UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION I
2100 RENAISSANCE BLVD., SUITE 100
KING OF PRUSSIA, PA 19406-2713

November 25, 2015

Mr. Robert Braun
President and Chief Nuclear Officer
PSEG Nuclear LLC – N09
P. O. Box 236
Hancocks Bridge, NJ 08038

SUBJECT: HOPE CREEK GENERATING STATION – COMPONENT DESIGN BASES INSPECTION REPORT 05000354/2015007

Dear Mr. Braun:

On October 23, 2015, the U.S. Nuclear Regulatory Commission (NRC) completed an inspection at the Hope Creek Generating Station. The enclosed inspection report documents the inspection results, which were discussed on October 23, 2015, with Mr. Eric Carr, Plant Manager, and other members of your staff.

The inspection 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. In conducting the inspection, the team examined the adequacy of selected components to mitigate postulated transients, initiating events, and design basis accidents. The inspection involved field walkdowns, examination of selected procedures, calculations and records, and interviews with station personnel.

This report documents two NRC-identified findings that were of very low safety significance (Green). These findings were determined to involve violations of NRC requirements. However, because of the very low safety significance of the violations and because they were entered into your corrective action program, the NRC is treating these findings as non-cited violations (NCVs) consistent with Section 2.3.2.a of the NRC Enforcement Policy. If you contest any NCV in this report, you should provide a response within 30 days of the date of this inspection report, with the basis for your denial, to the U.S. Nuclear Regulatory Commission, ATTN: Document Control Desk, Washington, D.C. 20555-0001, with copies to the Regional Administrator, Region I; the Director, Office of Enforcement, U.S. Nuclear Regulatory Commission, Washington, D.C. 20555-0001; and the NRC Senior Resident Inspector at Hope Creek. In addition, if you disagree with the cross-cutting aspect assigned to any finding in this report, you should provide a response within 30 days of the date of this inspection report, with the basis for your disagreement, to the Regional Administrator, Region I, and the NRC Senior Resident Inspector at Hope Creek.

In accordance with Title 10 of the *Code of Federal Regulations* (10 CFR) Part 2.390 of the NRC's "Rules of Practice," a copy of this letter, its enclosure, and your response (if any) will be available electronically for the public inspection in the NRC Public Docket Room or from the Publicly Available Record System (PARS) component of NRC's document system, Agencywide Documents Access and Management System (ADAMS). ADAMS is accessible from the NRC Website at http://www.nrc.gov/reading-rm/adams.html (the Public Electronic Reading Room).

Sincerely,

/RA/

Paul G. Krohn, Chief
Engineering Branch 2
Division of Reactor Safety

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

Enclosure:
Inspection Report 05000254/2015007
w/Attachment: Supplementary Information

cc w/encl: Distribution via ListServ

In accordance with Title 10 of the *Code of Federal Regulations* (10 CFR) Part 2.390 of the NRC's "Rules of Practice," a copy of this letter, its enclosure, and your response (if any) will be available electronically for the public inspection in the NRC Public Docket Room or from the Publicly Available Record System (PARS) component of NRC's document system, Agencywide Documents Access and Management System (ADAMS). ADAMS is accessible from the NRC Website at http://www.nrc.gov/reading-rm/adams.html (the Public Electronic Reading Room).

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U.S. NUCLEAR REGULATORY COMMISSION
REGION I

Docket No:	50-354
License No:	NPF-57
Report No:	05000354/2015007
Licensee:	Public Service Enterprise Group (PSEG) Nuclear LLC
Facility:	Hope Creek Generating Station (HCGS)
Location:	P.O. Box 236 Hancocks Bridge, NJ 08038
Inspection Period:	September 21 through October 23, 2015
Inspectors:	J. Schoppy, Senior Reactor Inspector, Team Leader Division of Reactor Safety (DRS) J. Brand, Reactor Inspector, DRS J. Kulp, Senior Reactor Inspector, DRS S. Makor, Reactor Inspector, RIV/DRS S. Kobylarz, NRC Electrical Contractor M. Yeminy, NRC Mechanical Contractor
Approved By:	Paul G. Krohn, Chief Engineering Branch 2 Division of Reactor Safety

SUMMARY

IR 05000354/2015007; 9/21/15 - 10/23/15; Hope Creek Generating Station; Component Design Bases Inspection.

The report covers the Component Design Bases Inspection conducted by a team of four NRC inspectors and two NRC contractors. Two findings of very low safety significance (Green) were identified, both of which were considered to be non-cited violations (NCVs). The significance of most findings is indicated by their color (Green, White, Yellow, Red) using Inspection Manual Chapter (IMC) 0609, "Significance Determination Process." Cross-cutting aspects associated with findings are determined using IMC 0310, "Components Within the Cross-Cutting Areas." The NRC's program for overseeing the safe operation of commercial nuclear power reactors is described in NUREG-1649, "Reactor Oversight Process," Revision 5.

<u>NRC-Identified Findings</u>

Cornerstone: Mitigating Systems

- <u>Green</u>. The team identified a finding of very low safety significance involving a non-cited violation of Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, Appendix B, Criterion V, "Instructions, Procedures, and Drawings," because PSEG did not establish appropriate acceptance criteria for the time allowed for starting the residual heat removal (RHR) and core spray pumps during simulated loss-of-coolant accident/loss-of-offsite power (LOCA/LOP) conditions in the 18-month integrated emergency diesel generator (EDG) surveillance test (ST) for the vital 4KV buses. Specifically, the ST acceptance criteria failed to confirm that the pumps started in accordance with the design basis loading sequence described in the design analyses and Updated Final Safety Analysis Report Table 8.3-1. PSEG's short-term corrective actions included reviewing LOCA/LOP test results and plant historical data to confirm current operability of the RHR and core spray pumps, and initiating corrective action notifications to determine the appropriate ST acceptance criteria and to trend pump start times.

  The team determined that the failure to specify adequate acceptance limits for the design basis assigned start times for the RHR and core spray pumps during LOCA/LOP conditions in the 18-month integrated EDG ST procedure was a performance deficiency. The performance deficiency was more than minor because it was associated with the procedure quality attribute of the Mitigating Systems Cornerstone and affected the cornerstone objective of ensuring the availability, reliability, and capability of systems that respond to initiating events to prevent undesirable consequences. The team evaluated the finding in accordance with IMC 0609, Appendix A, The Significance Determination Process (SDP) for Findings at Power, Exhibit 2 – Mitigating Systems Screening Questions, and determined that the finding was of very low safety significance (Green) because the finding was a design deficiency that did not result in the loss of operability or functionality. The team determined that this finding has a cross-cutting aspect in Human Performance, Documentation, in that PSEG failed to maintain accurate test acceptance documentation to aid plant staff in the identification of equipment performance that was outside the acceptable limits of design. (H.7) (Section 1R21.2.1.1)

- <u>Green</u>. The team identified a finding of very low safety significance involving a non-cited violation of Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, Appendix B, Criterion V, "Instructions, Procedures, and Drawings," because PSEG did not provide adequate work order instructions for the reinstallation of service water (SW) pump discharge isolation valve EAHV-2198C following planned valve maintenance in October 2013. Specifically, the inadequate work order instructions contributed directly to maintenance technicians installing the valve in the opposite orientation compared to the intended orientation. PSEG entered this issue into their corrective action program. In addition, PSEG's corrective actions included completing several associated technical evaluations, calculations, operability determinations, and motor-operated valve performance tests.

  The team determined that the failure to provide adequate work order instructions for the installation of safety-related SW valve 2198C was a performance deficiency. The team determined that this performance deficiency was more than minor in accordance with IMC 0612, "Power Reactor Inspection Report," Appendix B, because it was associated with the procedure quality attribute of the Mitigating Systems Cornerstone and affected the cornerstone objective of ensuring the availability, reliability, and capability of systems (SW) that respond to initiating events to prevent undesirable consequences. Additionally, the team determined that it was more than minor in accordance with IMC 0612, Appendix E, Example 3j, because PSEG's associated operability and technical evaluations did not adequately consider the worst case conditions, resulting in a potential underestimation of the maximum required opening torque and in a condition where there was a reasonable doubt on the operability of the 'C' SW train. The team evaluated the finding in accordance with IMC 0609, Appendix A, The Significance Determination Process (SDP) for Findings at Power, Exhibit 2 - Mitigating Systems Screening Questions, and determined that the finding was of very low safety significance (Green) because the finding was a deficiency that affected the design and qualification of safety-related SW valve 2198C but did not result in the loss of operability or functionality. The team determined that this finding has a cross-cutting aspect in Human Performance, Documentation, in that PSEG failed to ensure that design documentation and work packages were complete, thorough, accurate, and current. (H.7) (Section 1R21.2.1.2)

<u>Other Findings</u>

None

REPORT DETAILS

1. REACTOR SAFETY

Cornerstones: Initiating Events, Mitigating Systems, and Barrier Integrity

1R21 Component Design Bases Inspection (IP 71111.21)

.1 Inspection Sample Selection Process

The team selected risk significant components for review using information contained in the Hope Creek Probabilistic Risk Assessment (PRA) model and the U. S. Nuclear Regulatory Commission's (NRC) Standardized Plant Analysis Risk (SPAR) model for the Hope Creek Generating Station (HCGS). Additionally, the team referenced the Plant Risk Information e-Book (PRIB) for Hope Creek in the selection of potential components for review. In general, the selection process focused on components that had a Risk Achievement Worth (RAW) factor greater than 1.3 or a Risk Reduction Worth (RRW) factor greater than 1.005. The components selected were associated with both safety-related and non-safety related systems, and included a variety of components such as pumps, tanks, diesel engines, batteries, electrical buses, circuit breakers, and valves.

The team initially compiled a list of components based on the risk factors previously mentioned. Additionally, the team reviewed the previous component design bases inspection (CDBI) reports and excluded the majority of those components previously inspected. The team then performed a margin assessment to narrow the focus of the inspection to 16 components and 5 operating experience (OE) items. The team selected the suppression pool and a drywell spray valve to review for large early release frequency (LERF) implications. The team's evaluation of possible low design margin included consideration of original design issues, margin reductions due to modifications, or margin reductions identified as a result of material condition/equipment reliability issues. The assessment also included items such as failed performance test results, corrective action history, repeated maintenance, Maintenance Rule (a)(1) status, operability reviews for degraded conditions, NRC resident inspector insights, system health reports, and industry OE. Finally, consideration was also given to the uniqueness and complexity of the design and the available defense-in-depth margins.

The team performed the inspection as outlined in NRC Inspection Procedure (IP) 71111.21. This inspection effort included walkdowns of selected components; interviews with operators, system engineers, and design engineers; and reviews of associated design documents and calculations to assess the adequacy of the components to meet design basis, and licensing basis requirements. Summaries of the reviews performed for each component and OE sample are discussed in the subsequent sections of this report. Documents reviewed for this inspection are listed in the Attachment.

.2 Results of Detailed Reviews

.2.1 Results of Detailed Component Reviews (16 samples)

.2.1.1 'C' Emergency Diesel Generator (Electrical Review) and 'C' 4KV Bus 10A403

a. Inspection Scope

The team inspected the 'C' EDG and its associated 4KV electrical bus (10A403) to verify that they were capable of performing their design functions in response to transients and accidents. The team reviewed technical specifications (TSs), operating procedures, and the Updated Final Safety Analysis Report (UFSAR) to determine the licensing and operating basis for selected electrical components utilized for starting the 'C' EDG and for connecting the generator to the safety-related 'C' 4KV bus. The team reviewed the EDG loading design basis requirements for postulated loss-of-coolant accident (LOCA) and loss-of-offsite power (LOP) conditions. The team reviewed ST results to verify that operation of the EDG, and selected emergency core cooling system (ECCS) pumps, conformed to design basis loading requirements. The team reviewed voltage drop calculations for the diesel air starting solenoids and the generator field flash circuitry to assure that adequate voltage was available during limiting design basis conditions. The team interviewed the system engineer, reviewed the system health report, and performed a walkdown of the 'C' EDG and the 'C' 4KV bus to assess the observable material condition. The team also reviewed maintenance records and corrective action documents to ensure that PSEG properly maintained the components and identified and corrected deficiencies.

b. Findings

Introduction. The team identified a Green non-cited violation (NCV) Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, Appendix B, Criterion V, "Instructions, Procedures, and Drawings," because PSEG did not establish appropriate acceptance criteria for the time allowed for starting the residual heat removal (RHR) and core spray pumps during simulated LOCA/LOP conditions in the 18-month integrated EDG ST for the vital 4KV buses. Specifically, the ST acceptance criteria failed to confirm that the pumps started in accordance with the design basis loading sequence described in the design analyses and UFSAR Table 8.3-1.

Description. The team noted that the start time acceptance criteria in the 18-month integrated 'C' EDG ST for the RHR and core spray pump motors in HC.OP-ST.KJ-0007, Steps 5.4.8.S and 5.4.8.V, respectively, was 40 seconds and 27 seconds, respectively, after initiation of a simulated LOCA/LOP condition. Based on a review of the General Electric (GE) design drawings for the RHR and core spray pump start circuits, the team noted that the RHR pump was designed to start immediately when 4KV bus power was available either during a LOCA condition (with offsite power available) or during LOCA/LOP conditions after the EDG established bus power, and then for the core spray pump to start six seconds later by a timer circuit which was initiated when the bus power was available.

The team identified that the integrated EDG 18-month ST acceptance criteria did not correctly incorporate the GE pump start design criteria for the RHR and core spray pumps. For example, the EDG was designed to establish bus power nominally within 13-seconds after LOCA conditions and the RHR pump should then start immediately, but the ST acceptance criteria allowed for the pump to start up to 27 seconds later (40 seconds minus the 13 seconds for power to be established by the EDG after the LOCA conditions are detected). In addition, although the RHR pump should start immediately when the EDG breaker closes and 4KV power is available, followed 6 seconds later by the core spray pump in accordance with GE criteria, the acceptance criteria for the RHR pump was 40 seconds and 27 seconds for the core spray pump. These acceptance criteria could allow the core spray pump to start before the RHR pump, resulting in an unanalyzed condition contrary to the design basis loading sequence described in the design analyses and UFSAR Table 8.3-1. In fact, the team identified that technicians recorded pump start times in the last integrated 'B' EDG 18-month ST conducted in April 2015 that indicated that the core spray pump had started before the RHR pump, which would have been contrary to the GE design criteria for the pump starting sequence. The team also noted that PSEG had failed to identify this test anomaly during their post-test acceptance review. The team noted that PSEG had based the ST acceptance criteria on the maximum time for pump flow to be delivered to the reactor vessel and not the designed pump start time for the RHR and core spray pumps. Based on this, the team concluded that the ST start time acceptance criteria for the RHR and core spray pumps was incorrect and non-conservative. During the inspection, upon further review of the plant historical data and strip chart recordings from the April 2015 test, PSEG determined that the RHR and core spray pump start times recorded by the technicians were inadvertently "swapped" in the ST documentation as the actual recorded test data confirmed that the RHR pump actually started before the core spray pump in accordance with the GE design. This NRC-identified test discrepancy was neither identified nor evaluated by PSEG during their review of the test results in April 2015.

Notwithstanding, upon further review of the "swapped" data, the team found that the core spray pump started approximately 3.8 seconds after the EDG breaker was closed to establish bus power. However, starting the core spray pump 3.8 seconds after power was established during a LOCA/LOP was not in accordance with TS acceptance criteria for the minimum time for the core spray pump to start which was 5 seconds (6 seconds +/- 1 second) when power was available. For this case, during the inspection, PSEG engineers reviewed the strip chart recorder record traces for the EDG voltage and frequency conditions during the core spray pump start and confirmed that the voltage and frequency recovered within acceptable limits, thereby assuring EDG operability. Based on a review of the two most recent LOCA/LOP STs for each 4KV vital bus (completed in the Fall of 2013 and the Spring of 2015), the team also identified several additional examples of discrepant RHR and core spray pump start time data in the recorded and accepted test results. These discrepancies included:

1. During the 'A' EDG test in 2013, the core spray pump started only 3 seconds after bus power was established by the EDG (the TS minimum acceptance limit was 5 seconds as noted above). During the 'D' EDG test in 2013, the core spray pump started 4.9 seconds after power was established, which was

also not in accordance with the minimum TS acceptance limit. Subsequent STs performed since 2013 confirmed the proper operation and operability for the subject core spray pumps.

2. For the ‘A’ EDG test in 2015, for the “corrected” data for the ‘B’ EDG test in 2015, and for the ‘C’ EDG test in 2013, the recorded test data indicated that the RHR pump “started” before the EDG breaker was closed to establish bus power. The team noted that this condition was not possible based upon a review of GE’s design drawings for the RHR pump start circuit.

Based upon further review and discussions onsite, the team noted that the accuracy of technician’s recorded data was questionable and that some (see item 2 above), but not all, of the above discrepant conditions could be due to technician response time when using a stopwatch to record pump start times. Once again, the above NRC-identified discrepancies were neither identified nor evaluated by PSEG during their review of the test results at the time of the testing.

The team noted that the non-conservative ST acceptance criteria for the RHR and core spray pump start times had the potential to mask conditions where equipment performed outside expected design limits, and these conditions could neither be detected nor evaluated by PSEG for impact to plant equipment and systems. PSEG initiated notification (NOTF) 20706543 to evaluate test results for any adverse trend in pump start times and NOTF 20706542 to evaluate the ST test acceptance criteria for the RHR and core spray pump start times.

Analysis. The team determined that the failure to specify adequate acceptance limits for the design basis assigned start times for the RHR and core spray pumps during LOCA/LOP conditions in the 18-month integrated EDG ST procedure was a performance deficiency. The team determined that this finding was more than minor because it was associated with the procedure quality attribute of the Mitigating Systems Cornerstone and affected the cornerstone objective of ensuring the availability, reliability, and capability of systems that respond to initiating events to prevent undesirable consequences. Specifically, PSEG failed to identify appropriate EDG loading acceptance criteria for the RHR and core spray pump motor start timing that was used in the ST to confirm that safety-related equipment was operating in accordance with the limits specified in the design analyses. The team evaluated the finding in accordance with Inspection Manual Chapter (IMC) 0609, Appendix A, The Significance Determination Process (SDP) for Findings at Power, Exhibit 2 – Mitigating Systems Screening Questions, and determined that the finding was of very low safety significance (Green) because the finding was a design deficiency that did not result in the loss of operability or functionality. The team determined that this finding had a cross-cutting aspect in Human Performance, Documentation, in that PSEG failed to maintain accurate test acceptance documentation to aid plant staff in the identification of equipment performance that was outside the acceptable limits of design. (H.7)

Enforcement. Title 10 CFR Part 50, Appendix B, Criterion V, “Instructions, Procedures, and Drawings,” states, in part, that procedures shall include appropriate quantitative or qualitative acceptance criteria for determining that important activities have been satisfactorily accomplished. Contrary to the above, prior to October 22, 2015, PSEG had not established appropriate acceptance criteria in HC.OP-ST.KJ-0007, Steps 5.4.8.S and 5.4.8.V, respectively, for the time allowed for starting the RHR pump and core spray pumps during simulated LOCA/LOP conditions in the 18-month integrated EDG ST for the vital 4KV buses.

Specifically, the ST acceptance criteria failed to confirm that the pump(s) starting would be in accordance with the design basis loading sequence described in design analyses and UFSAR Table 8.3-1, "Emergency Loads Assignment of Class 1E and Selected Non-Class 1E Loads on Standby Diesel Generator Buses." PSEG's short-term corrective actions included reviewing LOCA/LOP test results and plant historical data to confirm current operability of the RHR and core spray pumps and initiating corrective action NOTFs to determine the appropriate ST acceptance criteria and trend pump start times. Because this finding was of very low safety significance and because it was entered into PSEG's corrective action program (NOTFs 20706542 and 20706543), this violation is being treated as an NCV, consistent with Section 2.3.2 of the NRC Enforcement Policy. **(NCV 05000354/2015007-01, Failure to Establish Appropriate Acceptance Criteria for RHR and Core Spray Pump Start Times during Simulated LOCA/LOP Testing**)

.2.1.2 Service Water Pump Discharge Valves (EAHV- 2198C and EAHV- 2198D)

a. Inspection Scope

The team reviewed applicable portions of TSs, the UFSAR, and system design basis documents (DBDs) to identify design basis requirements for service water (SW) pump discharge valves EAHV-2198 'C' and 'D'. The team reviewed drawings and vendor documents to verify that the installed configuration of the valves and their Limitorque motor operators supported the design basis function under normal and accident conditions. The team reviewed the valves' orientation and their distance from elbows and from the pumps' discharge check valves to assess possible cavitation and flow disturbances. The team interviewed the system engineer and the motor-operated valve (MOV) engineer to discuss the valves' analyses and operational and maintenance history, and to verify that PSEG appropriately addressed potentially degraded conditions. The team reviewed test procedures and recent test results against design bases documents to verify that acceptance criteria for tested parameters were supported by calculations or other engineering documents and that individual tests and analyses served to validate component operation under accident conditions. The team also reviewed MOV test data and valve operator test traces to validate that the torque required to open the valves did not exceed the rating of their Limitorque operators. The team reviewed vendor documentation, system health reports, preventive and corrective maintenance history, and corrective action system documents to verify that potential degradation was monitored or prevented, and that scheduled component inspections or replacements were consistent with trend data and vendor recommendations. The team conducted several detailed walkdowns to visually inspect the physical/material condition of the valves, their motor operators and support systems, and to ensure adequate configuration control.

b. Findings

Introduction. The team identified a Green NCV of 10 CFR Part 50, Appendix B, Criterion V, "Instructions, Procedures, and Drawings," because PSEG did not provide adequate work order instructions for the installation of SW pump discharge isolation valve 2198C following planned valve maintenance in October 2013. Specifically, the inadequate work order instructions contributed directly to maintenance technicians installing the valve in the opposite orientation compared to the intended orientation.

Description. 1EAHV-2198C is the 'C' SW pump discharge isolation valve. The valve is a 28-inch Weir Tricentric butterfly valve with a SMB-1/HBC-4 (60-1) Limitorque motor operator. The valve has an active safety function in the open position to provide normal SW flow to the safety-related safety auxiliaries cooling system (SACS) heat exchangers (HXs) and non-1E reactor auxiliaries cooling system (RACS) HXs, and emergency SW flow to other systems. PSEG had originally intentionally installed all four 1EAHV-2198 valves in the reverse flow direction to permit the downstream header pressure to seat the valve tighter to minimize seat leakage during SW pump and strainer on-line maintenance. During refueling outage 18 (RF18) in October 2013, PSEG performed a planned refurbishment of the 2198C valve and SMB-1 actuator under work order 60112463-410, Step 1.D. On October 22, 2013, maintenance technicians initiated NOTF 20626219 to document that while installing the 1EAHV-2198C adapter plate, they noticed that the valve was installed 180 degrees different from where it was removed and requested support. The NOTF also documented that the MOV engineer agreed that reconfiguring the valve operator would be the easiest way to correct the issue. In an October 23, 2013, update to the NOTF, maintenance stated that they had applied match marks to ensure that the valve would be installed in the same orientation, but during the course of the work the match marks were erased. Maintenance also updated the NOTF to reflect that they had identified that the 2198 valve installation orientation design specification was not documented in valve drawing M-10-1 or the vendor manual (VTD 323981) as expected. The team also noted that several diagrams within the work order depicted the wrong valve orientation and may have contributed to the configuration control error. Finally, the team noted that there was no documented evaluation of the impact of this misalignment and configuration error prior to operations declaring the 'C' SW pump operable following the 2198C maintenance on October 23. PSEG initiated NOTF 20705874 for this operability screening performance gap.

Based on the narrative logs, the team noted that operators started and stopped the 'C' SW pump several times during the period October 23 – 26, 2013 (with proper function of the 2198C). At 10:59 p.m. on October 26, 2013, operators started the 'C' SW pump (in support of the ongoing 'A' LOCA/LOP ST), but the 2198C failed to open. Operators promptly initiated NOTF 20627235 and entered an unplanned TS limiting condition for operation (LCO) for the 'C' SW pump. PSEG performed troubleshooting and identified that a high opening torque (> ~ 9500 ft-lbs) tripped the torque switch removing power to the valve actuator and resulting in a failure to stroke. PSEG "bumped up" the torque switch setting to ~ 13,200 ft-lbs and successfully stroked the valve open. At 4:44 p.m. on October 27, 2013, while stroking open the valve, engineers recorded a maximum opening torque of 10,201 ft-lbs via a MOV dynamic trace. At 8:53 p.m. on October 27, 2013, operators declared the 'C' SW pump operable and exited the TS LCO.

The team noted that there was no apparent documented evaluation of the cause of the unexpected high opening torque or an assessment of the recorded maximum opening torque (10,201 ft-lbs) relative to the maximum expected opening torque under design basis conditions compared to the MOV's weak link analysis and Limitorque limits.

On February 7, 2014, Weir Valves & Controls USA filed an Interim 10 CFR Part 21 Report for a potential failure associated with Weir valves installed in the forward flow orientation (like the 2198C valve). Based on testing (by PSEG and Weir in December 2013), Weir determined that there existed an unseating load which was not accounted for in Weir's Tricentric triple offset product line operator sizing methodology. A potential operator sizing issue could exist on Tricentric valves which have an open safety function during an event. Weir identified that the direction of flow across the non-symmetrical disc had an impact on the torque required to open/close the valve. PSEG initiated NOTF 20639544 and order 70163546 to evaluate and resolve the potential issue. For Hope Creek, PSEG determined that 17 MOVs could be affected by this issue. The preliminary evaluation under order 70163546-020 only identified one potential operational issue requiring any further evaluation (the 1EAHV-2198C valve that maintenance had installed backwards during RF18, prior to the issuance of the Part 21). For this installation, the maximum differential pressure (DP) only exists on the inlet side of the disc during disc opening when the 'C' SW pump is the first pump started in the 'A' SW loop. Engineering determined that the required stem torque to open the 2198C valve was above the component rating. PSEG's MOV program procedure guidance allows this condition (up to 113 percent of the rated torque) for a limited number of strokes (100). PSEG also initiated NOTF 20673076 to reverse the flow direction of the valve during RF20 in October 2016, so the allowed strokes would not be exceeded. In addition, PSEG performed a technical evaluation to assess the adequacy of MOV 1EAHV-2198C in its installed orientation and evaluated it for a Use-As-Is interim disposition as defined by PSEG procedure CC-AA-11 (70163546-070).

While performing the technical evaluation, engineering identified that the 2198C opening torque would exceed the 113 percent rated torque (14,464 ft-lbs) if they used the SW pump shutoff head in their calculation of maximum DP. PSEG contracted with MPR Associates to perform a more detailed evaluation. MPR's associated calculation reduced the required opening torque from 17,479 ft-lbs to 13,814 ft-lbs (108 percent of the Limitorque limit). The team observed that PSEG's associated technical evaluation noted the high opening torque (10,201 ft-lbs) recorded on October 27, 2013; however, the evaluation only cited it as evidence that the opening torque remained acceptable when opening the 2198C valve (while starting the 'C' SW pump) with the 'A' SW pump running under normal operating conditions (less than the maximum DP expected under design basis conditions). The team noted that there was no apparent documented evaluation comparing the recorded actual opening torque (10,201 ft-lbs) to the expected opening torque (calculated based on the DP at the time) to ensure validity and applicability of the Weir calculation methodology.

During the 2015 CDBI, based on the extremely high opening torque recorded under normal conditions and the valve's lack of margin, the team questioned the operability of the 2198C valve to function under design basis conditions (starting the 'C' SW pump without the 'A' SW pump running). Based on the team's concern, engineering initiated

NOTF 20704783 to perform a technical evaluation to determine if the 2198C actuator was capable of opening the valve under all required conditions based on the actual measured data. Engineering used conservative assumptions and appropriate engineering rigor to determine the approximate DP that existed when the 2198C valve opened on October 27, 2013, when the dynamic MOV trace recorded an opening torque of 10,201 ft-lbs. Engineering estimated the DP at 50.2 pounds square inch differential (PSID). PSEG entered this DP into the Weir spreadsheet (provided with the associated Interim Part 21 Report) and noted that it resulted in a much lower required opening torque (8,375 ft-lbs compared to 10,201 ft-lbs). The apparent disparity between the measured value (10,201 ft-lbs) and the calculated value (8,375 ft-lbs) affirmed the team's concern that other factors may be at play affecting the torque required to open this particular valve and/or called into question the validity of the Weir spreadsheet calculation for this particular configuration (parallel pump operation, closing the discharge isolation valve with the parallel pump running). Based on the 21.8 percent difference between the calculated Weir expected opening torque of 8,375 ft-lbs at 50.2 PSID and the measured torque of 10,201 ft-lbs, PSEG's technical evaluation (70180794-010) added an additional 3,039 ft-lbs (22 percent) to the Weir expected maximum opening torque of 13,814 ft-lbs at the MPR calculated maximum DP of 80.7 PSID to bound the potential impact.

This resulted in an expected maximum opening torque of 16,853 ft-lbs utilizing the Weir Tricentric unseating torque evaluation model. However, PSEG recognized that this final expected torque would exceed the Limitorque 113 percent rating of 14,464 ft-lbs, requiring additional analysis. To ensure sufficient torque margins, PSEG contracted with Kalsi Engineering to perform H4BC gear box torque analyses for the 2198C valve. Based on the Kalsi analysis, the EAHV-2198C H4BC gear box can continue to operate safely for at least 9 cycles (open strokes) at an opening torque level up to 20,000 ft-lbs. In addition, PSEG's technical evaluation noted that the torque switch is bypassed during 'C' SW pump starts under LOCA/LOP conditions ensuring that the torque switch would not preclude valve opening if the open torque exceeded 13,200 ft-lbs. Based on the Kalsi analysis and bypass of the open torque switch under accident conditions, the team concurred with PSEG's determination that the 2198C valve remained operable (although non-conforming).

The team noted that PSEG's technical evaluation also credited starting the 'C' SW pump twice in RF19 in April 2015, with the 'A' SW pump not running, demonstrating that the EAHV-2198C valve was fully capable of opening under the worst case condition (highest expected DP) without tripping the torque switch (not needing the additional torque margin calculated by Kalsi). The team independently reviewed the operator narrative logs and plant historical SW flow data associated with the two credited 'C' SW pump starts to verify that the conditions actually represented worst case conditions. The team confirmed that the 'A' SW pump was indeed out of service when operators started the 'C' SW pump on both occasions. However, the team identified that the 'A' SW pump was also not running on both occasions when the operators stopped the 'C' SW pump. More importantly, the 'A' SW pump discharge pressure was not present on the backside of the 2198C valve while it was closing (prior to the subsequent opening). The team recalled that the Weir Interim Part 21 Report stated that the DP across the valve while closing the valve made a noted difference to the subsequent unseating torque when re-opening the valve. The team noted that the ‘A’ SW pump was running when closing the 2198C on both occasions in October 2013 prior to the 2198C experiencing a relatively high torque on the subsequent opening. Thus, based on the facts and actual plant configuration during the October 2013 and April 2015 ‘C’ SW pump starts, the team determined that the ‘C’ SW pump starts in April 2015 did not adequately demonstrate the capability of the 2198C valve to function under worst case design basis conditions, and could not be credited solely to confirm continued operability of the 2198C. Also, based on the information provided during the inspection, the team noted that Weir’s testing in support of their February 2014 Interim Part 21 Report did not include parallel pump combinations and potential effects of closing the subject valve with the redundant (parallel) pump in service.

During the inspection, the team also noted that engineering did not completely and accurately follow PSEG procedure CC-AA-11, “Nonconforming Materials, Parts, or Components,” during their technical evaluation in response to the Weir Interim Part 21 Report (70163546-070). In particular, the team identified that engineering did not enter the operability determination process (OP-AA-108-115) as required by procedure CC-AA-11 for safety-related components which would likely had resulted in a determination of operable but non-conforming for the degraded 2198C valve. The team noted that this represented a minor procedure violation; however, failing to properly classify the condition as operable non-conforming represented a potential missed opportunity as PSEG management may have elected to correct the condition in May 2015 (RF19). PSEG initiated NOTF 20707031 for this issue.

The team noted that PSEG identified the underlying performance deficiency (less than adequate work order instructions and drawings) associated with the issue of concern discussed above. However, in accordance with NRC IMC 0612, NRC-identified findings include issues initially identified by the licensee to which the inspector has identified a previously unknown weakness in the licensee’s classification, evaluation, or corrective actions associated with the licensee’s correction of a finding or violation (i.e., NRC added value). As noted above, the NRC-identified PSEG shortcomings included: operability determination screenings and evaluations, procedure use and adherence, and adequacy of engineering rigor and questioning attitude in technical evaluations.

Analysis. The team determined that the failure to provide adequate work order instructions for the installation of safety-related SW isolation valve 2198C was a performance deficiency. Specifically, PSEG did not provide adequate instructions and drawings for the reinstallation of valve 2198C, which was previously removed for maintenance, nor did PSEG adequately analyze the resulting condition. The team determined that this performance deficiency was more than minor because it was associated with the procedure quality attribute of the Mitigating Systems Cornerstone and affected the cornerstone objective of ensuring the availability, reliability, and capability of systems (SW) that respond to initiating events to prevent undesirable consequences. Additionally, the team determined that it was more than minor in accordance with IMC 0612, “Power Reactor Inspection Reports,” Appendix B, and Appendix E, Example 3j, because PSEG’s associated operability and technical evaluations did not adequately consider the worst case conditions, resulting in a potential underestimation of the maximum required opening torque and in a condition where there was a reasonable doubt on the operability of the ‘C’ SW train.

The team evaluated the finding in accordance with IMC 0609, Appendix A, The Significance Determination Process (SDP) for Findings at Power, Exhibit 2 – Mitigating Systems Screening Questions, and determined that the finding was of very low safety significance (Green) because the finding was a deficiency that affected the design and qualification of safety-related SW valve 2198C but did not result in the loss of operability or functionality. The team determined that this finding had a cross-cutting aspect in Human Performance, Documentation, in that PSEG failed to ensure that design documentation and work packages were complete, thorough, accurate, and current. (H.7)

Enforcement. Title 10 CFR Part 50, Appendix B, Criterion V, “Instructions, Procedures, and Drawings,” states in part, that activities affecting quality shall be prescribed by documented instructions, procedures, or drawings, of a type appropriate to the circumstances and shall be accomplished in accordance with these instructions, procedures, or drawings. Contrary to the above, on October 22, 2013, PSEG did not provide proper procedures for the installation of SW pump discharge isolation valve EAHV-2198C in work order 60112463-410, Step 1.D, after it was removed from service during RF18 for maintenance activities. Because this violation is of very low safety significance and has been entered into PSEG’s corrective action program (NOTF 20704783), this violation is being treated as a NCV consistent with Section 2.3.2 of the NRC Enforcement Policy. **(NCV 05000354/2015007-02, Inadequate Work Order Instructions and Drawings Resulting in Improper Installation of a Safety-Related SW Valve)**

.2.1.3 High Pressure Coolant Injection Steam Supply Isolation Valve (FD-HV-F001) and Steam Supply Piping

a. Inspection Scope

The team inspected the high pressure coolant injection (HPCI) turbine steam supply outboard containment isolation (FD-HV-F001) to verify that it was capable of performing its design function in response to transients and accidents. The normally closed FD-HV-F001 valve is required to open for the HPCI system to perform its ECCS function and is required to close to isolate the main steam line and reactor vessel to prevent depressurization in case of a HPCI steam line break. The team reviewed applicable portions of Hope Creek’s TSs, the UFSAR, and the HPCI system DBD to identify design basis requirements for FD-HV-F001.

The team reviewed design calculations, including environmental qualifications, valve specifications, and the operating history to verify that the valve was acceptable for HPCI service, and to verify that it met the applicable American Society of Mechanical Engineers (ASME) Code in-service testing requirements. The team reviewed a sample of ST results to verify that valve performance met the acceptance criteria and that the criteria were consistent with the design basis. The team interviewed the system engineer and reviewed MOV diagnostic test results and trending to assess valve performance capability and design margin. The team reviewed a sample of HPCI system corrective action NOTFs, technical evaluations, the HPCI system health report, and applicable test results to determine if there were any adverse operating trends and to ensure that PSEG adequately identified and addressed any adverse conditions. The team also performed several walkdowns of the valve, adjacent area, accessible portions of the HPCI system steam piping, and associated control room instrumentation to assess the material condition, operating environment, and configuration control.

b. Findings

No findings were identified.

.2.1.4 'C' and 'D' Service Water Strainers and Motors (1C-F-509 & 1D-F-509)

a. Inspection Scope

The team inspected the 'C' and 'D' SW strainers to evaluate whether they were capable of meeting their design basis and operational requirements to pass the required SW flow rate while maintaining the SW system reasonably clean, to prevent debris from plugging the safety-related SACS HXs, and to prevent a high pressure drop across the strainers under all accident conditions. The team evaluated the strainers' pressure drop and the adequacy of their continuous backwash function to ensure continuous operation without impeding the proper operation of the SW System. The team reviewed monthly testing, flow rates and pressure drops as well as acceptance criteria affecting the strainers' function to verify that they were capable of performing their safety function and to determine if PSEG had adequately evaluated the potential for strainer degradation. The team interviewed the system and design engineers to assess the material condition of the strainers and scheduled maintenance activities. The team conducted several detailed walkdowns to visually inspect the physical/material condition of the strainers, their motors, and their support systems to validate their design details such as the seismic support of the cantilevered motor located at the top of each strainer, and to ensure adequate configuration control. Finally, the team reviewed corrective action documents and system health reports to evaluate whether there were any adverse operating trends and to assess PSEG's ability to evaluate and correct problems.

b. Findings

No findings were identified.

.2.1.5 Safety Auxiliaries Cooling System Air-Operated Valves EG-AOV-2457B and EG-AOV-2520B

a. Inspection Scope

The team inspected SACS air operated valves (AOVs) EG-AOV-2457B and EG-AOV-2520B to verify that they were capable of performing their design function. The SACS system has a safety-related function to provide cooling water to the engineered safety features (ESFs) equipment, including the RHR pumps and HXs, during normal operation, normal plant shutdown, LOP, and a LOCA. The 2457B valve is the SACS HX temperature control bypass isolation valve. This valve is normally open and has an active safety function to close to prevent flow diversion around the SACS HXs, which could prevent the SACS system from performing its design heat removal safety function.

This valve has no safety function in the open position. The 2520B valve is the 'B' RHR pump cooler SACS supply valve. This valve has an active safety function in the open position to provide SACS cooling water flow to the 'B' RHR pump seal and motor bearing coolers. This valve has no safety function in the closed position. The valve fails open on loss of power or air and automatically opens on a 'B' RHR pump start.

The team reviewed the UFSAR, calculations, associated TSs, and procedures to identify the design basis requirements of the valves. The team also reviewed accident system alignments to determine if component operation would be consistent with the design and licensing bases assumptions. The team also reviewed valve testing procedures and valve specifications to ensure consistency with design basis requirements. The team reviewed periodic verification diagnostic test results and stroke test documentation to verify acceptance criteria were met and consistent with the design basis. The team interviewed the AOV program engineer to gain an understanding of maintenance issues and overall reliability of the valves. The team conducted a walkdown to assess the material condition of the valves, associated piping and supports, and to verify that the installed valve configuration was consistent with design basis assumptions and plant drawings. The team also reviewed the maintenance and operating history of the valves, the SACS system health report, and applicable system test results to determine if there were any adverse operating trends and to ensure that PSEG adequately identified and addressed any adverse conditions. Finally, the team reviewed specific corrective action documents to verify that PSEG appropriately identified and resolved deficiencies, and properly maintained the valves.

b. Findings

No findings were identified.

.2.1.6 'C' 125 Volt Direct Current Battery

a. Inspection Scope

The team reviewed the design, testing, and operation of the 'C' 125 volt direct current (Vdc) station battery (1CD411) to verify that it was capable of performing its design function of providing a reliable source of direct current (DC) power to connected loads under operating, transient, and accident conditions. The team reviewed design calculations to assess the adequacy of the battery's sizing to ensure that it could power the required equipment for a sufficient duration, and at a voltage above the minimum required for equipment operation. The team reviewed short circuit and breaker coordination calculations to ensure that breakers were adequately sized and were capable of interrupting short circuit faults. The team verified that proper breaker coordination existed to provide adequate isolation of the affected portion of the circuit. The team reviewed battery test results to ensure that the testing was in accordance with design calculations, the HCGS TSs, and industry standards, and that the results confirmed acceptable performance of the battery. The team interviewed design engineers regarding design margin, operation, and testing of the DC system. The team performed a walkdown of the battery, DC buses, battery chargers, and associated distribution panels to assess the material condition, configuration control, and the operating environment. Finally, the team reviewed a sample of corrective action NOTFs to ensure that PSEG identified and properly corrected issues associated with the 'C' 125 Vdc (1CD411) station battery.

b. Findings

No findings were identified.

.2.1.7 Suppression Pool Water Level, Temperature, and Water Quality Control

a. Inspection Scope

The team inspected the suppression pool to verify that it was capable of performing its design function. The team reviewed the design basis documents pertaining to the suppression pool (torus) and the applicable sections of the UFSAR to determine the design requirements. The team also reviewed torus internal coating inspection results from inspections performed during the last two refueling outages to assess the material condition and structural integrity of the torus. The team reviewed recent pressure suppression chamber to drywell vacuum breaker and pressure suppression chamber to reactor building vacuum breaker test results to verify that the vacuum breakers remained operable and capable of performing their design function supporting suppression pool integrity. The team also reviewed associated corrective action NOTFs, and applicable instrumentation and control test results for the suppression pool temperature, pressure, and level instruments to determine if there were any adverse trends and to ensure that PSEG adequately identified and addressed any adverse conditions. The team conducted an extensive walkdown of the accessible portions of the exterior of the torus structure to assess the material condition (including evidence of leakage), structural supports, potential hazards, and configuration control.

b. Findings

No findings were identified.

.2.1.8 'C' Emergency Diesel Generator Load Sequencer

a. Inspection Scope

The team reviewed TSs, the UFSAR, and system DBDs to identify design basis requirements for the emergency load sequencer (ELS). The team reviewed drawings and vendor documents to verify that the installed configuration supported the design basis function under accident conditions. The team interviewed the system engineer, reviewed the system health report, and performed several walkdowns of the ELS cabinet to assess the observable material condition and operating environment. The team also verified that the location and installation of the cabinet mounting fasteners were in accordance with the installation drawings to ensure seismic adequacy. The team reviewed test procedures and recent test results against DBDs to verify that acceptance criteria for the tested sequenced time parameters were supported by calculations or other engineering documents and that individual tests and analyses served to validate component operation under accident conditions. The team reviewed vendor documentation, system health reports, preventive and corrective maintenance history, and corrective action system documents in order to verify that potential degradation was monitored or prevented, and that scheduled component inspections or replacements were consistent with vendor recommendations.

b. Findings

No findings were identified.

.2.1.9 Emergency Diesel Generator Fuel Oil Transfer Pumps

a. Inspection Scope

The team reviewed applicable portions of TSs, the UFSAR, and system DBDs to identify design basis requirements for the EDG fuel oil transfer pumps (FOTPs). The team inspected the FOTPs to evaluate whether they were capable of meeting their design basis and operational requirements to maintain each EDG fuel oil day tank (FODT) with sufficient fuel oil and with a flow rate greater than the peak fuel oil consumption rate of the EDGs under all accident conditions, including LOP. The team evaluated the pumps' net positive suction head (NPSH) and suction under the minimum level at the storage tank to ensure that pump operation would not be disrupted. The team reviewed the sizing of the FODTs and the levels associated with the FOTPs' start and stop to verify that the TS-required fuel oil quantity was not compromised. The team reviewed flow rate testing and in-service test (IST) results to verify that the pump performance bounded the analyzed performance of each of the eight FOTPs, and to determine if PSEG had adequately evaluated the potential for pump degradation. The team interviewed the system and design engineers to assess the material condition of the FOTPs and scheduled maintenance activities. The team also conducted several detailed walkdowns to visually inspect the physical/material condition of the FOTPs and their support systems, to validate the data associated with the instruments supporting FOTP operation, and to ensure adequate configuration control. Finally, the team reviewed corrective action documents and system health reports to evaluate whether there were any adverse operating trends and to assess PSEG's ability to evaluate and correct problems.

b. Findings

No findings were identified.

.2.1.10 'A' Safety Auxiliaries Cooling System Expansion Tank and 'A' Safety Auxiliary Cooling System Piping Integrity

a. Inspection Scope

The team reviewed the design, testing, inspection, and operation of the 'A' SACS expansion tank (1-EG-1AT-205), its associated tank level instruments, and associated piping to evaluate whether it could perform its design basis function. The team reviewed design calculations, drawings, and vendor specifications (including tank sizing and level uncertainty analysis) to evaluate the adequacy and appropriateness of design assumptions and operating limits. The team interviewed engineers, and reviewed test records, alarm response procedures, and operating procedures to evaluate whether maintenance and testing were adequate to ensure reliable operation, and to evaluate whether those activities were performed in accordance with regulatory requirements, industry standards, and vendor recommendations. The team also conducted walkdowns of the tank and associated piping and supports to assess the material condition. Finally, the team reviewed corrective action documents and system health reports to evaluate whether there were any adverse trends associated with the 'A' SACS expansion tank and to assess PSEG's ability to evaluate and correct problems.

b. Findings

No findings were identified.

.2.1.11 'A' 250 Volt, Direct Current Motor Control Center (10D251)

a. Inspection Scope

The team reviewed the design, testing, and operation of the 'A' 250 Vdc motor control center (MCC) to verify its ability to meet design basis requirements during plant transients and accidents. The MCC provides 250 Vdc power to HPCI system main and auxiliary components, including the HPCI steam supply isolation valve (FD-HV-F001). The team interviewed design engineers regarding design margin, operation, and testing of the DC system. The team performed several walkdowns of the MCC to assess the material condition, configuration control, and the operating environment. The team reviewed HPCI MCC internal inspection preventive maintenance (PM), battery sizing calculations, and voltage drop calculations. Finally, the team reviewed a sample of corrective action NOTFs to ensure that PSEG identified and properly corrected issues associated with the HPCI MCC.

b. Findings

No findings were identified.

.2.1.12 Drywell Spray Valve (BC-HV-F021B)

a. Inspection Scope

The team inspected the 'B' drywell spray valve (BC-HV-F021B) to verify that it was capable of performing its design function in response to transients and accidents. The normally closed drywell spray valve has a safety function in the open position to allow the RHR system to perform its containment cooling function of reducing and maintaining primary containment pressure and temperature to within acceptable limits following a LOCA. The drywell spray valve also has a safety function to close to provide a primary containment isolation. The team reviewed applicable portions of Hope Creek's TSs, the UFSAR, and the RHR system DBD to identify design basis requirements for BC-HV-F021B. The team reviewed design calculations, including environmental qualifications, valve specifications, and the operating history to verify that the valve was acceptable for RHR service, and to verify that it met the applicable ASME Code in-service testing requirements. The team reviewed a sample of ST results to verify that valve performance met the acceptance criteria and that the criteria were consistent with the design basis. The team interviewed the system engineer, and reviewed MOV diagnostic test results and trending to assess valve performance capability and design margin. The team reviewed a sample of related RHR system corrective action NOTFs, technical evaluations, the RHR system health report, corrective and preventive maintenance records, and applicable test results to determine if there were any adverse operating trends and to ensure that PSEG adequately identified and addressed any adverse conditions. The team also performed a walkdown of both drywell spray valves (F021A and F021B), accessible portions of the RHR system piping, and associated control room instrumentation to assess the material condition, operating environment, and configuration control.

b. Findings

No findings were identified.

.2.1.13 'C' Residual Heat Removal Pump Breaker, 'C' Service Water Pump Breaker, and 'C' Emergency Diesel Generator Output Circuit Breaker

a. Inspection Scope

The team reviewed TSs, the UFSAR, and system DBDs to identify design basis requirements for the 'C' RHR and 'C' SW pump motors and the 'C' EDG output circuit breakers. The team reviewed voltage drop calculations for the breaker closing circuits to assure that adequate voltage was available during limiting design basis conditions. The team also reviewed the current system health report, selected drawings and calculations, maintenance and test procedures, and corrective action NOTFs associated with the 'C' RHR and 'C' SW pump motors and the 'C' EDG output circuit breakers. Specifically, the team reviewed the pump maximum brake horsepower requirements to confirm the adequacy of the motor capability to supply power during worst case design conditions. The team reviewed the adequacy of motor starting and running during degraded offsite voltage conditions coincident with a postulated design basis accident.

The team verified motor overcurrent relay settings and periodic relay calibration test results for adequacy to ensure reliable motor operation during the most limiting design basis operating conditions. The team interviewed the system engineers and performed several walkdowns of the motors and the associated 4KV switchgear, including the control room panels, to assess the observable material condition, configuration control, and operating environment.

b. Findings

No findings were identified.

.2.1.14 Emergency Instrument Air Compressor (10K100) and Instrument Air Header Piping

a. Inspection Scope

The team reviewed the design, testing, inspection, and operation of the emergency instrument air compressor (EIAC) and instrument air header piping to evaluate whether they could perform their design basis function. The non-safety related service air (SA) system supplies normal air to the instrument air (IA) system. The IA system is also non-safety related; however, it is important to safety and has a high risk function to provide clean, dry, oil-free air at the normal temperature and pressure for the air-operated instruments and devices throughout the plant. The EIAC provides the motive force required to maintain IA system pressure should both SA compressors be non-operational.

The team reviewed design calculations, drawings, system modifications, and vendor specifications to evaluate the adequacy and appropriateness of design assumptions and operating limits. The team interviewed engineers, and reviewed test records, alarm response procedures, and operating procedures to evaluate whether maintenance and testing were adequate to ensure reliable operation, and to evaluate whether those activities were performed in accordance with regulatory requirements, industry standards, and vendor recommendations. The team also conducted several walkdowns of the SA compressors, IA dryers, EIAC, local alarm panels, associated control room instrumentation, and accessible IA piping and supports to assess the material condition, configuration control, and operating environment. Finally, the team reviewed corrective action documents and system health reports to evaluate whether there were any adverse trends associated with the EIAC or IA system and to assess PSEG's ability to evaluate and correct problems.

b. Findings

No findings were identified.

.2.1.15 'C' 125Vdc Bus 10D430 and Distribution Panel 1CD417

a. Inspection Scope

The team inspected the 'C' 125 Vdc bus (10D430) and DC distribution panel (1CD417) to verify that they were capable of meeting their design basis requirements to distribute preferred power to safety-related essential loads. The team reviewed the one-line diagrams, control schematics, and the design basis as defined in the UFSAR to verify the adequacy of the 125V bus to supply adequate voltage and current to the loads. The team reviewed the associated voltage drop, load flow, and short circuit calculations to verify that adequate voltage was available to components supplied by the bus under worst case loading and degraded voltage conditions. The team reviewed the bus supply and feeder breaker ratings and trip settings to verify that protection coordination was provided for the loads and for the feeder conductors. The team reviewed vendor specifications, nameplate data, and calculations related to the 125V bus supply. The team interviewed system and design engineers to answer questions that arose during document reviews to determine the adequacy of maintenance and configuration control. The team performed several walkdowns of the 10D430 bus and associated DC distribution panel to assess the material condition, configuration control, and the operating environment. Finally, the team reviewed corrective action NOTFs and system health reports to verify that PSEG appropriately identified and resolved deficiencies.

b. Findings

No findings were identified.

.2.1.16 'A' Standby Liquid Control Pump and Standby Liquid Control Tank

a. Inspection Scope

The team reviewed applicable portions of TSs, the UFSAR, and the system DBD to identify design basis requirements for the standby liquid control (SLC) system. The team inspected the 'A' SLC pump and SLC tank to evaluate whether the pump, taking suction from the tank, was capable of meeting its design basis and operational requirements to provide the required borated water to the reactor vessel under the most limiting accident conditions. The team evaluated the ability of the SLC pump to deliver the design and licensing bases flow rates while the redundant 'B' pump was operating and assessed possible interactions between the two pumps. The team reviewed surveillance testing using the SLC test tank, as well as IST acceptance criteria associated with the SLC pump. The team also validated the tank capacity and reviewed its operational capabilities with respect to Anticipated Transients Without Scram (ATWS) and the reactor pressure vessel (RPV) control portion of the emergency operating procedures (EOPs). The team also verified that the pump performance bounded the flow requirements in the safety analysis and verified that PSEG had adequately evaluated the potential for pump degradation. The team interviewed system and design engineers as well as the IST Program Manager to gather information regarding the condition of the pump, adequacy of pump maintenance, and outstanding issues affecting the pump. The team conducted several detailed walkdowns of the pump, SLC tank, associated support components and instruments, and control room indications to visually inspect the physical/material condition and to ensure adequate configuration control. Finally, the team reviewed corrective action documents and system health reports to evaluate whether there were any adverse operating trends and to assess PSEG's ability to evaluate and correct problems.

b. Findings

No findings were identified.

.2.2 Review of Industry Operating Experience and Generic Issues (5 samples)

The team reviewed selected OE issues for applicability at Hope Creek. The team performed a detailed review of the OE issues listed below to verify that PSEG had appropriately assessed potential applicability to site equipment and initiated corrective actions when necessary.

.2.2.1 NRC Information Notice 2013-14: Potential Design Deficiency in Motor-Operated Valve Control Circuitry

a. Inspection Scope

The team assessed PSEG's applicability review and disposition of NRC Information Notice (IN) 2013-14. This information notice discussed recent industry OE regarding a potential control circuit design deficiency in MOVs that could result in incorrect valve position indication with the valve in an improper position during a LOCA. The team reviewed PSEG's evaluation (70158062) performed in response to this OE. In addition, the team reviewed design drawings and circuit diagrams to assess PSEG's review of the issue.

b. Findings

No findings were identified.

.2.2.2 NRC Information Notice 2011-12: Reactor Trips Resulting from Water Intrusion into Electrical Equipment

a. Inspection Scope

The team assessed PSEG's applicability review and disposition of NRC IN 2011-12. The NRC issued the IN to inform licensees about OE regarding recent events involving water intrusion into electrical equipment that resulted in reactor trips. In addition, the IN described the root causes and corrective actions taken to prevent recurrence. The team assessed PSEG's evaluation of the IN as it applied to HCGS, including their review of the electrical equipment design to ensure that it remained reliable and that there were no vulnerabilities associated with possible water intrusion events. The inspection included a review of corrective action documents, interviews with electrical and design engineering and operations personnel, and a complete walkdown of all accessible safety-related and non-safety related electrical panels, MCCs, electrical cable spreading rooms, and switchgear rooms.

b. Findings

No findings were identified.

.2.2.3 NRC Information Notice 2012-03: Design Vulnerability in Electric Power System

a. Inspection Scope

The team assessed PSEG's applicability review and disposition of NRC IN 2012-03. The NRC issued the IN to inform licensees about OE involving the loss of one of the three phases of the offsite power circuit. The team assessed PSEG's evaluation of the IN as it applied to Hope Creek to confirm that PSEG performed an adequate review and assessment of the issue, and to verify that adequate indications and procedures were available to the operators to take appropriate actions when necessary. The inspection also included a review of associated corrective action documents.

b. Findings

No findings were identified.

.2.2.4 NRC Information Notice 2013-17: Significant Plant Transient Induced by Safety-Related Direct Current Bus Maintenance at Plant

a. Inspection Scope

The team assessed PSEG's applicability review and disposition of NRC IN 2013-17 for Hope Creek. The NRC issued the IN to inform licensees of recent OE involving the loss of one train of a DC distribution system at power in a nuclear power plant. The team reviewed PSEG's evaluation of the systems, components, processes, and procedures described in the assigned OE document to determine if similar deficiencies could represent potential operability issues. PSEG determined that Hope Creek was not vulnerable to the failure as their design differed in that the HCGS DC system has a fuse with a 4 second time delay (rated at 500 percent) to allow the fuse to pass normal current and surges instead of a breaker. The team reviewed the adequacy of PSEG's determination that there were no similar deficiencies that could represent potential operability issues and that the OE was not applicable at Hope Creek.

b. Findings

No findings were identified.

.2.2.5 NRC Information Notice 2010-03: Failures of Motor-Operated Valves due to Degraded Stem Lubricant

a. Inspection Scope

The team assessed PSEG's applicability review and disposition of NRC IN 2010-03. This IN discussed industry OE regarding recent failures and corrective actions for MOVs due to degraded lubricant on the valve stem and actuator stem nut threaded area. The team verified that PSEG entered the OE into their corrective action program (CAP) for review (NOTF 20453813). The team reviewed PSEG's evaluation (70108019) performed in response to this OE as well as PSEG's follow-up actions. The team also reviewed changes to maintenance procedures and lubrication databases made in response to this OE. In addition, the team assessed the adequacy of the PSEG's corrective actions during walkdowns of various MOVs.

b. Findings

No findings were identified.

4. OTHER ACTIVITIES

4OA2 Identification and Resolution of Problems (IP 71152)

a. Inspection Scope

The team reviewed a sample of problems that PSEG had previously identified and entered into the CAP. The team reviewed these issues to verify an appropriate threshold for identifying issues and to evaluate the effectiveness of corrective actions. In addition, the team reviewed NOTFs written on issues identified during the inspection to verify adequate problem identification and incorporation of the problem into the CAP. The specific corrective action documents that the team sampled and reviewed are listed in the Attachment.

b. Findings

No findings were identified.

4OA6 Meetings, including Exit

On October 23, 2015, the team presented the inspection results to Mr. Eric Carr, Plant Manager, and other members of the PSEG staff. The team verified that no proprietary information was retained by the inspectors or documented in the report.

SUPPLEMENTAL INFORMATION
KEY POINTS OF CONTACT

PSEG Personnel
E. Carr, Plant Manager
M. Conroy, AOV Program Engineer
A. Contino, 4KV System Manager
S. DelMonte, Branch Manager
K. Denny, SW System Manager
P. Duca, Senior Engineer, Regulatory Assurance
D. Dunn, RHR System Manager
A. Ghose, Design Engineer Civil Structural
J. Lane, Design Engineer
T. MacEwen, Hope Creek Compliance Engineer
S. Madden, Design Manager
S. Nevelos, Regulatory Assurance Manager
C. Payne, HPCI & RCIC System Manager
M. Peterson, IA System Manager
C. Reed, Remote Shutdown System Manager
N. Rock, SACS System Manager
C. Torres, NSSS Manager
A. Tramontana, Hope Creek Programs Engineering Manager
Z. VanNess, Design Engineer
E. Wagner, Capital Projects

NRC personnel
C. Cahill, Senior Reactor Analyst
S. Haney, Resident Inspector
J. Hawkins, Senior Resident Inspector

LIST OF ITEMS OPENED, CLOSED AND DISCUSSED

Open and Closed

NCV 05000354/2015007-01	NCV	Failure to establish appropriate acceptance criteria for RHR and core spray pump start times during simulated LOCA/LOP testing. (Section 1R21.2.1.1)
NCV 05000354/2015007-02	NCV	Inadequate work order instructions and drawings resulting in improper installation of a safety-related SW valve. (Section 1R21.2.1.2)

LIST OF DOCUMENTS REVIEWED

Audits and Self-Assessments
80113264, 2015 Focused Area Self-Assessment to Determine Readiness for NRC Component Design Basis Inspection (CDBI), dated 3/20/15

Calculations
1EA-HV-2198C, AC Motor Operated GL96-05 Butterfly Valve, Revision 7 1EA-HV-2198D, AC Motor Operated GL96-05 Butterfly Valve, Revision 4
12-0150, Suppression Pool Water Level Limitation for ECCS Pump Operation during Plant Shutdown, Revision 1
646-8, Equipment Foundation, Revision 2 1108-0064-CLC-01, Differential Pressure across Hope Creek Service Water Pump Discharge Valve 1EA-HV-2198C, Revision 0
1108-1407-0064, Differential Pressure across Hope Creek Service Water Pump Discharge Valve 1EA-HV-2198C, Revision 0
E-1.4, HC Class 1E 125 & 250VDC Systems: Short Circuit & Voltage Drop Studies, Revision 6
E-4.1, HC Class 1E 125 VDC Station Battery & Charger Sizing, Revision 17
E-4.2, Hope Creek Generating Station Class 1E DC Equipment & Component Voltage Study, Revision 5
E-4.6, Hope Creek 125 VDC Beyond Design Basis Event Battery Sizing Calculation, Revision 0
E-5.1, HC Class 1E 250 VDC Station Battery & Charger Sizing, Revision 8
E-6.1, Non-Class 1E 250 & 125 VDC Station Battery and Charger Sizing, Revision 12
E-7.4, Class 1E 4.kV System Protective Relay Settings, Revision 6
E-7.9, 125VDC & 250VDC Class 1E System, Revision 4
E-9, Standby Class 1E Diesel Generator Sizing, Revision 9
E-15.1, Hope Creek Load Flow and Degraded Voltage Analysis, Revision 11
E-17B, Voltage Drop for 125 VDC Control Circuit, Revision 0
E-17D, 125 VDC, Voltage Drop from Distribution Panel to Load Panel 1CD417 (Class 1E Channel C), Revision 5
EA-0001, Differential Pressure Calculations, Revision 3
EA-0003, Station Service Water System Hydraulic Analysis, Revision 12
EQ-HC-021A, Environmental Qualification Binder for Limitorque, Motor Operated Valves Model SMB Series, Revision 1
EQ-HC-021B, Environmental Qualification Binder for Limitorques, Motor Operated Valves Models SMB Series DC Valve, Revision 1
EQ-HC-021C, Environmental Qualification Binder for Limitorque, Valve Actuator Components, Revision 1
EQ-HC-028B, Environmental Qualification Binder for Automatic Switch Company (ASCO), Solenoid Valve Model(s) NP8316 Series, Revision 1
EQ-HC-056A, Environmental Qualification Binder for Tyco Electronics, Control and Timing Relays, Model(s) E7000 Series, Revision 1
EQ-HC-056B, Environmental Qualification Binder for Tyco Electronics, Control Timing Relays, Model(s) ETR Series, Revision 1
H-1-BC-MDC-0922 (028), MOV Capability Assessment for 1BC-HV-F021B, Revision 1
H-1-EA-MDC-4010, Elastic – Plastic Finite Element Analysis of Hope Creek Service Water Strainer Element, Revision 0
H-1-FD-MDC-0941 (002), MOV Capability Assessment for 1FD-HV-F001, Revision 1
H-1-GK-MDC-0735, Electrical Heat Load During the Station Blackout Event, Revision 1

H-1-JE-IST-6806, Fuel Oil Transfer Pumps Flow Rate, Revision 0
H-1-JE-IST-7510, Fuel Oil Transfer Pumps Suction Pressure, Revision 0
H-1-JE-IST-7513, Fuel Oil Transfer Pumps Discharge Pressure, Revision 0
H-1-KB-MDC-1007, Backup Pneumatic Supply for 1GSHV-4964 and 1GSHV-11541 Valves, Revision 0
JE-13, Diesel Fuel Oil Day Tank, Revision 7
J-121, Suppression Pool Level Low, Revision 0
MIDACALC Results: 1BC-HV-F021B (HCGS-1) AC Motor Operated GL96-05 Gate Valve, Revision 4
MIDACALC Results: 1FD-HV-F001 (HCGS-1) DC Motor Operated GL96-05 Gate Valve, Revision 5
Report No. 879A, Stress Analysis Calculation of 28 Inch Model 596 Strain-O-Matic Strainer, Revision 3
SC-JE-0059, Diesel Fuel Day Tank Level, Revision 7
XX-C-008, Drawing of Graphs to Show Contents of Tanks at all Levels, Revision 1

<u>Completed Surveillance, Performance, and Functional Tests</u>
HC.MD-ST.GS-0001, Torus to Drywell Vacuum Relief Valve 18 Month Testing, performed 11/4/13
HC.MD-ST.PK-0001, 125 Volt Weekly Battery Surveillance, performed 8/10/15
HC.MD-ST.PK-0002, 125 Volt Quarterly Battery Surveillance, performed 4/28/15 and 8/8/15
HC.MD-ST.PK-0006, 125 Volt Station Batteries Performance Discharge Test using BCT-2000 with Windows Software and Associated Surveillance Testing, performed 11/6/10
HC.MD-ST.PK-0007, 125 Volt Station Batteries 18 Month Service Test using BCT-2000 with Windows Software and Associated Surveillance Testing, performed 4/29/15
HC.OP-FT.KB-0001, H1KB-10-K-100 Emergency Instrument Air Compressor, performed 8/6/15
HC.OP-IS.BC-0003, BP202, B Residual Heat Removal Pump In-Service Test, performed 10/14/15
HC.OP-IS.BC-0102, Residual Heat Removal Subsystem B Valves – In-Service Test, performed 11/2/13
HC.OP-IS.BJ-0001, HPCI Main and Booster Pump Set – OP204 and OP217 – In-Service Test, performed 9/21/15
HC.OP-IS.EA-0101, Service Water Subsystem A Valves – In-Service Test, performed 7/4/15 & 10/9/15
HC.OP-IS.EG-0101, Safety Auxiliaries Cooling System – Subsystem A Valves – In-Service Test, performed 4/2/15, 7/19/15, & 10/8/15
HC.OP-IS.EG-0102, Safety Auxiliaries Cooling System – Subsystem B Valves – In-Service Test, performed 5/21/15 & 8/21/15
HC.OP-IS.JE-0008, H Diesel Fuel Oil Transfer Pump-HP401 – In-Service Test, performed 7/6/15
HP.OP-LR.BC-0203, Containment Isolation Valve Type C Leak Rate Test: CIVS 1BCHV-F021B, Penetration P24A: ‘B’ Drywell Spray, performed 11/2/13
HC.OP-ST.BC-0001, RHR System Piping and Flow Path Verification – Monthly, performed 10/14/15
HC.OP-ST.BC-0004, LPCI Subsystem C ECCS Time Response Functional Test – 18 months, performed 1/29/14
HC.OP-ST.BC-0005, LPCI Subsystem C ECCS Time Response Functional Test – 18 months, performed 6/11/14
HC.OP-ST.BC-0006, LPCI Subsystem C ECCS Time Response Functional Test – 18 months, performed 3/6/14

HC.OP-ST.BC-0007, LPCI Subsystem C ECCS Time Response Functional Test – 18 months, performed 9/6/13
HC.OP-ST.BH-0001, SLC Valve Operability Test – Monthly, performed 9/30/15
HC.OP-ST.BJ-0001, HPCI System Piping and Flow Path Verification – Monthly, performed 9/28/15
HC.OP-ST.EG-0001, SACS Flow Path Verification – Monthly, performed 9/27/15
HC.OP-ST.GS-0001, Drywell and Suppression Chamber Oxygen Concentration Verification - Weekly, performed 10/3/15
HC.OP-ST.GS-0003, Reactor Building/Suppression Chamber Vacuum Breaker Operability Test - Monthly, performed 10/18/15
HC.OP-ST.GS-0004, Suppression Chamber/Drywell Vacuum Breaker Operability Test - Monthly, performed 10/19/15
HC.OP-ST.KJ-0002, Emergency Diesel Generator 1BG400 Operability Test – Monthly, performed 10/12/15
HC.OP-ST.KJ-0003, Emergency Diesel Generator 1CG400 Operability Test – Monthly, performed 6/5/15, 10/6/15
HC.OP-ST.KJ-0004, Emergency Diesel Generator 1DG400 Operability Test – Monthly, performed 10/20/15
HC.OP-ST.KJ-0005, Integrated Emergency Diesel Generator 1AG400 Test – 18 Months, performed 11/8/10, 6/27/13, & 5/8/15
HC.OP-ST.KJ-0006, Integrated Emergency Diesel Generator 1BG400 Test – 18 Months, performed 11/5/13 & 4/24/15
HC.OP-ST.KJ-0007, Integrated Emergency Diesel Generator 1CG400 Test – 18 Months, performed 11/6/13 & 5/4/15
HC.OP-ST.KJ-0008, Integrated Emergency Diesel Generator 1DG400 Test – 18 Months, performed 11/6/13 & 4/24/15
HC.OP-ST.SV-0001, Remote Shutdown Monitoring Instrumentation Channel Check – Monthly, performed 8/9/15 & 10/11/15
HC.OP-ST.SV-0002, Remote Shutdown Control Operability - 18 Months RSP Transfer with “A” Shutdown Cooling In-Service, performed 4/12/15
HC-OP-ST.ZZ-0006, Drywell to Suppression Chamber Leak Rate Test – 18 Months, performed 4/10/15

<u>Completed Preventive Maintenance, Calibrations, and Inspections</u>
Calibration Report, Crystal XP2 Pressure Gauge Digital 1001-3500 PSIG, dated 3/15/15
HC.IC-CC.BC-0006, RHR-Division 2, Channel E11-N652B Pump Discharge Flow, performed 9/18/10
HC.IC-CC.BJ-0010, HPCI – Division 3 Channel L-48011 Suppression Chamber Level, performed 4/11/14
HC.IC-CC.BJ-0011, HPCI – Division 1 Channel L-4085-1 Suppression Chamber Level, performed 11/2/14
HC.IC-CC.GS-0009, Containment Atmosphere Control – Division 1 Channel P-4960A1 Suppression Chamber Pressure (Post Accident Monitoring), performed 1/1/15
HC.IC-CC.GS-0010, Containment Atmosphere Control – Division 4 Channel P-4960B1 Suppression Chamber Pressure (Post Accident Monitoring), performed 7/16/15
HC.IC-CC.GS-0014, Containment Atmosphere Control – Division 4 Channel P-4960B3 Suppression Chamber Pressure (Post Accident Monitoring), performed 7/17/15

HC.IC-CC.SB-0014, RPS – Non Divisional Monitor H1SB-1SBTY-3881B Suppression Pool Bulk Water Temperature, performed 5/20/14
HC.OP-SO.EA-0001, Service Water System Operation (A/C Pump Swap), performed 10/15/15
Motor Operated Valve PVT Report, dated 6/26/15
OU-AA-335-016, Visual Examination of SACS Expansion Tank 1-EG-1BT-205, performed 11/2/10
RCN-029, Hope Creek H1R18 Torus Project Desludge, Coating Inspection and Repair, Final
SH.MD-EU.ZZ-0009, Motor Power Monitor Data Acquisition for Motor Operated Valves, performed 4/26/03
S-IR-6H4-0011, Containment Coatings Condition Monitoring Report, Refueling Outage 1R19, Hope Creek Generating Station, dated 9/21/15
VEN015-003, General Visual Examination Suppression Chamber, dated 4/24/15
VTD 432614, C & D Technologies Battery Inspection Report, dated 8/7/15

Corrective Action Notifications (NOTFs)

20188379	20599639	20685606	20702852	20704910*
20192357	20600422	20686862	20702862	20704959*
20249278	20605880	20687007	20702863	20705022*
20381796	20608297	20687182	20702912	20705352
20404688	20612199	20688379	20702945	20705418*
20442488	20613955	20688759	20703138*	20705420*
20453813	20617870	20688773	20703139*	20705503*
20498861	20618872	20688828	20703155	20705506*
20503940	20619972	20689335	20703199	20705507*
20519749	20620806	20694973	20703218	20705513*
20521256	20621955	20695961	20703251*	20705597
20555348	20625154	20696370	20703257	20705616*
20555834	20626219	20698578	20703302	20705872*
20556952	20627235	20698782*	20703309*	20705873*
20558035	20627274	20698783*	20703310*	20705874*
20559255	20627777	20698784*	20703343	20705891*
20560095	20627787	20698785*	20703433*	20706542*
20563418	20628849	20698786*	20703449*	20706543*
20568722	20631818	20698787*	20703642	20706703*
20571913	20635146	20698788*	20703728*	20706707*
20573570	20641757	20698941	20703966	20706710*
20577490	20643437	20699521	20703967	20706712*
20584759	20653020	20701108*	20704264*	20706717*
20584760	20653539	20701119	20704347	20706720*
20584892	20663223	20702063	20704352*	20706856*
20590426	20668283	20702075	20704464*	20706857*
20593600	20670193	20702283	20704532*	20706937*
20594208	20670595	20702379	20704611*	20706958*
20595574	20673076	20702467	20704622*	20706937
20597608	20680341	20702491	20704726*	20707004*
20597981	20681254	20702550	20704783*	20707031*
20598216	20684134	20702555	20704862*	20707089*
20598733	20684479	20702588	20704884	20707135*

*NOTF written as a result of this inspection

Design and Licensing Bases

CD-143Y, Diesel Fuel Oil Storage and Transfer System Operation Commitment Document, dated 6/7/85

CD-392X, Diesel Fuel Oil Storage and Transfer System Operation Commitment Document, dated 6/7/85

D3.35, Design, Installation and Test Specification for Residual Heat Removal System for the Hope Creek Generating Station, Revision 9

D7.5, Hope Creek Generating Station Environmental Design Criteria, Revision 22

DE-CB.BC-0036, Configuration Baseline Documentation for Residual Heat Removal System, Hope Creek Generating Station, Revision 1

DE-CB.BJ/FD-0073, Configuration Baseline Documentation for High Pressure Coolant Injection (HPCI) System, Hope Creek Generating Station, Revision 0

DE-CB.EA/EP-0052, Configuration Baseline Documentation for Station Service Water System, Revision 2

DE-CB.KJ/PE-0083, Configuration Baseline Documentation Emergency Diesel-Generator System, Revision 1

DE-CB.NB/PB-0045, Configuration Baseline Documentation for 4KV Auxiliary Power System, Revision 1

H-1-VAR-MDS-0357, Design Specification for ECCS Suction Strainers, Revision 0

HC.DE-DB.BH-0001, Standby Liquid Control System, Revision 0

HC.DE-DB.KJ-0001, UFSAR Chapter 15 DB/LB System Validations HC EDG System, Revision 0

HC.DE-PS.ZZ-0041, Hope Creek Station Blackout Program, Revision 3

Hope Creek In-service Testing Program Submittal Interval 3, Revision 8

PN0-E11-4010-0361-(01), Residual Heat Removal System Design Specification, Revision 3

Drawings

10855-E151, 200 Amp 125 VDC Chargers, Revision 39

83916, 28 Inch Model 956 Final Assembly, Revision D

11874141, Tank, 550 Gallons Fuel Oil Day Tank, ASME III, Revision 0

A-0201-0, General Plant Floor Plan, Level 1-Elevation 54’-0”, Revision 13

A-0202-0, General Plant Floor Plan, Level 1-Elevation 77’-0”, Revision 20

A-0203-0, General Plant Floor Plan, Level 1-Elevation 102’-0”, Revision 19

A-0531-0, Separation Criteria Reactor Building Plan- El 54’-0”, Revision 4

A-0532-0, Separation Criteria Reactor Building Plan- El 77’-0”, Revision 4

A-0533-0, Separation Criteria Reactor Building Plan- El 102’-0”, Revision 6

A-0535-0, Separation Criteria Reactor Building Plan-El 145’0”, Revision 5

A-0541-0, Separation Criteria Auxiliary Building-Control/Diesel El. 54’-0”, Revision 6

A-0542-0, Separation Criteria Auxiliary Building-Control/Diesel El. 77’-0”, Revision 9

A-0543-0, Separation Criteria Auxiliary Building-Control/Diesel El. 102’-0”, Revision 14

A-0544-0, Separation Criteria Auxiliary Building-Control/Diesel El. 117’-6”, El. 124’-0”, El. 130’-0”, Revision 6

B617-5903, SACS Expansion Tank, dated 8/5/77

C-0399-0, Anchor Bolts Data for Remote generator & Engine Control Panels, Revision 3

DE-CB.BH-0079, Standby Liquid Control Mechanical Boundary, Revision 20

E-0001-0, Single Line Diagram Station, Revision 24

E-0006-1 Sh. 1, Single Line Meter & Relay Diagram 4.16 KV Class 1E Power System, Revision 11

E-0008-1, Single Line Meter & Relay Diagram Diesel Generators, Revision 4
E-0009-1 Sh. 1, 125 VDC System - Channels A & C, Revision 25
E-0009-1 Shs. 3 & 5, 125 VDC System, Revisions 28 & 22
E-0009-1 Sh. 4, 125 V DC System Channels C & D, Revision 13
E-0011-1 Sh. 2, 250V DC System - Unit 1, Revision 19
E-0012-1 Shs. 1, 2, 3, 4, & 5, 120V AC Instrumentation & Misc. Systems, Revisions 15, 30, 29, 8, and 39
E-0208-0 Sh. 3, Electrical Schematic Diagram 4.16KV Circuit Breaker Control Station Service Water Pump, Revision 10
E-219-0, Electrical Schematic Diagram RHR Pump Seal & Motor BRG. CLG. WTR SPLY. SOL. VLV ISV-2520B, Sheet 2, Revision 7
E-6234-0 Sh. 10, Electrical Schematic Diagram, Residual Heat Removal System, Containment Spray (Inboard) Valve (HV-F021A), Revision 5
E-6441-0 Shs. 1 & 2, Electrical Schematic Diagram Class 1E 4.16KV CKT Breaker Control RHR Pumps. 1DP202, Revisions 6 & 7
E-6443-0, Electrical Schematic Diagram 4.16 KV Circuit Breaker Control RHR Pump IBP202, Revision 8
I-03511, Strainer Element Assembly, Revision L
I-770912-A, Strain-O-Matic 180º Flow, Revision 5
J-11-0-9, Safety Auxiliaries Cooling-RHR HX BE 205 Outlet Valve/Seal and BRG. CLG. Water Valve, Revision 9
J105-0 Shs. 8 & 9, Logic Diagram Sequencer Fan Out, Revisions 6 & 5
M-10-1, Service Water, Revision 55
M-11-1 Shs. 1, 2, 3, & 4, Safety Auxiliaries Cooling, Reactor Building, Revisions 32, 42, 31, & 2
M-12-1 Shs. 1 & 2, Safety Auxiliaries Cooling, Auxiliary Building, Sheet 1, Revisions 31 & 1
M-15-0 Sh. 1, Compressed Air System, Sheet 1, Revisions 50 & 51
M-30-1, Sheet 1, Diesel Engine Auxiliary Systems Fuel Oil, Revision 19
M-48-1, Standby Liquid Control, Revision 16
M-48-1-BH-CBD, Standby Liquid Control, Revision 0
M-51-1 Sh. 1, Residual Heat Removal, Revision 47
M-55-1 Sh. 1, High Pressure Coolant Injection, Revision 24
M-56-1 Sh. 1, HPCI Pump Turbine, Revision 16
M-97-0, Intake Structure Building and Equipment Drains PI&D, Revision 7
O-P-EA-01, System Isometric Intake Structure Service Water, Revision 20
O-P-EA-012, Fab Isometric Intake Structure Service Water, Revision 20
PJ810-009 Shs. 1 & 2, Logic Diagram Emergency Load Sequencer Cabinet C, Revisions 7 & 6
PJ810-009 Sh. 3, Logic Diagram Step Timer Cabinet C, Revision 7
PJ810-009 Sh. 4, Logic Diagram Step Timer, Revision 7
PP302Q-0302 Sh. 0, H1/10-900 Flex Wedge Gate Valve, dated 4/26/12

<u>Engineering Evaluations</u>
1EGHV-2457 A&B, Air Operated Valve (AOV) Capability Evaluation, Revision 2
1EGHV-2520 A&B, Air Operated Valve (AOV) Capability Evaluation, Revision 2
10855-D7.3, Appendix E, Separation Review Data Sheet, Reactor Building Room 4218, Elevation 77’, Revision 1
10855-D7.3, Appendix E, Separation Review Data Sheet, Reactor Building Room 4301, Elevation 102’, Revision 1

317103(15), Maximum Thrust and Seismic Analysis for 10" – Class 900 Carbon Steel Flex Wedge Gate valve with SMB-1-60 Limitorque Motor Actuator, Revision 2
317103(41)-01, Maximum Thrust and Seismic Analysis for 16" – Class 300 Carbon Steel Flex Wedge Gate valve with SB-3-100 Limitorque Motor Actuator, Revision 0
70090160, Suppression Pool Level Low Alarm, dated 10/17/08
70102111-50, Determination of Whether the Reactor Building to Torus Vacuum Breaker, H1GS-1GSPSV-5030, was able to Perform its Design Function as Defined in Tech Specs and the Maintenance Rule Program, dated 10/15/09
70105023, Slowly Lowering Torus Level, dated 1/5/10
70106957, NRC Information Notice 2010-03, Revision 0
70124352, Functional Failure Cause Determination Evaluation: Suppression Pool Temperature, dated 7/7/11
70125650 (NOTF 20516551), IST Pump Evaluation, dated 6/29/11
70139234, MOV 1FDHV-F001 Needs Margin Improvement, Revision 0
70158062, OPEX Response: Potential Design Deficiency in Motor-Operated Valve Control Circuitry, dated 12/19/13
70158101, IST Rebaseline of H1BC-BC-HV-F021A, Revision 0
70162112, Maintenance Rule Functional Failure Cause Determination, BC-HV-021B Seat Leakage, dated 2/4/14
70163546, Use-As-Is Interim Disposition Technical Evaluation for 1EAHV-2198C Reverse Flow, Revision 0
70175293, HPCI Steam Admission Valve (FD-F001) Leakby, dated 5/14/15
70176210, Reportability Review for Rising Torus Level Trend (NOTF 20687007), dated 6/1/15
70176533, Valve H1BC-BC-HV-F021A In-service Test Valve Evaluation, Revision 0
70176608, Valve H1BC-BC-HV-F021A High As-found and As-left Open Thrust during Diagnostic Testing in H1R19 (30138724), Revision 0
70177495-10, Impact of the RF19 As-Found 'F' SRV Setpoint Pressure on the 'B' Main Steam Line and 'F' SRV Discharge Line, dated 8/27/15
70177495-40, RF19 SRV Setpoint Test Failures Assessment, dated 8/25/15
70178126, HPCI Core Spray Injection Valve Failed to Open during IST (OP-Eval 15-007), Revision 1
70180794, H1EA-EA-HV-2198C Reverse Flow Direction Evaluation, dated 10/20/15
80065877, Replace GE AKR DC Breakers, Revision 1
80078355, AKR 125 VDC and 250 VDC Breaker Replacement, Revision 0
80083976, Replace Model DC-2000 Trip Unit with Model DC-2000 NQ Trip Unit, Revision 1
80097309, HPCI Valve HV-8278 Replacement, Revision 0
80108793, "C" SSW Discharge Valve Failed IST Evaluation, dated 3/2/13
80110417, Technical Evaluation of As-Found leakage for Penetration P24A (1BCHV-F021B exceeding Administrative Limit), Revision 0
80114188, Multiple Pieces of Tape Discovered in 'H' T-quencher Piping Support Guide Lugs, Weldsand Dampeners, dated 5/20/15
DEH 110079, Walkdown Information for IER 11-1 Recommendation 3, Capability to Mitigate Internal and External Flooding Events, Revision 0
DEH 120195, SACS Expansion Tank Level Swings, Revision 1
DEH 120280, STACS Expansion Tanks Sluicing, Revision 10
EQ-HC-072A, Environmental Qualification Binder for Cutler-Hammer INC (EATON), Class 1E, 480V MCC, Reactor Area, Revision 0

H-1-BB-MEE-1168, Determination of Drywell Insulation Material Debris Sources and Quantities Generated Due to Postulated High Energy Pipe Breaks, Revision 2
H-1-ZZ-MEE-0864, Motor Operated Gate Valve Pressure Locking/Thermal Binding Review, Revision 0
HC15-008, Adverse Condition Monitoring and Contingency Plan: HPCI Steam Admission Valve (FD-F001) Leakby, Revision 3
Orders (Evaluations): 70056192, 70059015, 70060868, 70111202, 70115714, 70128893, 70134962, 70138725, 70139229, 70141532, 70150554, 70158231, 70159261, 70162113, 70163046, 70173642, 80104106, 80108793, 80108856, 80112286
TCCP 4HT-14-028, Defeat High Flow Switch 1KBFSH-7618 for Air Dryer 10F104, Revision 0

Maintenance Work Orders

30013826	30148488	30200706	30272880	60107488
30040357	30157118	30208969	60015966	60109690
30077629	30158854	30218556	60022564	60109691
30087884	30165813	30221175	60079674	60112463
30119900	30174260	30227181	60084133	60121909
30123531	30179032	30234076	60106988	60122197
30138724	30179104	30264028	60107486	
30148196	30190587	30265252	60107487	

Miscellaneous
Hope Creek Generating Station LER 96-001-00, Safety and Auxiliaries Cooling Systems Heat Exchangers Fouled with Grass Due to a Failed Service Water Strainer, dated 2/15/96
Hope Creek Generating Station LER 97-021-00, dated 9/22/97
Hope Creek Generating Station LER 97-027-00, Technical Specification Surveillance Requirement Implementation Deficiencies - 125/250 VDC Batteries, dated 12/15/97
Hope Creek Generating Station LER 98-007-00, dated 11/9/98
Hope Creek Generating Station LER 99-007-00, License Condition Violation - Class 1E Battery Charging, dated 7/19/99
Hope Creek MOV Program Basis Document, Revision 0
In-Service Testing Scoping Basis, H1BC -BC-HV-F021B, Revision 3.8
In-Service Testing Scoping Basis, H1FD -FD-HV-F001, Revision 3.12
OP-SH-111-101-1001, Hope Creek Narrative Log, dated 10/25/13 - 10/30/13 and 4/28/15 - 5/2/15
QCIR No. 1-CC-428-1-C-1.55, Installation and Testing of Undercut Anchors Inspection record, dated 9/4/84
Regulatory Guide 1.97, Instrumentation for Light-Water-Cooled Nuclear Power Plants to Assess Plant and Environs Conditions During and Following an Accident, Revision 2
WCDs: 4381567, 4382795

Normal and Special (Abnormal) Operations Procedures
HC.OP-AB.COMP-0001, Instrument and/or Service Air, Revision 6
HC.OP-AB.COOL-0002, Safety/Turbine Auxiliaries Cooling System, Revision 8
HC.OP-AB-ZZ-0024, CRIDS Computer Points Book 5 D3624 thru D4288, Revision 11
HC.OP-AB-ZZ-0025, CRIDS Computer Points Book 6 D4303 thru D4596, Revision 10
HC.OP-AB.ZZ-0149, 250 VDC System Malfunction, Revision 4
HC.OP-AB.ZZ-0150, 125 VDC Malfunction, Revision 7

HC.OP-AB.ZZ-0172, Loss of 4.16KV Bus 10A403, Revision 7
HC.OP-IO.ZZ-0008, Shutdown from Outside Control Room, Revision 34
HC.OP-SO.BC-0001, Residual Heat Removal System Operation, Revision 53
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LIST OF ACRONYMS

ADAMS	Agencywide Documents Access and Management System
AOV	Air-Operated Valve
ASME	American Society of Mechanical Engineers
ATWS	Anticipated Transients Without Scram
CAP	Corrective Action Program
CDBI	Component Design Bases Inspection
CFR	Code of Federal Regulations
DBD	Design Basis Document
DC	Direct Current
DP	Differential Pressure
DRS	Division of Reactor Safety
ECCS	Emergency Core Cooling System
EDG	Emergency Diesel Generator
EIAC	Emergency Instrument Air Compressor
ELS	Emergency Load Sequencer
EOP	Emergency Operating Procedure
ESF	Engineered Safety Feature
FODT	Fuel Oil Day Tank
FOTP	Fuel Oil Transfer Pump
GE	General Electric
HCGS	Hope Creek Generating Station
HPCI	High Pressure Coolant Injection
HX	Heat Exchanger
IA	Instrument Air
IMC	Inspection Manual Chapter
IN	Information Notice
IP	Inspection Procedure
IST	In-Service Test
LCO	Limiting Condition for Operation
LER	Licensee Event Report
LERF	Large Early Release Frequency
LOCA	Loss-of-Coolant Accident
LOP	Loss-of-Offsite Power

MCC	Motor Control Center
MOV	Motor-Operated Valve
NCV	Non-Cited Violation
NOTF	Notification
NPSH	Net Positive Suction Head
NRC	Nuclear Regulatory Commission
OE	Operating Experience
PARS	Publicly Available Records
PM	Preventive Maintenance
PRA	Probabilistic Risk Assessment
PRIB	Plant Risk Information e-Book
PSEG	Public Service Enterprise Group
PSID	Pounds Square Inch Differential
PVT	Periodic Verification Test
RACS	Reactor Auxiliaries Cooling System
RAW	Risk Achievement Worth
RF	Refueling Outage
RHR	Residual Heat Removal
RPV	Reactor Pressure Vessel
RRW	Risk Reduction Worth
SA	Service Air
SACS	Safety Auxiliaries Cooling System
SDP	Significance Determination Process
SLC	Standby Liquid Control
SPAR	Standardized Plant Analysis Risk
ST	Surveillance Test
SW	Service Water
TS	Technical Specification
UFSAR	Updated Final Safety Analysis Report
VDC	Volts, Direct Current
VTD	Vendor Technical Document
WCD	Work Clearance Document