



Entergy

Entergy Operations, Inc.  
P.O. Box 756  
Port Gibson, MS 39150  
Tel 601 437 6408  
Fax 601 437 2795

Joseph J. Hagan  
Vice President  
Operations  
Grand Gulf Nuclear Station

November 26, 1996

U.S. Nuclear Regulatory Commission  
Mail Stop P1-37  
Washington, D.C. 20555

Attention: Document Control Desk

SUBJECT: Grand Gulf Nuclear Station  
Docket No. 50-416  
License No. NPF-29  
Failure of Motor Pinion Keys in Low Pressure Coolant Injection (LPCI)  
Valves  
LER 96-005-00

GNRO-96/00130

Gentlemen:

Attached is Licensee Event Report (LER) 96-005 which is a final report.

Yours truly,

JJH/MLJ  
attachment  
cc:

Mr. R. B. McGehee (w/a)  
Mr. N. S. Reynolds (w/a)  
Mr. J. E. Tedrow (w/a)  
Mr. J. W. Yelverton (w/a)  
  
Mr. Leonard J. Callan (w/a)  
Regional Administrator  
U.S. Nuclear Regulatory Commission  
Region IV  
611 Ryan Plaza Drive Suite 400  
Arlington, TX 76011  
  
Mr. J. N. Donohew  
Office of Nuclear Reactor Regulation  
U.S. Nuclear Regulatory Commission  
Mail Stop 13H3  
Washington, D.C. 20555

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NRC FORM 366  
(4-95)

U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB NO. 3150-0104

EXPIRES 04/30/98

## LICENSEE EVENT REPORT (LER)

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS MANDATORY INFORMATION COLLECTION REQUEST: 50.0 HRS. REPORTED LESSONS LEARNED ARE INCORPORATED INTO THE LICENSING PROCESS AND FED BACK TO INDUSTRY. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE INFORMATION AND RECORDS MANAGEMENT BRANCH (T-6 F33), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20555-0001, AND TO THE PAPERWORK REDUCTION PROJECT (3150-0104), OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503

FACILITY NAME (1)

Grand Gulf Nuclear Station, Unit 1

DOCKET NUMBER (2)

05000-416

PAGE (3)

1 of 3

TITLE (4)

Failure of Motor Pinion Keys in Low Pressure Coolant Injection (LPCI) Valves

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 NAME	DOCKET NUMBER
10	27	96	96	005	00	11	26	96	N/A	05000
									N/A	05000

  

OPERATING MODE (9)	5	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR § (Check one or more) (11)							
POWER LEVEL (10)	0	20.2201(b)		20.2203(a)(2)(v)	X	50.73(a)(2)(i)		50.73(a)(2)(viii)	
		20.2203(a)(2)(i)		20.2203(a)(3)(i)		50.73(a)(2)(ii)		50.73(a)(2)(x)	
		20.405(a)(1)(ii)		20.2203(a)(3)(ii)		50.73(a)(2)(iii)		73.71	
		20.2203(a)(2)(ii)		20.2203(a)(4)		50.73(a)(2)(iv)		OTHER	
		20.2203(a)(2)(iii)		50.36(c)(1)		50.73(a)(2)(v)		Specify in Abstract below or in NRC Form 366A	
		20.2203(a)(2)(iv)		50.36(c)(2)		50.73(a)(2)(vii)			

## LICENSEE CONTACT FOR THIS LER (12)

NAME

Milton L. Jones / Licensing Specialist

TELEPHONE NUMBER (Include Area Code)

601-437-6198

## 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)

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

## ABSTRACT (Limit to 1400 spaces, i. e., approximately 15 single-spaced typewritten lines) (16)

On October 27, 1996, Low Pressure Coolant Injection (LPCI) "A" system injection valve E12F042A was disassembled for maintenance, which was to include replacing the motor pinion key. The motor pinion key was found sheared and was removed in two pieces. The key was scheduled for replacement during the current refueling outage with an American Iron and Steel Institute (AISI) 4140 steel key. GGNS has not previously experienced motor pinion key failures. Based on industry experience, GGNS has been replacing the keys with the new AISI 4140 steel keys at the valve's next scheduled MOV maintenance activity.

Based on our review of NEDO-24708, Rev. 1, "Additional information Required for NRC Staff Generic Report on Boiling Water Reactors", Entergy has concluded that sufficient ECCS capability existed to maintain adequate core cooling following postulated accidents during cycle 8. This report is being submitted pursuant to 10 CFR 50.73(a)(2)(i)(3).

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U.S. NUCLEAR REGULATORY COMMISSION

## LICENSEE EVENT REPORT (LER)

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Grand Gulf Nuclear Station, Unit 1	05000-416	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	2 OF 3
		96	005	00	

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

**A. Reportable Occurrence**

On October 27, 1996, GGNS discovered a failed motor pinion key that may have rendered the Low Pressure Coolant Injection System (LPCI) [BO] "A" inoperable. Because the key failure likely existed during Cycle 8 operations, this report is being submitted pursuant to 10 CFR 50.73(a)(2)(i)(B).

**B. Initial Conditions**

The plant was in OPERATIONAL CONDITION 5, Refuel, at the time of discovery.

**C. Description of Occurrence**

In 1990, as part of its response to NRC Information Notice (IN) 88-84 and other industry notices, GGNS reviewed its maintenance history and found no motor pinion key failures. At that time, GGNS established a plan to complete the replacement of motor pinion keys for applicable valves as a precautionary measure during Generic Letter 89-10 implementation. The GL 89-10 program provided prioritization of the valves based on safety significance. However, during the initial GL 89-10 maintenance activity for three valves discussed below, the motor pinion keys were not replaced but remained listed for replacement. Prior to Refueling Outage #8 (RFO8), 29 motor pinion keys had been replaced and 13 remained. GGNS experienced no motor pinion key failures until this outage when the LPCI injection valves were visited.

Motor pinion key changeouts for Limitorque motor operated valve actuators were scheduled for four valves at GGNS during the current refueling outage. The keys were being replaced with AISI 4140 steel keys. On October 27, the key for E12F042A, LPCI "A" Injection Valve was found sheared and was removed in two pieces. Although the LPCI "A" Injection Valve had performed as required on previous surveillance tests, the valve had not been stroked since refueling outage 7. Therefore, based on the as-found condition of the key, GGNS conservatively considered the valve inoperable for all of cycle 8.

On November 12, after RHR A had been returned to service, the key for E12F042B, LPCI "B" Injection Valve was found sheared and was removed in two pieces. The plant computer system indicated the valve had previously been successfully stroked twelve times during the current outage prior to disassembly. We believe that the majority of these operations were motor operated strokes. Using the guidance in NUREG 1022, the failure was determined to have occurred at time of discovery, and as such the LPCI "B" injection valve was operable during cycle 8 operation.

Also on October 27, the motor pinion key for E21F005, Low Pressure Core Spray Injection Valve, was removed and replaced with an AISI 4140 key as part of planned valve maintenance. An inspection of the removed key revealed that it was deformed but had not failed. Based on industry experience with broken keys [Ref. AEOD/96-01, "Engineering Evaluation Motor-Operated Valve Key Failures", dated March 29, 1996], the extent of the deformation, and the valve's surveillance history, Entergy believes that this valve would have performed its function during previous operating cycles if required.

**D. Apparent Cause**

The apparent cause of the failure was the suspect material used for the motor pinion keys as previously identified by Limitorque. Industry experience with the motor pinion keys has been promulgated through IN 88-84 and other industry documents, which resulted in GGNS' replacement program.

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		96	005	00	

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

**D. Apparent Cause (Continued)**

A root cause analysis of this failure is underway.

**E. Corrective Actions**

Immediate actions:

1. The list of valves requiring motor pinion key replacement was reviewed.
2. Replacement of the remaining 13 valves' motor pinion keys was made a startup restraint and all were completed with no other failures identified.
3. A root cause analysis was initiated. Additional corrective actions may be identified as a result of this root cause analysis.

**F. Safety Assessment**

The GGNS ECCS has built-in redundancy so that adequate cooling can be provided to protect against postulated loss-of-coolant accidents. The ECCS is comprised of one high-pressure core spray, one low-pressure core spray, three low-pressure coolant injection loops and one automatic depressurization system. The ECCS systems are supplied with on-site power from three independent divisions.

The existing Cycle 8 LOCA analysis evaluates a DBA LOP/LOCA with the most limiting single failure. The limiting single failure is the loss of the Division 2 diesel which causes the loss of two trains (LPCI B & C) of low pressure injection. In other words, the cycle 8 LOCA analysis assumes HPCS plus two low pressure systems are available for injection. The ADS is not credited or necessary for the large LOCA since the event depressurizes the system. Although the pumps used for the LPCI function are also used for other safety-related functions (e.g. decay heat removal), these functions are not affected by failure of the LPCI injection valve to open. Although highly unlikely, failure of the valve to close could affect containment spray.

Conservatively assuming that LPCI "A" (Division 1) was inoperable during the entire operating cycle since Refueling Outage 7, GGNS normally had available four ECCS pumps. GGNS uses the concept of divisional outages for on-line maintenance activities to comply with the GGNS Technical Specifications and to minimize risk. Based on this practice, a Division 1 or Division 3 outage could have resulted in one additional ECCS out of service (LPCS or HPCS) while a Division 2 outage could have resulted in two additional ECCS out of service (LPCI B and LPCI C). Therefore, there could have been limited periods where only two ECCS trains were available to respond to an accident. Based on our review of NEDO-24708A, Rev. 1, "Additional Information Required for NRC Staff Generic Report on Boiling Water Reactors", which utilized realistic, best-estimate assumptions, Entergy has concluded that sufficient ECCS capability existed to maintain adequate core cooling following postulated accidents during cycle 8. A review of the LCO logs revealed the removal of two ECCS pumps from service concurrently was minimized during cycle 8 operation.

Therefore, this event did not pose a threat to the health and safety of the general public.

**G. Additional Information**

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