PSE&G

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Nuclear Business Unit

NOV 29 1995

LR-N95221

U. S. Nuclear Regulatory Commission
Document Control Desk
Washington, DC 20555

Attn: Document Control Desk

Dear Sir:

HOPE CREEK GENERATING STATION
LICENSE NO. NPF-57
DOCKET NO. 50-354
UNIT NO. 1
LICENSEE EVENT REPORT NO. 95-026-00

This Licensee Event Report entitled "Shutdown LCO Action Statement Entered Due to Inoperable Accumulator Trouble Annunciator" is being submitted pursuant to the requirements of the Code of Federal Regulation 10CFR50.73(a)(2)(i)(B).

Sincerely,

M. E. Reddemann
General Manager
Hope Creek Operations

Attachment LER
SORC Mtg. 95-112
RJB

c Distribution
LER File 3.7

050121

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

LICENSEE EVENT REPORT (LER)

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

APPROVED BY OMB NO. 3150-0104
EXPIRES 0-4/30/98
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-5 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.

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
Hope Creek Generating Station	05000354	1 of 9

TITLE (4)

Shutdown LCO Action Statement Entered Due to Inoperable Accumulator Trouble Annunciator

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
10	26	1995	95	026	00	11	29	1995		05000
									FACILITY NAME	DOCKET NUMBER 05000

OPERATING MODE (9)	1	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more) (11)			
POWER LEVEL (10)	092	☐ 20.2201 (b)	☐ 20.2203 (a)(2)(v)	☒ 50.73 (a)(2)(i)(B)	☐ 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 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)
Harlan Hanson, Assistant Manager, Shift Operations	(609) 339-3005

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

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABL TO NPRDS		CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABL TO NPRDS
				N						

SUPPLEMENTAL REPORT EXPECTED (14)		EXPECTED SUBMISSION DATE (15)	MONTH	DAY	YEAR
☒ YES (If yes, complete Expected Submission Date)	☐ NO		02	01	1996

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

On 10/20/95, with reactor power at 94%, it was discovered during a weekly control rod Technical Specification (TS) surveillance test that the Reactor Manual Control System (RMCS) Display Memory Module (DMM) did not update rod position information changes. Hope Creek was in the end of cycle coast-down with all rods full out. During that test, the insert push-button was depressed. There was no indication that the rod had moved on the Four Rod Display or the Full Core Display. It was later determined that the control rods had moved and the RMCS system was in a locked-up condition. The RMCS DMM failure occurred again on 10/26. Failure of the RMCS renders the Control Rod Scram Accumulator alarm inoperable. The Operator entered the applicable LCO shutdown statement for an inoperable control rod scram accumulator alarm indicator. Entry into the LCO shutdown action statement may constitute operation in a condition prohibited by the TS. The basis for reportability is considered conservative and under review at the time of issuance of this report. This is reportable in accordance with 10 CFR 73(a)(2)(i)(B). The RMCS was declared operable prior to effecting any shutdown actions. The cause of the condition at this time is attributed to failure to maintain the power supplied within required tolerances. Corrective actions include operator training, operator and maintenance procedural enhancements, further hardware investigations and hardware modifications to the RMCS.

Plant and System Identification

General Electric -Boiling Water Reactor (BWR/4)
Annunciator System, EIIS Identifier - AB

Identification of Occurrence

Event Date:	October 20, 1995 October 26, 1995
Date determined to be Reportable	October 30, 1995
Report Date:	November 29, 1995

Description of Occurrence

On 10/20/95, at 2104 hours, a weekly Control Rod Drive exercise, was initiated. This surveillance test fulfills Technical Specification (TS) requirement 4.1.3.1.2 for control rod operability. Rod, 02-19 was selected. The Reactor Operator (RO) gave an insertion command for the rod. The insertion command caused no response in rod position indication on the Four Rod Display (FRD) or the Full Core Display (FCD). The FRD still indicated Position 48 and the FCD red light signifying rod full out was still illuminated. Furthermore the insert and settle lights on the Rod Select Module (RSM) did not illuminate indicating no rod movement. The RO perceived that either the insert push-button contacts were dirty or the push-button was not depressed fully.

The RO gave another insert command to rod 02-19 and subsequently 10-11, with similar results, again failing to notice that the rod select light on the FCD for the selected rod was not illuminated. The RO communicated the condition to the Work Control Nuclear Shift Supervisor (WC NSS) who witnessed the next insert command. It was noted that control rod, 42-03, was indicating "selected" on the FCD even though rod 02-19 was selected on the RSM. Insertion of rod 42-03 was attempted and also failed to indicate any movement on the FCD, FRD or RSM. The LCO action statement was entered for TS 3.1.3.7 due to the inoperability of the control rod position indication system.

The WC NSS noticed the inserted rod positions on the NSSS computer. Rod 02-19 had been inserted three notches to position 42 and both rods 10-11 and 42-03 had been inserted one notch to position 46. It was not known to the Operations shift that TS 3.1.3.5 for the control rod scram accumulators was applicable at this time (due to the loss of annunciation) for this mode of RMCS fault.

Description of Occurrence (Cont'd)

At the same time the NSS entered abnormal procedure HC.OP-AB.ZZ-106(Q) due to the symptom of an RMCS fault. The determination was made that T/S 3.1.3.7 should not have been invoked and was changed to tracking since both the NSSS computer and Control Room Integrated Display System (CRIDS) contained rod position information.

The fault/status lights on the RMCS were checked. The status lights on each card indicated that the clock was inoperable. Prior to troubleshooting, the three rods previously inserted were withdrawn at 2133 using the NSSS computer for rod position indication.

At 2228, the Display Memory Module (DMM) logic 5V power supply was down-powered and the source selector and display clock cards were re-seated. The Operator entered TS LCO 3.1.3.5 (control rod scram accumulators) because the control rod scram accumulator alarms were inoperable during the time the FCD was down-powered. When the system was re-powered, the two HCU Accumulator alarms came in which alerted the operators to the fact the HCU accumulator alarms had been inoperable during the RMCS lock-up.

Several control rods were selected and the FCD rod select light was verified to be correctly indicating the selected rod. Until the problem has been verified to be corrected a temporary log was set up to select a different rod every hour to verify that RMCS has not locked-up and the HCU accumulator alarms remain operable.

On 10/26/95, at 1708, while Hope Creek was at approximately 92.4% power, and during the performance of the temporary log rod selection process, RMCS was again found to be in a locked-up condition. The four lights indicating the clock inoperable condition were lit. The Operator entered LCO 3.1.3.5 for HCU accumulator alarms and complied with the "otherwise, be in at least HOT SHUTDOWN within 12 hours" action statement. There were no attempts at rod motion during this instance of RMCS lockup.

The "Volts OK/Low" light on the 5V power supply was lit indicating that the voltage was below the low voltage setpoint. While attempting to take voltage readings, the locked-up condition cleared itself. Recorders were hooked up to continuously monitor voltages to narrow down the location of the failure should it reoccur. At 1927, after evaluation and discussion, the DC buffer card was replaced. At 2225 the LCO was changed back to tracking status due to the clearing of the fault in the RMCS and the twelve hour LCO was exited prior to effecting any shutdown actions.

Description of Occurrence (Cont'd)

There have since been no known lock-ups of the RMCS system attributed to the DMM. The cause of the equipment failure is still under investigation. There have been multiple failures of the Rod Position Indication System between October 21 and October 28, 1995. These failures appear to be caused by the transponder cards or Branch Junction Modules and potentially unrelated to the DMM failures which occurred on November 20 and 26, 1995.

Analysis of Occurrence

The Operator failed to verify and validate the position or movement of the control rods by alternate means when he did not receive the expected results from the insert signals. He verified the lack of movement on the FRD the FCD and the RSM which he believed were all independent sources of rod position indication.

The emphasis placed on control rod movement has been to avoid selecting and moving the wrong rod as these have been the most common and highly publicized events. The verification of the rod select light on the full core display is treated as a second check of the light on the RSM. A wrong assumption was made that the light on the full core display is merely a second check of the rod selection and not an indication of DMM lockup.

The operator wrongly assumed that the RMCS either gives annunciation of a fault and/or blocks all rod movement. This assumption is based upon the lesson plan which states in the general description section:

> "To prevent inadvertent operator errors, reactor performance and rod positions are constantly monitored by systems which either give an alarm demanding operator attention or completely block all rod movement until the error has been corrected."

Since the failure mode of the RMCS that has been identified in this event was not previously known to the operators or the training center personnel, the above statement was believed to be true. The operator is given a false sense of security that the rods are not going to move if RMCS has a fault. All of the shift personnel questioned were very surprised that a mode of failure like this was possible.

The RO believed the problem with the RMCS was a case of a fault in the insert push-button. This belief was based on past experience with the

Analysis of Occurrence (Cont'd)

push-buttons. The RO commented in his description of the event and many other operators have concurred that the push-button does not always work and dirty contacts has been the perceived mode of failure. Several push-buttons were replaced coming out of the last refueling outage and the 7/12/95 forced outage.

Other events that had the effect of rendering the HCU Accumulator Alarm inoperable include multiple failures of the Rod Position Indication System (RPIS) between 10/21 and 10/28/95. A review of these failures and appropriateness of operator actions will be performed and reported in a supplement to this LER.

Based on the evaluation to date, the maximum time that the "locked-up" DMM condition could have existed is 13.5 hours. This information was derived based on log data and interviewing the RO on that shift.

On 10/26, the operators entered the "shutdown" statement of the LCO 3.1.3.5. The RMCS system was in a locked-up condition for a maximum of 58 minutes before the operators discovered the condition. This was determined to be potentially reportable on Monday, October 30, 1995. The basis for reportability is considered conservative and under review at the time of issuance of this report. The basis for reportability will be re-affirmed or changed as required in the supplement to this LER.

Prior Similar Occurrences

A similar hardware failure occurred in 1990 wherein the FCD did not respond to selected rods. The source selector, clock, DC buffer and receiver cards were removed and re-seated. No evidence of a recurrence of this problem from 1990 to 1995 was found in the search.

An external Operating Event (OE) 6600, dated April 28, 1994, "Control Rod Position Indication Did Not Reflect Rod Movement". The event describes a situation where an insert command was given to a control rod but the control rod position indication did not change. The fault was attributed to a power supply for the FRD that had drifted high. The OE recommended a hardware fix that was already a Design Change Request (DCR) at Hope Creek. This hardware fix would enable the overhead annunciator to identify the inoperable DMM. The DCR was written and proposed in May of 1990. Due to the relatively low score the DCR received on the NBU Resource Allocation Process Priority Score Sheet, the proposed modification has been deferred for three refueling outages.

Cause of the Occurrence

Equipment

The root cause of the hardware failure is not fully determined at this time. It is suspected that a low voltage condition exists at the card matrix which could include one or more of the following:

1. the Rod and Detector display 5VDC Power Supply voltage are not set within the required range. It was determined that no Preventive Maintenance previously existed to verify power supply voltage, and/or
2. the Rod and Detector display may have incorrect setpoints or the setpoints may have drifted such that the output exceeds one of the trip setpoints, or
3. excessive voltage drop between the power supply and the card matrix

A significant contributing causal factor for rod mispositioning included the lack of positive failure indication to the operator of an inoperable RMCS DMM. This includes the low priority given to the design change to install an indicator and the deferment of its installation.

Human Performance and Training Issues

Significant causal factors associated with operator actions include:

- The RO and the WC NSS attempted to continue the surveillance test despite problems with the RMCS. The attempt to continue overstepped the bounds between diagnostics and troubleshooting.
- The RO failed to verify and validate the position or movement of the control rods when he did not receive the expected results from the insert signals.
- The RO failed to check the select light on the full core display. Written direction is provided in the system operating procedure for RMCS.

Other contributing causal factors associated with operator actions include:

- the RO believed the RMCS problem was a case of a fault in the insert push-button. This belief was based on past experience with the push-buttons,
- the RO wrongly assumed that the RMCS either gives annunciation of a fault and/or blocks all rod movement. This is a result of an inadequate training lesson plan,

Cause of the Occurrence (Cont'd)

Human Performance and Training Issues (Cont'd)

- the failure to identify the inoperability of the HCU Accumulator is attributed to a failure to understand that the control rod scram accumulator alarm shared the same circuitry as the RMCS, and
- the OE or the previous failures at Hope Creek were not incorporated into the lesson plan or the simulator training. Had the experience been incorporated into training, the errors associated with repeated rod positioning attempts may not have occurred.

Safety Significance

The safety significance of this event was minimal under these core conditions. However under different core conditions and with much more severe rod mispositionings this scenario could have led to localized fuel damage. Nothing that occurred in the event degraded the ability of the reactor to reach a safe shutdown condition.

The Accumulators were operable throughout this event. The as-found nitrogen pressure within the Accumulators was well above the minimum limit of 940 psig required by the TS and fully capable of performing their intended design function.

In the event that it is postulated that all of the accumulators became depressurized, the Control Rod Drive (CRD) system would still have been capable of shutting down the reactor by scramming all control rods. In this case, the flange check valves in the CRD mechanisms open to apply reactor pressure below the control rod drive pistons. Scram time using only reactor pressure is only fractions of a second slower than with the accumulators.

Corrective Actions

1. Continue to investigate the cause of the locked-up condition of the RMCS. This investigation is anticipated to be completed by 2/1/96.

2. Prior to RFO6 restart, proper guidance and direction for identifying and rectifying the locked-up conditions will be provided to the ROs. This includes consulting the NSSS (or equivalent CRIDS screen) for rod position indication whenever the expected results are not achieved.

Corrective Actions

3. A rolldown of this event to all ROs will be completed prior to unit restart from the current refueling outage. This rolldown will include:
   - a brief description of this event,
   - reaffirmation of expectations regarding the use of system operating procedure guidance,
   - expectations regarding problem identification threshold when equipment is not functioning as designed,
   - stress the importance of qualification, validation and verification of control room indications, particularly when unexpected or uncertain conditions are observed.

4. Hourly verification will be performed of the RMCS system operability during OPERATIONAL CONDITIONS 1, 2, and 5* until such time that an RMCS inoperable condition alarm is installed or the cause of the RMCS failure is rectified.

   * at least each withdrawn control rod. Not applicable to control rods removed per Specification 3.9.10.1 or 3.9.10.2

5. An annunciator will be provided to identify a DMM inoperable condition. Following the installation, alarm response procedures and training modules will be changed to reflect the revised design.

6. Incorporate the RMCS failure into Operator simulator and classroom training and train all licensed operators. The following will be included in the training:

   - the purpose of verifying the rod select light on the FCD,
   - known failure mechanisms and their consequences that affect the Rod Select Module panel lights, the Full Core Display and the Four Rod Display,
   - cautions concerning reliance on using the FCD, FRD and/or the RSM as a means of checking the operability of the FCD, FRD and/or the RSM due to their lack of independence,
   - cautions concerning the lack of annunciation of the DMM failure until such time that the DCR is implemented,

Corrective Actions (Cont'd)

- the NSSS computer (or equivalent CRIDS screen) should be consulted for rod position indication whenever the expected results are not achieved, and
- caution that the HCU accumulator alarms are inoperable when the DMM locks up,
- the OE and previous failures at Hope Creek regarding the RMCS will be incorporated into the lesson plan or the simulator training, as appropriate and
- increased RO knowledge with respect to RMCS,
- identify the affected systems and components of a locked-up RMCS condition, including the affected TS LCO's (e.g. 3.1.3.5).

The above is expected to be completed by 6/30/96.

7. Review procedures for periodic maintenance on power supplies in TS applicable annunciator/display systems, and revise procedures as necessary, to ensure that periodic maintenance is performed to maintain the equipment within required tolerances.

8. The appropriate level of personnel accountability has been administered to the RO and NSS involved for failing to verify all control room indications.

Other events that had the effect of rendering the HCU Accumulator Alarm inoperable include multiple failures of the Rod Position Indication System (RPIS) between 10/20/95 and 10/28/95. A review of these failures and appropriateness of operator actions will be performed and reported in a supplement to this LER. The basis for reportability is considered conservative and under review at the time of issuance of this report. The basis for reportability will be re-affirmed or changed as required in the supplement to this LER.