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JAFP-95-0391

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

SUBJECT: DOCKET NO. 50-333
LICENSEE EVENT REPORT: LER-95-004-01:

Logic System Functional Test Procedure
Deficiencies due to Personnel Errors

Dear Sir:

This report is submitted in accordance with 10CFR50.73 (a)(2)(i)(B).

This revised report is submitted to update the status of corrective actions and change the Licensee Contact for this report.

Questions concerning this report may be addressed to Mr. Robert Bruns at (315) 349-6575.

Very truly yours,

HARRY P. SALMON, JR.

HPS:RWB:las

Enclosure

cc: USNRC, Region I
USNRC Resident Inspector
INPO Records Center

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

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

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.

LICENSEE EVENT REPORT (LER)

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

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
James A. FitzPatrick Nuclear Power Plant	05000333	01 OF 11

TITLE (4) Logic System Functional Test Procedure Deficiencies due to Personnel Errors

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
02	22	95	95	004	01	08	29	95	FACILITY NAME N/A	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)	000	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)	
		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)
Mr. Robert Bruns, Senior Licensing Engineer	(315) 349-6575

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 DATE (15)	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)

Final Report

The plant was shutdown for refueling and maintenance. While implementing corrective actions described in LER-95-002, additional deviations were identified in the logic system functional test procedures associated with primary containment isolation. With the exception of two valve position limit switch contacts which were not tested, the deviations involved testing performed on a once per operating cycle frequency versus semiannual as required by the Technical Specification. The testing deficiencies were caused by personnel error during the conduct of surveillance test procedure adequacy reviews. The procedures were corrected and the logic circuits tested. Additional corrective actions included an independent review of all marked up prints from the baseline logic system functional test review to ensure testing frequency is correct and a detailed review of additional test procedures, selected at random, to provide assurance that all functions are tested as required. LERs 95-002, 93-014, 92-032, 90-015, 90-007 and 89-008 describe similar occurrences.

Final Report

EIIS Codes are in []

EVENT DESCRIPTION

LER-95-002, dated February 13, 1995, reported deficiencies with logic system functional test procedures. During the performance of LER-95-002 corrective actions, the following additional procedure deviations were identified:

1. Reactor Water Sample Valves (KN) and Reactor Water Recirculation (AD) Pump Seal Purge Isolation Valves

   On February 22, 1995, while shutdown for refuel, maintenance and modification, it was determined that portions of the logic circuits for automatic isolation of the reactor water sample valves and reactor water recirculation pump seal purge isolation valves were being tested on a once per operating cycle frequency as opposed to being tested semiannually as part of the logic system functional test program. The reactor mode switch was in the refuel position and fuel loading was in progress.

   The surveillance test procedure for the subject valves (ST-1D) was being revised to incorporate previously identified deficiencies. ST-1D implements the requirements of Technical Specification Table 4.2-1, Minimum Test and Calibration Frequency for Primary Containment Isolation System [JM], for the listed primary containment isolation valves or valve groups.

   During the procedure revision process it was determined that not all relay contacts in the isolation logic circuits for reactor water sample valves and reactor water recirculation pump seal purge isolation valves were being tested as part of the semiannual logic system functional test. Technical Specification Table 4.2-1 requires a semiannual logic system functional test of the circuits that automatically isolate these valves. The test procedure contained steps which tested only half of the relay contacts in the logic circuits which automatically close the valves upon the receipt of low-low-low RPV water level signals. Specifically, contacts on Relays 16A-K1A and 16A-K1C were tested semiannually while the same contacts on relays 16A-K1B and 16A-K1D were tested only on a once per operating cycle frequency.

During the procedure revision it was also determined that the reactor water sample valve isolation control logic from the main steam [SB] line radiation monitor [IL] trip function testing was being performed once per operating cycle versus semiannual as required by Technical Specification Table 4.2-1.

Subsequent review and assessment determined that although the identified contacts and functions were not being tested at the required frequency, semiannually, the entire logic paths were being tested at a once per operating cycle frequency by a simulated automatic actuation test. This testing had been performed, as required, with satisfactory results. Therefore, the deviation was failure to perform logic testing for the identified contacts and function at the required Technical Specification frequency.

2. Off-Gas [WF] Isolation Valve

On March 3, 1995, while shutdown for refuel, maintenance and modification, it was determined that portions of the logic circuits for automatic isolation of the off-gas isolation valve were being tested once per operating cycle versus semiannually as part of the logic system functional test program. The reactor mode switch was in the refuel position and fuel loading was in progress.

The surveillance test procedure for the subject valves (ST-10A) was being independently reviewed to assess the adequacy of corrective actions described in LER 95-002. ST-10A implements the requirements of Radiological Effluent Technical Specification Table 3.10-2, Minimum Test and Calibration Frequency for Radiation Monitoring Systems [IL]. The procedure had been previously revised to ensure testing of the off-gas radiation monitor "high" radiation trip signals. During this review, it was discovered that the previous revision did not completely correct the deficiencies identified in LER 95-002 because the test methodology relied upon the receipt of an annunciator to confirm actuation of the logic circuit for off-gas isolation valve closure. This method was deficient because the circuitry uses separate contacts for annunciation and isolation valve closure. Specifically, all relay logic was tested and contacts associated with the isolation annunciation were tested; however, four contacts in the valve closure circuit were not being tested semiannually as part of the logic system functional test.

Subsequent review and assessment determined that although the identified contacts were not being tested at the required frequency, semiannually, they were being tested at a once per operating cycle frequency by a simulated automatic actuation test. This test had been performed, as required, with satisfactory results. Therefore, the deviation was failure to perform logic testing for the identified contacts at the required Technical Specification frequency.

3. Low Pressure Coolant Injection (LPCI) [BO] Inboard Injection Valves

On March 11, 1995, while shutdown for refuel, maintenance and modification, it was determined that two valve position limit switch contacts in the logic circuits for automatic isolation of the low pressure coolant injection inboard injection valves were not being tested as part of the logic system functional test program. The reactor mode switch was in the refuel position with fuel loaded in the reactor vessel.

The Primary Containment Isolation System (PCIS) Group 2 Logic System Functional Test (ST-34A) was being reviewed as a corrective action for LER 95-002. During this review, it was determined that not all valve position limit switch contacts for Shutdown Cooling Isolation Valves 10MOV-17 and 10MOV-18 were being tested as part of the logic system functional test. These contacts are in the isolation circuit for the LPCI Inboard Injection Valves 10MOV-25A and 10MOV-25B. The function of this isolation circuit is to close 10MOV-25A or 10MOV-25B in the event of a low RPV water level or high drywell pressure signal while in the shutdown cooling mode of operation. The test methodology employed for testing this function opened one shutdown cooling isolation valve and simulated open the other in order to simulate isolation conditions for the LPCI Inboard Injection Valves. As a result, only one of the two valve position switch contacts in each PCIS channel were tested semiannually as part of the logic system functional test. The two remaining limit switch contacts were not included in any Technical Specification required logic testing.

On March 16, 1995, while shutdown for refueling, maintenance and modification, an additional deficiency was discovered with procedure ST-34A. This deficiency concerns testing of the isolation circuit for 10MOV-25A and 10MOV-25B while the reactor is at power. During power operation, electrical jumpers are installed to simulate shutdown cooling operation in order to test the subject isolation circuit. These jumpers bypass contacts for the low pressure permissive signal for this isolation function. As a result these contacts have been tested once per operating cycle as opposed to semiannually as required by Technical Specifications.

4. Drywell [NH] Vent and Purge Valves

On March 15, 1995, while shutdown for refueling, maintenance and modification, it was determined that although all active components of the logic circuit which initiates isolation of the drywell vent and purge valves on primary containment high radiation was being tested semiannually as part of the logic system functional test program, there was inadequate overlap between two channels. The reactor mode switch was in shutdown with a reactor vessel hydrostatic test in progress.

The Primary Containment Isolation System (PCIS) Group 2 Logic System Functional Test (ST-34A) was being reviewed as a corrective action for LER 95-002. During this review, it was discovered that there was inadequate overlap in the test of drywell vent and purge valve isolation circuits initiated by the two containment high range radiation monitors. The isolation circuits initiate automatic isolation of the drywell vent and purge valves upon receipt of an upscale high-high trip from one radiation monitor or downscale trips from both radiation monitors.

The deviation identified with the logic system functional test was the fact that both radiation monitors were not simultaneously placed in the downscale condition in order to test the parallel contact arrangement for the downscale trip function. The methodology employed to test this trip function tested each downscale trip separately and relied upon visual inspection to verify contact actuation. Although all active components of the circuit were verified to operate, actuation of the isolation circuit upon receipt of both downscale trips was not directly demonstrated.

EVENT CAUSE

The events were caused by procedure deficiencies (Cause Code D). A logic system functional test is defined in Technical Specification definition 1.0.F.7 as " ... a test of relays and contacts of a logic circuit ...". The procedures did not contain steps for testing all relay contacts as required by Technical Specifications.

The failure to identify the procedure deficiencies was personnel error (Cause Code A). A baseline logic system functional test procedure adequacy review was completed in December, 1993. An adequacy review of all other test procedures was completed in December, 1994. The procedure developed for conduct of the adequacy review included a checklist of specific attributes to be used by the reviewer in the course of their review.

Although the checklist is comprehensive and the procedure fully encompasses the scope of the adequacy review, the task itself is very complex, requires the use of higher order cognitive skills by technically competent personnel and is best performed in an area free from distractions.

The logic system functional test procedure deficiencies were errors of omission that occurred during the course of the initial adequacy review. The omissions were caused by slips in attention to detail by personnel performing the adequacy review that were not subsequently identified and corrected through the review and approval process.

The event investigation identified the following contributing factors:

1. Personnel performing the surveillance test procedure adequacy review were too focused on ensuring all logic paths were being tested and were less attentive to the frequency of testing.

2. All events identified in this report were the result of system drawing markup errors by personnel performing the adequacy review. The errors were either failure to highlight or applying the wrong color highlight to the specific contacts or functions. All personnel involved in the review indicated cognitive overload as a contributing factor. The task is complex and there were frequent distractions (open work area, telephone calls, etc.).

3. In the case of the off-gas isolation valve and the drywell vent and purge valves logic omissions, the reviewers wrong assumptions regarding Technical Specification requirements. Technical Specification Table 4.2-1 requires logic system functional testing of valves, or valve groups. This includes signals from the trip functions listed in the upper section of the table and additional trip functions shared with primary containment isolation that are not listed in the table. The shared trip functions are identified in other sections of the Technical Specifications, often by means of footnote.

4. The Primary Containment Isolation Logic uses reverse operation from Emergency Core Cooling System logic. Contacts are customarily shown in the "relay coil deenergized position" while the logic is normally energized and is deenergized to actuate. Personnel that performed the initial adequacy review were reviewing both types of logic and indicated that the errors could have been introduced by failure to continually make distinction between the two logic types (energized vs. deenergized).

EVENT ANALYSIS

These events require a report under 10CFR50.73(a)(2)(i)(B). That is, an operation prohibited by Technical Specifications. The failure to test all trip functions and logic circuit relay contacts as part of the semiannual logic system functional test program means that the operability of the particular logic circuit was not demonstrated as required.

1. Reactor Water Sample Valves and Reactor Water Recirculation Pump Seal Purge Isolation Valves

The failure to test the main steam line high radiation monitor trip function for primary containment isolation of the reactor water sample valves every six months as part of the logic system functional test was not safety significant. The monitor instrument channels were being functionally tested every month by injecting a simulated signal into the measurement channel. This functional test demonstrated proper operation of the individual high radiation trip function relays but did not demonstrate proper operation of the relay contacts associated with reactor water sample valve isolation from main steam line high radiation which is part of the isolation logic circuit. The logic circuit was also subjected to a simulated automatic actuation test once each operating cycle (once/18 months). The simulated automatic actuation test (ST-1K) once every 18 months includes steps which verify proper operation of all the relays and relay contacts that automatically close the reactor water sample valves.

In summary, between the monthly functional testing and the once per cycle simulated automatic actuation test which was performed with satisfactory results, the requirements for logic system functional testing have been completed at an 18 month interval versus the required six month interval.

The failure to test two of the four primary containment isolation trip channels for the reactor water sample valves and the reactor water recirculation pump seal purge isolation valves every six months as part of the logic system function test was not safety significant. Trip channel logic relays which isolate the reactor water sample valves and reactor water recirculation pump seal purge isolation valves also isolate the main steam lines. Logic system functional test procedures test all four relays and the contacts for primary containment isolation of the main steam lines. The logic system functional test procedures did not test the relay contacts associated with isolation of the reactor water sample valves and the reactor water recirculation pump seal purge isolation valves on two of the four relays.

These contacts are tested during the performance of a Simulated Automatic Actuation Test (ST-1K) once every 18 months. In other words, procedure ST-1K included testing of the relays and relay contacts which were not included in the logic system functional test procedure ST-1D. Because the testing performed once every 18 months has demonstrated satisfactory operation of all logic trip channels, the failure to test two of the four trip channels every six months was not safety significant.

2. Off-Gas Isolation Valve

The failure to test four contacts in the off-gas isolation valve closure logic circuit every six months as part of the logic system functional test was not safety significant. The logic system functional test included testing of the relays which operate the contacts not tested. In addition, the logic system functional test included testing of the relay contacts associated with annunciation; therefore, there was reasonable assurance that the contacts not being tested were operable. This logic circuit was also subjected to testing once each operating cycle (once/18 months) which verified proper operation of all relays and contacts including the contacts in the valve closure circuit. This test, Off-Gas System Automatic Isolation and Closure Test (ST-10B) was completed with satisfactory results.

3. Low Pressure Coolant Inboard Injection Valves

The failure to test one of the two valve position limit switch contacts in the shutdown cooling isolation valve logic circuit every six months as part of the logic system functional test was not safety significant. The contacts not tested are physically on the same valve operator rotor as a set of contacts which provide open indication on a Control Room panel graphic display of primary containment isolation valve status. This display is used as an operator aid and is checked during control panel walkdowns at least once per shift as a part of shift turnover. There is reasonable assurance that an off-normal position indication would be detected within an eight hour shift; therefore, providing assurance that the second set of contacts, associated with the isolation logic circuit, would have been operable. Conversely, if the logic isolation circuit did not make contact as designed, there is reasonable assurance that the control panel graphic display would likewise provide the operator with abnormal valve position indication from which corrective actions could be initiated.

The failure to test contacts for the low pressure permissive signal for the LPCI inboard injection valves every six months as part of the logic system functional test was not safety significant. The contacts are tested at least once per operating cycle per surveillance test procedure ST-2P. ST-2P was satisfactorily completed on March 11, 1995. Furthermore, the relays which operate these contacts are functionally tested every month per instrument surveillance test procedure ISP-5-1.

4. Drywell Vent and Purge Valves

The failure to demonstrate actuation of the drywell vent and purge valve isolation circuit upon receipt of both containment high range radiation monitor downscale trips was not safety significant. The procedure did verify operation of all active components (contacts and relays) of the isolation circuit; therefore, there is reasonable assurance that the circuit was operable per design intent.

It should further be noted that probabilistic risk assessment review indicates that device failure (relay, switch, etc.) is more probable than contact failure by three orders of magnitude. In each of the events identified in this report, when contacts were subsequently tested, they performed as designed.

CORRECTIVE ACTIONS:

1. The main steam isolation valves, main steam line drain valves, RWR sample valves, and RWR minimum purge valves logic system functional test procedure (ST-1D) was revised and testing of the entire logic circuit was completed prior to startup following the Refuel Outage.

2. The off-gas line isolation logic system functional test procedure (ST-10A) was revised and testing of the entire logic circuit was completed prior to startup following the Refuel Outage.

3. The PCIS Group 2 Logic Functional and Simulated Automatic Actuation Test procedure (ST-34A) was revised and testing of the entire logic circuit for isolation of LPCI inboard injection valves was completed prior to startup following the Refuel Outage.

4. The instrument surveillance functional test/calibration procedure was revised to require continuity checks of the low pressure permissive contacts in the isolation circuit for LPCI inboard injection valves. (Completion date: May 1, 1995)

5. A temporary surveillance test procedure was developed and performed to demonstrate operability of the containment high range radiation monitors downscale isolation function for drywell vent and purge valves. This testing was incorporated into test procedure ST-34A. (Completion date: April 24, 1995)

6. An action plan was completed to identify and resolve any additional logic testing deficiencies based on the nature of the procedure weaknesses reported in this LER. Marked-up elementary logic diagrams from the baseline LSFT review were re-verified to ensure that PCIS logic circuits are tested at the required frequency. In addition, nine LSFT procedures were selected at random for an independent review to ensure that associated circuit functions are adequately tested. During this review, two minor deficiencies were identified with LSFT procedure ST-34B. This procedure performs a test of the logic which isolates the reactor building [NG] and initiates the standby gas treatment (SGT) system [BH]. One deficiency involved the failure to fully test SGT fan motor speed circuitry in that the slow speed contacts and relays were not verified to deactivate during the 6-month LSFT. This deficiency was not considered significant or reportable because proper SGT flow (and thus fan motor speed, was verified every 6 months in a radiation protection procedure for SGT filter testing. Therefore, the fan motor speed logic was being tested at the required 6-month frequency. The other LSFT deficiency involved the failure to test two isolation dampers for the reactor building ventilation system. This deficiency was not considered significant or reportable because the isolation dampers do not perform a safety function. ST-34B was revised to correct both of these deficiencies. (Completion date: June 26, 1995)

7. The lessons learned from review of the deficiencies described in this LER will be reviewed by all personnel involved in the development and review of logic system functional test procedures. (Planned completion date: October 1, 1995).

Additional Information:

Failed Components: None

Previous Similar Events: LERs 95-002, 93-014, 92-032, 90-015, 90-007 and 89-008.

Reason for Update: To update the status of corrective actions and change the Licensee Contact for this report.

Attachment 1

LER-95-004-01

Commitment Status

Number	Commitment	Due Date
LER-95-004-01	The main steam isolation valves, main steam line drain valves, RWR sample valves, and RWR minimum purge valves logic system functional test procedure (ST-1D) was revised and testing of the entire logic circuit was completed prior to startup following the Refuel Outage.	Completed
LER-95-004-02	The off-gas line isolation logic system functional test procedure (ST-10A) was revised and testing of the entire logic circuit was completed prior to startup following the Refuel Outage.	Completed
LER-95-004-03	The PCIS Group 2 Logic Functional and Simulated Automatic Actuation Test procedure (ST-34A) was revised and testing of the entire logic circuit for isolation of LPCI inboard injection valves was completed prior to startup following the Refuel Outage.	Completed
LER-95-004-04	The monthly instrument surveillance procedure was revised to require continuity checks of the low pressure permissive contacts in the isolation circuit for LPCI inboard injection valves.	Completed
LER-95-004-05	A temporary surveillance test procedure was developed and performed to demonstrate operability of the containment high range radiation monitors downscale isolation function for drywell vent and purge valves. This testing was incorporated into test procedure ST-34A.	Completed
LER-95-004-06	An action plan was completed to identify and resolve any additional logic testing deficiencies based on the nature of the procedure weaknesses reported in this LER. Marked-up elementary logic diagrams from the baseline LSFT review were re-verified to ensure that PCIS logic circuits are tested at the required frequency. In addition, nine LSFT procedures were selected at random for an independent review to ensure that associated circuit functions are adequately tested. During this review, two minor deficiencies were identified with LSFT procedure ST-34B. These deficiencies were not considered significant or reportable. ST-34B was revised to correct both of these deficiencies.	Completed
LER-95-004-07	The lessons learned from review of the deficiencies described in this LER will be reviewed by all personnel involved in the development and review of logic system functional test procedures.	10/01/95