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GNRO-2014/00038

May 15, 2014

U.S. Nuclear Regulatory Commission  
Attn: Document Control Desk  
Washington, DC 20555-0001

SUBJECT: Licensee Event Report (LER) 2014-002-00 due to Manual actuation of the  
Reactor Protection System (RPS) due to Steam Leak with Reactor Core  
Isolation Cooling (RCIC) manual initiation  
Grand Gulf Nuclear Station, Unit 1  
Docket No. 50-416  
License No. NPF-29

Dear Sir or Madam:

Attached is Licensee Event Report (LER) 2014-002-00 which is a final report. This report is submitted in accordance with Title 10 *Code of Federal Regulations* 50.73(a)(2)(iv)(A).

This letter contains no new commitments. If you have any questions or require additional information, please contact Mr. James Nadeau at 601-437-2103.

Sincerely,

A handwritten signature in black ink, appearing to read "James J. Nadeau".

JJN/ras

Attachment: Licensee Event Report (LER) 2014-002-00

CC: (See next page)

cc: with Attachment

NRC Senior Resident Inspector  
Grand Gulf Nuclear Station  
Port Gibson, MS 39150

U. S. Nuclear Regulatory Commission  
ATTN: Marc L. Dapas (w/2)  
Regional Administrator, Region IV  
1600 East Lamar Boulevard  
Arlington, TX 76011-4511

U. S. Nuclear Regulatory Commission  
ATTN: Mr. Alan Wang, NRR/DORL (w/2)  
Mail Stop OWFN 8 B1  
Washington, DC 20555-0001

**Attachment to**  
**GNRO-2014/00038**  
**Licensee Event Report (LER) 2014-002-00**

<b>NRC FORM 366</b> (01-2014)		<b>U.S. NUCLEAR REGULATORY COMMISSION</b>		APPROVED BY OMB: NO. 3150-0104      EXPIRES: 01/31/2017	
<b>LICENSEE EVENT REPORT (LER)</b> (See reverse 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 Section (T-5 F53), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to <a href="mailto:infocollects.resource@nrc.gov">infocollects.resource@nrc.gov</a> , 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> Grand Gulf Nuclear Station, Unit 1			<b>2. DOCKET NUMBER</b> <b>05000 416</b>		<b>3. PAGE</b> 1 OF 5
<b>4. TITLE</b> Manual actuation of the Reactor Protection System due to Steam Leak with Reactor Core Isolation Cooling manual initiation					
<b>5. EVENT DATE</b>		<b>6. LER NUMBER</b>		<b>7. REPORT DATE</b>	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REV NO.
3	17	2014	<b>2014 - 002 - 00</b>		
			5	15	2014
<b>8. OTHER FACILITIES INVOLVED</b>					
FACILITY NAME			DOCKET NUMBER		
N/A			05000 N/A		
FACILITY NAME			DOCKET NUMBER		
N/A			05000 N/A		
<b>9. OPERATING MODE</b>		<b>11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check all that apply)</b>			
1		<div style="display: flex; flex-wrap: wrap;"> <div style="width: 50%;"><input type="checkbox"/> 20.2201(b)</div> <div style="width: 50%;"><input type="checkbox"/> 20.2203(a)(3)(i)</div> <div style="width: 50%;"><input type="checkbox"/> 50.73(a)(2)(i)(C)</div> <div style="width: 50%;"><input type="checkbox"/> 50.73(a)(2)(vii)</div> <div style="width: 50%;"><input type="checkbox"/> 20.2201(d)</div> <div style="width: 50%;"><input type="checkbox"/> 20.2203(a)(3)(ii)</div> <div style="width: 50%;"><input type="checkbox"/> 50.73(a)(2)(ii)(A)</div> <div style="width: 50%;"><input type="checkbox"/> 50.73(a)(2)(viii)(A)</div> <div style="width: 50%;"><input type="checkbox"/> 20.2203(a)(1)</div> <div style="width: 50%;"><input type="checkbox"/> 20.2203(a)(4)</div> <div style="width: 50%;"><input type="checkbox"/> 50.73(a)(2)(ii)(B)</div> <div style="width: 50%;"><input type="checkbox"/> 50.73(a)(2)(viii)(B)</div> <div style="width: 50%;"><input type="checkbox"/> 20.2203(a)(2)(i)</div> <div style="width: 50%;"><input type="checkbox"/> 50.36(c)(1)(i)(A)</div> <div style="width: 50%;"><input type="checkbox"/> 50.73(a)(2)(iii)</div> <div style="width: 50%;"><input type="checkbox"/> 50.73(a)(2)(ix)(A)</div> <div style="width: 50%;"><input type="checkbox"/> 20.2203(a)(2)(ii)</div> <div style="width: 50%;"><input type="checkbox"/> 50.36(c)(1)(ii)(A)</div> <div style="width: 50%;"><input checked="" type="checkbox"/> 50.73(a)(2)(iv)(A)</div> <div style="width: 50%;"><input type="checkbox"/> 50.73(a)(2)(x)</div> <div style="width: 50%;"><input type="checkbox"/> 20.2203(a)(2)(iii)</div> <div style="width: 50%;"><input type="checkbox"/> 50.36(c)(2)</div> <div style="width: 50%;"><input type="checkbox"/> 50.73(a)(2)(v)(A)</div> <div style="width: 50%;"><input type="checkbox"/> 50.73(a)(2)(4)</div> <div style="width: 50%;"><input type="checkbox"/> 20.2203(a)(2)(iv)</div> <div style="width: 50%;"><input type="checkbox"/> 50.46(a)(3)(ii)</div> <div style="width: 50%;"><input type="checkbox"/> 50.73(a)(2)(v)(B)</div> <div style="width: 50%;"><input type="checkbox"/> 73.71(a)(5)</div> <div style="width: 50%;"><input type="checkbox"/> 20.2203(a)(2)(v)</div> <div style="width: 50%;"><input type="checkbox"/> 50.73(a)(2)(i)(A)</div> <div style="width: 50%;"><input type="checkbox"/> 50.73(a)(2)(v)(C)</div> <div style="width: 50%;"><input type="checkbox"/> OTHER</div> <div style="width: 50%;"><input type="checkbox"/> 20.2203(a)(2)(vi)</div> <div style="width: 50%;"><input type="checkbox"/> 50.73(a)(2)(i)(B)</div> <div style="width: 50%;"><input type="checkbox"/> 50.73(a)(2)(v)(D)</div> </div>			
<b>10. POWER LEVEL</b>		Specify in Abstract below or in NRC Form 366A			
41%					
<b>12. LICENSEE CONTACT FOR THIS LER</b>					
FACILITY NAME				TELEPHONE NUMBER (Include Area Code)	
James J Nadeau / Manager, Regulatory Assurance				601-437-2103	
<b>13. COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT</b>					
CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX	CAUSE
B	TF	DRN	ACP	N/A	N/A
					SYSTEM
					N/A
					COMPONENT
					N/A
					MANU-FACTURER
					N/A
					REPORTABLE TO EPIX
					N/A
<b>14. SUPPLEMENTAL REPORT EXPECTED</b>				<b>15. EXPECTED SUBMISSION DATE</b>	
<input type="checkbox"/> YES (If yes, complete 15. EXPECTED SUBMISSION DATE) <input checked="" type="checkbox"/> NO					
				MONTH	DAY
				N/A	N/A
				YEAR	
				N/A	N/A
<b>ABSTRACT (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines)</b>  On March 17, 2014, at 05:14 Central Daylight Time with the plant at 41 percent rated core thermal power during power ascension from refueling outage 19, Grand Gulf Nuclear Station manually actuated the Reactor Protection System (RPS) to shut down the reactor due to a steam leak in the turbine building. All control rods fully inserted and all safety systems operated as designed. The Main Steam Isolation Valves (MSIVs) were manually shut and the Reactor Core Isolation Cooling (RCIC) System was manually initiated. No Safety Relief Valves (SRVs) actuated automatically. Manual cycling of SRVs and RCIC was used to maintain reactor water level and pressure within normal bands. Group 2 and 3 Residual Heat Removal (RHR) isolation signals were received. However, no valve movement occurred since the affected valves are normally closed. The cause of the manual RPS actuation was a steam leak in the turbine building resulting from a failed turbine first stage pressure sensing line (TFSPSL) followed by a failed main steam line four inch drain line. The failed drain line has been replaced and both TFSPSLs have been removed. Temporary modifications have been issued for implementation of "a current source" strategy. This action removes the TFSPSLs and installs two electronic modules as an interim action while a design change to eliminate the need for the TFSPSLs is being developed. The event posed no threat to public health and safety.					

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

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 Section (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.

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**NARRATIVE****A. REPORTABLE OCCURRENCE**

This Licensee Event Report (LER) is being submitted pursuant to Title 10 Code of Federal Regulations (10 CFR) 50.73(a)(2)(iv)(A) for a manual actuation of the Reactor Protection System (EIIIS:JC) (RPS). Telephonic notification was made to the U.S. Nuclear Regulatory Commission (NRC) Emergency Notification System on March 17, 2014, within 4 hours of the event pursuant to 10 CFR 50.72(b)(2)(iv)(B) for the RPS actuation and within 8 hours of the event pursuant to 10 CFR 50.72(b)(3)(iv)(A) for manual initiation of Reactor Core Isolation Cooling (EIIIS:BN) (RCIC) system during the transient.

**B. INITIAL CONDITIONS**

On March 17, 2014, at 05:14 Central Daylight Time with the plant at 41 percent rated core thermal power during power ascension from refueling outage 19, Grand Gulf Nuclear Station (GGNS) initiated a manual actuation of the RPS system to shut down the reactor due to a steam leak in the turbine building caused by a sheared main steam line drain line. There were no systems, structures or components that were inoperable at the start of the event or contributed to the event. There were two failed components, the Main Steam Line (MSL) (EIIIS:SB) Drain Line and the "B" Turbine First Stage Pressure Sensing Line (TFSPSL) (EIIIS:TF) that contributed to this event.

**C. DESCRIPTION OF OCCURRENCE**

Turbine first stage steam pressure is measured to determine reactor power level which is expected to be linear with first-stage pressure. The "B" TFSPSL was attached to the side of the MSL drain line via welds. The drain line from MSLs is a common four inch line that services both the "A" and "B" MSLs. This drain line allows water and moisture to be removed from the MSLs and to be transferred to the condenser to prevent turbine damage. The drain line had been in service since original construction and was connected to the MSL via a two and one-half inch by four inch reducer. The "B" TFSPSL sheared followed by the MSL Drain Line shearing, resulting in a steam leak in the turbine building which resulted in manual actuation of the RPS to shut down the reactor.

At 05:14 Central Daylight Time on March 17, 2014, during power ascension from refueling outage 19, Grand Gulf Nuclear Station (GGNS) initiated a manual actuation of the RPS system to shut down the reactor due to an unexpected steam leak. At the time, the plant was operating at approximately 41 percent Rated Core Thermal Power.

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**NARRATIVE**

**C: DESCRIPTION OF OCCURRENCE (continued):**

At 03:31, the main turbine was at 1800 revolutions per minute (RPM), reactor power indicated 41 percent, TFSPSL "A" Pressure indicated 309 pounds per square inch gauge (psig) and TFSPSL "B" Pressure indicated 11 psig.

At 04:23 a condition report was initiated documenting an alarm was received in the Main Control Room (MCR) indicating that "B" TFSPSL was not indicating as expected.

At 05:12 alarms were received in the main control room indicating elevated ambient temperature in the Turbine Building areas.

At 05:14 a steam leak in the turbine building area was reported. The Operations Staff initiated a manual actuation of the RPS system to shut down the reactor and the Main Steam Isolation Valves (MSIVs) were manually closed.

**D: CAUSE**

The cause of the manual shutdown was a steam leak in the turbine building caused by the failed MSL four inch drain line (manufacturer – Allis Chalmers Power). The three-quarter inch TFSPSL that was attached to the four inch drain line sheared first contributing to the failed MSL four inch drain line. An MSL drain line pipe shear was discovered on the reducer which connected the Drain Line to the "A" MSL. The pipe shear was located on the weld between the two and one-half inch line connected to the MSL and the four inch x two and one-half inch reducer.

Preliminary cause of the three-quarter inch TFSPSL pipe shear was human error for inadequate pipe support design and analysis by utility personnel which allowed movement of the "B" TFSPSL in an unanalyzed manner. The TFSPSL modification was performed during refueling outage 19. The implementation of a rigid support for the sensing line was not confirmed during post installation walk-downs which could have identified the inadequate support. Additional investigation is planned through evaluation of vendor analysis to determine if there was fatigue or rapid fracture failure of the "B" TFSPSL and/or the drain line welds, inadequate design or design performance of the "B" TFSPSL, poor welds or sub-grade material.

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U.S. NUCLEAR REGULATORY COMMISSION

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**NARRATIVE**

## E. CORRECTIVE ACTIONS

Review of procedures for design inputs, engineering change process, and engineering task risk and rigor requirements with design engineering to focus on risk recognition and mitigating actions related to design changes address the human error aspect.

The failed drain line has been replaced and both TFSPSLs have been removed. Temporary modifications have been issued for implementation of a "current source" strategy. This action removes the TFSPSLs and installs two electronic module "beta" units as an interim action while a design change to eliminate the need for the TFSPSLs is being developed.

## F. SAFETY ASSESSMENT

The event posed no threat to public health and safety as the RPS performed as designed. All safety systems responded as designed.

At no time during the event were any technical specification safety limits violated or challenged. There were no Emergency Core Cooling (ECC) System actuations or malfunctions. RCIC was manually initiated to assist in level and pressure control.

Immediate actions performed by the Operations staff were adequate and appropriate in placing and maintaining the reactor in a safe shutdown condition.

Nuclear safety was not compromised because safety related equipment necessary to safely shutdown the unit performed its safety function. Radiological safety was not affected since there was no radiological release to the public during the event.

Response of the crew did not challenge established industrial safety protocol or requirements. There was no impact to the health and safety of the public or radiological safety as a result of this event. The offsite dose calculation manual limits were not exceeded and personnel were not affected as the area was vacated in a quick and orderly manner.

Industrial safety had high potential consequence significance. The pipe break and steam released by the failure would have made the area dangerous for any personnel who could have been working in the area. Coupled with the potential for fast moving pipes, this failure would have severely challenged industrial safety if personnel were in the area. Actions to prevent this type of industrial safety event are included in the action plan of the root cause evaluation and include permanent removal of the TFSPSLs via a design change.

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## **NARRATIVE**

### **G. ADDITIONAL INFORMATION**

The TFSPSL has failed several times prior to this event resulting in modifications.

During refueling outage 10 startup, the TFSPSL separated at the tube fitting on the MSL side of the 1N11FX300 valve.

During refueling outage 14 startup, the TFSPSL for division 2 failed. The tubing sheared at the toe of the weld to the tube adapter.

In refueling outage 16, flexible hoses were installed in division 1 and 2, MSL "A" and MSL "B", TFSPSL.

During cycle 17, approximately 1 month before refueling outage 17, the division 1 MSL "B" flex hose failed.

During refueling outage 17, both flex hoses were removed and tubing was installed utilizing the best previous design that had lasted with no failure for over 2 years before they were cut out to install the flexible connections.

During refueling outage 17, the TFSPSL and MSL were instrumented with accelerometers to measure vibration inputs and response during start-up periods when vibration is known to be most severe.

During cycle 18, approximately 2 months after refueling outage 17 startup, the TFSPSL for Division 2 failed. MSL "A" tubing sheared at the toe of the weld to the tube adapter. Corrective actions included temporary modification to install bypass signals for "B" turbine first stage pressure transmitters and a temporary leak repair to control the leak until refueling outage 18.

In refueling outage 18, an engineering change maintained the first stage pressure transmitters tap location on the main steam inlet piping, but relocated the branch connections to an area of lower vibration levels to reduce the fatigue stresses encountered with the current location and installed three-quarter inch piping up to the first anchor.

Preliminary cause for the 2014 event was human error for inadequate pipe support design and analysis which allowed movement of the "B" TFSPSL in an unanalyzed manner. The implementation of a rigid support for the sensing line was not confirmed during post installation walk-downs which could have identified the inadequate support.