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JAFP-93-0200

United States Nuclear Regulatory Commission
Document Control Desk
Mail Station P1-137
Washington, D.C. 20555

SUBJECT: DOCKET NO. 50-333
LICENSEE EVENT REPORT: 92-002-01 - MOV Deficiencies Related to Generic Letter 89-10 Testing

Dear Sir:

This updated report is submitted in accordance with 10 CFR 50.73(a)(2)(ii) and 10CFR 50.73(a)(2)(v).

Questions concerning this report may be addressed to Mr. Verne Childs at (315) 349-6071.

Very truly yours,

HARRY P. SALMON, JR.

HPS:WVC:tld

Enclosure

cc: USNRC, Region 1
USNRC Resident Manager
INPO Records Center

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NRC FORM 366 (6-89)

U.S. NUCLEAR REGULATORY COMMISSION

LICENSEE EVENT REPORT (LER)

FACILITY NAME (1): James A. FitzPatrick Nuclear Power Plant

DOCKET NUMBER (2): 05000333

PAGE (3): 1 OF 19

TITLE (4): MOV Deficiencies Related to Generic Letter 89-10 Testing

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)
01	07	92	92	-002	-01	04	08	93		05000
										05000

OPERATING MODE (9): N

POWER LEVEL (10): 000

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more of the following) (11)

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)	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)	X 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
Mr. W. Verne Childs, Senior Licensing Engineer	AREA CODE 315 349-6071

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	
A	BN	V	L200	Y		D	BI	V	L200	Y	
B	B5	V	L200	Y		X	BM	V	L20	Y	

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)

UPDATE REPORT - Previous Report Date 2/4/92

EIIS Codes are in []

The plant was shutdown and in cold condition for maintenance, modification, and refueling. Planned testing of motor operator valves to meet Generic Letter 89-10 requirements was completed on 94 valves/valve operators within the scope of the Generic Letter. A total of 126 valve operators were overhauled. Test and/or valve operator overhaul revealed 18 separate deficiencies. The deficiencies included operator designs that would not provide adequate valve stem thrust for valve closure; poor conversion of valve operator torque to valve stem thrust; discover of sheared or nearly sheared motor shaft to pinion gear keys, wrong motor operator spring pack stiffness and wrong torque switch settings. Causes include procedure deficiencies, operating experience review program inadequacies and design deficiencies. Corrective actions include procedure changes, valve operator overhaul, modification of valve operators, key replacements and training. Reevaluation due to a 10CFR21 report issued by the test equipment vendor may result in changes to deficiencies considered reportable under 10CFR50.73.

UPDATE REPORT - Previous Report Date February 4, 1992

EIIS Codes are in [ ]

Event Description

The plant was shutdown and in the cold condition for maintenance, modification and refuel. One of the significant maintenance tasks included in-place testing of selected motor operated valves in safety-related systems to verify that the valves were capable of being placed in the proper position for the systems to perform the required safety functions. This testing was conducted to satisfy the requirements of NRC Generic Letter 89-10.

Prior to in-place testing, an evaluation was performed to determine the most limiting conditions that could exist for both normal and abnormal events within the plant design basis. The evaluation considered such factors as worst case differential pressure, operator terminal voltage under degraded voltage conditions, and component design limitations. The result of the evaluation was a determination of the minimum thrust required to operate the valve under the most limiting conditions and the maximum thrust permissible to preclude component damage.

During operation of the valve (for testing) the actual thrust developed was determined from strain gages mounted on the valve. The maximum thrust developed by the valve operator was controlled (limited) by torque switches which interrupt (stop) valve operation by opening the valve operator motor controller contactor at a predetermined torque switch setting. The minimum thrust developed was a function of motor operator characteristics such as valve stem thread characteristics, coefficient of friction, torque spring stiffness, and torque switch setting. Ideally, the thrust applied to the valve stem would be in close correlation with the torque applied to the stem nut. Thus proper selection of torque switch setting and other motor operator design features will result in control of valve stem thrust within the acceptable range to assure valve operation while limiting thrust to prevent valve and/or valve operator damage.

Several factors can result in inadequate torque (and thus thrust) being provided by the motor operator and several factors can interfere with conversion of the torque (on the valve stem nut) to thrust on the valve stem. These factors include (but are not limited to) inadequate lubrication of stem nut and/or valve stem threads, improper torque spring stiffness and improper torque switch setting. In general, testing which reveals inadequate thrust application with a specified torque switch setting is an indication of the presence of one or more deficiencies of the nature noted above.

Calculations performed prior to testing, testing of motor operated valves in the "as-found" condition, and/or overhaul of the valve operators revealed a number of deficiencies. Because the testing and overhauls extended over a period of more than 30 days, additional deficiencies discovered after submittal of the Interim Report have been incorporated into this Updated Report.

Between January 7, 1992 and November 17, 1992, 126 motor operated valves were tested. Deficiencies were identified as indicated below for the 94 valves that were within the scope of Generic Letter 89-10 required testing.

1. Deficiency Description: On January 7, 1992, Residual Heat Removal/Low Pressure Coolant Injection (RHR/LPCI) system [BO] valves 10MOV-26A&B, which are outboard primary containment [NH] (drywell) spray isolation valves for the containment spray mode of the RHR/LPCI system, were determined to be designed with inadequate torque and thrust capability. Analysis of the required valve operator torque revealed a minimum of 137 foot-pounds required. The available torque was calculated to be 100 foot-pounds at degraded voltage conditions and 124 foot-pounds at full voltage. As a result, the drywell spray function was declared inoperable for both safety divisions.

   Cause: The cause of the inadequate torque and thrust capability is attributed to design (Cause Code B). The original valve operator selection criteria used a different (less conservative) value for disc friction, valve stem packing drag load, and valve stem to stem nut coefficient than is currently used when performing calculations for valve motor operator selection.

   Analysis: Inoperability of valves 10MOV-26A&B resulted in primary containment [NH] drywell spray mode of both safety divisions of the RHR/LPCI system being declared inoperable. As a result, the deficiency is a reportable condition under 10CFR50.73(a)(2)(v)(C) and (D). That is, the condition could have prevented fulfillment of safety functions needed to control the release of radioactive material and to mitigate the consequences of accidents described in the Final Safety Analysis Report (FSAR).

   Corrective Actions:

   A. The valve operators for 10MOV-26A&B were modified by changing the motor pinion and worm shaft gear sets to increase the torque and thrust capability. Reference Modification F1-92-149.

B. The valve operators were overhauled. Overhaul includes valve stem/valve stem nut lubrication.

C. Post work testing demonstrated satisfactory performance of the valves and valve operators.

2. Deficiency Description: On January 15, 1992, during "as-found" testing prior to valve operator overhaul, core spray [BM] loop B suction valve 14MOV-7B tripped on torque switch actuation. The thrust at torque switch trip was 5,978 pounds-force compared to a minimum of 6,211 pounds-force.

Cause: The cause of the torque switch trip is attributed to a relaxed valve operator spring pack (Cause Code X). This condition was found during overhaul of the valve operator.

Analysis: Valve 14MOV-7B is a normally open core spray pump suction line isolation valve between the pressure suppression pool and the pump suction. The valve is not provided with any automatic primary containment isolation signals. No additional primary containment isolation valves are provided. Failure of the valve to fully close (as a result of early torque switch trip) in response to an operator demand for valve closure would result in a failure to properly isolate the line. As a result, the condition requires a report under 10CFR50.73(a)(2)(v)(C) and (D). That is, the potential inability to fully close valve 14MOV-7B is a condition that could have prevented the fulfillment of safety functions needed to control the release of radioactive material and mitigate the consequences of accidents discussed in the FSAR.

Corrective Actions:

A. The valve operator was overhauled. Overhaul includes valve stem/valve stem nut lubrication.

B. Post work testing demonstrated satisfactory performance of the valve and valve operator.

3. Deficiency Description: On January 17, 1992, during testing, main steam leak collection system [BD] Division 2 drain line isolation valve 29MOV-204B was found to trip on high torque at a valve steam thrust of 1,082 pounds-force. The target thrust values for the valve are 2,434 pounds-force (minimum thrust) and 8,597 pounds-force (maximum thrust).

Cause: The cause of the torque switch trip on the valve operator for 29MOV-204B without producing adequate valve stem thrust is attributed to poor conversion of torque to thrust due to inadequate valve stem/valve yoke bushing lubrication on this rotating stem valve (Cause Code D).

Analysis: Valve 29MOV-204B is normally open. When main steam leakage collection Train B is placed in service following an accident, any water collected in the main steam lines is routed to the main condenser [SG] via 29MOV-204B. The inability to close the valve after the draining of the water would allow radioactive gases to also be directed to the main condenser. This flow path bypasses the intended flow path which includes filtering of the radioactive material in the Standby Gas Treatment (SGT) [BH] system prior to elevated release from the plant stack [VL]. Since the redundant main steam leak collection train was also degraded (refer to 4 below) the conditions are considered reportable under 10CFR50.73(a)(2)(v)(C) and (D). That is, the main steam leakage collection system could not perform safety functions needed to control the release of radioactive material and mitigate the consequences of accidents described in the FSAR.

Corrective Actions:

A. The valve operator was overhauled. Overhaul includes valve stem/valve yoke bushing lubrication.

B. Post work testing demonstrated satisfactory performance of the valve and valve operator.

4. Deficiency Description: On January 18, 1992, main steam leak collection system (MSLCS) [BD] outboard main steam isolation valve stem leak-off isolation valve 29MOV-203A failed to close during testing. The valve motor controller was interrupted by torque switch actuation at less than the expected valve stem thrust of 3,173 to 4,695 pounds-force (minimum and maximum thrust respectively).

Cause: The cause of the torque switch trip on the valve operator for 29MOV-203A without producing adequate valve stem thrust is attributed to inadequate lubrication of the valve stem/yoke nut on this rotating stem valve (Cause Code D).

Analysis: The inability to close valve 29MOV-203A could result in the release of steam and radioactive gases to the Standby Gas Treatment System (SGT) as a result of outboard Main Steam [SB] isolation valve stem packing leaks. While the operability of SGT would not be effected, the inability to isolate the leakage path degraded Train A while Train B was also inoperable as discussed in 3 above. As a result, it is judged that the condition requires a report under 10CFR50.73(a)(2)(v)(C) and (D). That is, the MSLCS may not have been able to fulfill safety functions needed to control the release of radioactive material and mitigate the consequences of accidents described in the FSAR.

Corrective Actions:

A. The valve operator was overhauled. Overhaul includes valve stem/valve yoke nut lubrication.

B. Post work testing demonstrated satisfactory performance of the valve and valve operator.

5. Deficiency Description: On January 22, 1992, during testing of low pressure core spray [BM] loop B full flow test valve 14MOV-26B tripped on torque switch actuation. Testing indicated a valve stem thrust of 26,738 pounds-force compared to minimum required thrust of 30,271 pounds-force and a maximum thrust of 43,549 pounds-force.

Cause: The cause of the inability of the valve operator for 14MOV-26B to develop adequate thrust is attributed to poor valve stem/valve stem nut lubrication (Cause Code D).

Analysis: Valve 14MOV-26B is normally closed. Failure of the valve to fully close following flow testing of the core spray pump would be detected by valve position indication in the Control Room when the system is returned to the normal standby status at the completion of testing or by annunciation of the inability to maintain the system full of water. In either case, corrective action to fully close the valve would restore containment integrity and restore the core spray system to an operable status. This deficiency is reportable under 10CFR50.73(a)(2)(v)(C) and (D).

Corrective Actions:

A. The valve operator was overhauled. Overhaul includes valve stem/valve stem nut lubrication.

B. Post work testing demonstrated satisfactory performance of the valve and valve operator.

6. Deficiency Description: On January 24, 1992, during test of High Pressure Coolant Injection (HPCI) system [BJ] injection line outboard isolation valve 23MOV-20 the valve stem thrust exceeded the calculated maximum value of 58,465 pounds-force. The indicated thrust was 68,298 pounds-force.

   Cause: The higher than expected thrust was caused by a design deficiency (Cause Code B). The valve operator was inspected and tested to verify that the high thrust was not caused by hydraulic (grease) locking of the spring pack or an excessively stiff spring pack. Testing revealed gear train inertia and a long contactor drop out time as the source of the higher than expected thrust. Evaluations were conducted to verify that the actual thrust was within the design capability of the valve operator and the valve. As a result, there was no potential damage to the valve or valve operator.

   Analysis: Since the high thrust condition did not make the valve or the HPCI system inoperable, this specific condition did not result in a condition where any of the reporting requirements of 10CFR50.73 were applicable.

   Corrective Actions:

   A. The valve operator was replaced with an operator of a different design which included springs for absorbing the end-of-stroke thrust.

   B. Post work testing demonstrated satisfactory valve and valve operator performance.

7. Deficiency Description: On January 29, 1992, during "as found" testing prior to the valve operator overhaul, RHR/LPCI heat exchanger B shell side drain to the suppression pool valve 10MOV-21B tripped on torque switch actuation. The thrust at torque switch trip was 2,913 pounds-force compared to a target range of 3,013 to 6,484 pounds-force.

   Cause: The cause of the inability of the valve operator for 10MOV-21B to develop adequate thrust is attributed to poor valve stem/valve stem nut lubrication (Cause Code D).

   Analysis: Valve 10MOV-21B is normally closed. The valve is open when the RHR/LPCI system is being operated in the steam condensing mode and the condensate from the heat exchanger is being routed to the pressure suppression pool. When steam condensing mode operations are terminated and the RHR/LPCI system

is restored to the normal standby mode of operation, valve 10MOV-21B would be closed. Failure of the valve to fully close could result in an inability to fill and/or maintain the heat exchanger and attached piping in a water solid condition. This condition would be indicated by an alarm system for detecting the presence of air at high points in the attached piping. Valve 10MOV-21B also functions as a normally closed primary containment isolation valve. The piping associated with the valve connects to the RHR/LPCI Loop B full flow test and suppression pool cooling line between the penetration of the suppression pool and the isolation valve in the suppression pool cooling and test line. This line terminates inside the suppression pool below the lowest expected water level and is thus a water sealed line. Leakage of water from the suppression pool through 10MOV-21B is unlikely because the line also contains normally closed valves 10AOV-71B and 10MOV-36B. Notwithstanding these conclusions, the condition is considered to be reportable under 10CFR50.73(a)(2)(v)(C) and (D). That is, a condition that could prevent fulfillment of a safety function (primary containment isolation) needed to control the release of radioactive material and to mitigate the consequences of accidents described in the FSAR.

Corrective Actions:

A. The valve operator was overhauled. Overhaul included valve stem/valve stem nut lubrication.

B. Post work testing demonstrated satisfactory performance of the valve and valve operator.

8. Deficiency Description: On February 1, 1992, during "as-found" testing prior to valve operator overhaul, Emergency Service Water (ESW) [BI] return isolation valve 15MOV-175B tripped on torque switch actuation. The thrust at torque switch trip was 2,588 pounds-force compared to a target value of 3,866 to 5,718 pounds-force.

Cause: The cause of the inability of the valve operator for 15MOV-175B to develop adequate thrust is attributed to poor valve stem and/or valve stem nut lubrication (Cause Code D).

Analysis: Valve 15MOV-175B is normally closed. The valve opens automatically when Emergency Service Water (ESW) [BI] is initiated for cooling of selected components which are normally cooled by Reactor Building Closed Loop Cooling (RBCLC) [CC]. Valve 15MOV-175B would be closed during the restoration of RBCLC to service when the cause of ESW initiation has been corrected.

Incomplete closure of the valve during the process of RBCLC restoration would be indicated by an inability to fill (and maintain filled) the RBCLC system and thus result in discovery and correction of the problem. The failure of the valve to completely close as a result of inadequate thrust development would not result in the degradation of any safety function. Further, while testing did not indicate that the valve was not capable of being fully opened, the redundant valve (15MOV-175A) was fully operable and would also have provided a full capacity flow path for ESW cooling water if 15MOV-175B failed to fully open. Accordingly this specific deficiency did not result in a condition requiring a report under 10CFR50.73.

Corrective Actions:

A. The valve operator was overhauled. Overhaul includes valve stem/valve stem nut lubrication.

B. Post work testing demonstrated satisfactory performance of the valve and valve operator.

9. Deficiency Description: On March 16, 1992, the valve operator for RHR/LPCI outboard LPCI mode injection valve 10MOV-27B was found with the motor pinion gear to motor shaft key nearly sheared when the pinion gear was removed. No rotation of the motor shaft within the pinion gear was evident. Analysis of the key for alloying elements indicates that the key was American Iron and Steel Institute (AISI) 1018 type steel. NRC information Notice 81-08 and correspondence with the valve operator vendor (Limitorque) indicates that the key for the 10MOV-27B valve operator (and other valve operators that develop torque of 100 or more foot-pounds) should have had the AISI type 1018 steel motor pinion gear keys replaced with type 4140 steel keys. Replacement of the type 1018 steel keys was originally addressed in 1981 and 1982 as a result of review of NRC Information Notice 81-08. The valve operators requiring installation of the type 4140 steel keys were identified and keys were ordered from the vendor for installation during a subsequent plant outage. However, actual installation did not occur. This event was previously reported and is fully discussed in LER-92-028. The discussion above is provided in this LER only to note that the deficiency was found as part of the activities related to Generic Letter 89-10.

Analysis: A complete event analysis for the discovery of the wrong type steel motor pinion gear key being found in the valve operator for 10MOV-27B is contained in LER-92-028. The event required a report under 10CFR50.73(a)(2)(v).

Corrective Actions:

A. The valve operator motor pinion gear key was replaced with the proper key.

B. Post work testing demonstrated satisfactory performance of the valve and valve operator.

C. Additional corrective actions are discussed in LER-92-028.

10. Deficiency Description: On March 20, 1992, during overhaul of the valve operator for RHR/LPCI heat exchanger B outlet valve 10MOV-12B, the valve operator motor pinion gear key was found sheared. There was no evidence of motor shaft rotation within the pinion gear and the valve had operated properly during the last demand prior to removal of the operator for overhaul. NRC Information Notice 88-84 noted that prior to September, 1983, the vendor purchased keys without certification of material type or properties and did not perform testing to verify that the purchased materials conformed to specifications. Since the sheared key was supplied by the vendor prior to 1983 it may have been suspect.

Cause: The cause of the key failure is attributed to improper material provided by the vendor prior to September, 1983 (Cause Code B).

Analysis: Valve 10MOV-12B is normally open and remains open during operation of the RHR/LPCI system in the safety related containment spray, suppression pool cooling and LPCI modes of operation. Failure of the key during opening of the valve could degrade operation of the system in any mode in which cooling is intended as a result of flow through the heat exchanger. As a result, the deficiency has conservatively been classified as requiring a report under 10CFR50.73(a)(2)(v)(B),(C) and (D).

Corrective Actions:

A. The key was replaced during overhaul of the valve operator with a new key certified to be of the correct material.

B. Post work testing demonstrated satisfactory performance of the valve and valve operator.

11. Deficiency Description: On April 2, 1992, Reactor Core Isolation Cooling (RCIC) [BN] steam supply line inboard primary containment isolation valve 13MOV-15 was found with open and close torque switch settings of 1.0 and 1.0 rather than 1.25 and 1.25 as specified in the Motor Operated Valve Database.

Cause: Examination of plant maintenance records revealed that the torque switch settings were left at 1.0 and 1.0 at the completion of maintenance work on May 7, 1990, due to a communication error (Cause Code A). During the 1990 Refuel Outage, difficulties were encountered in obtaining satisfactory Local Leak Rate Testing (LLRT) conducted as required by 10CFR50, Appendix J. At one point in time, the valve vendor suggested that the excessive leakage was caused by excessive torque (thrust) applied to the valve and that the torque switch settings should be reduced to 1.0 and 1.0. Additional testing and repairs demonstrated that excessive thrust was not the cause of leakage, and acceptable LLRT test results were obtained. During the process of completing work on the valve (which included verification of the proper torque switch settings), a communications error resulted in the settings being left at 1.0 and 1.0 while documentation indicated "as-left" settings of 1.25 and 1.25.

Analysis: The torque switch settings are based on calculations that consider the valve operator torque (valve stem thrust) necessary for proper operation of the valve under both static and dynamic conditions that can exist during design basis events. These calculations indicate that torque switch settings of 1.25 and 1.25 are necessary for the valve and valve operator to perform the design safety functions. Operation of the valve with torque switch settings at lower torque values could result in failure of the valve to close in response to a postulated steam line rupture event. This failure, coincident with the failure of the outboard isolation valve to close would result in a failure to isolate the primary containment penetration. As a result, the deficiency requires a report under 10CFR50.73(a)(2)(v)(C) and (D). That is, the condition could have prevented fulfillment of safety functions (primary containment isolation) that are needed to control the release of radioactive material and mitigate the consequences of accidents described in the FSAR.

Corrective Actions:

A. The torque switch settings were returned to 1.25 and 1.25 as part of the overhaul of the valve operator.

B. Post work testing demonstrated proper performance of the valve and valve operator.

12. Deficiency Description: On April 7, 1992, documentation for beginning an evaluation of potential deficiencies in certain double disc gate valves manufactured by Anchor/Darling was initiated. Anchor/Darling (A/D) had informed the plant by a letter dated March 16, 1992, that certain valves manufactured prior to 1975, which were installed in an orientation other than with the valve stem in the vertical (pointing upward) position, might experience inconsistent operating thrusts and erratic data results during diagnostic testing such as that performed to satisfy Generic Letter 89-10. The potential deficiency discussed in the letter concerned "premature" engagement of the wedges which provide tight valve disc seating forces and the lack of valve disc retainers in certain valves manufactured prior to 1975. The A/D letter and applicability of the letter to valves installed in the plant was evaluated. LER-92-018, which was submitted to the NRC on May 7, 1992, contains details of the deficiency, cause of the deficiency, deficiency analysis and corrective actions. Since LER-92-018 contains a complete discussion of the deficiency, it is noted in this LER for information purposes only.

13. Deficiency Description: On April 28, 1992, it was determined (by analysis) that Reactor Water Cleanup (RWC) system [CE] return line primary containment isolation valve 12MOV-69 valve operator closing thrust requirements were greater than that available from the valve operator. The analysis, based on Generic Letter 89-10 requirements was more conservative than the analysis originally used to select the valve operator. As a result, the available predicted thrust was lower than necessary.

Cause: The deficiency was caused by design at the time the original calculations were made for valve operator design characteristics (Cause Code B).

Analysis: Valve 12MOV-69 is normally open and functions as the outboard primary containment isolation valve in the RWC system return flow path to the reactor vessel. The RWC return line connects to Reactor Feedwater [SJ] line A between the inboard and

outboard isolation valves. Thus the inboard feedwater isolation valve is also the inboard RWC return isolation valve. The failure of valve 12MOV-69 to fully close upon demand could result in leakage of reactor coolant (in the event of breach of the RWC system and coincident failure of the inboard feedwater isolation valve) to the Reactor Building (secondary containment) [NG].

Accordingly the deficiency results in a condition requiring a report under 10CFR50.73(a)(2)(v)(C) and (D). That is, the deficiency could have prevented the fulfillment of a safety function (primary containment isolation) needed to control the release of radioactive material and mitigate the consequences of accidents described in the FSAR.

Corrective Actions:

A. The valve operator for 12MOV-69 was modified by installing a larger motor, changing the spring pack to a stiffer configuration and installation of a stiffer compensating spring. The valve operator was also overhauled.

B. Post work testing demonstrated proper performance of the valve and valve operator.

14. Deficiency Description: On April 30, 1992, during "as found" testing prior to the valve operator overhaul, RHR/LPCI heat exchanger A shell side drain to the suppression pool valve 10MOV-21A tripped on torque switch actuation. The thrust at torque switch trip was 2,752 pounds-force compared to a target range of 3,013 to 6,484 pounds-force.

Cause: The cause of the inability of the valve operator for 10MOV-21A to develop adequate thrust is attributed to poor valve stem/valve stem nut lubrication (Cause Code D).

Analysis: Valve 10MOV-21A is normally closed. The valve is open when the RHR/LPCI system is being operated in the steam condensing mode and the condensate from the heat exchanger is being routed to the pressure suppression pool. When steam condensing mode operations are terminated and the RHR/LPCI system is restored to the normal standby mode of operation, valve 10MOV-21A would be closed. Failure of the valve to fully close could result in an inability to fill and/or maintain the heat exchanger and attached piping in a water solid condition. This condition would be indicated by an alarm system for detecting the presence of air at high points in the attached piping. Valve 10MOV-21A also functions as a normally closed primary containment isolation

valve. The piping associated with the valve connects to the RHR/LPCI Loop A full flow test and suppression pool cooling line between the penetration of the suppression pool and the isolation valve in the suppression pool cooling and test line. This line terminates inside the suppression pool below the lowest expected water level and is thus a water sealed line. Leakage of water from the suppression pool through 10MOV-21A is unlikely because the line also contains normally closed valves 10AOV-71A and 10MOV-36A. Notwithstanding these conclusions, the condition is considered to be reportable under 10CFR50.73(a)(2)(v)(C) and (D). That is, a condition that could prevent fulfillment of a safety function (primary containment isolation) needed to control the release of radioactive material and to mitigate the consequences of accidents described in the FSAR.

Corrective Actions:

A. The valve operator was overhauled. Overhaul included valve stem/valve stem nut lubrication.

B. Post work testing demonstrated satisfactory performance of the valve and valve operator.

15. Deficiency Description: On April 4, 1992, during "as-found" testing prior to valve operator overhaul RHR/LPCI system A outboard pressure suppression chamber spray line valve 10MOV-39A tripped on torque switch actuation. The thrust at torque switch trip was 13,377 pounds-force compared to target range of 18,975 to 24,000 pounds-force. The cause of the inadequate thrust was initially attributed to inadequate valve stem and/or valve stem nut lubrication. However, during overhaul of the valve operator, it was discovered that the valve stem nut was severely worn and was probably a significant contributor to the poor conversion of valve operator torque to valve stem thrust. Post work testing demonstrated proper valve operator performance. On November 17, 1992, additional testing was conducted with design basis flow through the valve to develop design basis differential pressure. The valve failed to fully close during this test. Since the valve operator had produced thrust within the range considered to be adequate for valve closure, deficiencies internal to the valve were suspected. Disassembly and internal inspection revealed excessive wear. The valve disc guides were repaired by weld buildup.

It should also be noted that similar problems were not encountered with the functionally identical valve (10MOV-39B) in the other RHR/LPCI system. Valve 10MOV-39B and the valve operator had been replaced due to a history of the need for extensive repairs being required to obtain acceptable LLRT results. Due to the replacement of 10MOV-39B, the valve operator for 10MOV-39A was also replaced with an identical (and larger than original) operator.

Cause: The cause of the inability of the valve operator for 10MOV-39A to develop adequate valve stem thrust is attributed to poor conversion of valve operator torque to valve stem thrust as a result of poor lubrication of the valve stem/valve stem nut (Cause Code D) and a worn stem nut (Cause Code X). Wear of the valve disc guides was the cause of the higher than expected thrust required to properly close the valve when design basis differential pressure was present (Cause Code X).

Analysis: Valve 10MOV-39A is the outboard primary containment isolation valve for RHR/LPCI system A pressure suppression chamber spray line. Suppression pool cooling and RHR pump test flow is also directed through the valve and then, via a branch line and an additional valve, to the suppression pool. The suppression pool cooling and RHR pump test line terminates below the lowest expected suppression pool level and thus is water sealed. The suppression chamber spray line includes an inboard isolation valve (10MOV-38A) and terminates in the suppression chamber atmosphere at the spray header nozzles. The deficiencies associated with inadequate valve stem thrust to assure complete valve closure resulted in a condition requiring a report under 10CFR50.73(a)(2)(v)(C) and (D). That is, the condition could have prevented fulfillment of safety functions (primary containment isolation) needed to control the release of radioactive material and mitigate the consequences of accidents described in the FSAR.

Corrective Actions:

A. Initially, the valve operator was overhauled and the valve stem nut was replaced. Overhaul included valve stem/stem nut lubrication.

B. The valve disc guides were repaired to reduce the friction of valve internals.

C. The valve operator was replaced with a different model operator with more torque/thrust capability.

D. Post work testing demonstrated proper performance of the valve and valve operator.

16. Deficiency Description: On May 22, 1992, while performing corrective maintenance, the valve operator motor pinion gear to motor shaft key was found sheared and the shaft rotated approximately 180 degrees within the pinion gear on the valve operator for 10MOV-27A. Valve 10MOV-27A is the outboard RHR/LPCI system A injection valve. The corrective maintenance had been initiated as a result of a similar condition found in the valve operator for functionally identical redundant valve 10MOV-27B which is discussed above in Item 9 and was also previously reported in LER-92-028.

The deficiency cause, analysis, and corrective actions were the same as those described above in Item 9 and in LER-92-028.

This deficiency has been noted in this LER only to note that the deficiency was found as part of activities related to Generic Letter 89-10.

17. Deficiency Description: On June 12, 1992, it was determined based on analysis that the valve operator for Reactor Water Cleanup supply inboard primary containment isolation valve 12MOV-15 was designed with inadequate valve stem thrust capability. In addition, "as-found" testing prior to overhaul of the valve operator revealed lower than required valve stem thrust at the maximum torque switch setting.

Cause: The deficiency is attributed to design (Cause Code B). The process of valve operator selection did not include enough conservatism to account for valve disc friction and similar factors.

Analysis: This valve and valve operator was previously evaluated in a plant specific safety assessment prepared for Generic Letter 89-10, Supplement 3. While this assessment indicated that the valve operator was not of the optimum size, the assessment also indicated that the valve operator was acceptable. Notwithstanding the assessment of the marginal, but acceptable, capability of the valve operation, the deficiency is conservatively classified as requiring a report under 10CFR50.73 (a)(2)(v)(C) and (D). That is, the potential inability of the valve operator to close 12MOV-15 under design basis conditions could prevent the fulfillment of safety functions (primary containment isolation) needed to control the release of radioactive material and mitigate the consequences of an accident.

Corrective Actions:

A. The valve operator was modified by installation of a larger (more torque) motor.

B. The valve operator was overhauled.

C. Post work testing demonstrated proper performance of the valve and valve operator.

18. Deficiency Description: On July 9, 1992, during "as-found" testing prior to overhaul, the valve operator for High Pressure Coolant Injection (HPCI) [BJ] system turbine steam inlet valve 23MOV-14 tripped on torque switch actuation. The valve stem thrust at torque switch trip was 20,891 pounds-force compared to a target value of 22,000 to 23,074 pounds-force.

Cause: The cause of the inadequate valve stem thrust is attributed to poor conversion of valve operator torque to valve stem thrust as a result of inadequate valve stem/valve stem nut lubrication (Cause Code D).

Analysis: Valve 23MOV-14 is normally closed when the HPCI system is in the normal standby status. Valve 23MOV-14 opens when a HPCI system automatic initiation signal is provided to admit steam to the HPCI turbine stop valve and remains open until signaled to close by an operator during HPCI system restoration to the normal standby status. Failure of the valve to fully open during HPCI system operation could cause restriction of steam flow and inability of the system to provide design flow of water to the reactor vessel. Failure of the valve to fully close could cause an accumulation of water at the turbine stop valve. The turbine stop valve, turbine governor valve, turbine or other components could be damaged by the water upon system initiation. The poor conversion of valve operator torque to valve stem thrust is considered a reportable condition under 10CFR50.73 (a)(2)(v)(D). That is, the condition could prevent the fulfillment of a safety function needed to mitigate the consequences of an accident.

Corrective Actions:

A. The valve operator for 23MOV-14 was overhauled. Overhaul included valve stem/valve stem nut lubrication.

B. Post work testing demonstrated proper performance of the valve and valve operator.

General Discussion of Deficiency Causes

A number of deficiencies were attributed to poor conversion of valve operator torque to valve stem thrust as a result of poor lubrication of the valve stem/valve stem nut. Procedure deficiencies were the root cause of some of the occurrences of poor lubrication. Procedures did not require complete removal of old lubricants. Experience gained during Generic Letter 89-10 testing shows that the old lubricants should be completely removed and replaced.

Procedure deficiencies also may have contributed to the lack of lubrication of the valve stem/valve yoke nut on valves with a rotating stem. On these valves (29MOV-204B and 29MOV-203A discussed in Item 3 and 4 above) the valve "yoke nut" is physically part of the valve rather than the valve operator. Procedures for valve operator maintenance did not clearly require lubrication of the valve yoke nut. Procedure changes have corrected the procedural inadequacy.

Additional Reporting Requirements

The discussions in Items 1 through 18 above include a section concerning the requirements for reporting under 10CFR50.73. In general, each of the discussions considered the nature of the deficiency and reporting requirements without regard to other deficiencies. NUREG 1022 includes, in the section explaining the reporting requirements of 10CFR50.73(a)(2)(ii), a discussion of the use of engineering judgement when making a determination of whether or not a deficiency requires a report. When the principles of the engineering judgement discussion are applied to each individual deficiency noted in 1 through 18 above, it can be concluded that the individual deficiency lacks the significance to require a report under 10CFR50.73(a)(2)(ii)(B). When the deficiencies are considered in the aggregate they may be considered significant and thus require a report under 10CFR50.73(a)(2)(ii)(B). That is, the deficiencies are considered to be "outside of design basis" conditions that could make the systems or components involved incapable of performing as designed and as described in the Final Safety Analysis Report (FSAR).

Additional Corrective Actions:

In addition to correction of each deficiency noted in Items 1 through 18 and the correction of procedural deficiencies, supervisory personnel involved in the Motor Operated Valve Test Program have conducted training for electrical and mechanical maintenance personnel to discuss the deficiencies and the lessons learned to reduce the probability of recurrence.

Discussion of Liberty Technologies 10CFR21 Report

The diagnostic test equipment used was the Valve Operation Test and Evaluation System (VOTES) developed by Liberty Technologies. The plant was informed by a Liberty Technologies letter dated October 2, 1992, that Liberty had issued a 10CFR21 notification to the NRC and utilities concerning circumstances where use of the VOTES equipment can cause the indicated valve stem thrust to be less than the actual thrust. As a result, some of the deficiencies described in Items 1 through 18 above in which the valve stem thrust was below the target thrust range may actually have been acceptable and, conversely some of the valve stem thrust values that were indicated as being within the target range may actually be outside the range in the high direction. Evaluation of the effect of the deficiency noted in the 10CFR21 report continues and will be applied to testing of additional valves during the remainder of the Generic Letter 89-10 test program.

Additional Information:

Failed Components:	Valve Operator
Manufacturer:	Limitorque
Model Numbers:	SMB-4T, SMB-3, SMB-0, SMB-00, SMB-000, SB-0, SB-00, and SB-000
Similar Events:	LER-92-018 and 92-028 described similar motor operated valve/valve operator deficiencies.

Reason for Update:

This LER is updated to incorporate additional deficiencies found during Generic Letter 89-10 motor operated valve testing conducted during the 1992 Refuel Outage. The update report also includes the causes of the deficiencies, and analysis of the potential effect of each deficiency and corrective actions taken to reduce the probability of recurrence. A vertical bar in the right hand margin is provided where text was changed or added except where minor editorial changes or typographic errors were corrected.