NRC FORM 366 (4-95) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB NO. 3150-0104
EXPIRES 04/30/98
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.

LICENSEE EVENT REPORT (LER)

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

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TITLE (4)

Reactor Coolant System Power Operated Relief Valve Block Valves Inoperable due to Potential Structural Design Deficiency

EVENT DATE (5)			LER NUMBER (6)			REPORT DATE (7)			OTHER FACILITIES INVOLVED (8)	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REVISION	MONTH	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
06	27	96	96	019	01	01	24	97	FACILITY NAME	DOCKET NUMBER

OPERATING MODE (9)	5	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more) (11)			
POWER LEVEL (10)	000	20.2201(b)	20.2203(a)(2)(v)	50.73(a)(2)(i)	50.73(a)(2)(viii)
		20.2203(a)(1)	20.2203(a)(3)(i)	[X] 50.73(a)(2)(ii)	50.73(a)(2)(x)
		20.2203(a)(2)(i)	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	TELEPHONE NUMBER (Include Area Code)
J.M. Peschel, MP3 Nuclear Licensing Manager	(860)437-5840

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

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

On June 27, 1996, at 1350 hours with the plant shutdown in Mode 5, the Reactor Coolant System (RCS) Power Operated Relief Valves (PORV) Block Valves (3RCS*MV8000A/B) were determined to be unable to perform their intended safety functions to close and reopen under design basis accident conditions. Tests performed at Kalsi Engineering Inc. (KEI) provided evidence showing the valves would require greater thrust to close than had been previously calculated, and damage to the valve during attempted closure under design basis conditions could prevent reopening. Since this was potentially a condition outside the design basis of the plant, an immediate notification was made at 1445 hours on June 27, 1996, pursuant to 10CFR50.72(b)(1)(ii)(B) and on July 26, 1996, a Licensee Event Report was submitted under the provisions of 10CFR50.73(a)(2)(ii)(B). Failure of the valves to perform their required opening or closing function during design basis events could result in difficulty controlling Reactor Coolant System (RCS) pressure and inventory, thereby potentially increasing the severity of an accident. The cause of this event appeared to be a structural design deficiency.

Further full scale testing has been performed by KEI and the results provided in a report. Based upon these new results, an inspection will be performed on the subject valves and, as necessary, a plant modification will be implemented, prior to entry into MODE 4, that will ensure that the valves can perform their intended safety function and are restored to an operable condition.

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

I. Description of Event

On June 27, 1996, at 1350 hours with the plant shutdown in Mode 5 the Reactor Coolant System (RCS) Power Operated Relief Valves (PORV) Block Valves (3RCS*MV8000A/B) were determined to be susceptible to damage that would prevent them from performing their intended safety functions to close and reopen under design basis accident conditions. Tests performed at Kalsi Engineering Inc. (KEI) provided evidence showing the valves would require greater thrust to close than had been previously calculated, and damage to the valve during attempted closure under design basis conditions could prevent reopening. Since this was a condition outside the design basis of the plant, an immediate notification was made at 1445 hours on June 27, 1996, pursuant to 10CFR50.72(b)(1)(ii)(B) and subsequently, on July 26, 1996, LER 96-019-00 was submitted pursuant to 10CFR50.73.(a)(2)(ii)(B). This supplemental LER is also being submitted under 10CFR50.73.(a)(2)(ii)(B) to detail the additional evaluation and resultant corrective actions determined necessary.

II. Cause of Event

The cause of this event has been determined to be a structural design deficiency. The valve body and the valve wedge on each PORV Block Valve are fabricated of type 316 stainless steel. With valve body guide rail- to - valve wedge guide slot surface clearances less than roughly 60 thousandths of an inch, binding can occur between the guide rail and wedge surfaces due to a build-up of gouged material. Therefore, if the PORV Block Valve clearances are less than 60 thousandths, this binding condition could exist under design loading resulting in abnormally high closing thrust requirements which, in turn, could prevent the valves from performing their intended safety function. Since the valves have not been inspected to determine their as-built clearances, they will continue to be considered inoperable until found otherwise.

III. Analysis of Event

The safety function of PORV Block Valves (3RCS*MV8000A/B) is to be able to open or close in order to control RCS pressure in the event of the failure of the PORV.

In Generic Letter (GL) 89-10 (June 28, 1989), "Safety-Related Motor-Operated Valve Testing and Surveillance," the US Nuclear Regulatory Commission (NRC) staff requested holders of operating licenses and construction permits to provide verification of the capability of safety-related motor-operated valves (MOVs) and certain other MOVs in safety-related systems by reviewing MOV design bases, verifying MOV switch settings (initially and periodically), testing MOVs under design basis conditions where practicable, improving evaluations of MOV failures and necessary corrective action, and trending MOV problems.

As part of the plant's response to GL 89-10, calculations were performed by Kalsi Engineering Inc. to determine the thrust required to operate valves under design basis conditions that could not be tested in-situ. The pressurizer PORV Block Valves (3RCS*MV8000A/B) were among those evaluated. The initial evaluation for these valves indicated the possibility of unpredictable behavior in mid-stroke which could adversely effect the amount of thrust required to operate the valves. Mock-up tests were initiated in early June, 1996 to obtain empirical data upon which to base future calculations and comparisons to the conservative bounding values previously used. These tests were performed at Kalsi Engineering Inc. (KEI) in Sugarland, Texas using a qualified separate effects rig which was part of the EPRI MOV Program. The purpose of the test was to determine stem thrust at mid-stroke where the unpredictable behavior was expected to occur. During setup and equipment checkout of the KEI simulation rig prior to the test, loads were applied to the disc in various positions to verify the load profile that would be used during the test. This evolution resulted in an

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unexpected guide rail failure which had not been previously observed during EPRI full scale testing. The lower 2-1/2" of both guide rails deflected and sheared from the SS-316 specimen simulating the valve body. The test apparatus functioned properly, but the failure precluded continuation with the intended test.

The failure exhibited during the test setup would have caused the valve to require more thrust for closure under design basis conditions than had been previously calculated. Although impossible to accurately predict at the time, it was assumed that the thrust required would be more than the available actuator output. Based on this information, the valves were assumed to be incapable of performing their intended safety function.

Failure of the valves to perform their required opening or closing function during design basis events could result in difficulty in controlling Reactor Coolant System (RCS) pressure and inventory, thereby potentially increasing the severity of an accident.

Subsequently, Kalsi Engineering, Inc. (KEI) conducted additional full scale testing on actual components. This testing, documented in KEI Report 1959C, Rev 0, dated September 26, 1996, determined that a structural design deficiency existed. The original testing, which was performed with a partial mock-up (i.e., only the body guide rails and the disc guide slots) demonstrated a failure of the guide rails under load. The subsequent full scale testing, with the addition of the body seat ring and disc seating surface, was performed at design basis disc loading and temperature. Catastrophic failure of the guide rails was not expected, as their displacement would be limited by the disc contact with the seat, but some damage was anticipated based upon the results of the earlier test.

In the tests performed, both guide slots and guide rails showed significant damage. This damage was in the form of a "rough machining" action between components that removed material (metal chips) and displaced material (galling), which did not preclude valve operation when guide clearances were greater than 60 thousandths. Galling, when the guide clearance was close to the minimum value of the manufacturer's recommendations, was sufficient to require much higher thrust values which exceeded the capability of the currently installed actuators (i.e., the valves would not have closed under design conditions if the as-built guide clearances were at, or near, the minimum specified by the manufacturer. Because the PORV Block Valve as-built clearances have not yet been determined by inspection; they continue to be considered inoperable until found otherwise..

Examination of the components from the testing that produced a failure of the high operating thrust requirement indicated that the much greater thrust required was due to the buildup of material gouged from the component surfaces becoming trapped in the guide rail-to-guide slot interface, effectively reducing the clearance to zero, resulting in binding. This effect has been previously identified by the EPRI Performance Prediction Program for carbon steel on carbon steel guide surfaces with a guide clearance of less than .0625" (EPRI TR-103244, Nov., 1994) and can be applied to stainless steel because of the similar properties.

IV. Corrective Action

The valves were declared inoperable in accordance with the Technical Specifications. With the plant shutdown in mode 5, the Reactor Coolant System (RCS) Power Operated Relief Valves (PORV) Block Valves (3RCS*MV8000A/B) are required to be maintained open as a portion of the Cold Over-Pressure Protection System. Based on this requirement, Operations personnel have ensured the valves were open and maintained open following notification and determination that the valves were inoperable.

Further testing has been performed by Kalsi Engineering to determine the full extent of the problem and a report has been provided to the plant. Since the results of the additional testing identify the above-described galling problem, an inspection of the subject valves will be performed and, as necessary, plant modification will be implemented, prior to entry into MODE 4, to correct the problem and restore operability.

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V. Additional Information

None

Similar Events

No similar events have been reported.

Manufacturer Data

PORV Block Valves, 3RCS*MV8000A/B are 3 inch 1550# class stainless steel (SA351 CF8M) gate valves, style N-6226-EMO-SP manufactured by Crane-Aloyco Co. The valve is operated by a SMB-00 electric motor actuator manufactured by Limitorque Corp.

EIIS System Codes
Reactor Coolant System - AB

EIIS Equipment Codes
Block Valve - SHV