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March 29, 2016

L-16-057

10 CFR 50.73

ATTN: Document Control Desk  
United States Nuclear Regulatory Commission  
Washington, D.C. 20555-0001Subject:  
Davis-Besse Nuclear Power Station, Unit 1  
Docket Number 50-346, License Number NPF-3  
Licensee Event Report 2016-002

Enclosed is Licensee Event Report (LER) 2016-002-00, "Unanticipated Steam and Feedwater Rupture Control System Actuation." This event is being reported pursuant to 10 CFR 50.73(a)(2)(iv)(A).

There are no regulatory commitments contained in this letter or its enclosure. The actions described represent intended or planned actions and are described for information only. If there are any questions or if additional information is required, please contact Mr. Patrick J. McCloskey, Manager – Site Regulatory Compliance, at (419) 321-7274.

Sincerely,



Brian D. Boles

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Enclosure: LER 2016-002

cc: NRC Region III Administrator  
NRC Resident Inspector  
NRR Project Manager  
Utility Radiological Safety BoardIEZZ  
NRR



**LICENSEE EVENT REPORT (LER)**

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

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](mailto: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.

<b>1. FACILITY NAME</b> Davis-Besse Nuclear Power Station, Unit 1	<b>2. DOCKET NUMBER</b> 05000346	<b>3. PAGE</b> 1 OF 4
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**4. TITLE**  
Unanticipated Steam and Feedwater Rupture Control System Actuation

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
01	30	2016	2016-002-00			03	29	2016	FACILITY NAME	DOCKET NUMBER 05000

<b>9. OPERATING MODE</b> 3	<b>11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check all that apply)</b>			
	<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 checked="" type="checkbox"/> 50.73(a)(2)(iv)(A)	<input type="checkbox"/> 50.73(a)(2)(x)
<b>10. POWER LEVEL</b> 0	<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 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 Vicki Wadsworth, Senior Nuclear Engineering Specialist – Regulatory Compliance	TELEPHONE NUMBER (Include Area Code) (419) 321-7690
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**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

<b>14. SUPPLEMENTAL REPORT EXPECTED</b> <input type="checkbox"/> YES (If yes, complete 15. EXPECTED SUBMISSION DATE) <input checked="" type="checkbox"/> NO	<b>15. EXPECTED SUBMISSION DATE</b> MONTH:      DAY:      YEAR:
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**ABSTRACT** (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines)

On January 30, 2016, with the plant in Mode 3, with the Auxiliary Feedwater System (AFW) in operation and proceeding with Post Trip recovery actions from the January 29, 2016 Steam Feedwater Rupture Control System (SFRCS) High Level Trip (reference Licensee Event Report (LER) 2016-001) when a SFRCS Steam Generator (SG) 1 High Reverse Differential Pressure (D/P) Trip was unexpectedly received. The trip was a result of a feedwater isolation valve being opened to align the Motor Driven Feed Pump's (MDFP) discharge to SG 1. The unexpected SFRCS SG 1 Reverse D/P Trip resulted in the closure of the appropriate Main Steam and Main Feedwater (MFW) valves, as designed. AFW Pumps 1 and 2 remained in operation, as expected and the plant was verified to be stable.

The cause of this event was inadequate procedural guidance contained in the Trip Recovery Procedure with a corrective action to revise the procedure. This report is being submitted as an event that resulted in an automatic actuation of the SFRCS, therefore, reportable in accordance with 10 CFR 50.72(b)(3)(iv)(A).



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

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1. FACILITY NAME		2. DOCKET NUMBER	3. LER NUMBER		
			YEAR	SEQUENTIA NUMBER	REV NO.
Davis-Besse Nuclear Power Station Unit 1		05000-346	2016	- 002	00

**NARRATIVE**

Energy Industry Identification System (EIIIS) codes are identified in the text as [XX].

**System Description:**

The Davis-Besse Nuclear Power Station (DBNPS) Steam and Feedwater Line Rupture Control System (SFRCS) [JB] is a protection system that initiates the Auxiliary Feedwater System (AFW) [BA] and isolates the affected Steam Generator (SG) [AB-SG] on a steam or feedwater line rupture. The SFRCS is required to ensure an adequate feedwater supply to the steam generators to remove reactor decay heat during periods when the normal feedwater supply and/or the electric power supply to essential auxiliaries has been lost. The design of the SFRCS is to mitigate release of high energy steam, to automatically start the AFW System in the event of a main steam line or Main Feedwater (MFW) line rupture, or on the loss of both main feed pumps [SJ-P] or the loss of all four Reactor Coolant Pumps (RCPs) [AB-P], and to prevent steam generator overfill and subsequent spillover into the main steam lines. The SFRCS also provides a trip signal to the Anticipatory Reactor Trip System (ARTS). In the event of a main steam line rupture, the SFRCS will close both Main Steam Isolation Valves (MSIVs) [SB-ISV] and all MFW control [SJ-LCV] and stop valves [SJ-ISV] and trip the main turbine [TA-TRB].

A loss of normal feedwater is sensed by monitoring the differential pressure across the main feedwater check valves. On a high reverse differential pressure, the SFRCS opens the steam supply from either steam generator to either auxiliary feedwater pump turbine and aligns the auxiliary feedwater pump to its associated steam generator. SFRCS also isolates MFW, main steam, and trips the reactor and the main turbine. On a reduced steam generator(s) inventory, the SFRCS responds similarly, with the exception that MFW and main steam will not be isolated.

**DESCRIPTION OF EVENT:**

On January 29, 2016, at 1322 hours, the DBNPS experienced a reactor trip and subsequent SFRCS actuation on SG 1 High Level. This resulted in various automatic actions, including the isolation of MFW to the SGs and starting both trains of AFW. The Plant was stable in Mode 3 with the AFW System providing AFW to the SGs, as designed. Refer to LER 2016-001 for more information on the January 29, 2016 events.

On January 30, 2016, with the plant remaining in Mode 3, Operations personnel were proceeding with Post Trip recovery actions using procedure DB-OP-06910, Trip Recovery, to transition from AFW to MFW supplying feedwater to the SGs. The Motor Driven Feedwater Pump (MDFP) was started and operated on minimum recirculation flow back to the Deaerator. The MDFP discharge flowpath was then aligned to the MFW system to refill and pressurize the downstream MFW header through the individual Minimum Bypass Throttle Valves (FW139, FW44) up to the closed MFW Isolation Valves (FW612, FW601). The MDFP continued to deliver feedwater to the MFW header establishing a stable FW pressure upstream of the Minimum Bypass Throttle Valves (FW139, FW44). The MDFP flow remained steady at approximately 12-15 gallons per minute for approximately 5 minutes. In accordance with procedure DB-OP-06910, Operations personnel verified MFW pressure upstream of the Minimum Bypass Throttle Valves (FW139 and FW44) was greater than SG pressure. MFW to SG 2 Isolation Valve (FW601) was opened and in approximately 1 minute, MFW to SG 1 Isolation Valve (FW612) was opened. This resulted in a reverse delta pressure indication across the MFW check valve at 0123 hours as MFW to SG 1 Isolation Valve (FW612) was opened, resulting in an automatic actuation of the SFRCS



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**DESCRIPTION OF EVENT (Continued)**

on High Reverse Differential Pressure and realignment of several valves in the Main Steam Feedwater System as designed. AFW continued to operate throughout the event and the Plant was verified to be stable.

**CAUSE OF EVENT**

The direct cause of the event was insufficient pressure in the piping upstream of the MFW to SG 1 Check valve (FW147), resulting in the SFRCS Actuation. When MFW to SG 1 Isolation Valve (FW612) was opening, the downstream SG pressure of approximately 870 pounds per square inch gauge (psig) was immediately applied to the downstream side of MFW to SG 1 Check Valve (FW147), developing greater than 125 pounds per square inch differential (psid) reverse DP, thus causing the SFRCS SG 1 High Reverse DP trip. The unexpected SFRCS SG 1 High Reverse D/P trip resulted in the reclosure of affected valves, including the MFW Isolation Valves, as designed. The AFW Pumps remained in operation, as expected. The MDFP remained operating aligned to the MFW Header and continued to pressurize the piping between the FW Heaters up to the MFW Isolation Valves.

The apparent cause of the event is that less than adequate procedural guidance is contained in procedure DB-OP-06910, Trip Recovery. The guidance in this procedure was inadequate to ensure that the MFW piping segment between MFW Bypass Throttle Valve (FW139) and MFW to SG 1 Isolation Valve (FW612) was sufficiently pressurized prior to opening MFW to SG 1 Isolation Valve (FW612).

**ANALYSIS OF EVENT**

The SFRCS is a protection system required to actuate AFW to the SG's to remove reactor decay heat during periods when normal feedwater supply has been lost and/or upon loss of power to the RCP motors. Crossover piping exists that may be used to direct feedwater from either AFW source to either SG. The SFRCS also functions to isolate steam and main feedwater lines to mitigate overcooling events caused by steam depressurization.

At the time of the event, the AFW System was operating and feeding the Steam Generators. The unit remained in Mode 3 and stable. This actuation did not have any negative impact to the AFW system and the ability to feed the steam generators.

A bounding quantitative evaluation of risk impact was performed, using best available information, which estimated the delta Core Damage Frequency (CDF) to be 4.9E-07/yr. Based on this analysis, this event is considered to have a very low safety significance.

**Reportability Discussion:**

The Auxiliary Feedwater System by the SFRCS on a valid reverse differential pressure is reportable within 8 hours of the event in accordance with 10 CFR 50.72(b)(3)(iv)(A). This notification was completed at 07:32 on January 30, 2016 (Event Number 51702). The receipt of an actuation signal of the Auxiliary Feedwater System and the actuation/closure of several main steam system valves is reportable as a Licensee Event Report per 10 CFR 50.73(a)(2)(iv)(A). All safety systems performed as required in response to the event, and no loss of safety function occurred.



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**CORRECTIVE ACTIONS**

Procedure, DB-OP-06910, Trip Recovery, will be revised to add the requirement to verify that the pressure in SG 1 (2) Feedwater piping segment between valves MFW to SG 1 Check Valves (FW139 and FW147) and MFW to SG 2 Check Valves (FW44 and FW156) exceeds SG 1 (2) steam pressure prior to opening MFW to SG 2 (SG 1) Isolation Valve FW612 (FW601). This verification will require the installation of a temporary pressure indicator(s).

**PREVIOUS SIMILAR EVENTS**

Licensee Event Report (LER) 2015-002 documents the manual actuation of SFRCS in May 2015 to isolate a steam leak in the turbine building. LER 2016-001 documents the automatic actuation of SFRCS on January 29, 2016, in response to high SG levels following a reactor trip. There have been no LERs at the DBNPS involving an SFRCS reverse differential pressure trip in the past three years.