U. S. NUCLEAR REGULATORY COMMISSION

REGION I

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Licensee:	Public Service Electric and Gas Company
Facility:	Hope Creek Nuclear Generating Station
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EXECUTIVE SUMMARY

Hope Creek Generating Station
NRC Inspection Report 50-354/98-08

This integrated inspection included aspects of licensee operations, engineering, maintenance, and plant support. The report covers a six-week period of resident inspection.

Operations

Several minor deficiencies were identified by the inspectors, including a hydraulic control unit valve leaking on a pressure switch enclosure, degraded lighting in several areas throughout the plant, a clogged ventilation unit air filter, and uncontrolled copies of procedures located throughout the plant. PSE&G corrected these individual deficiencies upon identification by the inspector. (O1.1)

The standby liquid control system was found to be in an acceptable standby readiness mode for operation. However, the methodology for conducting in-service testing for both standby liquid control system pumps did not appear to be consistent with ASME code specifications in that a two minute stabilization period was not achieved prior to obtaining flow rate data. Further NRC review is necessary to determine acceptability for this testing method. (O2.1)

Operators did not adequately control the emergency operating procedure lockers staged in the plant. Specifically, the NRC inspectors identified missing and inappropriately modified equipment associated with emergency operating procedure use, although these deficiencies would not have significantly degraded PSE&G's ability to respond to events. PSE&G corrected the individual deficiencies and planned additional long term corrective actions to ensure that this problem would not recur. (O2.2)

Control room operators inconsistently applied operating practices for monitoring radiation monitoring system chart recorders. Specifically, the operators failed to periodically check and identify problems with some radiation monitors located on the back panel in the main control room. This was a minor violation of station procedures. (O4.1)

PSE&G improperly categorized four condition resolution type action requests as business process action requests, thereby circumventing the corrective action system for identifying, correcting and trending deficiencies. None of the issues that were mis-categorized resulted in operability issues, and PSE&G initiated efforts to correct this misapplication of the action request system. This was a minor violation of station administrative procedures. (O7.1)

Maintenance

NRC inspectors identified three separate instances where maintenance personnel failed to follow station procedures, including performing a leak check on a containment hydrogen-oxygen analyzer without a procedure, wearing improper protective clothing while working in a radioactively contaminated area, and failing to complete required work order documentation during steam leak repairs. There were no adverse safety consequences for the individual instances, and PSE&G appropriately addressed each occurrence. (M1.1)

PSE&G failed to promptly correct minor steam leaks from a non-safety-related portion of the high pressure coolant injection and reactor core isolation cooling systems (located in the torus room). The steam leaks wetted safety-related electrical components and ultimately led to the failure of a residual heat removal (RHR) pump minimum flow valve, rendering the RHR pump inoperable. Also, operators were not routinely verifying the physical conditions of the torus room, a large area containing a substantial number of safety-related components, to identify and/or monitor problems. (M2.1)

Engineering

PSE&G engineers failed to properly maintain design control in that the engineers developed a system operating procedure for the post-accident operation of the containment hydrogen recombiner system that was not consistent with the design basis as specified in the operating license application. Although identified by the NRC, this deficiency involved an old design issue that would likely have been licensee identified during the Hope Creek Updated Final Safety Analysis Review validation program. The system operating procedure, although non-conforming, would not have been adverse to recombiner operation or to the primary containment accident response. (E2.1)

Plant Support

Chemistry, operations, and station management provided an appropriate level of attention to adverse trends in various chemistry parameters. Strong management oversight and interdepartmental communications resulted in cautiously planning a system outage of the reactor water cleanup system. In one instance, however, ineffective guidance and communications resulted in exiting the reactor water cleanup system outage prior to completing all planned work as chemistry parameters rapidly trended in an adverse direction, which required an additional system outage to perform technical specification required surveillances. (R2.1)

The inspectors considered the chemistry and radiation protection technicians' analysis and surveillance conduct to be exacting. The Hope Creek Chemistry and Radiation Protection Departments initiated prompt corrective actions to ensure that lessons learned from previous problems were understood by all technicians. (R4.1)

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<u>Report Details</u>

<u>Summary of Plant Status</u>

Hope Creek was operated at or near full power for the duration of the inspection period. During the August 21, 1998, and September 11, 1998, weekends, Hope Creek operators reduced power to about 70% for the performance of scheduled maintenance.

I. Operations

O1 Conduct of Operations

O1.1 <u>General Observations</u>

a. <u>Inspection Scope (71707)</u>

The inspectors reviewed ongoing activities and conducted plant tours throughout this inspection period in accordance with Inspection Procedure 71707.

b. <u>Observations and Findings</u>

On August 21, 1998, PSE&G commenced a planned load reduction in order to perform several maintenance activities. The inspectors reviewed the operator logs and other documentation associated with the load reduction. The inspectors also observed several of the activities that were accomplished after power was reduced to 70%. These activities included turbine electro-hydraulic control system filter inspections and control rod scram time testing. The inspectors found that the load reduction and associated activities were conducted safely and conservatively.

On September 16, 1998, the inspector accompanied an equipment operator (EO) on a tour of the outside area (transformers, service water intake structure, circulating water building, fuel oil storage, etc). The EO demonstrated an excellent knowledge of plant areas and responsibilities. Minor deficiencies were identified, questioned, and communicated. The inspectors concluded that this tour was conducted thoroughly, and the EO demonstrated a strong questioning attitude.

During routine plant tours, the inspectors identified several minor deficiencies as follows.

- A leaking directional control valve associated with one of the control rod drive hydraulic units (HCU) was identified as leaking several drops per minute. However, the leakage was not contained and was leaking directly on an associated HCU pressure switch. PSE&G initiated prompt actions by installing a catch containment device.

- There were several uncontrolled procedures located in various plant areas, including field copies for surveillances and extra copies of operating procedures. The inspectors notified the Operations Manager, who initiated prompt actions to remove the uncontrolled procedures. The Operations

Manager also provided feedback to operators regarding proper use and control of field copies of procedures.

- General area lighting had degraded in several plant areas due to burnt out light bulbs. Also, a ventilation filter for a monitoring system field console appeared to be clogged with dust. PSE&G promptly initiated corrective actions for these items.

In each instance, PSE&G initiated prompt corrective actions, however, the inspectors determined that operations and maintenance personnel likewise had opportunities to identify these minor deficiencies during routine plant tours, but did not.

c. Conclusions

PSE&G's efforts during a planned load reduction were characterized by conservative operations and decision making, and numerous maintenance activities were effectively completed. An equipment operator tour was conducted thoroughly, and the equipment operator demonstrated an excellent knowledge of plant areas and responsibilities. Several minor deficiencies were identified by the inspectors, and were corrected by PSE&G.

O2 Operational Status of Facilities and Equipment

O2.1 Walkdown of Standby Liquid Control System

a. Inspection Scope (71707)

The inspectors conducted a review and walkdown of the standby liquid control system. The inspectors reviewed selected surveillance and operating procedures, the UFSAR, and technical specifications (TS). The inspectors also conducted a detailed walkdown of the accessible portions of the SLC system.

b. Observations and Findings

The inspectors obtained copies of the mechanical lineup and piping and instrumentation drawing for the SLC system, and conducted a detailed walkdown of the system. The inspectors found the system to be properly aligned for standby readiness. Overall, housekeeping and the material condition of the SLC system were good.

The inspectors selected several of the surveillance requirements identified in Technical Specification 4.1.5 and verified that surveillance procedures appropriately implemented the requirement. However, the inspectors identified a discrepancy related to surveillance procedures HC.OP-IS.BH-0001(Q) and HC.OP-IS.BH-0002(Q), *Standby Liquid Control Pump - AP208 (BP208) - Inservice Test*. Specifically, the procedures did not appear to be consistent with Part 6 of ASME Operation and Maintenance of Nuclear Power Plants (OM - 1987). Section 5.6 (Duration of Tests) of OM - 1987, Part 6, states that after pump conditions are as stable as the system permits, each pump shall be run at least two minutes, and at the end of this time, at least one measurement or observation of each of the quantities required shall be made and recorded. The above surveillance procedures meet this specification for measuring or observing pump vibration and discharge pressure. However, the pump is then shut down, re-started, and operated for only one minute to obtain required flow rate data (without a two minute re-stabilization period).

The inspectors discussed this with the IST Program Manager, who stated that the pump run in the prior procedure section constituted the stabilization period. This part of the test is performed by measuring the test tank level change because PSE&G cannot measure flow rate by installed instrumentation (due to flow pulsations to the test tank). Test tank volume is pumped from the test tank and into 55-gallon drums for one minute, and then the flow rate is calculated by measuring the tank level change. The inspectors plan to discuss this issue further with NRC technical specialists to determine whether this testing methodology meets Part 6 of OM - 1987. Pending resolution of this issue, this item is unresolved. **(URI 50-354/98-08-01)**

c. Conclusions

The standby liquid control system was found to be in an acceptable standby readiness mode for operation. However, the methodology for conducting in-service testing for both standby liquid control system pumps did not appear to be consistent with ASME code specifications in that a two minute stabilization period was not achieved prior to obtaining flow rate data. Further NRC review is necessary to determine acceptability for this testing method.

O2.2 Emergency Operating Procedure Equipment Control

a. Inspection Scope (71707)

The inspectors examined the condition of equipment staged for use during implementation of Hope Creek's emergency operating procedures.

b. Observations and Findings

PSE&G staged equipment for use during conduct of emergency operating procedures in several areas, including the main control room, the operations support center, outside the emergency diesel generator (EDG) rooms, the standby liquid control room, and near both banks of control rod drive (CRD) hydraulic control units. The inventory was controlled by listing the required equipment in each respective emergency operating procedure (EOP). PSE&G performs EOP equipment inventories on an annual frequency by verifying that all the equipment was staged in accordance with each EOP procedure.

On August 29, 1998, the NRC inspectors walked down the EOP kits and lockers, and discovered some discrepancies. EOP kit No. 304 was located in the operations support center but should have been staged in the main control room. The EOP locker in the standby liquid control room was missing equipment for venting CRD over pistons. The EOP locker outside the emergency diesel generator EDG rooms had a flange to hose adapter that had been inappropriately modified rendering it unusable for its intended purpose without reversing the modification. The same EOP locker was missing one fire hose spanner wrench. Both the EOP lockers in the standby liquid control room and outside the EDG rooms contained extraneous equipment and hoses.

The inspectors also discovered that the equipment staged for venting CRD over pistons was not properly inventoried since the procedure and required equipment list is contained within a system operating procedure not referenced by the recurring task statement.

Once informed, PSE&G was prompt to correct all the deficiencies that the inspectors had identified. PSE&G also initiated long term appropriate corrective actions to ensure that EOP lockers would not be unnecessarily entered or used for other purposes and that a complete accurate inventory would be developed. The inspectors determined that the equipment that was missing or modified would not have adversely affected the performance of any EOP. The failure to properly stage and maintain all the EOP equipment was a minor violation and was not subject to formal enforcement action.

c. Conclusions

Operators did not adequately control the emergency operating procedure lockers staged in the plant. Specifically, the NRC inspectors identified missing and inappropriately modified equipment associated with emergency operating procedure use, although this minor violation would not have significantly degraded PSE&G's ability to respond to events. PSE&G corrected the individual deficiencies and planned additional long term corrective actions to ensure that this problem would not recur.

O2.3 Preparations for Severe Weather Conditions

a. Inspection Scope (71707, 62707)

The inspectors reviewed PSE&G's preparations for severe weather conditions in response to a hurricane forecast. The inspectors reviewed the applicable administrative controls and toured vulnerable plant areas.

b. Observations and Findings

In response to Hurricane Bonnie, which was forecasted to potentially affect the Salem and Hope Creek facilities, both nuclear stations entered the common Nuclear Operations Services Department Severe Weather Guide (DTG-SWG-001) on August 25, 1998. The Guide established a Severe Weather Team consisting of operations, maintenance, services, emergency preparedness, procurement, loss prevention (fire protection), radiological protection, and security personnel. These personnel initiated daily status meetings to discuss their efforts. In accordance with the Guide, personnel had conducted site walkdowns, and initiated efforts to remove or secure loose materials that could become missiles when exposed to high winds, with particular attention provided for the electrical switchyards.

Station personnel verified diesel fuel tanks associated with station equipment, such as EDG fuel oil storage tanks. Tanks were filled as needed. PSE&G also tested personnel pagers, and verified operability of several watertight door seals.

The inspectors confirmed that station personnel had reviewed relevant procedures such as abnormal procedures for acts of nature (high winds and flooding) and station blackout, and the Event Classification Guide. Safety systems were not to be taken out of service for the remainder of the week for scheduled maintenance. Repairs to other safety-related or important equipment were expedited such as the Hope Creek 'B' reactor protection system motor-generator. All EDGs were operable (three for each Salem unit and four for Hope Creek).

Hope Creek's Acts of Nature procedure requires that if a Hurricane Watch is forecast for the area, operators are to make preparations to allow for placing the unit in Cold Shutdown such that Cold Shutdown could be achieved at least two hours prior to the arrival of hurricane force winds.

The storm did not pass near the site and therefore the site was unaffected by the hurricane. The inspectors determined that PSE&G's response to the forecasted storm was appropriate and in accordance with the established plans.

c. Conclusions

Station personnel appropriately and conservatively implemented actions in response to a severe weather forecast that had the potential to impact the site. These actions were timely and were consistent with established guidelines.

O2.4 Key Control (71707)

The NRC inspectors examined PSE&G's key control program for vital security area keys, high radiation area keys, emergency operating procedure locker keys, and numerous equipment and control panel keys. The inspectors verified that PSE&G had established adequate administrative controls. The administrative programs ensured that the keys were only issued to authorized individuals, yet the keys were readily available to plant operators during emergency situations requiring rapid access.

O4 Operator Knowledge and Performance

O4.1 Main Control Room Chart Recorder Maintenance

a. Inspection Scope (62707, 71707)

The inspectors performed daily walkdowns of main control room chart recorders and interviewed control room operators to assess PSE&G's practices for identifying and correcting minor chart recorder problems.

b. Observations and Findings

On August 31, 1998, the NRC inspectors identified that the Hope Creek main control room had four chart recorders with temporary paper installed. The paper was temporary in that it did not have the correct units or dimensions for the parameter being measured and that a replacement supply of the correct chart paper was not available. Also on August 31, 1998, the inspectors identified three chart recorders without any paper installed on the 10C604 panel, a radiation monitoring system panel in the back of the Hope Creek main control room. The NRC inspectors questioned operators regarding how long the recorders had been operating without paper. The control room operators were unable to answer the question since the recorders were not date and time stamped automatically or manually by control room operators. Once the control room operators were notified, the paper for the chart recorders was promptly replaced.

On September 16, 1998, the NRC inspectors identified three chart recorders on the 10C604 panel and one recorder on the remote shutdown panel which were not recording a trace. The ink pen was not in contact with the chart paper. The control room operators had the chart recorders promptly corrected once notified.

Based on the frequency and number of chart recorder problems identified by the NRC inspectors, the inspectors concluded that control room operators were inconsistently monitoring back panel chart recorders. The operators were significantly more attentive to the front panel chart recorders. The inspectors identified that failure to date and initial all control room recorder charts was not in accordance with Hope Creek daily logs and concluded that this constituted a violation of minor significance not subject to formal enforcement action.

The inspectors also determined that the instrumentation and controls (I&C) maintenance department was not rigorously repairing simple back panel chart recorder problems. The chart recorder maintenance program responsibility had recently been transferred from one maintenance superintendent to another, but the I&C maintenance department failed to actively ensure that all control room recorders were maintained.

The inspectors discussed the concern about the inconsistent attention devoted by both operators and maintenance technicians to the back panel chart recorders with the Operations Manager. The Operations Manager stated that the operators should carefully monitor the condition and trends of the back panel chart recorders. The Operations Manager made a Night Order entry to ensure that operators are sensitive to all chart recorder trends as well as maintenance problems. The I&C Maintenance Superintendent intended to devote personnel on a routine basis to ensure that minor chart recorder problems are promptly identified and repaired.

c. Conclusions

Control room operators inconsistently applied operating practices for monitoring radiation monitoring system chart recorders. Specifically, the operators failed to periodically check and identify problems with some radiation monitors located on the back panel in the main control room. This was a minor violation of station procedures. In addition, maintenance technicians had not been prompt or sensitive to correct minor control room chart recorder problems.

O7 Quality Assurance in Operations

O7.1 Corrective Action System Implementation Weaknesses

a. Inspection Scope (40500, 71707)

The inspectors reviewed PSE&G's Action Request (AR) System to confirm proper use of the condition reporting subsystem (corrective action system) and the business process subsystem (non-corrective action system).

b. Observations and Findings

PSE&G administrative procedure NC.NA-AP.ZZ-0000(Q), *Action Request Process*, describes the method for reporting conditions requiring corrective action, enhancement, or interdepartmental support. Two types of action requests include the condition resolution (CR) request, used to identify and correct a condition adverse to quality, and the business process (BP) request, used for enhancement or support that is not a condition adverse to quality. The inspectors reviewed the AR database, and selected several BPs for review to determine that PSE&G was properly categorizing conditions adverse to quality and placing these conditions in the 10 CFR 50 Appendix B corrective action system (CR process).

Attachment 2 to NC.NA-AP.ZZ-0000(Q) provides examples of items that should be categorized as significance level 3 (a low priority) CRs, as well as examples of items that are not conditions adverse to quality (BPs). The inspectors selected 17 BPs from the AR database that appeared to meet the significance level 3 CR threshold. The corrective action group reviewed these 17 BPs and determined initially that eight of them were questionable. After a more detailed review, the corrective action group concluded that four of them should have been categorized as significance level 3 CRs. AR 980515138 involved a reactor building ventilation breaker tripping below its setpoint. AR 980707228 involved a blown fuse replaced in kind, but proper fuse type could not be confirmed and the cause of failure was not known. AR 980722093 involved a river water temperature recorder reading high. AR 980724082 involved a condensate demineralizer pressure switch range that was inadequate to support required setpoint.

PSE&G planned to re-categorize these four AR - BPs as AR - CRs, and to initiate a separate CR to identify, evaluate and correct the improper categorization of BPs. The inspectors found this action plan to be appropriate. In addition, the inspectors did not identify any operability concerns associated with these items. The inspectors determined that PSE&G's failure to comply with administrative procedure NC.NA-AP.ZZ-0000(Q) was a violation of minor significance and was not subject to formal enforcement.

c. Conclusions

PSE&G improperly categorized four condition resolution type action requests as business process type action requests, thereby circumventing the corrective action system for identifying, correcting and trending deficiencies. None of the issues that were mis-categorized resulted in operability issues, and PSE&G initiated efforts to correct this misapplication of the action request system. This was a minor violation of station administration procedures.

O8 Miscellaneous Operations Issues

O8.1 (Closed) 50-354/E97-563-01013,Shutdown Margin Demonstration

a. Inspection Scope (92901)

The inspectors performed an onsite inspection and reviewed corrective actions described in PSE&G's April 20, 1998, response to a Notice of Violation and Proposed Imposition of Civil Penalty for the failure by an operating crew to follow procedures and act conservatively during a test to demonstrate core shutdown margin.

b. Observations and Findings

During the November 12, 1997, shutdown margin test, PSE&G operators increased the control rod drive hydraulic system drive water pressure in accordance with abnormal operating procedures after some control rods could not be moved. However, after individual rods were freed, the operators inappropriately remained in the stuck rod procedure without first meeting the prerequisite for unsuccessful control rod movement. This resulted in withdrawing several additional control rods from the core at speeds faster than normal.

In response to this violation, PSE&G initiated several actions, including 1) issuing memoranda to the appropriate personnel regarding conservative decision making and a questioning attitude towards procedures, 2) reviewing this event with operating crews with a focus on reactivity management and conservative decision making, and 3) revising the stuck rod abnormal procedure to ensure operators return control rod drive hydraulic system drive water pressure to normal after notching a stuck control rod. In addition, PSE&G revised the Operations Standards to enhance management's expectations relative to reactivity management, and a procedure was developed to provide guidance specifically for infrequently performed tests.

The inspectors verified the actions specified in PSE&G's April 20, 1998, letter and found the actions to be completed acceptably. Further, the inspectors periodically observed operators manipulate stuck control rods by use of the stuck control rod abnormal procedure, and found that operators and supervisors demonstrated appropriate reactivity management. This violation is closed.

c. Conclusions

PSE&G appropriately implemented corrective actions following non-conservative actions during a shutdown margin demonstration.

O8.2 (Closed) Violations 50-354/98-02-02, -03, & -04, Three Examples of Inadequate Procedure Controls Associated with Temporary Equipment in the Service Water Intake Structure

a. Inspection Scope (92901)

The inspectors performed an onsite inspection and reviewed corrective actions described in PSE&G's response to the Notice of Violation for problems related to inadequate control of temporary equipment in the service water intake structure (SWIS).

b. Observations and Findings

The three problems involved 1) a failure to follow procedures and perform inspections and administrative controls for a scaffold work platform erected around a safety-related service water pump strainer, 2) a failure to perform procedure required administrative controls for floor drain plugs installed in the safety-related SWIS, and 3) a failure to properly follow a troubleshooting procedure for a temporary hose installed on a service water bay sump pump system.

The inspectors verified that PSE&G completed a procedure revision to the service water pump strainer preventive maintenance procedure that adequately controlled the installation of the strainer temporary work platform. The inspectors verified that the floor drain plugs were removed from the SWIS and that an operations department Night Order entry had been made to alert the operators to the administrative requirements for installation of floor drain plugs. PSE&G included 10 CFR 50.59 training for senior reactor operator candidates in the initial license class training as a long term corrective action for the service water bay sump pump system temporary modification problem. PSE&G intended to include similar training for the licensed senior reactor operators in the requalification training program. The inspectors determined that PSE&G had completed appropriate corrective actions for each example of the violation. This violation is closed.

c. Conclusions

PSE&G implemented adequate corrective actions for NRC violations that involved improper control of temporary equipment in the service water intake structure.

II. Maintenance

M1 Conduct of Maintenance

M1.1 Maintenance Activities

a. Inspection Scope (62707)

The NRC inspectors used Inspection Procedure 62707 to observe the conduct of several routine maintenance activities by maintenance technicians and to review completed work orders.

b. Observations and Findings

On August 29, 1998, the NRC inspectors observed an instrumentation and controls (I&C) maintenance technician perform a leak check on the 'A' primary containment hydrogen/oxygen concentration analyzer (H2/O2 analyzer). Preventive maintenance had been in progress on the 'A' H2/O2 analyzer and the leak check rig had already been installed by other maintenance technicians. The I&C technician was pressurizing the analyzer components at a slow rate and stopping at increments to allow for stabilization. The inspectors observed that the I&C technician was knowledgeable about the work activity, but he did not have any procedure, work order, or technical guidance available at the job site. The inspectors questioned the I&C technician about the lack of procedural guidance for the leak check, and the technician stated that he had forgotten the work order but started the activity without it. The inspectors determined that the failure to use the procedure at the job site was a violation of minor significance and was not subject to formal enforcement action.

On September 1, 1998, the inspectors toured the torus room. The torus room is a radiologically contaminated area that requires specific protective clothing for entry, dependent upon the nature of work. The inspectors noticed from the catwalk, that a nuclear worker at the bottom of the torus room did not have any protective clothing on his head. Three other nuclear workers, correctly wore the required protective clothing, including the required protective clothing and safety gear on their heads. All four nuclear workers were sorting scaffold for storage in the torus room. The inspectors discussed this observation with a radiation protection supervisor, who promptly corrected the protective clothing problem. The NRC inspectors determined that the failure to follow radiation work permit requirements was a violation of minor significance and is not subject to formal enforcement action.

The inspectors reviewed work order (WO) 980803081. WO 980803081 was used to perform encapsulations and leak sealant repairs on the high pressure coolant injection and reactor core isolation cooling systems common steam trap drain line in the torus room (See Section M2.1 for further discussion of the steam leaks in the torus room). WO 980803081 included portions of procedure VSH.MD-GP.ZZ-0199(Q) Revision 0, *Inservice Temporary Leak Repair*, which was used during the conduct of the leak sealant repairs. A total of three injections were performed on the two encapsulations. The inspectors identified that the maximum sealant gun pressure obtained during injection was not recorded, contrary to the procedure, for the first two sealant injections performed on September 1, 1998. The inspectors also identified that step 5.2.1 in VSH.MD-GP.ZZ-0199(Q) was also not performed for the third sealant injection. Step 5.2.1 required the technician to record technical data about the leak seal repair. The inspectors determined through interviews with maintenance supervisors and engineers that the leak sealant injections were performed safely, but some data obtained during the procedure implementation was not recorded. The inspectors determined that the failure to follow VSH.MD-GP.ZZ-0199(Q) was a violation of minor significance and is not subject to formal enforcement action.

The inspectors concluded that based on the number of NRC identified minor violations in a short period of time, some fundamental maintenance practices were not always followed by maintenance technicians. However, the inspectors also determined that the minor violations were not programmatic as evidenced by other observed good maintenance practices. The inspectors determined based on interviews, that each problem was appropriately addressed by the responsible supervisors.

c. Conclusions

NRC inspectors identified three separate instances where maintenance personnel failed to follow station procedures, including performing a leak check on a containment hydrogen-oxygen analyzer without a procedure, wearing improper protective clothing while working in a radioactively contaminated area, and failing to complete required work order documentation during steam leak repairs. There were no adverse safety consequences for the individual instances, and PSE&G appropriately addressed each occurrence.

M2 Maintenance and Material Condition of Facilities and Equipment

M2.1 Steam Leak in Torus Room

a. Inspection Scope (62707, 71707)

The inspectors reviewed PSE&G's emergent repair of two steam leaks on a common drain line associated with a high pressure coolant injection (HPCI) system steam trap and a reactor core isolation cooling (RCIC) system steam trap.

b. Observations and Findings

On August 3, 1998, PSE&G identified two steam leaks that had developed on a common drain line associated with a HPCI system steam trap and a RCIC system steam trap. The steam leaks were in the overhead above the torus room catwalk. At the time, PSE&G did not consider the steam leaks to threaten the operation of any equipment in the area. Motor-operated valves (MOV) and electrical junction boxes were near the leaks but were not being wetted by condensed steam or the steam plume. The HPCI and RCIC system operability was also considered to be unaffected by the steam leaks. PSE&G developed work orders and scheduled the work to be performed on September 12, 1998.

On August 22, 1998, operators noticed that the steam leaks had worsened and that repairs to the steam leaks should be expedited. PSE&G pulled up the schedule for the steam leak repairs to September 1, 1998.

On August 31, 1998, the 'C' residual heat removal (RHR) pump minimum flow MOV failed to close remotely during inservice testing (IST). Control room operators determined that the MOV breaker thermal overloads had tripped. Control room operators also realized that the 'C' RHR pump minimum flow MOV was located in the vicinity of the torus room steam leaks. The operators declared the 'C' RHR pump inoperable and entered a 30 day shutdown limiting condition for operation (LCO).

PSE&G valve engineers were dispatched to the 'C' RHR minimum flow MOV. The valve engineers had not previously been made aware of the torus room steam leak conditions. The valve engineers determined that the steam leaks most likely caused the MOV failure. PSE&G expedited both the steam leak repairs, already scheduled for September 1, 1998, and repairs on the 'C' RHR minimum flow MOV.

On September 1, 1998, the torus room steam leaks were encapsulated. On September 4, 1998, the 'C' RHR pump minimum flow MOV actuator was rebuilt and the motor was replaced. Control room operators exited the 30 day LCO after successful re-tests of the 'C' RHR pump minimum flow valve.

PSE&G determined that the 'C' RHR pump MOV actuator and motor had become severely wetted from condensed steam that had collected in an electrical junction box and traveled through conduit to the MOV actuator. After the steam leaks had been repaired, PSE&G inspected all other electrical junction boxes in the vicinity of the steam leaks and determined that water had not entered any other junction boxes. Environmental qualification (EQ) engineers verified that the particular mechanism for water intrusion into the 'C' RHR minimum flow MOV was outside the environmental qualification design basis. The inspectors determined that the follow-up investigation to the 'C' RHR minimum flow valve failure was thorough, including PSE&G's consideration of generic environmental qualification issues.

The inspectors determined that PSE&G had not effectively monitored deteriorating conditions in the torus room that ultimately led to a safety-related MOV failure and declaring its associated RHR pump inoperable. PSE&G's failure to promptly repair the steam leaks in the vicinity of safety-related equipment is a violation of 10 CFR 50, Appendix B, Criterion XVI, *Corrective Action*. The Operations Manager recognized that PSE&G had inadequately prioritized the steam leak repairs and that operators had not consistently monitored the steam leak conditions. The Operations Manager initiated a corrective action item to communicate the lessons learned from this problem. The NRC inspectors, in their review of this problem, determined that aside from the steam leaks in the torus room, PSE&G did not as a routine basis inspect conditions in the torus room. The Operations Manager determined that the torus room should be a part of the operators periodic rounds and initiated a temporary log for such a tour. The Operations Manager intended to revise the operator rounds to include a daily torus room tour from the catwalk. **(VIO 50-354/98-08-02)**

The inspectors determined that PSE&G had taken appropriate and prompt corrective actions after the self revealing failure of the 'C' RHR minimum flow MOV. The Operations Manager initiated corrective actions to ensure that the torus room would be inspected by equipment operators on a routine basis. PSE&G also intended to communicate the lessons learned from the failure to monitor the degrading steam leaks and to promptly initiate repairs. Action Request 980902231 was initiated to ensure that the lessons learned from this event were properly communicated to PSE&G personnel.

c. Conclusions

PSE&G failed to promptly correct minor steam leaks from a non-safety-related portion of the high pressure coolant injection and reactor core isolation cooling systems (located in the torus room). The steam leaks wetted safety-related electrical components and ultimately led to the failure of an RHR pump minimum flow valve, rendering the RHR pump inoperable. PSE&G's failure to promptly repair the steam leaks and prevent safety-related equipment from being damaged was a violation of 10 CFR Appendix B, Criterion XVI, *Corrective Action*. In addition, NRC inspectors determined that Hope Creek operators were not routinely verifying the physical conditions of the torus room, a large area containing a substantial number of safety-related components, to identify and/or monitor problems.

III. Engineering

E2 Engineering Support of Facilities and Equipment

E2.1 Containment Hydrogen Recombiner System Operating Procedure Problems

a. Inspection Scope (71707, 37551)

The inspectors performed a detailed system walkdown, and review of licensing and design basis information and system operating procedures for the containment hydrogen recombiner system (CHRS).

b. Observations and Findings

The inspectors verified that the material condition of both trains of the CHRS was adequate and properly aligned in a standby condition. The inspectors also verified that PSE&G adequately implemented functional tests for the CHRS using surveillance test procedure, HC.OP-ST.GS-0005(Q) - Revision 6, *Containment Recombiner Functional Test - Semi-Annual.*

The inspectors reviewed PSE&G's system operating procedure, HC.OP-SO.GS-0003(Q) - Revision 3, *Containment Hydrogen Recombiner System Operation*. The system operating procedure requires the operator to startup the recombiner and establish recombiner drywell flow at 80 scfm indicated using inlet valve, HS1. Recombiner total flow is then established at 100 scfm indicated by throttling recirculation valve, HS2. After those parameters are established, the procedure requires the operator to monitor recombiner drywell flow at 80 scfm and total flow at 100 scfm.

The inspectors reviewed the Updated Final Safety Analysis Report (UFSAR), Section 6.2.5.3.5, to determine the licensing basis for the recombiner operation during a design basis loss of coolant accident inside the primary containment. An associated design calculation (12-141(Q), Revision 2, dated May 3, 1985), performed to support the UFSAR, assumed the recombiners would operate at 150 scfm. The calculation also assumed that the recombiners would not be allowed to operate until containment pressure was below 27 psia. However, the UFSAR stated that the recombiner was limited to operate at full flow below 30 psia. The design calculation used a more restrictive limit of 27 psia for recombiner operation than the UFSAR.

The design calculation also considered other recombiner flow rates, such as 60 scfm, but those calculations were not acceptable because the assumed containment initial oxygen concentration was non-conservative (3%) and was below the maximum allowed technical specification limit (4%).

Based upon the above, the inspectors determined that there were several inconsistencies among the hydrogen recombiner system operating procedure, and the design and licensing bases. The design basis and UFSAR assumed the recombiner operated at 150 scfm and only after containment pressure had been reduced below 27 psia. Further, the hydrogen recombiner system operating procedure directed that the recombiner be started at 80 scfm regardless of containment pressure. The inspectors determined that the problem with Hope Creek operating procedure HC.OP-SO.GS-0003(Q) was a violation of 10 CFR 50, Appendix B, Criterion III, *Design Control*, which requires that design basis, as specified in the license application, shall be correctly translated into procedures.

The inspectors presented the recombiner problems to design engineers and Hope Creek senior reactor operators. PSE&G developed an operability determination and determined the recombiners to be operable, but non-conforming. PSE&G's basis for operability considered that in all likelihood, the operating limit should be 30 psia (maximum). Engineers located vendor supplied data that supported the blower motor operating to 35.8 psia and the nameplate data on the blower motor stated 30 psia. PSE&G considered that containment pressure would drop and remain below 30 psia within 200 seconds of a design basis accident and that the recombiners would not be started during this short time. Design engineers were able to use the data provided in the other calculations and determined that even 60 scfm would be sufficient to maintain hydrogen and oxygen limits acceptable during a design basis accident based upon oxygen production and removal rates.

PSE&G initiated a root cause evaluation and corrective actions to ensure that the system operating procedure, design basis information, and licensing basis would be made consistent. Design engineers contacted the recombiner vendor, and the vendor verified that PSE&G had purchased its recombiners with a 30 psia operating limit. The inspectors considered PSE&G's immediate and intended long term corrective actions to be thorough and appropriate.

The NRC inspectors interviewed PSE&G engineers involved in the Hope Creek UFSAR validation program and concluded that PSE&G would have likely identified the recombiner design basis and operating procedure problems before January 2000, based upon the scope and schedule of PSE&G's ongoing UFSAR review. The NRC inspectors also considered this a violation involving an old design issue because the system operating procedure always required the recombiner to be operated at 80 scfm ever since initial plant operation. This NRC identified violation of 10 CFR 50 Appendix B, Criterion III, *Design Control*, is being treated as a Non-Cited Violation, consistent with Section VII.B.3 and Enforcement Guidance Memorandum 98-007 of the NRC Enforcement Policy. **(NCV 50-354/98-08-03)**

c. Conclusions

PSE&G engineers failed to properly maintain design control in that the engineers developed a system operating procedure for the post-accident operation of the containment hydrogen recombiner system that was not consistent with the design basis as specified in the operating license application. Although identified by the NRC, this deficiency involved an old design issue that would likely have been licensee identified during the Hope Creek Updated Final Safety Analysis Review validation program. The system operating procedure, although non-conforming, would not have been adverse to recombiner operation or to the primary containment accident response.

E8 Miscellaneous Engineering Issues

E8.1 (Closed) Inspector Follow-up Item 50-354/96-04-05, Torque Switch Repeatability Assumptions

a. Inspection Scope (92903)

The inspectors performed an onsite inspection and reviewed PSE&G's actions associated with torque switch repeatability assumptions in the motor-operated valve program

b. Observations and Findings

PSE&G conducted a special test program to justify reducing the torque switch repeatability values published in Limitorque Maintenance Update 92-2. In 1996, the NRC found that PSE&G's approach was acceptable for closure of NRC Generic Letter (GL) 89-10 motor-operated valve program at Hope Creek. This item was opened to track use of the revised values at Salem to determine whether there would be any impact on any Hope Creek motor-operated valves. The inspector reviewed the test configurations and data described in Attachment 17 of report EE:H-1-ZZ-MEE-0905, "Generic Letter 89-10 Closure Summary for the Motor-Operated Valve Program Implemented at Hope Creek Generating Station." PSE&G tested 18 combinations of motors, SMB-00 and SMB-000 actuators, and various torque switches to evaluate repeatability errors at a torque switch setting of 1.0. The data from over 600 motor-actuator strokes were analyzed statistically and torque switch repeatability error values at a 95% confidence level were derived (i.e. 2.38% and 3.98% for torque outputs greater than and less than 50 foot-pounds, respectively). PSE&G therefore adopted repeatability values of 10% for torque switch settings less than 50 foot-pounds and 5% for settings greater than 50 foot-pounds for SMB-0 and smaller actuators. The licensee conforms to Limitorque's guidelines for SMB-1 and larger actuators and for all actuators with torque switch settings greater than 1.0.

c. Conclusions

PSE&G appropriately addressed the above concerns, and this item is closed.

E8.2 (Open) LER 50-354/98-05: 'B' primary containment hydrogen/oxygen concentration analyzer (H2/O2 analyzer) inoperability due to missed inservice test. This Licensee Event Report (LER) described a licensee identified problem in that inservice testing (IST) had not been performed on two check valves, and failure of either would have rendered the 'B' H2/O2 analyzer inoperable. The check valves had been erroneously characterized during Hope Creek's first IST ten-year program as having no function requiring inservice testing. PSE&G completed the check valve testing on August 11, 1998, satisfactory and declared the 'B' H2/O2 analyzer operable. The inspectors determined that PSE&G's immediate corrective actions were appropriate. PSE&G has initiated a Level 1 Root Cause Evaluation, the most detailed level of investigation, into the problems associated with this IST issue. The inspectors left this LER open pending completion of PSE&G's Level 1 Root Cause Evaluation. Any possible enforcement sanctions will be identified as part of the LER follow-up inspection.

IV. Plant Support

R2 Status of RP&C Facilities and Equipment

R2.1 Review of Chemistry Parameters and Operations

a. Inspection Scope (71707, 62707, 71750)

The inspectors reviewed chemistry results for reactor and balance of plant parameters, and discussed out of specification results with chemistry and operations personnel. The inspectors also reviewed related activities that were completed to improve chemistry parameters.

b. Observations and Findings

Since about May 1998, the Hope Creek condensate system had shown steady increases in conductivity, chlorides, sulfates, and sodium levels. Chemistry personnel have been evaluating these trends to assess potential condenser tube leaks and condensate polisher system performance.

Technical Specification 3.4.4 require that reactor coolant conductivity and chlorides be maintained less than specified values (less than 1.0 μmho/cm for conductivity and less than 0.2 ppm for chlorides). Changes in the reactor coolant conductivity level are an indication of abnormal conditions. High chloride and sulfate levels promote inter-granular stress corrosion cracking in stainless steel (generally associated with condenser in-leakage, radioactive waste processing system inputs, or resin ingress). High sodium levels are indicative of a condenser in-leakage or demineralizer system problems. The chemistry guidelines utilized at Hope Creek are consistent with industry guidelines and prescribe three discrete action levels as the parameters begin to fall out of specification (limits are conservative when compared to those in technical specifications).

Hope Creek has seven condensate demineralizers (polisher resin beds), with all seven beds normally in service. However, the increase in conductivity, chlorides, sulfates, and sodium levels since May 1998, due to small condenser in-leakage, has caused the polisher bed capabilities to decrease more rapidly. This resulted in more frequent polisher bed regeneration. Another operational challenge for the condensate cleanup system was the large amount of feedwater system iron. This iron accumulation in the polisher beds also contributed to bed inefficiency.

Hope Creek reduced reactor power during the August 22, 1998, weekend. During the downpower, minor leaks were identified and repaired on the 'C' south condenser waterbox. This effort, however, was only partially effective in reducing the elevated chemistry parameters because small leaks were also apparent in the 'B' north condenser waterbox. These leaks were repaired during a subsequent downpower on September 11, 1998. Since then, conductivity and other chemistry parameters began to slowly improve. Additionally, PSE&G had begun construction of a feedwater iron pre-filter system, to be placed in service upon startup from the next refueling outage (Winter 1999).

The inspectors determined that PSE&G has provided appropriate level of attention to the elevated chemistry parameters. During the inspection period, PSE&G planned to remove the entire reactor water cleanup (RWCU) system from service for maintenance and surveillance. The organization was sensitive to minimizing the time the system was out of service due to the corresponding increase in chemistry parameters that would be expected. However, even though chemistry personnel estimated the rate of increase for the various chemistry parameters, operators became concerned about the increasing levels, and conservatively exited the outage. Subsequent discussions among operations, maintenance, and chemistry personnel identified some communication and guidance weaknesses regarding the expected response of the chemistry parameters. Although the decision to prematurely terminate the RWCU outage was conservative and was based upon increasing chemistry parameters, additional technical specification required testing remains to be performed. Accordingly, the RWCU will be required to be removed from service again.

c. <u>Conclusions</u>

PSE&G provided an appropriate level of attention to adverse trends in various chemistry parameters. Strong management oversight and interdepartmental communications resulted in cautiously planning a system outage of the reactor water cleanup system. In one instance, however, guidance and communications deficiencies resulted in exiting the reactor water cleanup system outage prior to completing all planned work as chemistry parameters rapidly trended in an adverse direction, which will require an additional system outage to perform technical specification required surveillances.

R4 Staff Knowledge and Performance in Radiological Protection and Chemistry

R4.1 <u>Standby Liquid Control Chemistry Analysis and Liquid Effluent Radiation Monitor Surveillance</u>

a. <u>Inspection Scope (71750)</u>

The inspectors observed a chemistry technician analyze a standby liquid control sample for sodium pentaborate concentration and a radiation protection technician perform surveillance checks on the liquid radwaste and cooling tower blowdown radiation monitors prior to a radwaste discharge to the Delaware River.

b. Observations and Findings

The inspectors observed that the chemistry technician was careful and ensured that the analysis was performed exactly as prescribed by the procedure. The chemistry analysis was performed in triplicate to ensure that the results were accurate and consistent. The inspectors questioned the technician about recent problems that had been seen during standby liquid control sample analysis, (See NRC Inspection Report 50-354/98-06 Section R4.1). The technician was familiar with the recent standby liquid control analysis and the corrective actions that had been taken.

The inspectors also observed that the radiation protection technician was careful and consistently used the principles of STAR (Stop, Think, Act, Review) during the conduct of the radiation monitor surveillance checks. Problems had been encountered with this same procedure, HC.RP-ST.SP-0007(Q), *Liquid Effluent Surveillance,* in April 1998, (See NRC Inspection Report 50-354/98-05 Section R4.1). PSE&G had enhanced the procedure to ensure that similar problems would not recur. The inspectors determined that the radiation protection technician had been trained on those problems and that he was familiar with the procedure enhancements and revision.

c. Conclusions

The inspectors considered the chemistry and radiation protection technicians' analysis and surveillance conduct to be exacting. The Hope Creek Chemistry and Radiation Protection Departments initiated prompt corrective actions to ensure that lessons learned from previous problems were understood by all technicians.

V. Management Meetings

X1 Exit Meeting Summary

The inspectors presented the inspection results to members of licensee management at the conclusion of the inspection on September 29, 1998. The licensee acknowledged the findings presented.

INSPECTION PROCEDURES USED

IP 37551:	Onsite Engineering
IP 40500:	Effectiveness of Licensee Controls in Identifying, Resolving, and Preventing Problems
IP 62707:	Maintenance Observations
IP 71707:	Plant Operations
IP 71750:	Plant Support Activities
IP 92901:	Followup - Plant Operations
IP 92903:	Followup - Engineering

ITEMS OPENED, CLOSED, AND DISCUSSED

Opened

50-354/98-08-01	URI	Inservice testing of standby liquid control pumps. (Section O2.1)
50-354/98-08-02	VIO	Inadequate corrective action for steam leak in torus room. (Section M2.1)

Opened/Closed

50-354/98-08-03	NCV	Containment hydrogen recombiner system operating procedure problems. (Section E2.1)

Closed

50-354/96-04-05	IFI	Torque switch repeatability assumptions. (Section E8.1)
50-354/E97-563-01013	VIO	Shutdown margin demonstration. (Section O8.1)
50-354/98-02-02,03, 04	VIO	Inadequate procedure controls associated with temporary equipment in the service water intake structure. (Section O8.1)

Discussed

50-354/98-05	LER	'B' primary containment hydrogen/oxygen concentration analyzer inoperability due to missed inservice test. (Section E8.2)

LIST OF ACRONYMS USED

AR	Action Request
BP	Business Process
CHRS	Containment Hydrogen Recombine System
CR	Condition Resolution
CRD	Control Rod Drive
EDG	Emergency Diesel Generator
EO	Equipment Operator
EOP	Emergency Operating Procedure
EQ	Environmental Qualification
GL	Generic Letter
H2/02	Hydrogen/Oxygen
HCU	Hydraulic Unit
HPCI	High pressure Coolant Injection
I&C	Instrumentation and Controls
IFI	Inspector Follow-up Item
IST	Inservice Testing
LCO	Limiting Condition for Operation
LER	Licensee Event Report
MOV	Motor Operated Valve
NRC	Nuclear Regulatory Commission
PDR	Public Document Room
PSE&G	Public Service Electric and Gas
PSIA	Pounds per Square Inch (Absolute)
RCIC	Reactor Core Isolation Cooling
RHR	Residual Heat Removal
RWCU	Reactor Water Cleanup
SCFM	Standard Cubic Feet per Minute
SLC	Standby Liquid Control
SWIS	Service Water Intake Structure
TS	Technical Specification
UFSAR	Updated Final Safety Analysis Report
URI	Unresolved Item
VIO	Violation
WO	Work Order