



DEC 24 2015

LR-N15-0259

U.S. Nuclear Regulatory Commission  
Attn: Document Control Desk  
Washington, DC 20555-0001

Hope Creek Generating Station  
Renewed Facility Operating License No. NPF-57  
Docket No. 50-354

Subject: Denial of NCV 05000354/2015007-02, Inadequate Work Order Instructions and Drawings Resulting in Improper Installation of a Safety-Related SW Valve

Reference: Hope Creek Generating Station - Component Design Bases Inspection Report 05000354/2015007

By letter dated November 25, 2015 (Reference), the U.S. Nuclear Regulatory Commission (NRC) issued Inspection Report 05000354/2015007 concerning the Component Design Bases Inspection (CDBI Inspection) completed on October 23, 2015.

The inspection report identified a Green non-cited violation (NCV) of Title 10 CFR Part 50, Appendix B, Criterion V, "Instructions, Procedures, and Drawings," asserting that PSEG did not provide proper procedures for the installation of SW pump discharge isolation valve EAHV-2198C. The enclosure to this letter provides Hope Creek's response denying the NCV.

There are no regulatory commitments associated with this submittal. If you have any questions, please contact Ms. Susan D. Simpson at (856) 339-1224.

Sincerely,

A handwritten signature in black ink that reads "Paul J. Davison".

Paul J. Davison  
Site Vice President – Hope Creek

ttm

Enclosure – Basis for NCV Denial

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cc: Mr. D. Dorman, Regional Administrator, NRC Region I  
Ms. C. Parker, Project Manager – Hope Creek  
Mr. J. Hawkins, NRC Senior Resident Inspector - Hope Creek (X24)  
Ms. P. Holahan, Director, Office of Enforcement, US NRC  
Mr. P. Mulligan, Manager IV, NJ Bureau of Nuclear Engineering  
Mr. T. MacEwen - Hope Creek Commitment Coordinator (H02)  
Mr. L. Marabella - Corporate Commitment Coordinator (N21)

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bcc: Plant Manager, Hope Creek  
Director, Regulatory Compliance  
Manager, Licensing  
Records Management

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## **Basis for NCV Denial**

### NRC Inspection Report NCV Discussion

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)**



### Hope Creek Response

PSEG denies that the NRC identified any new information that impacted the licensee's conclusions regarding operability or corrective actions. The improper re-installation of valve EAHV-2198C was promptly identified by the licensee and entered into CAP, and the additional analyses performed in response to NRC questions supported the licensee's initial conclusions.

In addition, PSEG contends the identified weaknesses associated with the classification, evaluation, and corrective actions of EAHV-2198C do not meet the threshold for more than minor.

### Basis for Denial

PSEG initiated notification 20626219 on October 22, 2013, when it was recognized that the subject valve, EAHV-2198C, had been installed in the reverse direction than intended. This occurred during valve maintenance. PSEG entered this condition into the Corrective Action Program, performed evaluations, and developed corrective actions as a result of the condition. Valve test data were obtained which demonstrated that the valve torque during normal valve operations was within the capability of the motor operator and contained margin to the maximum torque setting and additional margin to the maximum operator capability under accident conditions (torque limit switch bypassed). On February 7, 2014, the valve manufacturer issued a Part 21 report (EN 49809) that identified an additional unseating load that was not accounted for in the original design of the valve for the normal flow direction. PSEG engaged the valve manufacturer to evaluate actuator capabilities with respect to the Part 21 report and due to the effect of the valve being installed in the reverse direction. The review concluded that the EAHV-2198C settings were appropriate for the service conditions (reference 70163546).

The NRC has contended that the torque value measured during a routine stroke had insufficient margin to account for the worst case. This contention was made without knowledge of the actual operating conditions of the system at the time that the data were collected. The system alignment, flowrates, and valve differential pressure (DP) were not recorded and were unknown. Without knowing actual system operating conditions, data cannot be extrapolated to a different system condition with any certainty.

In response to NRC concerns, PSEG developed additional analyses to address the speculated worst case scenario expressed by the inspection team. These evaluations demonstrated that the valve operator would still function to meet these conditions, with margin.

The NRC cited IMC 0612, stating that "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)."

PSEG contends that the weaknesses identified in the inspection report regarding "classification, evaluation and corrective actions" are not more than minor in that PSEG's conclusions on operability and corrective actions were not impacted.

In their determination that the violation was more than minor, the NRC cited the Appendix B cornerstone objective of Mitigating Systems as being "adversely affected." The cornerstone objective for Mitigating Systems is: "To ensure the availability, reliability, and capability of systems that respond to initiating events to prevent undesirable consequences (i.e. core damage)." The inspection report cites the procedure quality attribute but does not specify how the weaknesses identified by the NRC would have adversely affected the Mitigating Systems cornerstone. There was no effect on the operability of any system or component and no impact

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to the conclusions of the previous evaluations. Additionally, PSEG takes exception to the assertion that the work instructions lacked sufficient detail.

#### Summary

PSEG denies that the NRC identified any new information that impacted the licensee's conclusions regarding operability or corrective actions. The improper re-installation of valve EAHV-2198C was promptly identified by the licensee, and entered into CAP, and the additional analyses performed in response to NRC questions supported the licensee's initial conclusions. Therefore, the issue remains licensee identified.

In addition, PSEG contends the identified weaknesses associated with the classification, evaluation, and corrective actions of EAHV-2198C do not meet the threshold for more than minor.

#### Proposed Remedy

The proposed remedy is for the NRC to reassess the issue against the criteria of IMC 0612 Appendix B. The weaknesses identified by the NRC should be reclassified as not more than minor, and not included in the inspection report per the guidance in IMC 0612-14.