NRC Form 366
(4-95)

U.S. NUCLEAR REGULATORY COMMISSION

LICENSEE EVENT REPORT (LER)

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

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

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TITLE (4)
RCIC System Inoperable Due to Turbine Overspeed Trip During Surveillance

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
04	17	97	97	009	00	05	19	97	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)	016		20.2201 (b)		20.2203(a)(2)(v)		50.73(a)(2)(i)		50.73(a)(2)(viii)
			22.2203(a)(1)		20.2203(a)(3)(i)		50.73(a)(2)(ii)		50.73(a)(2)(x)
			20.2203(a)(2)(i)		20.2203(a)(3)(ii)		50.73(a)(2)(iii)		73.71
			20.2203(a)(2)(ii)		20.2203(a)(4)		50.73(a)(2)(iv)		OTHER
			20.2203(a)(2)(iii)		50.36(c)(1)	X	50.73(a)(2)(v) (D)		Specify in Abstract below or in NRC Form 366A
			20.2203(a)(2)(iv)		50.36(c)(2)		50.73(a)(2)(vii)		

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER (Include Area Code)
Douglas W. Ellis	508-830-8160

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)

On April 17, 1997, at 1315 hours, the reactor core isolation cooling (RCIC) system became inoperable, and a 14 day Technical Specification 3.5.D.2 limiting condition for operation (LCO) was entered. The system became inoperable because of a mechanical overspeed trip of the RCIC turbine that occurred during a surveillance test of the RCIC system. The test was conducted during startup from the 1997 refueling outage.

The cause was a gear change in the motor operator of the RCIC system flow test valve. The gear change was made during the refueling outage and affected the time used to position (open) the flow test valve before the RCIC turbine-pump is started for the test. Applicable RCIC system procedures were not identified as impacted by the gear change. Corrective action taken included a change in the surveillance procedure. The change increased the time, from approximately three seconds to approximately five seconds, used to position the flow test valve for the test. The RCIC system was tested with satisfactory results, and the LCO was terminated on April 18, 1997. Corrective action planned includes reviewing RCIC system procedures for potential revision and including this report in the engineering support training program.

The event occurred during startup from the 1997 refueling outage. The reactor mode selector switch was in the RUN position, and reactor power was 16 percent. The reactor vessel pressure was approximately 955 psig with the reactor water temperature at the saturation temperature for the pressure. The event posed no threat to public health and safety.

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BACKGROUND

As part of startup activities at the end of the 1997 refueling outage, the reactor core isolation cooling (RCIC) system was tested on April 15, 1997. At the time of the test, the reactor pressure was approximately 130 psig -- less than the 150 psig pressure at which the system is required to be operable (Technical Specification 3.5.D.1). The test was performed in accordance with procedure 8.5.5.3, "RCIC Flow Rate Test at Less Than or Equal to 150 PSIG," section 8.2. The test was completed with satisfactory results at approximately 1950 hours. The high pressure coolant injection (HPCI) system was similarly tested in accordance with procedure 8.5.4.3, "High Pressure Coolant Injection Operability Demonstration and Flow." The test was completed with satisfactory results at approximately 1835 hours on April 15, 1997.

EVENT DESCRIPTION

On April 17, 1997, at 1315 hours, the RCIC system became inoperable, and a 14 day Technical Specification 3.5.D.2 limiting condition for operation (LCO) was entered.

The system became inoperable due to a mechanical overspeed trip of the RCIC turbine. The turbine trip occurred when the RCIC turbine steam supply valve was opened at step 14 of surveillance test 8.5.5.1 (rev. 40) Attachment 1, "RCIC Pump Tech Spec and IST (Quarterly) Test." Prior to step 14, valve MO-1301-53 was jogged opened in accordance with step 12 of the procedure. The RCIC pump test valve (MO-1301-53) is located in the RCIC pump flow test line piping. The control switch for valve MO-1301-53 is spring loaded. After the control switch was moved to and held in the OPEN position for approximately 3 three seconds, the control switch was released. Subsequently, at step 14, the turbine steam supply valve MO-1301-61 was opened, and the overspeed trip occurred.

Initial utility licensed operator actions consisted of investigating the cause of the trip. Except for the overspeed trip linkage, the RCIC system was aligned to its normal configuration. Valve MO-1301-53 was closed via its control switch. The mechanical overspeed trip linkage of the turbine trip throttle valve was left in the tripped condition pending further investigation for the cause of the overspeed trip.

Problem Report 97.9287 was written to document the overspeed trip, a maintenance request (MR 19701258) was written for further investigation, and an LCO (A97-100) was written to track continued plant operation with the RCIC system inoperable. Attachment 7, "RCIC System Inoperable," of procedure 8.C.34 (rev. 14), "Operations Technical Specifications Requirements for Inoperable Systems/Components," was completed by 1400 hours. The NRC Operations Center was notified of the event at 1408 hours in accordance with 10 CFR 50.72.

The event occurred during startup from the 1997 refueling outage. The reactor mode selector switch was in the RUN position, and reactor power was 16 percent. The reactor vessel pressure was approximately 955 psig with the reactor water temperature at the saturation temperature for that pressure.

CAUSE

The direct cause of the RCIC system becoming inoperable at 1315 hours was the activation of the RCIC turbine mechanical overspeed trip device. The device is mounted on the turbine shaft. Upon activating, the device trips the mechanical linkage that is connected to the turbine trip throttle valve. The trip throttle valve (SV-1301-1) is located in the turbine steam supply piping downstream of the RCIC steam supply valve MO-1301-61 and upstream of the turbine steam governor valve HO-1301-159. The overspeed trip setting (5512 to 5737 rpm) of the overspeed device is approximately 125 percent +/- 2 percent of the rated turbine speed (4500 rpm).

As part of the cause investigation, the RCIC turbine-pump was manually started in accordance with procedure 8.5.5.11 (rev. 0), "Manual Start of the RCIC Turbine for Maintenance Activities," at 1659 hours. The procedure was conducted to verify the turbine controls were operating properly. The test includes jogging valve MO-1301-53 open for approximately three seconds at step 10 and opening the turbine steam supply valve MO-1301-61 at step 11. The jogging open of valve MO-1301-53 for approximately three seconds was based on previous experience and is necessary to establish the RCIC turbine-pump parameters near to the system test parameters. After opening valve MO-1301-61 at step 11, the turbine started and was brought to normal operating parameters in accordance with the subsequent steps in the procedure using the handwheel of the turbine trip throttle valve. The turbine controls, including the RCIC flow controller FIC-1340-1, were tested in the manual and automatic control modes with satisfactory results.

Continued investigation identified a gear change made to valve MO-1301-53 during the 1997 refueling outage. The change was made in accordance with a design change (PDC 96-10B) that was part of upgrades made to motor operated valves (Generic Letter 89-10). The gear change was implemented by a maintenance document (P9500704) and changed the overall gear ratio of MO-1301-53 by approximately 60 percent. The change effectively increased the time needed for jogging open MO-1301-53 to the desired position necessary to establish the RCIC turbine-pump parameters near to system test parameters for the surveillance test. The applicable RCIC system procedures, including procedure 8.5.5.1 were not identified as impacted by the design modification (gear change) made to valve MO-1301-53. As a result of not increasing the time for jogging open MO-1301-53, less flow was able to pass through the RCIC flow test line. When the turbine steam supply valve was opened for the surveillance test at 1315 hours, the turbine started and accelerated as expected. Meanwhile, the RCIC flow controller, receiving flow signals that were less than normal due to less flow through valve MO-1301-53, maintained the turbine governor valve (HO-1301-159) in the full open position to achieve the desired turbine speed/pump flow. The governor valve, however, should quickly throttle (close) to control the turbine's acceleration or an overspeed condition will occur. The governor valve did not throttle because the test flow was less than the flow demanded by the flow controller. The test flow was less than the flow demand (400 gpm) because of the noted effect of the gear change made to MO-1301-53, and the turbine's mechanical overspeed device functioned to trip the turbine's trip throttle valve linkage and result in the event. Therefore, the root cause of the overspeed trip that occurred at 1315 hours was the applicable RCIC system procedures, including procedure 8.5.5.1, were not identified as impacted by the design modification (gear change) made to valve MO-1301-53 during the 1997 refueling outage.

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Procedure 8.5.5.1 was changed (via SRO 97-135) to increase the opening time for valve MO-1301-53 from approximately three seconds to approximately five seconds. After the change to procedure 8.5.5.1, the RCIC system was started automatically in accordance with procedure 8.5.5.1 Attachment 1 at 1755 hours. Valve MO-1301-53 was jogged open, this time for approximately five seconds (SRO 97-135) at step 12, the turbine steam supply valve MO-1301-61 was opened at step 14, and the turbine-pump started. As part of step 15, operator actions are to verify or adjust the flow controller (FIC-1340-1) and adjust the position of valve MO-1301-53. Per step 15, the manipulation of MO-1301-53 may be accomplished either locally at the valve by using the valve's handwheel or remotely from the control room by using the valve's control switch. Valve MO-1301-53 was momentarily jogged in a closed direction via its control switch to adjust the turbine speed/pump flow. The valve, however, continued to fully close automatically, and a turbine overspeed trip occurred at 1755 hours.

The investigation for the overspeed trip at 1755 hours revealed that valve MO-1301-53 fully closed instead of throttling in the closed direction as expected. The valve was stroked and the valve's control circuitry functioned as a seal-in type circuit in the closed direction. Problem Report 97.9290 was written to document that the closing portion of the control circuit of valve MO-1301-53 was found to be functioning as a seal-in type circuit instead of a jog type circuit. The closing of the valve resulted in a flow decrease and shortly, no flow through the flow test line. The effect of no flow caused the turbine governor valve to fully open, and the turbine speed increased until the overspeed trip occurred at 1755 hours. The investigation included an inspection of the former cubicle/breaker D781 that powered valve MO-1301-53. The inspection revealed wiring that had been relanded at auxiliary relay RCR. The relanding had changed the control switch circuit from a seal-in to a jog circuit in the close direction; this wiring change was not documented on wiring diagram E9-9-6 and RCIC elementary drawings M1G11-11 and M1G27 that showed the circuit to be a seal in circuit. A design modification (PDC 93-38) was issued in July 1994 for the replacement of 125 vdc and 250, vdc cubicles, including cubicle D781. Cubicle D781 was replaced during the 1997 refueling outage (RFO-11). The new cubicle was wired in accordance with a new wiring diagram E9A-8 that was based on wiring diagram E9-9-6. After the replacement of cubicle D781, the control switch circuit functioned as a seal-in type circuit in the close direction in accordance with design drawing E9A-8 (PDC 93-38) because the previous (undocumented) wiring change was not documented on drawing E9-9-6. The time frame of the undocumented wiring change could not be determined. Review of past drawing revisions and historical maintenance request(s) for cubicle D781 revealed no documented changes for the circuit. The undocumented change could have been made during initial RCIC system testing conducted as part of plant startup testing (c. 1972) or during some subsequent activity prior to the 1997 refueling outage.

The noted problems with the opening time of MO-1301-53 and the valve's control circuitry were not detected during the performance of procedure 8.5.5.3 on April 15, 1997, because the test was performed when the steam, pressure was approximately 130 psig. At 130 psig steam pressure, there is not as much energy in the steam, and therefore, the RCIC turbine governor valve remains at or near the full open position during testing (approximately 130 psig). Valve MO-1301-53 was jogged open for approximately three seconds at procedure section 8.2 step [7] and was adjusted (jogged further open) at section 8.2 step [13]. Review of plant information computer (EPIC) data indicates valve MO-1301-53 was jogged open to meet test criteria and was not jogged closed.

The noted problem with the control switch closing circuit of valve MO-1301-53 was not detected during the performance procedures 8.5.5.1 (April 17, 1997, at 1315 hours) and 8.5.5.11 (April 17, 1997, at 1659 hours) while at 955 steam pressure because valve MO-1301-53 was not jogged in the closed direction during the tests. Prior to RFO-11, the control switch for valve MO-1301-53 functioned as a jog circuit, not a seal-in circuit.

The replacement of cubicle D781 effectively changed the function to that of a seal-in circuit in the close direction. The effect of this change was not known to the operators who performed the noted tests on April 15, 1997, and April 17, 1997. Valve MO-1301-53 was jogged in the open direction, not the close direction, at the beginning of the tests. The valve was adjusted (jogged in the open direction), not jogged in the close direction during the tests. The valve was closed at the completion of the tests by the operators' use of the control switch, held in the close direction, until the valve was fully closed in accordance with previous experience (valve MO-1301-53 functioning as a jog valve in the open and close position). To the operators, the full closing of the valve while holding the control switch in the close direction was consistent with past experience, but they were unaware the control switch circuit in the close direction was functioning as a seal-in circuit. Therefore, the root cause of the turbine overspeed trip that occurred at 1755 hours on April 17, 1997, was the wiring change in the former cubicle (D781) that was not documented on wiring diagram E9-9-6 and RCIC system elementary drawings M1G11-11 and M1G27.

Neither the valve MO-1301-53 gear change nor the undocumented wiring change resulted in a failure of valve MO-1301-53. The automatic closing circuit for valve MO-1301-53 is wired in parallel with the valve's control switch and was not affected by the seal-in circuit wiring. Valve MO-1301-53 is designed to close automatically if a low reactor water level condition occurs or either of the two normally-closed, in-series RCIC pump suction valves (MO-1301-25 and -26) from the suppression pool are fully open. The RCIC system is designed to automatically start if a low reactor water level condition occurs.

CORRECTIVE ACTION

Corrective action taken included the following:

- Procedure 8.5.5.1 (rev. 40) was changed on April 17, 1997. Specifically, the change (SRO 97-135) was made to Attachment 1 step 12 and step 9 of Attachment 2, "RCIC System Checkout Test." These changes pertain to the time for jogging open valve MO-1301-53. The time for jogging open valve MO-1301-53 was changed from approximately three seconds to approximately five seconds.

- An engineering design change (FRN 93-38-21) was issued on April 18, 1997. The document changed the closing circuit from a seal-in type circuit to a jog type circuit. The affected drawings will be revised as part of the routine modification close-out process. With this change, the control circuitry for MO-1301-53 functions as a jog circuit in the open and close directions. The change did not affect the automatic closing function of valve MO-1301-53.

After FRN 93-38-21 was implemented, valve MO-1301-53 was stroked (jogged in the open and close directions) with satisfactory results at 0731 hours on April 18, 1997. The RCIC system was subsequently tested in accordance with procedure 8.5.5.1 (rev. 40 with SRO 97-135) Attachment 1. The test was completed with satisfactory results, and the LCO (A97-100) was terminated at 1723 hours on April 18, 1997.

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A review was conducted of the other cubicles replaced via PDC 93-38. The review focused on cubicles that power motor-operated valves that contain a jog control switch circuit. The review included operations department personnel involvement regarding the respective valve's operational function (jog versus seal-in). The review concluded the cubicles are wired in accordance with design, and the undocumented wiring change was an isolated instance that could date back to initial startup testing (c. 1972). Current procedures and work practices require approved design changes for wiring changes, and documenting wiring discrepancies in accordance with the problem report process.

Corrective action planned includes the following:

- RCIC system procedures including 2.2.22 (currently rev. 47B), "Reactor Core Isolation Cooling System," 8.5.5.3 (currently rev. 26) and 8.5.5.11 (currently rev. 0) will be reviewed. The focus of the review is for potential revision to change the time for jogging valve MO-1301-53 open from approximately three seconds to approximately five seconds.

- RCIC system procedures including procedures 8.5.5.3 and 8.5.5.11 will be reviewed. The focus of the review is for potential revision to identify the methods of manipulating the position of valve MO-1301-53 similar to the methods (local handwheel or remotely via the control switch) contained in procedure 8.5.5.1.

- Corrective action for the failure to identify the impact of the gear change (design modification) to the motor operator of MO-1301-53 relative to the RCIC procedures is to include this report in the engineering support training program.

SAFETY CONSEQUENCES

This event posed no threat to public health and safety.

The HPCI system was operable during the period the RCIC system was inoperable.

This report was submitted in accordance with 10 CFR 50.73(a)(2)(v)(D) because the RCIC system became inoperable.

SIMILARITY TO PREVIOUS EVENTS

A review for similarity was conducted of Pilgrim Station LERs submitted since January 1984. The review was focused to LERs involving an overspeed trip of the RCIC turbine. The review identified a previous instance of a RCIC turbine overspeed trip that was reported in LER 91-025-00.

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For LER 91-025-00, a RCIC turbine mechanical overspeed trip occurred on October 30, 1991. The trip occurred when the RCIC system was being started for reactor water level control (injection mode) following a loss of off-site power event. The system was started in accordance with step 5 of Attachment 8 of procedure 2.2.22, "Reactor Core Isolation Cooling System." For the step, the RCIC turbine steam supply valve (MO-1301-61) is opened first with the injection valve opened when the turbine speed increases. The steam inlet valve was opened, and the overspeed trip occurred approximately four seconds before the injection valve was opened. Corrective action taken included the revision of procedure 2.2.22 to provide instructions on the opening of the injection valve at the same time the turbine steam supply valve is opened, and a design modification. The modification (PDC 92-55) installed a single push button on control room panel C904 for starting the RCIC system in the injection mode.

ENERGY INDUSTRY IDENTIFICATION SYSTEM (EIIS) CODES

The EIIS codes for this report are as follows:

COMPONENTS	CODES
Breaker (D781)	BKR
Device, overspeed	12
Valve (SV-1301-1)	V
Valve, test (MO-1301-53)	TV

SYSTEMS	
High pressure core isolation cooling system	BJ
Reactor core isolation cooling system	BN