November 5, 2004

Mr. A. Christopher Bakken, III
President and Chief Nuclear Officer
PSEG Nuclear LLC - N09
P. O. Box 236
Hancocks Bridge, NJ 08038

SUBJECT: HOPE CREEK NUCLEAR GENERATING STATION – NRC SUPPLEMENTAL INSPECTION REPORT 05000354/2004011

Dear Mr. Bakken:

On September 24, 2004, the U. S. Nuclear Regulatory Commission (NRC) completed a supplemental inspection at your Hope Creek Station. The enclosed report documents the inspection results which were discussed on September 24, 2004, with Mr. M. Brothers and Mr. J. Carlin and other members of your staff.

The NRC performed this supplemental inspection to assess your evaluation of a low to moderate (White) safety significant finding involving a station service water traveling screen failure which occurred on July 1, 2003. This was a self-revealing event which involved performance deficiencies with inadequate maintenance procedures and a failure to adhere to procedural instructions. The supplemental inspection was conducted to determine if the root and contributing causes of the White finding were understood, to assess the extent of the condition review, and to determine if the corrective actions were sufficient to address causes and prevent recurrence. The inspection was conducted in accordance with Inspection Procedure 95001, "Inspection For One Or Two White Inputs In A Strategic Performance Area," and examined activities conducted under your license as they relate to safety and compliance with the Commission's rules and regulations and with the conditions of your license.

Based on the results of this inspection, we concluded that you have adequately completed a root cause analysis of the performance deficiencies surrounding the event and have identified appropriate corrective actions. No findings of significance were identified concerning the root cause evaluation and corrective actions. Given your acceptable performance in addressing the traveling screen failure, the White finding associated with this issue will only be considered in assessing plant performance for a total of four quarters in accordance with the guidance in Inspection Manual Chapter (IMC) 0305, "Operating Reactor Assessment Program."

In accordance with 10 CFR 2.390 of the NRC's "Rules of Practice," a copy of this letter and its enclosure will be available electronically for public inspection in the NRC Public Document Room or from the Publicly Available Records (PARS) component of NRC's document system (ADAMS). ADAMS is accessible from the NRC Web site at http://www.nrc.gov/reading-rm/adams.html (the Public Electronic Reading Room).

Sincerely,

/RA/

Lawrence T. Doerflein, Chief
Safety Systems Branch
Division of Reactor Safety

Docket No: 50-354
License No: NPF-57

Enclosure: Inspection Report 05000354/2004011
w/Attachment: Supplemental Information

cc w/encl:
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J. T. Carlin, Vice President - Nuclear Assessment
M. Gallagher, Acting Vice President - Engineering and Technical Support
W. F. Sperry, Director - Business Support
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U.S. NUCLEAR REGULATORY COMMISSION

REGION I

Docket No:	05000354
License No:	NPF-57
Report No:	05000354/2004011
Licensee:	PSEG LLC
Facility:	Hope Creek Nuclear Generating Station
Location:	P.O. Box 236 Hancocks Bridge, NJ 08038
Dates:	September 20 – September 24, 2004
Inspectors:	F. Arner, Senior Reactor Inspector, DRS T. Wingfield, Reactor Inspector, DRP (In Training)
Approved By:	Lawrence T. Doerflein, Chief Safety Systems Branch Division of Reactor Safety

SUMMARY OF FINDINGS

IR 05000354/2004011; 09/20/2004 – 09/24/2004; Public Service Electric Gas Nuclear LLC, Hope Creek Generating Station; Supplemental Inspection; IP 95001, "Inspection For One Or Two White Inputs In A Strategic Performance Area."

The inspection was conducted by two regional inspectors. The NRC's program for overseeing the safe operation of commercial nuclear power reactors is described in NUREG-1649, "Reactor Oversight Process," Revision 3, dated July 2000.

Cornerstone: Mitigating Systems

The NRC performed this supplemental inspection to assess PSEG's evaluation of a low to moderate (White) safety significant finding involving a station service water traveling screen failure which occurred on July 1, 2003. This was a self-revealing event which involved performance deficiencies with inadequate maintenance procedures and a failure to adhere to procedural instructions.

PSEG's evaluation of the issue included an apparent cause evaluation which addressed corrective actions relative to the traveling water screen equipment failures. PSEG subsequently performed a formal, structured root cause evaluation to identify the root and contributing causes associated with the screen failure. The root cause evaluation was thorough and documented weaknesses with associated traveling screen maintenance procedures, the spare part refurbishment process, procedural and general work practice adherence, traveling screen load cell equipment reliability, and the preventive maintenance deferral of the traveling water screen.

Based on the results of the inspection, the inspectors concluded that PSEG had adequately completed a root cause evaluation of the performance deficiencies associated with the event and completed and planned corrective actions were reasonable to address the related causes. Given PSEG's acceptable performance in addressing the traveling screen failure, the White finding associated with this issue will only be considered in assessing plant performance for a total of four quarters in accordance with the guidance in IMC 0305, "Operating Reactor Assessment Program."

REPORT DETAILS

01 Inspection Scope

The U.S. Nuclear Regulatory Commission (NRC) performed this supplemental inspection to review and assess PSEG Nuclear's evaluation of the root and contributing causes specific to the July 1, 2003 Hope Creek "A" service water "traveling screen" failure. This failure had resulted in a low to moderate nuclear safety impact as assessed through the NRC significance determination process. The inspection included a review of associated evaluations (Orders) and notifications related to the service water system. The inspectors performed a plant walkdown of the traveling water screens, completed interviews with selected PSEG staff relative to the event, and attended a corrective action review board (CARB) meeting which involved a self-identified revision to the original root cause evaluation. The inspectors reviewed the facts associated with the event to assess whether PSEG's evaluations had considered and developed corrective actions for both the root and contributing causes for the performance deficiencies identified.

Background

The traveling screens at Hope Creek are continuously run while the respective in-line service Water pump is in-service. These screens are comprised of a head shaft with three sprockets mated by separate 316 stainless steel keys. The outermost sprocket is driven by a chain drive attached to a 5 horsepower motor, providing the driving force to rotate the head shaft. The other two sprockets are located within the traveling screen structural framing and are aligned to the basket carrier chains to provide the rotation to the screen baskets.

02 EVALUATION OF INSPECTION REQUIREMENTS

02.01 Problem Identification

a. Determination of who identified the issue and under what conditions

The "A" station service water traveling screen was out of service from June 20 through 26, 2003, to perform corrective maintenance. The work included replacement of the screen head-shaft and sprockets. The screen was returned to service on June 26, 2003. On June 28, the shear pin on the "A" service water screen motor failed and was replaced. Subsequently, on July 1, 2003, a self-revealing finding occurred when the "A" service water traveling screen stopped rotating due to the head-shaft shifting laterally and binding the screen. The screen failure was detected by the traveling water screen motionless alarm and was initially investigated by operations and maintenance personnel.

PSEG staff performed an apparent cause evaluation under Order 70032466 and a subsequent root cause evaluation which identified various direct, root and contributing causes of the event.

b. Determination of how long the issue existed and prior opportunities for identification

PSEG's apparent cause evaluation and subsequent root cause evaluation (RCE) determined that less than adequate procedural guidance had resulted in the inappropriate modification to the "A" traveling screen drive sprocket mating key. The key had been cut such that inadequate surface contact area existed after maintenance rework which had been completed on June 26, 2003. The inspector determined that the root cause evaluation of the issue (condition report 70039048, revisions 0 and 1) appropriately recognized that a missed opportunity to identify the degraded condition with the screen had occurred on June 28, 2003, (several days after the maintenance rework) when a run shear pin failed causing the screen to stop rotating. The RCE identified that the screen was capable of supporting only 5 days of operation prior to failing with the new head shaft in place.

c. Determination of the plant-specific risk consequences and compliance concerns associated with the issue

PSEG's evaluation referenced that the performance deficiencies associated with the loss of the traveling screen were assessed as having a low to moderate importance to safety (White), in accordance with the NRC significance determination process. The evaluation referenced the NRC Notice of Violation issued on May 10, 2004, in accordance with 10 CFR50 Appendix B Criterion V, "Instructions, Procedures and Drawings." The violation involved inadequate procedure guidance, failure to follow procedure guidance, and failure to document work performed. In addition to this, the RCE documented the site specific regulatory basis and business imperative for having procedures, and general expectations for the procedure program, including procedure use and adherence contained in NC.NA-AP.ZZ-0001(Q) –Rev. 15, Nuclear Procedure Program (NAP-01).

The inspectors concluded that PSEG's evaluation appropriately documented the regulatory compliance considerations of the issue.

02.02 Root Cause and Extent of Condition

a. Evaluation of methods used to identify root causes and contributing causes

PSEG utilized an event and causal factors chart to identify the events and conditions that led up to the event. PSEG also developed a fault tree analysis diagram to identify relationships among events and the probability of event occurrence.

PSEG identified one direct cause, three root causes, and four contributing causes. The maintenance technicians' combined actions of failing to properly tension the traveling screen carrier chain and cutting the drive-side head shaft sprocket key too short were the direct causes of the event. PSEG identified the following root causes: lack of ownership, responsibility, and accountability for timely refurbishment of spare parts; inadequate procedure development process; and failure to follow established work practices. Additionally, PSEG identified the following four contributing causes: use of

inaccurate load cells during tensioning of the traveling screen carrier chain; inadequate use of a questioning attitude, self-checking, and verification techniques; personnel knowledge deficiencies and inexperience; and inadequate technical information contained in maintenance procedures.

The inspectors reviewed the root cause analysis methods employed and concluded that a formal, structured approach was utilized to identify root and contributing causes.

b. Level of detail of the root cause evaluation

The inspectors determined that the root cause evaluation was conducted to a sufficient level of detail. PSEG's evaluation was self critical and identified weaknesses in the following areas: carrier chain tensioning method; sprocket key modification; preventive maintenance (PM) deferral process; spare part refurbishment control program; maintenance procedural development process; procedural adherence; load cell equipment reliability; general work practice adherence; and, pre-job brief consideration of first-time or infrequently performed evolutions.

c. Consideration of prior occurrences of the problem and knowledge of prior operating experience

The inspectors determined that PSEG included sufficient consideration of prior occurrences of similar problems and other operating experience. PSEG's evaluation included the review of over 100 Hope Creek and Salem corrective action program notifications related to the service and circulating water systems. The evaluation also included a review of 25 Institute of Nuclear Power Operations (INPO) operating experience event reports.

d. Consideration of potential common causes and extent of condition of the problem

The inspectors found that PSEG's evaluation properly addressed the extent-of-condition through the following corrective actions: revision of the traveling screen maintenance procedure to include specific sprocket key insertion length dimension requirements; development of a program to improve ownership of spare part refurbishment; an extent-of-condition review of PM deferrals; a review of the PM deferral process; a review of the procedure writing program to evaluate technical accuracy; an extent of condition review of system maintenance procedures for evaluation of critical parameters; reinforcement of the fundamental behaviors of Stop, Think, Act, and Review (STAR) and self-check; emphasis of work package documentation expectations; and, revision of the maintenance pre-job brief template to address first-time and infrequently performed evolutions.

The inspectors found that PSEG's evaluation adequately addressed extent-of-condition in that the identified causes were evaluated across departments, for different programmatic activities, for human performance, and for different types of equipment.

02.03 Corrective Actions

a. Appropriateness of corrective actions

PSEG staff initiated Notification 20150715 in response to the traveling water screen (TWS) motionless alarm received on July 1, 2003. A Technical Issues Resolution meeting was performed in accordance with applicable station procedures. The purpose of the meeting was to analyze possible causes of the head shaft failure and recommend solutions to correct the condition. The repair plan generated included replacement of the head shaft and draining the service water bay for inspection. In addition to the key failure, the system engineer and maintenance staff found a misaligned traveling screen foot shaft due to inadequate tensile load placed on the drive side carrier chain during work on the screen performed between June 19 and June 26, 2003. Immediate corrective actions included installing a new head shaft and load cells, and re-tensioning of the carrier chains in accordance with PSEG procedure HC.MD-PM.EP-0001 (Q), "Service Water Traveling Screen 12 Month Preventive Maintenance." The "A" TWS was returned to service on July 9, 2003 and was run for a 20 hour duration prior to declaring satisfactory operation.

PSEG staff performed an apparent cause evaluation, Order 70032466, which consisted of determining why the maintenance staff had cut the driven sprocket key too short to support the screen design requirements for operating loads and induced stresses. PSEG revised the appropriate maintenance procedure to preclude recurrence of a key failure by incorporating the proper design specification for contact surface area of the key. Additionally, procedures HC.MD-PM.EP-0001(Q) and HC.OP-SO.EP-0001(Q), "Service Water Traveling Screens System Operation," were revised to require operating the screen for a revolution utilizing a test pin if a normal shear pin has failed. This would allow for easier detection of mechanical binding since the test pin is weaker in strength and designed to fail earlier under conditions of mechanical screen binding. This action was also in response to the June 28, 2003 event where a TWS shear pin had failed and was replaced without identifying the cause leading to the subsequent failure several days later (July 1, 2003) of the screen.

PSEG staff subsequently performed a root cause evaluation within condition report 70039048. This analysis documented a direct cause of the event along with three root causes and four contributing causes. The corrective actions ranged from design control considerations, such as proposing a review of similar procedures to identify and determine if other critical component specifications need to be included in existing maintenance procedures, to parts issue evaluations and procedure adherence training. One of the root causes identified actions pertaining to ensuring that accountability and ownership is provided for spare parts refurbishment, such that preventive maintenance would not have to be deferred because of the lack of parts. In their review, PSEG determined that preventive maintenance had been deferred several times due to the lack of a spare TWS, as parts had been used for emergent issues on the other traveling screens. Additionally, PSEG proposed corrective actions include a bench-marking effort of other top performing plants with respect to evaluating maintenance procedure writing guidelines.

The inspectors determined that initial corrective actions had addressed the equipment concerns and the corrective actions from the root cause evaluation addressed the root and contributing causes of the issue. The inspectors found the completed and proposed corrective actions to be reasonable with regard to addressing the performance deficiencies identified with respect to the issue.

b. Prioritization of corrective actions

Prioritization of the corrective actions was not directly based on risk perspectives or analysis, but rather based on a deterministic approach considering the significance of the problem. The inspectors reviewed the prioritization of the corrective actions and verified that actions of a generally higher priority were scheduled for completion in a reasonable time-frame. This included actions which had been completed with regard to timely revision to the maintenance procedure to address the direct cause with regard to clarifying the proper specification for sprocket key insertion.

c. Establishment of schedule for implementing and completing corrective actions

PSEG's corrective actions and proposed corrective action plan provided dates for completion of corrective actions described in their root cause evaluation. The inspectors reviewed the proposed schedule and determined that the corrective actions could reasonably be accomplished by the dates specified.

d. Establishment of quantitative and qualitative measures of success for determining the effectiveness of the corrective actions to prevent recurrence

The inspectors determined that the root cause evaluation included actions with regard to effectiveness reviews for completed and proposed corrective actions. The actions consisted of requirements to assess the effectiveness of corrective actions at a later date in order to determine if additional actions may be necessary. Additionally, senior management has increased their oversight of the broader programmatic issue of procedure adherence within the maintenance department which had been identified as an adverse trend by PSEG in July 2003.

03 Management Meetings

Exit Meeting Summary

The results of this inspection were discussed with Mr. M. Brothers and Mr. J. Carlin and other members of their staff at the conclusion of the inspection on September 24, 2004. The meeting was considered a Regulatory Performance Meeting in accordance with Manual Chapter 0305, "Operating Reactor Assessment Program," and focused on discussion involving the performance deficiencies associated with the issue and proposed corrective actions. No proprietary information was discussed.

ATTACHMENT 1

SUPPLEMENTAL INFORMATION

KEY POINTS OF CONTACT

J. Anthes, Service Water System Engineer
T. Carucci, Maintenance Superintendent
G. Delp, Reliability Analysis Engineer
C. Gilbert, Maintenance Planner
J. Hutton, Plant Manager
B. Thomas, Licensing Engineer
P. Tocci, Maintenance Manager
R. Zak, Inspector, New Jersey Bureau Of Nuclear Engineering

LIST OF ITEMS OPENED, CLOSED, AND DISCUSSED

Opened

None

Closed

50-354/03-05-02 EA-04-086	URI, NOV	Inadequate Procedure Adherence During Maintenance on the "A" Traveling Screen

LIST OF DOCUMENTS REVIEWED

Procedures

NC.CA-TM.ZZ-0004(Z) -Rev. 1, Root Cause Evaluation Template
HC.MD-PM.EP-0001(Q) -Rev. 13, Service Water Traveling Screen 12 Month Preventive Maintenance
HC.MD-PM.EP-0001(Q), Rev. 14, Service Water Traveling Screen Monthly and Bi Annual Preventive Maintenance
HC.MD-CM.EP-0003(Q), Rev. 11, Service Water Traveling Screens Overhaul and Repair
HC.MD-CM.EP-0003(Q), Rev. 12, Service Water Traveling Screen Overhaul and Repair
HC.OP-SO.EP-0001(Q), Rev. 15, Service Water Traveling Screens System Operation
NC.WM-AP.ZZ-0002(Q), Rev. 7, Corrective Action Process
NC.PM-DG.ZZ-0022(Z), Rev. 1, Material Repair Process Desk Guide
NC.WM-AP.ZZ-0000(Q), Rev. 6, Notification Process
SH.MD-DG.ZZ-0007(Z), Rev. 8, Maintenance Standards

Notifications

20157359, “A” SSW Traveling Screen shear pin
20150565, “A” SSW Traveling Screen shear pin
20150715, “A” SSW Traveling Screen motion
20147067, Thumping noise from ‘A’ Traveling Screen
20133942, “A” TWS noise
20187679, Preliminary White Finding for HC TWS

Orders

70032795, “B” Traveling Screen Potential Shear Pin Failure
70033178, “A” Traveling Screen Shear Pin Failure
70033881, “A” TWS lack of procedure/document control
70035149, Less than adequate maintenance practices
70037021, 1B-S-501 head sprocket
70037115, “C” SW TWS Washers Added Without Order
70039048, Preliminary White Finding for HC TWS
70032466, “A” SSW Traveling Screen Motionless

Other

CARB Meeting minutes, Root Cause Evaluation, September 21, 2004
Condition Report, Root Cause Evaluation 70039048, revisions 0 and 1, White Finding Service Water Traveling Screen

LIST OF ACRONYMS

CARB	Corrective Action Review Board
CFR	Code Of Federal Regulations
CR	Condition Report
HC	Hope Creek
INPO	Institute Of Nuclear Power Operations
NRC	Nuclear Regulatory Commission
PM	Preventive Maintenance
PSEG	Public Service Electric and Gas
RCE	Root Cause Evaluation
SSW	Station Service Water
STAR	Stop, Think, Act and Review
URI	Unresolved Item
TWS	Traveling Water Screen