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July 10, 1992

U.S. Nuclear Regulatory Commission
Mail Station P1-137
Washington, D.C. 20555

Attention: Document Control Desk

SUBJECT: Grand Gulf Nuclear Station
Unit 1
Docket No. 50-416
License No. NPF-29
Voluntary Report on ECCS Valve Malfunction
LER 92-001-00

GNRO-92/00031

Gentlemen:

Attached is Licensee Event Report (LER) 92-001 which is a final report.

Yours truly,

WTC/BAB/cg
attachment
cc: Mr. D. C. Hintz (w/a)
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IE22 1/1

NRC Form 366 (9-83)

U.S. NUCLEAR REGULATORY COMMISSION
APPROVED OMB NO. 3150-0104
EXPIRES: 8/31/88

LICENSEE EVENT REPORT (LER)

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
Grand Gulf Nuclear Station	0 5 0 0 0 4 1 6	1 OF 0 4

TITLE (4)
Voluntary Report on ECCS Valve Malfunction

EVENT DATE (5)			LER NUMBER (6)			REPORT DATE (7)			OTHER FACILITIES INVOLVED (8)	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	MONTH	DAY	YEAR	FACILITY NAMES	DOCKET NUMBER(S)
										0 5 0 0 0
0 1 0 8 9 2			9 2	— 0 0 1	— 0 0	0 7	1 0	9 2		0 5 0 0 0

OPERATING MODE (9)	4	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more of the following) (11)			
POWER LEVEL (10)	0 0 0	20.402(b)	20.405(c)	50.73(a)(2)(iv)	73.71(b)
		20.405(a)(1)(i)	50.36(c)(1)	50.73(a)(2)(v)	73.71(c)
		20.405(a)(1)(ii)	50.36(c)(2)	50.73(a)(2)(vii)	X OTHER (Specify in Abstract below and in Text, NRC Form 366A)
		20.405(a)(1)(iii)	50.73(a)(2)(i)	50.73(a)(2)(viii)(A)	
		20.405(a)(1)(iv)	50.73(a)(2)(ii)	50.73(a)(2)(viii)(B)	Voluntary
		20.405(a)(1)(v)	50.73(a)(2)(iii)	50.73(a)(2)(x)	

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER
Bruce Burke/Licensing Engineer	AREA CODE 6 0 1 4 3 7 - 6 3 3 3

COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS		CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS	

SUPPLEMENTAL REPORT EXPECTED (14)		EXPECTED SUBMISSION DATE (15)	MONTH	DAY	YEAR
YES (If yes, complete EXPECTED SUBMISSION DATE)	X NO				

ABSTRACT (Limit to 1400 spaces, i.e., approximately fifteen single-space typewritten lines) (16)

Division 1 residual heat removal (RHR A) system pump suction valve E12F004A to suppression pool failed to open when operators were realigning the system from shutdown cooling mode to standby low pressure coolant injection (LPCI) mode as reactor heatup commenced on January 8, 1992. LPCI safety function position for E12F004A is open. This event is considered to be of interest to the industry and is being submitted as a voluntary report.

This malfunction of E12F004A was determined to have been caused by the valve phenomenon known as pressure locking (or bonnet pressurization). The valve has an internal volume in the bonnet which can trap process fluid. A temperature increase of trapped process fluid can pressurize that volume if the valve is closed and leaktight. Pressure locking and thermal binding of gate valves have been the subject of several industry operating experience reports.

NRC Form 366A (9-83)

LICENSEE EVENT REPORT (LER) TEXT CONTINUATION

U.S. NUCLEAR REGULATORY COMMISSION
APPROVED OMB NO. 3150-0104
EXPIRES: 9/31/88

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6)			PAGE (3)
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	
Grand Gulf Nuclear Station	0 5 0 0 0 4 1 6	9 2	— 0 0 1	— 0 0	0 2 OF 0 4

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

A. Reportable Occurrence

Division 1 residual heat removal (RHR A) system [BO] pump ion valve E12F004A to suppression pool failed to open when operators were realig. ne system from shutdown cooling mode to standby low pressure coolant injection (LPCI) mode as reactor heatup commenced on January 8, 1992. LPCI safety function position for E12F004A is open. This event is considered to be of interest to the industry and is being submitted as a voluntary report. Requirements of Grand Gulf Nuclear Station (GGNS) Technical Specifications were satisfied during this event.

B. Initial Conditions

The plant was in Operational Condition 4 with reactor water at approximately 175 degrees F and zero psig. Plant operators attempted to open E12F004A remotely and locally while realigning RHR A system from shutdown cooling (SDC) mode to LPCI standby mode.

C. Description of Event

On January 8, 1992 at approximately 1400 hours CST, licensed plant operators were realigning RHR A from shutdown cooling mode to standby low pressure coolant injection mode as reactor heatup commenced following a plant outage. E12F004A's motor operator thermal overload circuit tripped on the first attempt to open the valve from the control room. The overload device was reset and immediately tripped again. At the time E12F004A's overload circuit tripped, reactor coolant temperature was approximately 175 degrees F and suppression pool temperature was 74 degrees F.

Operators re-established RHR A shutdown cooling operation and reduced reactor coolant temperature to approximately 135 degrees F. Operators again attempted to open E12F004A remotely, but again the thermal overload circuit tripped. Operators then attempted to open E12F004A locally via handwheel, but it would not open. The temperature difference across the valve was about 43 degrees F when the local opening was attempted.

Reactor coolant temperature was reduced further with a resultant temperature difference of approximately 20 degrees across E12F004A. The valve opened successfully via the motor operator. A nonconformance report was initiated by operations personnel to resolve E12F004A's malfunction. Visual inspection of E12F004A's external surface following this malfunction revealed no visible deformation of the valve components.

★ U.S. GPO: 1986-0-624-538/455

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6)			PAGE (3)
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	
Grand Gulf Nuclear Station	0 5 0 0 0 4 1 6	9 2	— 0 0 1	— 0 0	0 3 OF 0 4

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

D. Apparent Cause

This malfunction of E12F004A was determined to have been caused by the valve phenomenon known as pressure locking (or bonnet pressurization). The flexible wedge gate valve has an internal volume in the bonnet which can trap process fluid. A temperature increase of trapped process fluid can pressurize that volume if the valve is closed and leaktight. The resultant mechanical forces are proportional to the temperature increase of the process fluid.

Pressure locking and thermal binding of gate valves have been the subject of several industry operating experience reports. Thermal binding causes mechanical interference between valve components and increases friction due to thermal contraction of the valve components. These phenomenon typically occurs with gate valves subjected to high temperature conditions while closed. Pressure locking, as a result of heating the trapped fluid volume or the trapping of a high differential pressure, causes additional forces on the valve wedge. The forces imposed on the valve wedge, either by thermal binding or pressure locking, must be overcome by valve operator thrust for the valve to open. The thrust required to open a pressure locked valve can exceed the valve operator capability. Trip settings for motor operator thermal overload devices can be exceeded when subjected to such conditions.

E12F004A and E12F004B were judged as not being susceptible to thermal binding or pressure locking because of their distance from potential heat sources when previously evaluated for these concerns.

Based on actual data of this event, E12F004A and its Division 2 sister valve E12F004B have the potential to become inoperable when subjected to a temperature differential of approximately 15 degrees or greater across the valve. Such conditions may exist with the respective RHR train in SDC configuration. An RHR train in SDC mode operation with these limitations is inoperable for LPCI safety function. An RHR train in LPCI standby configuration (with the respective E12F004 valve open) is considered operable.

E. Corrective Actions

Interim procedural controls were implemented for E12F004A and B to address pressure locking until system modifications were implemented. These interim controls were considered an extension of existing procedural controls which provided guidance for realignment of a pressurized RHR train from the SDC configuration. Corrective actions performed for E12F004A and E12F004B include modification of each valve to prevent pressurization of the bonnet volumes.

Similar valves are being investigated to assess susceptibility to pressure locking due to the proximity of the potential heat source.

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6)			PAGE (3)
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	
Grand Gulf Nuclear Station	0 5 0 0 0 4 1 6	9 2	— 0 0 1	— 0 0	0 4 OF 0 4

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

F. Supplemental Information

Although not germane to the design configuration or specific event at GGNS, these valve phenomena present potential common mode failure mechanisms. Configuration of a plant's ECCS is critical when considering the safety consequences of pressure locking or thermal binding of valves. Redundant ECCS trains with identical valve configurations could fail to meet single failure criteria. This is important particularly during transient conditions which cause temperature variations and during plant conditions which have redundant trains of ECCS out of service or inoperable.

Plants operating in a configuration that have other ECCS inoperable, such as during extended system outages, are more likely to be susceptible to a single failure event scenario. Safety risk should be assessed for each plant's configurations. Operating instructions can be used to minimize the effects of pressure locking and thermal binding as recommended in SOER 84-7. Pressure locking can be prevented by modifying the valve as recommended in SOER 84-7. Specific valve function and valve control logic schemes must be considered when evaluating corrective actions.

G. Safety Assessment

Requirements of GGNS Technical Specifications were satisfied during this malfunction. Other ECCS trains were available and operable to perform their intended safety function. Consequently, safety and health of the general public were not compromised by this event.

H. Additional Information

Energy Industry Identification System (EIIS) codes are identified in the text within brackets [ ].