UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION I
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June 20, 2019

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

SUBJECT: HOPE CREEK GENERATING STATION – TEMPORARY INSTRUCTION TI-193 INSPECTION REPORT 05000354/2019012

Dear Mr. Sena:

On May 21, 2019, the U.S. Nuclear Regulatory Commission (NRC) completed an inspection at your Hope Creek Generating Station and discussed the results of this inspection with Ms. Jean Fleming, Director, Site Regulatory Compliance and other members of your staff. The results of this inspection are documented in the enclosed report.

NRC inspectors documented one finding of very low safety significance (Green) in this report. The finding did not involve a violation of NRC requirements.

If you disagree with a cross-cutting aspect assignment or a finding not associated with a regulatory requirement 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 U.S. Nuclear Regulatory Commission, ATTN: Document Control Desk, Washington, DC 20555-0001; with copies to the Regional Administrator, Region I; and the NRC resident inspector at Hope Creek.

This letter, its enclosure, and your response (if any) will be made available for public inspection and copying at http://www.nrc.gov/reading-rm/adams.html and at the NRC Public Document Room in accordance with 10 CFR 2.390, "Public Inspections, Exemptions, Requests for Withholding."

Sincerely,

/RA/

Matthew R. Young, Chief
Projects Branch 6

Docket No.: 05000354
License No.: NPF-57

Enclosure:
Inspection Report 05000354/2019012

cc w/ encl: Distribution via ListServ

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U.S. NUCLEAR REGULATORY COMMISSION
Inspection Report

Docket Number:	05000354
License Number:	NPF-57
Report Number:	05000354/2019012
Enterprise Identifier:	I-2019-012-0012
Licensee:	PSEG Nuclear, LLC
Facility:	Hope Creek Generating Station
Location:	Hancocks Bridge, NJ 08038
Inspection Dates:	April 08, 2019 to April 12, 2019
Inspectors:	F. Arner, Senior Reactor Analyst C. Cahill, Senior Reactor Analyst C. Lally, Project Engineer
Approved By:	Matthew R. Young, Chief Projects Branch 6 Division of Reactor Projects

Enclosure

SUMMARY

The U.S. Nuclear Regulatory Commission (NRC) continued monitoring the licensee's performance by conducting a temporary instruction TI-193 inspection at Hope Creek Generating Station in accordance with the Reactor Oversight Process. The Reactor Oversight Process is the NRC's program for overseeing the safe operation of commercial nuclear power reactors. Refer to https://www.nrc.gov/reactors/operating/oversight.html for more information. Findings and violations being considered in the NRC's assessment are summarized in the table below.

List of Findings and Violations

Failure to Properly Fill and Vent Flow Indicators Results in Loss of SAWA/SAWM Flow Instrumentation Accuracy			
Cornerstone	Significance	Cross-cutting Aspect	Report Section
Barrier Integrity	Green FIN 05000354/2019012-01 Open/Closed	[H.7] - Documentation	2515/193
The team identified a finding of very low safety significance (Green) for the failure to ensure adequate procedures were in place to ensure that the Severe Accident Water Addition (SAWA) flow indicators, 1APFI-0100 and 1BCFI-0100, would be reliable or functional to provide proper flow indication when either the SAWA flooded or non-flooded flowpaths were used during an extended loss of alternating current power (ELAP) event. Both flow instruments are of the Rosemount Annubar design, and are required to be maintained filled and vented. PSEG maintains the SAWA flowpaths for both the flooded and non-flooded conditions dry until placed in service during an ELAP event. Therefore, the flow indication used to control the flowrate with flow control valves within HC.OP-EO.ZZ-0410(Q), "Severe Accident Water Addition From River (Non-Flood Condition)," and HC.OP-EO.ZZ-0411, "SAWA Injection From the Turbine Building," (TB) for flooded conditions, would not have been accurate and for the non-flooded procedure could have impacted the ability to provide and maintain the initial required flowrate and subsequent throttling of flowrates later in the event response. This would challenge the operators to ensure that enough flow was being delivered to properly remove containment heat while simultaneously preventing too much flow to protect the containment vent.			

Additional Tracking Items

None.

INSPECTION SCOPES

Inspections were conducted using the appropriate portions of the inspection procedures (IPs) in effect at the beginning of the inspection unless otherwise noted. Currently approved IPs with their attached revision histories are located on the public website at http://www.nrc.gov/reading-rm/doc-collections/insp-manual/inspection-procedure/index.html. Samples were declared complete when the IP requirements most appropriate to the inspection activity were met consistent with Inspection Manual Chapter (IMC) 2515, "Light-Water Reactor Inspection Program - Operations Phase." The inspectors reviewed selected procedures and records, observed activities, and interviewed personnel to assess licensee performance and compliance with Commission rules and regulations, license conditions, site procedures, and standards.

OTHER ACTIVITIES – TEMPORARY INSTRUCTIONS, INFREQUENT AND ABNORMAL

2515/193 - Inspection of the Implementation of EA-13-109: Order Modifying Licenses with Regard to Reliable Hardened Containment Vents Capable of Operation under Severe Accident Conditions

Inspection of the Implementation of EA-13-109: Order Modifying Licenses with Regard to Reliable Hardened Containment Vents Capable of Operation under Severe Accident Conditions (1 Sample)

Based on samples selected for review, the inspectors verified that the licensee satisfactorily implemented appropriate elements of the reliable hardened containment wetwell vent as described in the plant specific submittals and the associated safety evaluation (ADAMS Accession No. ML18290A876) and determined that the licensee was in compliance with NRC Order EA-13-109 Phase 1, "Reliable, Severe Accident Capable Wetwell Venting System" (ML13143A321).

The inspectors verified that the licensee satisfactorily:

- Installed the HCVS to meet the performance objectives outlined in Section A.1.1 of Attachment 2 to the Order EA-13-109;
- Installed the HCVS system with the design features specified in Section A.1.2 of Attachment 2 to the Order EA-13-109;
- Designed the HCVS to meet the quality standards described in Section A.2 of Attachment 2 to the Order EA-13-109;
- Developed and implemented adequate maintenance and testing of HCVS equipment to ensure their availability and capability;
- Developed and issued procedures to safely operate the HCVS using normal power supplies, during an ELAP, and during a postulated severe accident scenario, and integrated the procedures into existing plant procedures; and
- Trained their staff to assure personnel can proficiently operate the HCVS.

Based on samples selected for review, the inspectors verified that the licensee satisfactorily implemented appropriate elements of the reliable wetwell venting strategy as described in the plant specific submittals and the associated safety evaluation (ML18290A876) and determined that the licensee was in compliance with NRC Order EA-13-109 Phase 2, "Reliable, Severe Accident Capable Drywell (or alternative strategy) Venting System" (ML13143A321).

The inspectors verified that the licensee satisfactorily developed a strategy making it unlikely that the licensee would need to vent from the containment drywell that includes the following:

- Implemented the SAWA/SAWM systems as defined and fulfilled functional requirements for installed and portable equipment;
- Installed and/or identified the previously-installed instrumentation necessary to implement SAWM;
- Developed and implemented adequate maintenance and testing of SAWA/SAWM equipment to ensure availability and capability;
- Developed and issued procedures to safely operate the SAWA/SAWM during an ELAP and during postulated severe accident scenario, and integrated their procedures into their existing plant procedures such that entry into and exiting from the procedures are clear when using existing plant procedures; and
- Trained their staff to assure personnel can proficiently operate the HCVS during an ELAP and accident scenario.

The inspectors verified that any noncompliance with requirements, and standards identified during the inspection were entered into the licensee's corrective action program.

INSPECTION RESULTS

<table>
<tr><td colspan="4">Failure to Properly Fill and Vent Flow Indicators Results in Loss of SAWA/SAWM Flow Instrumentation Accuracy</td></tr>
<tr><td>Cornerstone</td><td>Significance</td><td>Cross-cutting Aspect</td><td>Report Section</td></tr>
<tr><td>Barrier Integrity</td><td>Green
FIN 05000354/2019012-01
Open/Closed</td><td>[H.7] - Documentation</td><td>2515/193</td></tr>
<tr><td colspan="4">The team identified a finding of very low safety significance (Green) for the failure to ensure adequate procedures were in place to ensure that the Severe Accident Water Addition (SAWA) flow indicators, 1APFI-0100 and 1BCFI-0100, would be reliable or functional to provide proper flow indication when either the SAWA flooded or non-flooded flowpaths were used during an extended loss of alternating current power (ELAP) event. Both flow instruments are of the Rosemount Annubar design, and are required to be maintained filled and vented. PSEG maintains the SAWA flowpaths for both the flooded and non-flooded conditions dry until placed in service during an ELAP event. Therefore, the flow indication used to control the flowrate with flow control valves within HC.OP-EO.ZZ-0410(Q), “Severe Accident Water Addition From River (Non-Flood Condition),” and HC.OP-EO.ZZ-0411, “SAWA Injection From the Turbine Building,” (TB) for flooded conditions, would not have been accurate and for the non-flooded procedure could have impacted the ability to provide and maintain the initial required flowrate and subsequent throttling of flowrates later in the event response. This would challenge the operators to ensure that enough flow was being delivered to properly remove containment heat while simultaneously preventing too much flow to protect the containment vent.</td></tr>
<tr><td colspan="4">Description: The team reviewed the licensee's SAWA and Severe Accident Water Management (SAWM) mitigation strategies and equipment in order to assess their ability to perform as designed. Order EA-13-109, “Order Modifying Licenses with Regard to Reliable Hardened Containment Vents Capable of Operations Under Severe Accident Conditions,” and its requirements ensure that BWR Mark I and Mark II containments have reliable</td></tr>
</table>

hardened venting capability. Order EA-13-109 requires installation of reliable hardened wetwell vents that not only will assist in preventing core damage when normal containment heat-removal capability is lost, but also will function in severe accident conditions (i.e., after core damage has occurred). The order was structured as having two phases with different implementation schedules. Phase 1 requires installation of a severe-accident-capable hardened wetwell venting system. Phase 2 requires licensees to either install a severe-accident-capable drywell venting system or develop and implement a reliable containment venting strategy that makes it unlikely that a licensee would need to vent from the containment drywell during severe accident conditions. The Nuclear Energy Institute (NEI) developed NEI 13-02, "Industry Guidance for Compliance with Order EA-13-109," Revision 1, which provides guidance to assist licensees with the identification of measures needed to comply with the requirements of Order EA-13-109.

The team identified that the licensee's installed SAWA flow indicators, 1APFI-0100 and 1BCFI-0100, would not be reliable or functional because, by design, the SAWA flowpaths for both the flooded or non-flooded conditions are maintained dry until placed in service. Both flow instruments are of the Rosemount Annubar design and are required to be maintained filled and vented. The sensing lines for both instruments are not self-venting and the 1APFI-0100 instrument lines also have high point vents. Access to these high point vents is restricted, as the room in which they are contained is a locked high radiation area during plant operation. Following plant shutdown, radiation levels return to near normal general plant area levels, but access to the high point vents would still require health physics support to unlock and survey the area prior to venting being performed. These would need to be vented, as well as the 1APFI-0100 instrument manifold and flow indicator itself. The licensee had not recognized the requirements to dynamically vent the instruments when placing the system in service, and thus had not included these actions in their procedures. Therefore, the flow indications used to control the flowrate with flow control valves within HC.OP-EO.ZZ-0411, and HC.OP-EO.ZZ-0410(Q) would not have been accurate. The team identified that existing procedures for placing either the TB SAWA pumps (flooded condition) or the Diesel driven SAWA pump (non-flooded condition) did not contain steps to perform venting of the flow indicators when the pumps would be placed in service, and therefore would not ensure their accuracy. The PSEG final integrated plan (FIP) and NRC technical evaluation of Order EA-13-109, Phase 2, states that a minimum flowrate of 500 gpm would be established within 8 hours. Because the condition may result in erratic or inaccurate flow indication, the initial flowrates established would not have had accurate indication for the operators, both for the initial establishment of 500 gpm, and subsequent throttling of flow to ensure containment vents were not covered.

Corrective Action: Immediate actions taken by the licensee included implementation of a standing order to direct filling and venting of 1APFI-0100 and 1BCFI-0100 during use of HC.OP-EO.ZZ-0410(Q) and HC.OP-EO.ZZ-0411, respectively. Additionally, procedure changes for the aforementioned procedures were initiated to include similar steps to those included in the standing order.

Corrective Action References: 20823786, 20823787

Performance Assessment:

Performance Deficiency: NEI 13-02, Industry Guidance for Compliance with Order EA-13-109, Revision 1, Section 6.1.2.1, requires in part, "Procedures to operate, test, and maintain the severe accident capable HCVS and SAWA systems during ELAP conditions should include the following elements: system operation including system startup, shutdown

and off-normal indications...and instrumentation available that supports HCVS and SAWA operation."

The Hope Creek Nuclear Generating Station final integrated plan (FIP) Section I.A.2, Summary of Phase 2 Compliance, in part, states that the Phase 2 actions included the availability of parameters which can be measured such as drywell pressure, torus water level and the SAWA flowrate. FIP Section IV.C.10.1 states that Table 1 contains a listing of all instruments needed for SAWA and SAWM implementation. Included in Table 1 are SAWA Non-flooded Flow Element 1BCFE-0100, SAWA Non-flooded Flow Indicator 1BCFI-0100, SAWA Flooded Flow Element 1APFE-0100, and SAWA Flooded Flow Indicator 1APFI-0100. This is consistent with NEI 13-02 guidance, where Appendix I outlines acceptable measures to be in place such as local flow indication provided by portable in-line or skid mounted flow instruments.

Contrary to this, the team identified that the SAWA implementing procedures HC.OP-EO.ZZ-0410(Q) and HC.OP-EO.ZZ-0411, non-flood condition and flooded condition respectively, were deficient in that they would not have ensured the SAWA flow indicators were filled and vented to ensure accurate flow indication. This would have impacted the ability of the installed flow indicators to provide accurate indication, and for the non-flooded procedure, could have impacted the ability to provide and maintain the initial required flow rate of 500 gpm as stated within section I.A.2 and IV.C.1 (Detailed SAWA flow path) of the FIP. Section IV.C.7, Strategy time line, states in part, "the initial SAWA flow rate will be approximately 500 gpm. After a period of time, estimated to be about 4 hours during which the maximum flow rate is maintained, the SAWA flow will be reduced." Specifically, these flow indicators were installed into a dry system from the date of the FIP (7/25/18) to the date of inspection (week of 4/8/19), providing no reasonable assurance that these flow indicators would remain filled and vented, and therefore accurate. Flow indicator 1BCFI-0100 would be used to throttle the associated control valve, 1-BC-V643 as necessary to maintain an initial flowrate of 500 gpm and ensure that a two-inch hose line gated wye valve would be opened when flowrates are 100 gpm or less to ensure minimum flowrates are maintained for the diesel driven SAWA pump..

Screening: The inspectors determined the performance deficiency was more than minor because it was associated with the Procedure Quality attribute of the Barrier Integrity cornerstone and adversely affected the objective to provide reasonable assurance that the physical design barrier (containment) protects the public from radionuclide release caused by an accident. Specifically, implementing procedures were not adequate in that they would not have properly vented SAWA flow indicators, impacting their functionality. This would complicate the response to a beyond design bases scenario and could have resulted in not providing the analyzed initial required flowrates for a non-flooded condition per the associated Phase 2 technical analyses performed for Order EA-13-109. This lack of proper indication could also impact minimum pump flow protection for non-flooded conditions, as the unvented FI could have had the potential to result in the parallel path 2 inch valve remaining closed, when actual pump flowrate was less than 100 gpm.

Significance: The inspectors assessed the significance of the finding using Appendix A, "Significance Determination of Reactor Inspection Findings for At - Power Situations." The inspectors assessed the significance of the finding using Inspection Manual Chapter (IMC) 0609, Appendix A, "The Significance Determination Process (SDP) For Findings At-Power," Exhibit 3, Barrier Integrity Screening questions, Section B, Reactor Containment. The finding screened as Green, or of very low safety significance because it did not represent an actual

open pathway in the physical integrity of reactor containment and was determined to not impact heat removal components such that there would be an impact on large early release frequency (LERF). Further review by a senior reactor analyst (SRA) determined that the finding would not adversely impact any of the IMC 0609, Appendix H (Containment Integrity SDP), Table 4.1, containment related structures, systems, and components considered for LERF impact and therefore was appropriate to screen to Green within Exhibit 3 of IMC 0609, Appendix A.

Specifically, if the initial SAWA flowrate would be below the required flowrate in either scenario, the containment would potentially pressurize with the reduced quenching of the ex-vessel debris, which would result in the operators needing to use the wetwell vent to control containment parameters within severe accident guideline (SAG) guidance. This may result in a lowering of wetwell level, and the SAG guidance is to maintain a minimum wetwell level which would eventually result in the operators increasing flow to the reactor pressure vessel (RPV)/containment, regardless of what the local flow indicators would be indicating. Additionally, the wetwell level indication range is such that if the water level would be rising or getting too high, when the top end of the indication range would be reached it would be expected the operators would reduce the flowrate to protect the wetwell vent, realizing there is too much flow being provided. Therefore, because other indications would be available (wetwell level and drywell pressure), the containment boundary would be expected to be maintained and protected, and water addition would be controlled through other means of indication.

Cross-cutting Aspect: H.7 - Documentation: The organization creates and maintains complete, accurate and up-to-date documentation. The team determined that this finding had a cross-cutting aspect in the area of Human Performance, Documentation, because PSEG's documents failed to ensure SAWA procedures and flow instrumentation would be functional and reliable for beyond-design basis external events.

Enforcement: Inspectors did not identify a violation of regulatory requirements associated with this finding.

EXIT MEETINGS AND DEBRIEFS

The inspectors verified no proprietary information was retained or documented in this report.

- On May 21, 2019, the inspectors presented the temporary instruction TI-193 inspection results to Ms. Jean Fleming, Director, Site Regulatory Compliance and other members of the licensee staff.
- On April 12, 2019, the inspectors presented the TI-193 inspection debrief to Mr. Eric Carr, Site Vice President and other members of the licensee staff.

DOCUMENTS REVIEWED

Inspection Procedure	Type	Designation	Description or Title	Revision or Date
2515/193	Corrective Action Documents	20822244		
	Corrective Action Documents Resulting from Inspection	20823419, 20823682, 20823765, 20823786, 20823787, 20823788, 20823783		
	Miscellaneous	LR-N18-0056	Hope Creek Generating Station's Report of Full Compliance with Phase 1 and Phase 2 of June 6, 2013 Commission Order Modifying Licenses with Regard to Reliable Hardened Containment Vents Capable of Operation Under Severe Accident Conditions (Order Number EA-13-109)	07/25/2018
		ML18290A876	Hope Creek Generating Station-Safety Evaluation Regarding Implementation of Hardened Containment Vents Capable of Operation Under Severe Accident Conditions Related to Order EA-13-109	12/06/2018
		TI-2515/193	Inspection of the Implementation of EA-13-109: Order Modifying Licenses with Regard to Reliable Hardened Containment Vents Capable of Operation Under Severe Accident Conditions	01/01/2018
	Procedures	HC.OP-AM.ZZ-0001(Z)	Severe Accident Guidelines	5
		HC.OP-EO.ZZ-0318(Q)	Containment Venting	14
		HC.OP-EO.ZZ-0401(Q)	FLEX Electrical - Phase 2	3
		HC.OP-EO.ZZ-0410(Q)	Severe Accident Water Addition From River (Non-Flood Condition)	1
		HC.OP-EO.ZZ-0411	SAWA Injection From Turbine Building	1

Inspection Procedure	Type	Designation	Description or Title	Revision or Date
		HC.OP-EO.ZZ-0412	Alternate 10B212 / 10B222 Control for SAWA	0