



Public Service Electric and Gas Company P.O. Box 236 Hancocks Bridge, New Jersey 08038-0236

Nuclear Business Unit

JUN 11 1996

LR-N96165

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

Dear Sir:

HOPE CREEK GENERATING STATION  
DOCKET NO. 50-354  
UNIT NO. 1  
LICENSEE EVENT REPORT NO. 96-008-01

This Licensee Event Report supplement entitled "Plant Operation With Control Rod Withdrawal Speeds Outside of Design Basis Due to Mis-Adjustment of the Control Rod Drive System Flow Control Needle Valves" is being submitted pursuant to 10CFR50.73(a)(2)(ii)(B).

Sincerely,

Clay Warren  
Acting General Manager -  
Hope Creek Operations

JWK  
SORC Mtg. 96-058

C Distribution  
LER File

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The power is in your hands.

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Attachment A

The following items represent the commitments that Public Service Electric & Gas is making to the Nuclear Regulatory Commission relative to LER 354/96-008-01. The commitments are as follows:

1. Hope Creek procedure HP.OP-FT.BF-0001(Q) will be revised to ensure that as found rod speeds are adjusted to within 10% of the allowed value, require that all rods are stroke timed at least once per 18 months, and incorporate the UFSAR values for withdrawal speed. This procedure revision will be implemented by June 14, 1996.
2. A review of GE Technical Information (GEKs) applicable to operation, maintenance, and testing of the CRD system will be performed to ensure plant procedures are consistent with vendor recommendations. This review will be completed by June 13, 1996.
3. The sections of the UFSAR pertaining to the CRD system will be reviewed to ensure consistency with plant implementing procedures. This review will be completed by June 27, 1996.
4. Licensed operator training materials will be updated to include discussions on rod withdrawal speed limits. This action will be completed by August 1, 1996.
5. An UFSAR change notice will be completed by June 11, 1996, to improve section 4.6 regarding the basis for the 6.0 ips maximum obtainable withdrawal speed.

NRC FORM 366 (4-95)			U.S. NUCLEAR REGULATORY COMMISSION			APPROVED BY OMB NO. 3150-0104 EXPIRES 04/30/98				
<b>LICENSEE EVENT REPORT (LER)</b>  (See reverse for required number of digits/characters for each block)										
FACILITY NAME (1) <b>Hope Creek Generating Station</b>						DOCKET NUMBER (2) <b>05000354</b>		PAGE (3) <b>1 OF 6</b>		
TITLE (4) <b>Plant Operation With Control Rod Withdrawal Speeds Outside of Design Basis Due to Mis-Adjustment of Control Rod Drive System Flow Control Needle Valves</b>										
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
05	10	92	96	-- 008	-- 01	06	11	96	FACILITY NAME	DOCKET NUMBER
OPERATING MODE (9)		4	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more) (11)							
POWER LEVEL (10)		0	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)		X 50.73(a)(2)(ii)(B)		50.73(a)(2)(x)	
			20.2203(a)(2)(i)		20.2203(a)(3)(iii)		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 <sup>0</sup> (1)		50.73(a)(2)(v)		Specify in Abstract below or in NRC Form 366A	
			20.2203(a)(2)(iv)		50.36 <sup>0</sup> (2)		50.73(a)(2)(vii)			
LICENSEE CONTACT FOR THIS LER (12)										
NAME <b>John W. Karrick, Hope Creek LER Coordinator</b>								TELEPHONE NUMBER (Include Area Code) <b>(609) 339-5298</b>		
COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)										
CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPDs		CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPDs
SUPPLEMENTAL REPORT EXPECTED (14)						EXPECTED SUBMISSION DATE (15)		MONTH	DAY	YEAR
YES (If yes, complete EXPECTED SUBMISSION DATE).					X	NO		XX	XX	XX
ABSTRACT (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines) (16)										
<p>On March 14, 1996 it was discovered that on various past occasions, the Hope Creek Generating Station had operated outside of the plant's design basis for control rod withdrawal speeds. These occurrences involved operation with control rod withdrawal speeds that were faster than the design basis assumptions used in the analysis for a Rod Withdrawal Error. The cause of the excessive withdrawal speeds was mis-adjustment of the Control Rod Drive system's flow control needle valves. Contributing factors were procedural inadequacy and insufficient operator training. Operation of the plant in the power range with the rod withdrawal speeds outside of their specified values did not, nor could it have resulted in a violation of the Minimum Critical Power Ratio (MCPR) safety limit. Operation with the faster withdrawal speeds in the startup range is bounded by an assessment of analyses for Rod Withdrawal Errors which has been provided by General Electric. Corrective actions include revisions to the procedure used to adjust the rod speeds, improved operator training, increased rod speed testing, and a review of vendor and UFSAR information pertaining to the Control Rod Drive System.</p>										

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

## PLANT AND SYSTEM IDENTIFICATION

General Electric - Boiling Water Reactor (BWR/4)  
Control Rod Drive System (CRD) (EIS Identifier AA)

## IDENTIFICATION OF OCCURRENCE

Event Date(s): May 10, 1992 and August 5, 1994  
Discovery Date: March 14, 1996

## CONDITIONS PRIOR TO OCCURRENCE

Discovery Date: OPERATIONAL CONDITION 5 (Refueling). There were no structures, systems, or components that were inoperable at the start of this event that contributed to this event.

## DESCRIPTION OF OCCURRENCE

On March 14, 1996, a discrepancy was discovered by an NRC inspector between the Hope Creek Generating Station (HCGS) Rod Withdrawal Error analysis in the Updated Final Safety Analysis Report (UFSAR) and the procedure that is used to adjust control rod withdraw speeds [HC.OP-FT.BF-0001(Q)]. The Rod Withdrawal Error analysis assumes a withdrawal speed of 3.6 inches per second, which corresponds to a stroke time of 40 seconds for a rod to withdraw its full length (144 inches). The procedure allowed a minimum stroke time of 39 seconds, which was a less conservative value than what the analysis assumed.

A review of as found data for the control rod stroke time tests performed during Refuel Outage (RFO) 6 revealed that 15 of the 185 control rods had stroke times less than 39 seconds and 5 other rods had times that fell between 39 and 40 seconds. None of the 15 rods that were less than 39 seconds had speeds faster than 28.8 seconds or a rate of greater than or equal to 5.0 inches per second. These 20 control rods were all adjusted to a value greater than 43.2 seconds prior to startup from RFO 6.

An assessment of Rod Withdrawal Error (RWE) analyses performed by General Electric for other plants, which was determined to be applicable to Hope Creek, indicates that changes to rod withdraw speeds from 3.0 to 5.0 inches per second are bounded within the margins of the RWE analysis.

During investigation of this event, data from previous control rod withdraw speed testing was reviewed. The results of this review indicated that the withdrawal speed for control rod 10-35 during a plant startup conducted on August 4, 1994, was 26.4 seconds which is equivalent to a rate of 5.5 inches per second. Additionally, on May 10, 1992, control rod 22-35 was documented as having a withdrawal speed of 28.8 seconds which is equivalent to a rate of 5.0 inches per second.

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## TEXT

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

Previous operation of the plant with control rod withdrawal speeds faster than the value in the UFSAR RWE analysis constituted operation outside of the design basis of the plant and is being reported pursuant to 10CFR50.73(a)(2)(ii)(B).

Control rod 10-35 was adjusted to 46.8 seconds on August 5, 1994, one day after the startup. Control rod 22-35 was adjusted to 51.8 seconds on October 12, 1992, after work was performed during RFO 4. The delay between discovery of the rod 22-35 out of specification condition and implementation of corrective actions was approximately 5 months.

Several other control rods were identified as having as left stroke times between 39.0 and 40.0 seconds during past refuel outages. It is recognized that these were also outside of the assumptions in the Hope Creek UFSAR RWE analysis, but as stated above, the GE review of this data indicated that these rod speeds are bounded by the margins in the RWE analysis.

## ANALYSIS OF OCCURRENCE

Adjustments to the withdraw speed is normally accomplished by adjusting the flow control needle valve (FCV) that is integral to the design of the CRD system's directional control valves. It has been concluded that for rod 10-35, an adjustment was made to the FCV at some time prior to August 5, 1994, that caused the increased rod speed. This conclusion is supported by the fact that the rod speed was returned to within specifications by re-adjusting the FCV without any other work on the rod drive mechanism.

Control rod 22-35 was stroke timed at power on May 10, 1992 as a result of a work order written because of observed double notching. The as found stroke time was 31.2 seconds; a rate of 4.6 inches per second. In this case, the rod speed was not able to be adjusted to a slower value because the rod was unable to be stroked if the FCV was throttled any further. After several attempts were made at lowering the speed, the FCV was throttled to an as left value that corresponds to 28.8 seconds and a rate of 5.0 inches per second. Control rod 22-35 was ultimately restored to design requirements on October 12, 1992.



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## APPARENT CAUSE OF OCCURRENCE

The apparent cause of the excess withdraw speed for control rod 10-35 is the mis-adjustment of the flow control needle valve. This conclusion was drawn by evaluating and eliminating other causes of an increased withdrawal speed. This occurred at some time between October 20, 1992 and August 5, 1994, most probably during a startup evolution to free the rod. This apparent cause is also supported by the following: (1) The rod was recorded as having double notched three times during the August 4, 1994 startup. (2) Once the FCV was properly set on August 5, 1994, the stroke time remained satisfactory when next tested on March 8, 1996 during RFO 6. (3) The rod has not double notched since its speed was properly set on August 5, 1994.

The apparent cause of the excess withdraw speed for control rod 22-35 is also mis-adjustment of its flow control needle valve. However, it is known that this FCV was throttled open to this position on May 10, 1992 in order to prevent rod sticking. The cause of the control rod sticking was later determined to be from leaking directional control valves which were repaired on October 12, 1992, during RFO 4. After these repairs, control rod 22-35 was adjusted to be within acceptable withdrawal speeds and no further sticking was observed. Subsequent stroke times measured during RFO 6 were satisfactory.

The fact that rod 22-35 had been left with a withdrawal speed outside of design basis for approximately 5 months represents a failure to correct a condition adverse to quality in a timely manner. This failure is attributed to the following:

1. No deficiency report (DR) was generated when the rod was recorded with an out of specification withdrawal speed.
2. Personnel were not familiar with the impact of rod withdrawal speed on design basis assumptions.
3. Personnel involved in this issue (Shift Supervisor and CRD system engineer) focused only on the double notching and consequently failed to recognize the implications of the as-left rod speed.

A contributing factor was that Operations training did not address rod speed requirements or the adverse affects associated with excessive withdrawal speed.

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The apparent cause of the other rods that had as left values faster than 40.0 seconds was normal wear of the control rod drive mechanisms (CRDM), which tends to increase stroke speed over time. A contributing factor associated with these rod withdrawal speed problems was a discrepancy in the procedure used for testing and adjusting withdrawal speeds (HC.OP-FT.BF-0001Q). The procedural discrepancy was an incorrect allowable range for as found withdrawal speeds of 39-57 seconds. It has been concluded that this range was derived using a target stroke time of 48 seconds with a 20% tolerance versus the vendor recommendation (GEK) of 10%. The use of the 10% tolerance would have resulted in stroke time adjustments to within 43-53 seconds; a value sufficiently above the 40 second UFSAR minimum. A second contributor was the length of time between stroke time tests. Some of the rods were not tested during RFO-5 which may have increased the effects of normal CRDM wear.

## ASSESSMENT OF SAFETY CONSEQUENCES AND IMPLICATIONS

Control rod withdrawal speed is an input to the Rod Withdrawal Error (RWE) transient analysis since the rate of reactivity addition effects energy deposition in the fuel bundle. For the analysis of a RWE in the startup range, it must be shown that the peak enthalpy criteria of 170 calories/gram is not exceeded and in the power range, the Minimum Critical Power Ratio (MCPR) safety limit is not violated. GE assessment was requested upon discovery of the rod withdrawal speed data during RFO-6.

The additional assessment evaluated the impact of rod speeds up to 8.0 inches per second (18.0 seconds total) which bounds all of the as found withdrawal speed data. Withdrawal speeds up to 8.0 inches per second in the startup range does not affect the conclusions of the Hope Creek UFSAR RWE analysis because the peak enthalpy criteria of 170 calories/gram is not exceeded. In the power range, the faster speed could possibly result in a small overtravel to the next Rod Block Monitor position. However, previous GE evaluations and a review of the RWE analysis show that this effect is less than a 0.01 change in Critical Power Ratio (CPR). The faster withdrawal speeds documented in this event could not have resulted in a violation of the MCPR safety limit in the power range or the RWE analysis for startup range operation.

The scram insertion times of the subject rods were not affected by the misadjustment of the FCVs; therefore, the ability of the control rods to scram was not affected by this condition.

It has been noted that the Hope Creek UFSAR, section 4.6.2.3.2.2, item 12 states, "Tests have shown that accidental opening of the speed control valve to the fully open position produces a velocity of approximately 6 in./s". Contrary to this, empirical plant data has shown that the maximum stroke

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speed with the flow control needle valve fully open is approximately 8 in./s. This apparent discrepancy between analytical and empirical data does not impact the subject issues of this report or the respective conclusions. Neither does it introduce any additional safety significance since it is bounded by the GE assessment which took into account speeds up to 8 in./s.

## PREVIOUS OCCURRENCES

There have been no previous similar events involving the Control Rod Drive system in the last three years at the Hope Creek Generating Station.

## CORRECTIVE ACTIONS

1. All rods were properly set to within UFSAR limits.
2. Hope Creek procedure HP.OP-FT.BF-0001(Q) will be revised to ensure that as found rod speeds are adjusted to within 10% of the allowed value, require that all rods are stroke timed at least once per 18 months, and incorporate the UFSAR values for withdrawal speed. This procedure revision will be implemented by June 14, 1996.
3. A review of GE Technical Information (GEKs) applicable to operation, maintenance, and testing of the CRD system will be performed to ensure plant procedures are consistent with vendor recommendations. This review will be completed by June 13, 1996.
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5. Licensed operator training materials will be updated to include discussions on rod withdrawal speed limits. This action will be completed by August 1, 1996.
6. An UFSAR change notice will be completed by June 11, 1996, to improve section 4.6 regarding the basis for the 6.0 ips maximum obtainable withdrawal speed.

PSE&G is confident in the implementation of the current Corrective Action Program to promptly identify and correct deficiencies such as those described above concerning rod 22-35. Effective implementation of this new process precludes situations such as the 5 month delay in completing corrective action without an appropriate design basis review.