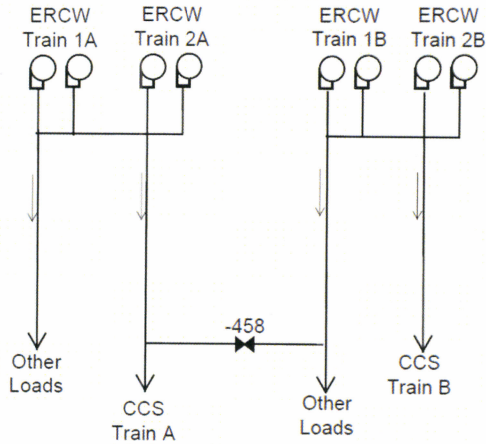


# LICENSEE EVENT REPORT (LER) CONTINUATION SHEET

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## NARRATIVE



Simplified ERCW Figure