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 FACIL: 50-261 H.B. Robinson Plant, Unit 2, Carolina Power & Light Co 05000261
 AUTH. NAME AUTHOR AFFILIATION
 JURY, K.R. Carolina Power & Light Co.
 YOUNG, D.E. Carolina Power & Light Co.
 RECIP. NAME RECIPIENT AFFILIATION

SUBJECT: LER 94-002-01: on 940425, plant in hot shutdown conditions due to MSIV failure to meet TS stroke time requirements.
 Addl MSIV accumulator tanks installed to increase design margin. W/950314 ltr.

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10 CFR 50.73

Carolina Power & Light Company
Robinson Nuclear Plant
3581 West Entrance Road
Hartsville SC 29550

Robinson File No: 13510C
RNP-RA/95-0048
MAR 14 1995

United States Nuclear Regulatory Commission
Attn: Document Control Desk
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H. B. ROBINSON STEAM ELECTRIC PLANT, UNIT NO. 2
DOCKET NO. 50-261/LICENSE NO. DPR-23
LICENSEE EVENT REPORT NO. 94-002-01

Gentlemen:

The enclosed Supplemental Licensee Event Report (LER), is submitted in accordance with 10 CFR 50.73. This report contains information that was provided by Carolina Power and Light (CP&L) to the NRC during a July 26, 1994, Enforcement Conference, and our September 29, 1994, Reply to a Notice of Violation and Imposition of Civil Penalty (NRC Inspection Report 94-16). The revised information is identified by a right hand margin bar.

Very truly yours,

Dale E. Young
Plant General Manager

RDC:rdc
Enclosure

c: Mr. S. D. Ebnetter, Regional Administrator, USNRC, Region II
Ms. B. L. Mozafari, USNRC Project Manager, HBRSEP
Mr. W. T. Orders, USNRC Senior Resident Inspector, HBRSEP

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Highway 151 and SC 23 Hartsville SC

NRC FORM 366
(5-92)

U.S. NUCLEAR REGULATORY COMMISSION

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

LICENSEE EVENT REPORT (LER)

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

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 (MNB 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)

H. B. ROBINSON STEAM ELECTRIC PLANT, UNIT NO.2

DOCKET NUMBER (2)

050-261

PAGE (3)

1 OF 8

TITLE (4)

PLANT CONDITION OUTSIDE DESIGN BASIS DUE TO MSIV INOPERABILITY

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
04	25	94	94	002	01	03	15	95	FACILITY NAME	DOCKET NUMBER 05000
									FACILITY NAME	DOCKET NUMBER 05000

OPERATING MODE (9)	N	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more) (11)								
POWER LEVEL (10)	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)		OTHER
		20.405(a)(1)(iii)			X 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

K. R. Jury: Manager-Licensing/Regulatory Programs

TELEPHONE NUMBER (Include Area Code)

(803) 857-1363

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

(If yes, complete EXPECTED SUBMISSION DATE).

X

NO

EXPECTED SUBMISSION DATE (15)

MONTH

DAY

YEAR

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

On January 29, 1994, H. B. Robinson Steam Electric Plant (HBRSEP), Unit No. 2 was in hot shutdown conditions. During Main Steam Isolation Valve (MSIV) operability testing, all three MSIVs were declared inoperable when they failed to meet the Technical Specification (TS) required closure time. Each valve was secured in its TS required closed position; however, the "B" MSIV drifted partially open, placing the plant outside of the TS containment integrity requirements.

Plant staff subsequently determined that the original MSIV actuator design incorporated minimum design margin. A complicating factor was that a design enhancement related to inadequate MSIV air accumulator volume was not pursued following its initial identification. A modification was implemented on February 7, 1994, to enhance the design margin, and all three valves were subsequently declared operable.

This condition had minimal impact on actual plant safety. During the time that this condition was discovered, conditions did not exist that would have caused radiological release limits to be exceeded. Based on the possibility that the MSIVs may have been inoperable in the past, and the associated TS action was not taken, we concluded that this condition was reportable on April 25, 1994, pursuant to 10 CFR 50.73(a)(2)(i)(B).

NRC FORM 366A
(5-92)

U.S. NUCLEAR REGULATORY COMMISSION

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

LICENSEE EVENT REPORT (LER)

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I. DESCRIPTION OF EVENT

On January 29, 1994, H. B. Robinson Steam Electric Plant (HBRSEP), Unit No. 2 was in hot shutdown conditions and at normal operating temperature and pressure. During post maintenance testing following removal, testing, and re-installation of the "A" Main Steam Isolation Valve (MSIV)(EHS Code: ISV) control solenoid, the "A" MSIV failed to close within five seconds with non-safety related instrument air supplied to the valve actuator. Technical Specification (TS) 3.4.1.e states that the reactor shall not be heated above 350 degrees F unless the main steam stop valves (i.e., MSIVs) are operable and capable of closing in five seconds or less. TS 4.7.1 states that the MSIVs are tested at each refueling interval to verify closure time of five seconds or less, and that the valves are tested at "no flow and at no load conditions" (i.e., Reactor Coolant System (RCS) at 547 degrees F and no steam flow). On January 30, 1994, at 2223 hours, the "C" MSIV was tested to verify its capability to close within five seconds after receiving a close signal at no flow and at no load conditions. This MSIV also failed to meet the stroke time requirements. As a result of the "A" and "C" MSIVs failing to meet stroke time requirements, the "B" MSIV was tested; it also exceeded the five second requirement.

Because the stroke times for all three valves were in excess of five seconds, the valves were declared inoperable in accordance with TS 3.4.1.e, and each valve was secured in its closed position and the motive force (i.e., instrument air) was isolated from the valve actuators in accordance with the action statement of TS 3.6.3 for an inoperable containment isolation valve. Subsequent testing determined that, with instrument air isolated to the MSIV actuators (i.e., only the safety-related MSIV air accumulators providing the actuating motive force), all three valves required in excess of five seconds to close.

At approximately 2134 hours, control room operators noticed that the "B" MSIV position indicator was showing dual indication (i.e., dual indication means that the valve is between full open and full closed). The dual indication occurred because with instrument air isolated and the actuator vent closed, an insufficient pressure differential existed across the actuator piston (see attached diagram) to keep the valve shut. As a result, the "B" MSIV drifted partially open for a period of approximately eight minutes. This condition placed the plant outside of the containment integrity requirements of TS 3.6.3. Instrument air was subsequently unisolated to the "B" MSIV, which resulted in the valve closing, and remaining closed.

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I. DESCRIPTION OF EVENT (Continued)

On April 25, 1994, following a review of the completed root cause investigation of the MSIV failures, Plant management determined that the previous practice of testing the MSIVs with instrument air valved in may not have adequately demonstrated valve operability. Subsequent evaluation concluded that the design margin of the MSIV actuators was minimal, and that testing under different conditions was the preferred method to establish operability. Review of historical test data identified that MSIV testing was performed in this configuration (i.e., with instrument air valved in) from 1984 to 1994. As a result, the capability of the MSIVs to perform their design function may not have been consistently demonstrated since 1984. Accordingly, the applicable TS action was not entered during that time period for inoperable MSIVs. The following pertinent historical data provides the circumstances surrounding this condition.

During November, 1984, the NRC conducted an inspection of MSIV testing. This inspection resulted in Notice of Violation (NOV) 84-44-02 which stated that, contrary to American Society of Mechanical Engineers (ASME) Code requirements invoked by TS 4.0.1.a, the MSIVs, as "fail-safe" valves, were not being tested by "observing the operation of the valves upon loss of actuator power." NRC Inspection Report 84-44 interpreted the requirement as meaning that the ASME Code test of the MSIVs should be conducted without the use of instrument air as the source of actuator power since instrument air is a non-safety grade system. Note that the original Final Facility Design and Safety Analysis Report (FFDSAR) and the Updated Final Safety Analysis Report (UFSAR) Revision 1 identified the MSIVs as "fail as-is" valves.

On January 8, 1985, the ASME Code stroke test of the MSIVs was conducted under Special Procedure SP-647, "Main Steam Isolation Valve Operability Test," with steam line pressure at approximately 980 psig, no pressure differential across the valve, and with instrument air isolated. The safety-related MSIV air accumulators provided the only motive force to close the valves during the test. However, the test did not adequately confirm that closure times were within five seconds. Conclusions from the testing were that all three MSIVs closed; however, they drifted open within ten minutes after closing (i.e., due to the actuator vent valve remaining closed). To compensate for this concern, a temporary nitrogen source was added to the valve actuators to provide the additional motive force to keep the valves closed in the event of a loss of instrument air. Our response to NOV 84-44-02 on March 8, 1985, stated that the Operations Surveillance Test (OST) Procedure OST-702, "ISI Secondary Side Valve Test," was intended to meet the TS 4.0.1.a (i.e., ASME Section XI Code) requirements. The response further stated that the test was performed at cold shutdown conditions, and that Procedure OST-501, "Main Steam Isolation Valve (Refueling)," satisfied the operability requirements of TS 4.7 (i.e., MSIV closure within five seconds) at hot, no load conditions. At that time, no changes to Procedure OST-501 were considered necessary.

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I. DESCRIPTION OF EVENT (Continued)

This response summarized the results of the January 8, 1985, test and stated that a bottled nitrogen backup to the MSIV actuators had been provided on an interim basis to ensure adequate pressure is available to close the valves within the safety analysis assumption for steam generator tube rupture. Procedure OST-702 was subsequently revised to isolate instrument air.

The temporary nitrogen backup was removed during 1986 by modification M-882. This modification also installed a redundant solenoid in the closing side of the actuator vent path. The addition of this redundant solenoid valve, powered from an alternate AC power channel, addressed the identified concern that the actuator as originally designed was subject to a single failure. Accordingly, the addition of a redundant solenoid valve prevented the motive closing air from being vented off of the actuator. However, post modification testing did include specific acceptance criterion for the MSIV closure time.

II. CAUSE OF EVENT

The potential of failure of the MSIVs to meet their TS stroke time requirements to be undetected was caused by failure of the surveillance and modification testing program to account for the minimal design margin of the actuators. Additionally, failure to provide adequate design control measures to enhance the MSIV design margin identified during the 1984 NRC Inspection contributed to the potential failure of the valves to meet the TS required function. The NRC concern regarded the susceptibility of the MSIVs to a single failure (i.e., MSIV closure could not be assured if instrument air was isolated and the accumulator vent valve failed). As stated above, the modification that eliminated this susceptibility was implemented in 1986.

A complicating factor for this condition was that a design enhancement related to MSIV air accumulator volume was not pursued following its initial identification in 1985. NRC Information Notice (IN) 85-84, "Inadequate Inservice Testing of Main Steam Isolation Valves," issued in October 1985, referenced ASME Section XI, and stated that reliance should not be placed on a non-safety related system (e.g., instrument air) to mitigate the consequences of an accident. An evaluation of IN 85-84 performed in 1985, concluded that the actions being taken in response to the 1984 NRC violation adequately addressed the IN. As a result, further evaluation of the potential need to provide a supply of safety-related instrument air to the MSIV accumulator, was not performed until February 1994. Therefore, failure to comprehensively evaluate and act upon this information during 1985 resulted in the potential failure of the valves to meet the TS required five second closure time when tested in the 1994 test configuration. Testing the MSIVs with instrument air supplied to the actuators masked the fact that the accumulators were minimally sized to close the valves within five seconds under hot, no load conditions, and to maintain the valves closed if instrument air was isolated from the valve actuators.

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II. CAUSE OF EVENT (Continued)

Testing of the MSIVs to comply with TS operability requirements was previously performed under the hot, no load condition with non-safety related instrument air supplied to the MSIV actuators. As a result of the NRC violation cited in 1984, the ASME Code Section XI stroke test of the MSIVs was previously conducted under cold conditions without non-safety related instrument air supplied to the MSIV actuators. Since testing the MSIVs under conditions identical to actual design basis conditions is not practical, artificialities introduced in the testing methods (i.e., testing with instrument air connected, and testing under "cold" rather than "hot" conditions) may not have accounted for the minimal design margin but did provide reasonable assurance of operability.

Since testing under "no load, no flow," rather than with steam flow, is highly conservative, these artificialities should have been reduced in the testing methods to the maximum extent practical. Analysis of historical test data for testing performed "cold," both with and without instrument air, and for tests performed with and without instrument air under "hot" conditions, showed that "hot" versus "cold" test conditions had a more pronounced effect on MSIV closure time than testing with or without instrument air provided to the MSIV actuators.

III. ANALYSIS OF EVENT

TS 3.4.1.e states that the reactor shall not be heated above 350 degrees F unless the main steam stop valves (i.e., MSIVs) are operable and capable of closing in five seconds or less. TS 4.0.1.a requires safety related components to be tested in accordance with Section XI of the ASME Code. TS 4.7.1 states that the MSIVs are tested at each refueling interval to verify closure time of five seconds or less, and that the valves are tested at no flow and at no load conditions. While the TS requirements are not explicit either with regard to the conditions which tests are to be performed, we have interpreted that this testing should be conducted at maximum steam pressure, which is the most challenging testing condition for meeting the five second closure time requirement. Additionally, the testing should be performed under worst case conditions (i.e., instrument air is isolated). Since the MSIV actuator design margin has been determined to be minimal, and testing was not consistently performed under these conditions from 1984-1994, MSIV operability may not adequately have been demonstrated prior to this event.

The basis of TS 4.7 states that the MSIVs serve to limit an excessive RCS cooldown rate and the resultant reactivity insertion following a Main Steam Line Break (MSLB) accident. The five second closure time requirement is conservative with respect to the MSLB accident analysis. The Updated Final Safety Analysis Report (UFSAR) Chapter 15 safety analysis of the most limiting MSLB is based upon full closure of the MSIVs within seven seconds of receipt of a Safety Injection signal.

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III. ANALYSIS OF EVENT (Continued)

A review of historical test data shows that the TS required closure time (i.e., \leq five seconds) for the MSIVs is more significantly affected by temperature conditions than by the supply or isolation of instrument air to the accumulators during testing. Review of historical test data demonstrates that MSIV closure times under "hot" conditions averaged 4.5 seconds. This is approximately 1.3 seconds slower than under "cold" conditions. However, the closure time is not significantly affected by the unavailability of instrument air (i.e., closure time is 0.3 seconds slower). Therefore, we have concluded that surveillance testing of the MSIVs provided reasonable assurance that the valves would have performed their intended design function under the most limiting, postulated MSLB accident conditions analyzed, and that degraded performance would have been revealed through the testing process.

The capability of the MSIVs to shut against and isolate a pressurized Steam Generator (SG) is implicit in the UFSAR Chapter 15 analysis for SG tube rupture scenarios. The UFSAR states that the intact SG will blowdown for a short period of time until the MSIVs close approximately 14 seconds after a break. The safety analysis is based upon isolation of the ruptured SG within 30 minutes. Under such conditions, sufficient pressure would exist across the valve to ensure that it remains closed. As a result, any release to the environment would be limited to a small fraction of the 10 CFR Part 100 limits in the event of a SG tube rupture.

Based on the possibility that the MSIVs may have been inoperable in the past without the associated TS action being taken, and the "B" MSIV drifting partially open in violation of the TS 3.6.3 containment integrity requirements, this report is submitted pursuant to 10 CFR 50.73 (a)(2)(i)(B) as operation in a condition prohibited by TS.

IV. CORRECTIVE ACTIONS

On February 7, 1994, additional MSIV accumulator tanks were installed to increase the actuator design margin by providing an increased accumulator air volume capacity to provide additional margin for MSIV closure time within the required five second time period. Following completion of this modification and subsequent post-modification testing, all three valves were declared operable.

Procedure OST-501 is now conducted with the plant in hot shutdown conditions with the main steam header warmed and pressurized. The procedure establishes a no flow condition downstream of the MSIVs and is performed with instrument air isolated. The test was successfully performed prior to returning the unit to power operations on February 11, 1994.

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IV. CORRECTIVE ACTIONS (Continued)

Procedure OST-702 was revised to allow hot testing of the MSIVs by including sections to establish a no flow condition downstream of the MSIVs and to isolate instrument air during the MSIV operability portion of the test. This test was also performed prior to returning the unit to power operations on February 11, 1994.

The Design Basis Document for the Main Steam System has been revised to include references to the licensing basis for the system and supporting calculations and studies that define the details of expected MSIV performance.

A revision to the UFSAR has been initiated to ensure that it correctly characterizes the accident mitigation requirements for the MSIVs. This revision will be included in the next UFSAR submittal, scheduled for 1995.

As additional measures, the adequacy of periodic testing that is currently in place to verify the MSIV air actuation system leak tightness will be verified, and the need for additional post-accident controls to ensure the MSIVs remain closed, will be evaluated.

V. ADDITIONAL INFORMATION

A. Component Failures

None

B. Previous similar events

None

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

DIAGRAM: MSIV DUAL POSITION INDICATION

