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

APPROVED BY OMB NO. 3150-0104

EXPIRES 04/30/99

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS MANDATORY INFORMATION COLLECTION REQUEST: 50.0 HRS. REPORTED LESSONS LEARNED ARE INCORPORATED INTO THE LICENSING PROCESS AND FED BACK TO INDUSTRY. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE INFORMATION AND RECORDS MANAGEMENT BRANCH (T-6 F33), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20555-0001, AND TO THE PAPERWORK REDUCTION PROJECT (3150-0104), OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503.

LICENSEE EVENT REPORT (LER)

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

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TITLE (4)

Manual Reactor Trip Due To High Conductivity In The Condensate System

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
09	15	1998	1998	-- 038 --	00	10	15	1998	FACILITY NAME	DOCKET NUMBER

OPERATING MODE (9)	3	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more) (11)			
POWER LEVEL (10)	000	☐ 20.2201(b)	☐ 20.2203(a)(2)(v)	☐ 50.73(a)(2)(i)	☐ 50.73(a)(2)(viii)
		☐ 20.2203(a)(1)	☐ 20.2203(a)(3)(i)	☐ 50.73(a)(2)(ii)	☐ 50.73(a)(2)(x)
		☐ 20.2203(a)(2)(i)	☐ 20.2203(a)(3)(ii)	☐ 50.73(a)(2)(iii)	☐ 73.71
		☐ 20.2203(a)(2)(ii)	☐ 20.2203(a)(4)	☒ 50.73(a)(2)(iv)	☐ OTHER
		☐ 20.2203(a)(2)(iii)	☐ 50.36(c)(1)	☐ 50.73(a)(2)(v)	Specify in Abstract below or in NRC Form
		☐ 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)
David A. Smith, Manager Unit 3 Regulatory Compliance	(860)437-5840

COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS		CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS

SUPPLEMENTAL REPORT EXPECTED (14)		EXPECTED SUBMISSION DATE (15)	MONTH	DAY	YEAR
☐ YES (If yes, complete EXPECTED SUBMISSION DATE).	☒ NO				

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

On September 15, 1998, at 17:35, with the Unit in Mode 1 at 100 percent power, a manual reactor trip was initiated when condensate pump discharge conductivity exceeded the limits allowed by the Abnormal Operating Procedure. This event occurred after restoring the Steam Generator (SG) Blowdown System to closed cycle service following maintenance activities. A prompt notification of this reactor trip was made pursuant to the requirements of 10 CFR 50.72(b)(2)(ii). This event is reportable pursuant to 10 CFR 50.73(a)(2)(iv) as "...any event or condition that resulted in a manual or automatic actuation of any Engineered Safety Feature, including the Reactor Protection System (RPS) ...".

The root cause of the event was the failure of the implementing procedure to fully address all design conditions in that the procedure utilized to remove the SG blowdown system from service did not provide adequate guidance to prevent a vacuum from being drawn in the Blowdown Receiver Tank as the tank cooled to ambient conditions.

The plant responded as expected during the reactor trip. There was minor safety significance associated with this event in that a transient was imposed on the unit due to the conservative chemistry criteria utilized in the Abnormal Operating Procedure. There were no consequences associated with this event. Operator actions were in accordance with operating procedures.

Operations Procedure OP 3316C, "Steam Generator Blowdown" was revised to ensure the blowdown receiver tank does not reach vacuum conditions during removal from service. Operating procedures will be revised to incorporate new criteria for manual trip of reactor on high condensate discharge conductivity.

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

I. Description of Event

On September 15, 1998, at 17:35, with the Unit in Mode 1 at 100 percent power, a manual reactor trip was initiated when condensate pump discharge conductivity exceeded the limits allowed by the Abnormal Operating Procedure (AOP). This event occurred after restoring the Steam Generator (SG) Blowdown System to closed cycle service following maintenance activities.

On September 15, 1998, at 14:45, following Steam Generator restoration to open cycle blowdown, inline instrumentation indicated a minor conductivity increase in the hotwell. Grab samples indicated a salt water intrusion. The unit was placed in action level 1, calling for increased monitoring by Chemistry personnel, based on increased sodium levels in condensate pump discharge and the hotwell. The initial increase in conductivity was discussed between Chemistry and the Operating Crew Shift Manager / Unit Supervisor. Based on past experience with problems in open cycle blowdown, it was decided to place the plant in closed cycle blowdown for system cleanup (performed at 17:22). About 5 minutes after switching to closed cycle blowdown, a slug of salt water passed through the hotwell resulting in a dramatic increase in conductivity. The "Condensate High Conductivity" alarm came in due to a large spike increase in conductivity [condensate pump discharge sodium peaked at 180 parts-per-billion (ppb)]. A manual reactor trip was initiated as required by AOP 3558, "Condenser Tube Leak," when the conductivity exceeded 1 Micromho at the condensate pump discharge.

On September 15, 1998, at 18:10, a prompt notification of this reactor trip was made pursuant to the requirements of 10 CFR 50.72(b)(2)(ii). This event is reportable pursuant to 10 CFR 50.73(a)(2)(iv) as "...any event or condition that resulted in a manual or automatic actuation of any Engineered Safety Feature, including the Reactor Protection System (RPS) ...".

II. Cause of Event

The root cause of the event was the failure of the implementing procedure to fully address all design conditions in that the procedure utilized to remove the SG blowdown system from service did not provide adequate guidance to prevent a vacuum from being drawn in the Blowdown Receiver Tank as the tank cooled to ambient conditions. The combination of Circulating Water System backpressure and Blowdown Receiver Tank vacuum resulted in backflow of salt water to the blowdown system.

III. Analysis of Event

Inventory from the SG Blowdown Tank is discharged to either the condenser hotwell (closed cycle) or to the circulating water discharge tunnel (open cycle). Level control valves, valve 3BDG-LV25 on the drain line to the condenser, or valve 3BDG-LV36 on the drain line to the circulating water discharge tunnel, modulate to control blowdown tank level. On September 15, 1998, there was a SG Blowdown System maintenance outage. As part of the event evaluation, it was determined that the removal of the system from service was performed properly in accordance with the procedure for isolating the system for maintenance. However, as the blowdown tank cooled, a vacuum was drawn in the tank causing salt water to be drawn up the drain line (past the leaking drain line isolation valve) from the circulating water system tunnel. The valve in this line leaked causing water to enter the piping, and due to elevation differences, gradually (over a period of hours) drain into the drain pipe to the condenser hotwell. [Both blowdown tank drain lines tee together at an elevation below the S/G blowdown tank.] Negative pressure indications in the S/G Blowdown tank during this event supports this assumption.

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Calculations indicate that approximately 1 to 2.5 gallons of salt water collected in the piping upstream of level control valve 3BDG-LV25. Based upon minor conductivity increases downstream of the hotwell at the condensate pump(s) discharge, this valve had leaked by to some extent as pressure increased in the blowdown system while the system was in the open cycle mode of operation. Subsequently, when the Operators restored the system to closed cycle operation and opened level control valve 3BDG-LV25, this "slug" of salt water resulted in a very high increase in sodium concentration leading the Operators to trip the reactor in accordance with the Abnormal Operating Procedures.

The plant responded as expected during the reactor trip. There was minor safety significance associated with this event in that a transient was imposed on the unit due to the conservative chemistry criteria utilized in the AOP. There were no consequences associated with this event. Operator actions were in accordance with operating procedures. AOP 3558, "Condenser Tube Leak," requires a reactor trip to ensure the correct water chemistry is maintained (primarily for the steam generators). This procedure directs the reactor to be tripped when the conductivity at the condensate pump discharge (upstream of the demineralizers) is equal to or greater than 1 Micromho. This is very conservative since in most cases the condensate demineralizers are capable of cleaning up the impurities to acceptable levels.

IV. Corrective Action

The following corrective action(s) have been completed:

1. Chlorides were flushed from the Steam Generator Blowdown System prior to placing the system in service.

2. Operations Procedure OP 3316C, "Steam Generator Blowdown" was revised to ensure the blowdown receiver tank does not reach vacuum conditions during removal from service.

The following corrective action(s) will be performed:

1. Revise appropriate operating procedures to incorporate new criteria for manual trip of reactor on high condensate discharge conductivity by December 15, 1998.

V. Additional Information

A similar salt water intrusion event, which did not result in a plant trip, occurred in November 1993. Plant Information Report (PIR) 3-93-319 determined that salt water intrusion resulting from a pressure differential in the blowdown system allowed the siphoning of sea water into the condensate system. Corrective actions recommended modification of the procedure (OP 3316C) to preclude salt water intrusion. This corrective action was never performed. Although the action was listed to be incorporated into Revision 7 of the procedure, this never happened. It appears that the action was inadvertently left out of the procedure and not caught by the reviewers. The Corrective Action program has undergone extensive changes since this 1993 event. A review of corrective actions for significant plant transients and/or trips since 1990 is ongoing to identify/rectify any corrective actions which may not have been implemented. This review is being tracked under the Millstone Corrective Action Program.

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Similar Events

No similar events occurred during the last two years when the unit was shutdown since the unit was in an extended outage.

Manufacturer Data

EIIS Codes

Systems:

Condensate System.....SD
Condensate Demineralizer System.....SF
Condenser System.....SG
Sampling and Water Quality System.....KN

Components:

Valve.....V
Valve, Level, Control,.....LCV