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April 26, 1994

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
Multiple Control Rods Failing Technical
Specification Scram Time Requirements
LER 94-004-00

GNRO-94/00069

Gentlemen:

Attached is Licensee Event Report (LER) 94-004 which is a final report.

Yours truly,

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NRC FORM 366 (5-92) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB NO. 3150-0104
EXPIRES 5/31/95

LICENSEE EVENT REPORT (LER)

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
Grand Gulf Nuclear Station, Unit 1	05000-416	01 of 04

TITLE (4)
Multiple Control Rods Failing Technical Specification Scram Time Requirements

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
									N/A	05000
03	26	94	94	004	00	04	26	94	FACILITY NAME: N/A	DOCKET NUMBER: 05000

OPERATING MODE (9)	1	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR § (Check one or more) (11)							
POWER LEVEL (10)	073		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)	X	50.73(a)(2)(vii)		OTHER
			20.405(a)(1)(iii)		50.73(a)(2)(i)		50.73(a)(2)(viii)(A)	(Specify in abstract below and in text, NRC Form 366A)	
			20.405(a)(1)(iv)		50.73(a)(2)(ii)		50.73(a)(2)(viii)(B)		
			20.405(a)(1)(v)		50.73(a)(2)(iii)		50.73(a)(2)(x)		

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER (Include Area Code)
Charles Holifield / Licensing Engineer	601-437-6439

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
B	AA	V	A610	Y						

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

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

On March 26, 1994, scram time testing was being performed which found five slow rods. Although these failures did not constitute a violation, the plant was ordered shutdown in consideration of Technical Specification 3.1.3.2 Action c.1. An additional 163 control rods were analyzed at 0001 on March 27, 1994, when the reactor was manually scrammed and scram times recorded. Of these rods, 44 additional rods were slow moving but all were satisfactory for insertion to position 13.

The cause of the slow moving control rods was determined to be contamination of the internal surfaces of the scram solenoid pilot valve head assemblies. A thread sealant used during maintenance on the valves caused the seats in the top head assembly to adhere slightly to adjacent surfaces resulting in a delay in the initial opening of air exhaust ports. In its uncured state, the sealant attacked the viton seats and may have caused metallic moving parts to stick.

Immediate remedial actions included installing the pilot valve top head assemblies using a thread sealant tape rather than the sealant previously used and using an approved detergent to clean 193 new assemblies. Long term corrective actions are: evaluate training maintenance personnel on proper use of various thread sealants, write generic procedure on proper use of various thread sealants and evaluate, in other applications, the use of sealants and other similar generic materials.

A review of operating data determined that all safety systems behaved as expected. This incident did not degrade the ability of other plant systems or equipment to perform their intended function. The safety and health of the general public were not compromised by this event.

NRC FORM 366A (5-92) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB NO. 3150-0104
EXPIRES 5/31/95

LICENSEE EVENT REPORT (LER)
TEXT CONTINUATION

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST: 50.0 HRS. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE INFORMATION AND RECORDS MANAGEMENT BRANCH (MNBB 7714), 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)	DOCKET NUMBER (2)	LER NUMBER (6)	PAGE (3)
Grand Gulf Nuclear Station, Unit 1	05000-416	94-004-00	2 of 04

A. Reportable Occurrence

On March 26, 1994, scram time testing was being performed on 20 randomly selected control rods in addition to post-maintenance testing of 6 other control rods with recently rebuilt Hydrualic Control Units. The testing resulted in failure of 4 rods from the sample group in addition to failure of one rod from the post-maintenance test group. Being only one control rod failure away from the 10 percent Technical Specification limit, the plant was ordered shutdown in consideration of Technical Specification 3.1.3.2 Action c.1. This event could have eventually resulted in a condition that alone might have prevented the fulfillment of the Control Rod Drive System [AA] safety function. This condition is reportable per 10 CFR 50.73(a)(2)(vii).

B. Initial Condition

The reactor was in OPERATIONAL CONDITION 1 with reactor water level, temperature and power at 36 inches, 530 degrees F and 73 percent respectively. Scram time testing was being performed.

C. Description of Occurrence

On March 26, 1994, scram time testing was being performed on 20 randomly selected control rods in addition to 6 other control rods with recently rebuilt Hydraulic Control Units. Twelve rods had been tested resulting in eight fast and four slow times obtained for insertion from position 48 to position 43. Testing the next rod scram time resulted in the fifth slow rod. Since all slow rods were not a part of the 10 percent sample group, this failure did not constitute a violation of Technical Specifications.

The plant was ordered shutdown in consideration of Technical Specification 3.1.3.2 Action c.1. An additional 163 control rods were analyzed at 0001 on March 27, 1994, when the reactor was manually scrammed and scram times recorded. Of these 163 rods, 44 additional rods were slow moving to position 43. However, all rods were satisfactory for insertion to position 13.

A nonconformance report was issued to identify the slow scram times for the 49 control rods. Disposition of the nonconformance report required that Electrical Maintenance remove and replace all scram pilot valve head assemblies. Removed assemblies were retained for testing and inspection to aid in a root cause determination.

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FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6)	PAGE (3)
Grand Gulf Nuclear Station, Unit 1	05000-416	94-004-00	3 of 04

D. Apparent Cause

The cause of the slow control rods was determined to be contamination of the internal surfaces of the scram solenoid pilot valve (SSPV) head assemblies. A thread sealant used during maintenance work on the SSPVs caused the elastomeric (Viton) seats to adhere slightly to the adjacent seating surfaces, resulting in a delay in the initial opening of air exhaust ports. In its uncured state, the thread sealant attacked the Viton seats, and may also have caused metallic moving parts to stick upon curing.

Further investigation revealed that the root cause was the lack of readily available vendor and industry experience information related to the incompatibility of thread sealant materials with Viton seating materials. Vendor supplied SSPV installation instructions indicate that a pipe compound should be used. However, a list of vendor approved compounds is not provided. Numerous thread sealant materials have been used on SSPV connections throughout the industry, with varying degrees of success. Thread sealants have been identified as contributing to SSPV malfunctions in cases where excess sealant was introduced into the valve internals. Industry experience identified that SSPVs with urethane seat materials could be adversely affected by use of sealants with ester base. However, use of urethane seats was discontinued by the vendor in favor of Viton seats. SIL 509 was reviewed by GGNS in 1990 and it was determined that all urethane rebuild kits at GGNS had been discarded. No further action was considered necessary in response to SIL 509.

The potential for ester based thread sealants to contribute to malfunctions in SSPVs with Viton seats was identified by GE in 1991 after SSPV malfunctions at Perry. However, this information was not widely disseminated throughout the industry. SSPV malfunctions at Brunswick 2 in October, 1993 were also later attributed to use of a thread sealant similar to that used at GGNS. Information regarding the root cause of the malfunctions was not made available until March, 1994. The lack of detailed information related to the potential effects of thread sealant compounds on Viton resulted in this failure mechanism not being identified by GGNS. Therefore, the potential effects of changes in the SSPV rebuild process during RF06 were not fully considered.

During RF06, the SSPVs were rebuilt in the field using the valve manufacturer's pre-assembled replacement top-head assembly. Rather than removing and replacing the entire valve as a unit, only the top-head assembly kit and diaphragm kit were replaced. Neolube 100, a Methacrylate Ester based thread sealant, was used on tubing fittings at the air inlet port as done in the past. In some cases, the valves were pressurized soon after installation and the Hydraulic Control Unit (HCU) returned to service during the shift following the SSPV rebuild. When returning a HCU to service, the SSPV is tested in place which results in a couple of air blasts through the valve. This apparently caused the uncured Neolube 100 to migrate within the valve internals.

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FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6)	PAGE (3)
Grand Gulf Nuclear Station, Unit 1	05000-416	94-004-00	4 of 04

D. Apparent Cause (cont'd)

Prior to RFO6, the SSPVs were rebuilt in the shop by installing replacement parts kits. During this rebuild process, Neolube 100 was used as a thread sealant. After rebuilding, the valves would be set aside for days awaiting reinstallation. Since Neolube 100 requires only 24 to 72 hours in the presence of metal ions and the absence of oxygen to cure properly, this pre-RFO6 rework process adequately allowed for this cure time and did not result in SSPV malfunction.

Several contributing causes of the SSPV malfunctions were identifed during the investigation. The work instructions for rebuilding the SSPV had a precaution regarding introduction of Neolube 100 into the air system, but did not specify the proper method for applying the thread sealant. Also, performing the rebuild work in the field rather than in the shop, as had been done in the past, made it more difficult to keep the valve internals completely free of thread sealant. A final contributing cause was that evaluations of two previous similar events at GGNS were not successful in identifying the root cause of suspected SSPV malfunctions.

E. Corrective Actions

Immediate remedial actions included:

- Using an approved detergent, disassemble and clean 193 new SSPV top head assemblies.
- Install new top head assemblies using Teflon tape as a thread sealant.
- NPE evaluated similar industry events to provide possible generic implications.

Long term corrective actions are:

- Evaluate training maintenance personnel on proper use of various thread sealants.
- Write generic procedure on proper use of various thread sealants.
- Evaluate use of sealants and other similar generic use materials in other applications.

F. Safety Assessment

The plant was manually scrammed from 73 percent power. Based on a review of operating data, it was determined that all safety systems behaved as expected. This incident resulted in slow control rod operation but scram function was still maintained. Additionally, it did not degrade the ability of other plant systems or equipment to perform their intended function. The safety and health of the general public were not compromised by this event.

G. Additional Information

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