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

August 6, 2019

EA-19-074

Mr. Eric Carr
President and Chief Nuclear Officer
PSEG Nuclear, LLC
P.O. Box 236
Hancocks Bridge, NJ 08038

SUBJECT: SALEM NUCLEAR GENERATING STATION, UNITS 1 AND 2 – INTEGRATED INSPECTION REPORT 05000272/2019002 AND 05000311/2019002 AND EXERCISE OF ENFORCEMENT DISCRETION

Dear Mr. Carr:

On June 30, 2019, the U.S. Nuclear Regulatory Commission (NRC) completed an inspection at Salem Nuclear Generating Station, Units 1 and 2 in Hancocks Bridge, New Jersey. On July 11, 2019, the NRC inspectors discussed the results of this inspection with Mr. Charles McFeaters, Salem Site Vice President and other members of your staff. The results of this inspection are documented in the enclosed report.

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

A violation of the licensee's current site-specific licensing basis for tornado-generated missile protection was identified. Because this violation was identified during the discretion period covered by Enforcement Guidance Memorandum 15-002, "Enforcement Discretion for Tornado Missile Protection Noncompliance" and because the licensee was implementing compensatory measures, the NRC is exercising enforcement discretion by not issuing an enforcement action for the violation and allowing continued reactor operation.

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 Salem.

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 Title 10 of the *Code of Federal Regulations* (10 CFR) 2.390, "Public Inspections, Exemptions, Requests for Withholding."

Sincerely,

/RA/

Brice A. Bickett, Chief
Reactor Projects Branch 3
Division of Reactor Projects

Docket Nos. 05000272 and 05000311
License Nos. DPR-70 and DPR-75

Enclosure:
Inspection Report 05000272/2019002 and 05000311/2019002

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SUBJECT: SALEM NUCLEAR GENERATING STATION, UNITS 1 AND 2 – INTEGRATED INSPECTION REPORT 05000272/2019002 AND 05000311/2019002 AND EXERCISE OF ENFORCEMENT DISCRETION DATED AUGUST 6, 2019

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U.S. NUCLEAR REGULATORY COMMISSION
Inspection Report

Docket Numbers:	05000272 and 05000311
License Numbers:	DPR-70 and DPR-75
Report Numbers:	05000272/2019002 and 05000311/2019002
Enterprise Identifier:	I-2019-002-0041
Licensee:	PSEG Nuclear, LLC
Facility:	Salem Nuclear Generating Station, Units 1 and 2
Location:	Hancocks Bridge, NJ 08038
Inspection Dates:	April 01, 2019 to June 30, 2019
Inspectors:	J. Hawkins, Senior Resident Inspector A. Ziedonis, Senior Resident Inspector M. Hardgrove, Resident Inspector P. Finney, Senior Project Engineer N. Floyd, Senior Reactor Inspector J. Furia, Senior Health Physicist
Approved By:	Brice A. Bickett, Chief Reactor Projects Branch 3 Division of Reactor Projects

Enclosure

SUMMARY

The U.S. Nuclear Regulatory Commission (NRC) continued monitoring the licensee's performance by conducting an integrated inspection at Salem Nuclear Generating Station, Units 1 and 2 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. Two self-revealing findings are summarized in the table below.

List of Findings and Violations

Fuel Handling Procedures Not Followed			
Cornerstone	Significance	Cross-Cutting Aspect	Report Section
Barrier Integrity	Green FIN 05000311,05000272/2019002-01 Open/Closed	[H.12] - Avoid Complacency	71152
A self-revealing Green finding (FIN) was identified because PSEG did not follow their procedures for the movement of spent fuel. Specifically, PSEG did not follow their Fuel Handling procedure, SC.RE-FR.ZZ-0001, to ensure that spent fuel assemblies (FAs) with top-nozzle-separation susceptibility to intergranular stress corrosion cracking (IGSCC) have either their supporting rods inspected or an instrument tube tie rod (ITTR) installed prior to being moved. This led to PSEG inappropriately moving two FAs susceptible to this condition without the required inspection or installed ITTR, which had the potential for top-nozzle-separation and a dropped FA.			

Inadequate Procedures for the Removal of Baffle Bolts			
Cornerstone	Significance	Cross-Cutting Aspect	Report Section
Occupational Radiation Safety	Green FIN 05000272,05000311/2019002-02 Open/Closed	[H.5] - Work Management	71153
A Green self-revealing finding was identified for PSEG having inadequate procedures related to the movement of irradiated material in and around the reactor cavity during refueling operations and maintenance. Specifically, the procedures governing the control and use of air operated vice grippers (tool) used for the extraction and replacement of degraded baffle-former bolts (BFBs) did not adequately control the tool when not in use or properly verify the tool's configuration prior to reuse. This resulted in PSEG inadvertently and unknowingly re-engaging a discarded BFB in the tool and moving the highly irradiated BFB over the reactor cavity and core barrel causing an individual to receive an unexpected dose rate alarm on May 9, 2019.			

Additional Tracking Items

Type	Issue Number	Title	Report Section	Status
EDG	EA-19-074	Enforcement Action EA-19-074: LER 2018-001-00 for Salem Nuclear Generating Station, Unit 1, Inadequate Protection from Tornado Missiles Due to Nonconforming Design Conditions	71153	Closed
LER	05000272,05000311/2010-001-00	Manual Reactor Trip Due to Degraded Condenser Heat Removal	71153	Closed
LER	05000272/2018-001-00	LER 2018-001-00 for Salem Nuclear Generating Station, Unit 1, Inadequate Protection from Tornado Missiles Due to Nonconforming Design Conditions.	71153	Closed
LER	05000311/2019-001-00	LER 2019-001-00 for Salem Nuclear Generating Station Unit 2, Manual Reactor Trip Due to Circulating Water Intake Frazil Ice Blockage.	71153	Closed

PLANT STATUS

Unit 1 began the inspection period at rated thermal power. On April 12, 2019, Unit 1 was manually tripped from 11 percent power as part of a pre-planned evolution to commence the 1R26 refueling outage. A reactor startup was commenced on June 18, 2019 and reach rated thermal power on June 28, 2019. There were no other operational power changes of regulatory significance for the remainder of the inspection period.

Unit 2 began the inspection period at rated thermal power. The unit remained at or near rated thermal power for the remainder of the inspection period.

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 performed plant status activities described in IMC 2515 Appendix D, "Plant Status" and conducted routine reviews using IP 71152, "Problem Identification and Resolution." 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.

REACTOR SAFETY

71111.01 - Adverse Weather Protection

Seasonal Extreme Weather Sample (IP Section 03.02) (2 Samples)

(1) The inspectors evaluated readiness for seasonal extreme weather conditions prior to the onset of a tornado watch/severe thunderstorms on April 15, 2019

(2) The inspectors evaluated readiness for seasonal extreme weather conditions prior to the onset of summer readiness on June 18, 2019

71111.04 - Equipment Alignment

Partial Walkdown Sample (IP Section 03.01) (4 Samples)

The inspectors evaluated system configurations during partial walkdowns of the following systems/trains:

(1) Unit 1, 11 & 13 charging pump during 12 charging pump maintenance window on May 13, 2019
(2) Unit 1, 250 ventilation duct chase batteries during work to replace battery cells on May 20, 2019
(3) Unit 2, Auxiliary feedwater pump while 22 auxiliary feedwater out for service on April 8, 2019

(4) Unit 2, Control room envelope air conditioning system during 1R26 refueling outage lineup on April 18, 2019

71111.04S - Equipment Alignment

Complete Walkdown Sample (IP Section 03.02) (1 Sample)

(1) The inspectors evaluated system configurations during a complete walkdown of the following system Unit 2 4KV switchgear and EDGs on May 14, 2019

71111.05Q - Fire Protection

Quarterly Inspection (IP Section 03.01) (5 Samples)

The inspectors evaluated fire protection program implementation in the following selected areas:

(1) Unit 1, Auxiliary building 84' elevation on April 3, 2019
(2) Unit 1, Reactor containment elevations 78', 100' & 130' on April 17, 2019
(3) Unit 1, 11 Containment fan cooling unit hot work preparation for welding on April 24, 2019
(4) Units 1 and 2, Circulating water building complex on May 30, 2019
(5) Unit 1, Reactor containment elevations 78' & 130' (11 reactor coolant pump fire detector) on June 18, 2019

71111.06 - Flood Protection Measures

Inspection Activities - Internal Flooding (IP Section 02.02a.) (1 Sample)

The inspectors evaluated internal flooding mitigation protections in the:

(1) 21 component cooling heat exchanger room on May 16, 2019

71111.07A - Heat Sink Performance

Annual Review (IP Section 02.01) (2 Samples)

The inspectors evaluated readiness and performance of:

(1) Unit 1, 14 container fan cooler unit on May 30, 2019
(2) Unit 1, 11 component cooling heat exchanger on June 24, 2019

71111.08P - Inservice Inspection Activities (PWR)

PWR Inservice Inspection Activities Sample (IP Section 03.01) (1 Sample)

(1) The inspectors verified that the reactor coolant system boundary, steam generator tubes, reactor vessel internals, risk-significant piping system boundaries, and containment boundary were appropriately monitored for degradation and that repairs and replacements were appropriately fabricated, examined and accepted by reviewing the following activities from April 22 to April 30, 2019, and June 3, 2019:

03.01.a – Nondestructive Examination and Welding Activities.

1. Manual phased array ultrasonic testing of the pressurizer spray nozzle to safe-end dissimilar metal weld, 4-PS-1131-29 (NDE Summary 033500). This review involved a relevant indication that was analytically evaluated and accepted for continued service.
2. Manual ultrasonic testing of the reactor coolant pump 12 cold-leg weld, 27.5-RC-1120-2 (NDE Summary 057900).
3. Remote ultrasonic testing of the original baffle-former bolts (612 total) and a sample of the baffle-former bolts previously replaced in 2016 (42 total) inside the reactor vessel performed in accordance with MRP-227-A, "Materials Reliability Program: Pressurized Water Reactor Internals Inspection and Evaluation Guidelines". In addition, this review included remote visual examinations of the thermal shield support bracket bolts and thermal shield flexures. Furthermore, the inspectors reviewed the replacement of 272 baffle-former bolts and 4 thermal shield support bracket bolts during this refueling outage.
4. Visual examinations of the containment accessible surfaces, including the liner, thermal insulation panels, and penetrations (Orders 50202001 and 60138419).
5. Welding activities and magnetic particle testing associated with the localized repair of the containment liner panel #100-80 under Order 60138419.

03.01.c – Pressurized-Water Reactor Boric Acid Corrosion Control Activities.

1. Boric acid evaluation for S1SJ -1SJ903 under Order 70196933.
2. Boric acid evaluation for S1SJ -1SJ235 under Order 70197431.

71111.11Q - Licensed Operator Requalification Program and Licensed Operator Performance

Licensed Operator Performance in the Actual Plant/Main Control Room (IP Section 03.01) (1 Sample)

(1) The inspectors observed and evaluated licensed operator performance in the Control Room during Unit 1 start up during the week of June 17 through June 21, 2019

71111.12 - Maintenance Effectiveness

Routine Maintenance Effectiveness Inspection (IP Section 02.01) (4 Samples)

The inspectors evaluated the effectiveness of routine maintenance activities associated with the following equipment and/or safety significant functions:

(1) Unit 1, 11 steam generator feedwater pump turbine (quality control) mechanical emergency governor assembly found bound, repeat issue from 12 steam generator feedwater pump turbine during 1R24 on June 17, 2019
(2) Unit 2, 2D VIB inverter on April 15, 2019
(3) Common, 13 Chill water pump inboard breaking oil leak and similar Unit 2 chill water pump oil leaks on April 15, 2019
(4) Common, 22 Chiller divider gasket plate on May 17, 2019

71111.13 - Maintenance Risk Assessments and Emergent Work Control

Risk Assessment and Management Sample (IP Section 03.01) (7 Samples)

The inspectors evaluated the risk assessments for the following planned and emergent work activities:

(1) Unit 1, Review of Salem Unit 1 refueling outage 1R26 shutdown risk assessment, contingencies and defense in-depth on April 12, 2019
(2) Unit 1, Core barrel lift on May 1, 2019
(3) Unit 1, Midloop operations and pulling vacuum prior to startup-orange risk on June 14, 2019
(4) Unit 2, 22 Auxiliary feedwater pump out of service for planned maintenance on April 8, 2019
(5) Unit 2, Spent fuel pool cooling after Unit 1 defueled on April 23, 2019
(6) Unit 2, 2CH151 isolation valve to penetration area coolers valve leak-by on May 17, 2019
(7) Unit 2, Chilled Water Expansion Tank Makeup Isolation on June 10, 2019

71111.15 - Operability Determinations and Functionality Assessments

Operability Determination or Functionality Assessment (IP Section 02.02) (6 Samples)

The inspectors evaluated the following operability determinations and functionality assessments:

(1) Unit 1, 13 Chiller operability following installation on April 2, 2019
(2) Unit 1, 11 Containment fan cooling unit structure frame on April 16, 2019
(3) Unit 1, Charging/safety injection pump emergency core cooling system throttle valve testing on May 8, 2019
(4) Unit 1, Safety injection hot leg injection full flow technical specification delta on May 9, 2019
(5) Units 1 and 2, Baffle former bolts and thermal shield support bolts for justification for past operability and justification for continuous operability following 1R26 outage discovery on June 11, 2019.
(6) Unit 2, 21 Service water nuclear header supply flange degraded on April 24, 2019

71111.18 - Plant Modifications

Temporary Modifications and/or Permanent Modifications (IP Section 03.01 and/or 03.02) (1 Sample)

The inspectors evaluated the following temporary or permanent modifications:

(1) Advanced Digital Feedwater Control System - Steam Generator Feedwater Pump trips on unit trip on June 24, 2019

71111.19 - Post-Maintenance Testing

Post Maintenance Test Sample (IP Section 03.01) (6 Samples)

The inspectors evaluated the following post maintenance tests:

(1) Unit 1, 1C emergency diesel generator jacket water pump replacement on April 15, 2019
(2) Unit 1, 1B emergency diesel generator jacket water pump, turbo, and air injector replacement on April 24, 2019
(3) Unit 1, main steam isolation valve (14MS167) repairs after failing to stroke on May 23, 2019
(4) Unit 2, 23 chiller freeze seal followed by 23CH25 outlet drain value leakby on April 10, 2019
(5) Unit 2, 2C emergency diesel generator following jacket water leak and other preventative maintenance on June 12, 2019
(6) Unit 2, Loop 23 Overpower Delta-Temperature setpoint bistable on June 28, 2019

71111.20 - Refueling and Other Outage Activities

Refueling/Other Outage Sample (IP Section 03.01) (1 Sample)

(1) The inspectors evaluated Unit 1 refueling outage (S1R26) activities from April 15, 2019 to June 15, 2019.

71111.22 - Surveillance Testing

The inspectors evaluated the following surveillance tests:

Containment Isolation Valve Testing (IP Section 03.01) (2 Samples)

(1) Unit 1, Containment isolation valve independent system operator - 1SS104 and 1SS33 fire protection containment penetration 18 containment isolation valves on May 30, 2019
(2) Unit 1, Containment isolation valve independent system operator - Steam generator blowdown containment isolation valves on June 24, 2019

FLEX Testing (IP Section 03.02) (1 Sample)

(1) Unit Common, 1FLXE18 and 1FLXE93 on June 24, 2019

Inservice Testing (IP Section 03.01) (1 Sample)

(1) Unit 2, Auxiliary feedwater pump inservice testing on April 4, 2019

Surveillance Tests (other) (IP Section 03.01) (3 Samples)

(1) Unit 1, 13 Chiller surveillance test following installation of new chiller on April 2, 2019
(2) Unit 1, Surveillance inspection hot leg injection full flow test on May 9, 2019
(3) Unit 2, 2A Emergency diesel generator on May 28, 2019

RADIATION SAFETY

71124.01 - Radiological Hazard Assessment and Exposure Controls

High Radiation Area and Very High Radiation Area Controls (IP Section 02.05) (1 Sample)

(1) The inspectors reviewed the procedures and controls for HRAs, VHRAs, and radiological transient areas in the plant.

Instructions to Workers (IP Section 02.02) (1 Sample)

The inspectors evaluated instructions to workers including radiation work permits used to access high radiation areas.

(1) The inspectors reviewed high radiation area (HRA) work permit controls and use, observed containers of radioactive materials and assessed whether the containers were labeled and controlled in accordance with requirements.

Radiation Worker Performance and Radiation Protection Technician Proficiency (IP Section 02.06) (1 Sample)

(1) The inspectors evaluated radiation worker performance with respect to radiation protection work requirements. The inspectors evaluated radiation protection technicians in performance of radiation surveys and in providing radiological job coverage.

Radiological Hazards Control and Work Coverage (IP Section 02.04) (1 Sample)

The inspectors evaluated in-plant radiological conditions during facility walkdowns and observation of radiological work activities.

(1) The inspectors evaluated in-plant radiological conditions and performed independent radiation measurements during facility walkdowns and observation of radiological work activities. The inspectors examined the physical controls for selected HRAs, locked high radiation areas (LHRAs) and very high radiation areas (VHRAs) to verify conformance with the occupational PI.

71124.02 - Occupational ALARA Planning and Controls

Radiation Worker Performance (IP Section 02.04) (1 Sample)

The inspectors evaluated radiation worker and radiation protection technician performance during:

(1) The inspectors observed radiation worker and radiation protection technician performance during radiological work to evaluate worker ALARA performance according to specified work controls and procedures.

OTHER ACTIVITIES – BASELINE

71151 - Performance Indicator Verification

The inspectors verified licensee performance indicators submittals listed below:

IE01: Unplanned Scrams per 7000 Critical Hours Sample (IP Section 02.01) (1 Sample)

(1) Unit 1 & Unit 2 March 2018 to March 2019

IE03: Unplanned Power Changes per 7000 Critical Hours Sample (IP Section 02.02) (1 Sample)

(1) Unit 1 & Unit 2 March 2018 to March 2019

IE04: Unplanned Scrams with Complications (USwC) Sample (IP Section 02.03) (1 Sample)

(1) Unit 1 & Unit 2 March 2018 to March 2019

71152 - Problem Identification and Resolution

Annual Follow-up of Selected Issues (IP Section 02.03) (1 Sample)

The inspectors reviewed the licensee's implementation of its corrective action program related to the following issues:

(1) Review of PSEG's root cause of evaluation for the Unit 2 reactor trip during elevated river ice conditions on June 18, 2019

INSPECTION RESULTS

Observation: Issue Identification, Evaluation and Resolution: Semi Annual Review	71152
The inspectors evaluated a number of issues and associated notifications (NOTFs) generated over the course of the past two quarters by departments that provide input to the quarterly trend reports. The inspectors determined that, in most cases, issues were appropriately identified, evaluated and resolved by PSEG. The inspectors also determined that potential trends were identified and resolved within the scope of the CAP. Examples of these are documented below: • PSEG performed an evaluation of a potential common cause related to solenoid operate valve failures related to air particulate binding and insufficient air supply. PSEG assigned appropriate corrective actions (CAs) for resolution of the failures under NOTF 20827328 and evaluations 70201902 and 70202094. • During the retest of the 11 SG feed pump turbine PSEG documented in NOTF 20827641 that the replacement emergency governor assembly anti-rotation set screw caused the turbine to trip unexpectedly. PSEG appropriately evaluated the issue which was similar to an issue on the 12 SGFPT (20737145) in 1R24. PSEG appropriately assigned CAs to review the extent of condition and extent of cause related to other refurbished components.	

- PSEG's CAP program audit self-identified and documented areas for improvement with respect to CAP trending and the station's management of the backlog of CAP issues in NOTFs 20826240, 20826239, 20826200, and 20825560.

However, the inspectors also noted a few instances where PSEG was not timely or did not recognize, until prompted by the inspectors, that issues and potential adverse trends were not appropriately identified, evaluated and resolved. Examples of these are documented below:

- During 1R26, the inspectors noted that PSEG's follow-up visual evaluation of a baffle-former bolt (BFB) during 1R25 represented a missed opportunity to potentially identify a degraded BFB. The inspectors also identified that PSEG's evaluation of that issue did not appropriately address revising the applicable vendor procedures for BFB inspections. PSEG documented this concern in NOTF 20822894 and initiated CAs to revise both the vendor and PSEG inspection procedures.
- During walk downs of the EDGs, the inspectors noted that jacket water leakage had not been identified by the operators. Due to the inspector's observations, PSEG initiated NOTFs 20822744 and 20826458 for jacket water leakage. PSEG determined that immediate operability was not affected, cleaned the areas where the leakage had occurred and repaired the leaks.
- The inspectors noted a number of NOTFs had been generated by PSEG since January 1, 2019, documenting issues with gaskets on various components and systems. This also included causal evaluations associated with gasket issues under evaluations 70206911, 70207136, 70206390, and 70206714. PSEG documented the potential adverse trend in NOTFs 20828868 and 20823377.
- The inspectors reviewed evaluation 70207108 for fraying of the air tubing on the 11SW127, which is the 11 component cooling heat exchanger service water regulation valve. The inspectors found that the extent of condition operation was not properly entered into CAP for tracking and completion. The inspectors also noted that while the evaluation did identify a missed opportunity in 2011 under 70123429 for a PM change that was not implemented, it did not identify a missed opportunity from a previous NRC inspection team that found a similar example in 2014 under 20657320 for another valve that was not fixed. PSEG documented these concerns in NOTF 20828769.
- The inspectors reviewed an as-found test failure evaluation of safety injection valve 1SJ167 under 70207144. The inspectors noted previous actions to revise the maintenance plan for this and other similar valves had not been updated (NOTF 20728492 (1R24) and evaluation 70186912). PSEG documented this issue in NOTF 20827889.
- The inspectors reviewed PSEG's failure analysis tracking form and noted multiple potential actions not being tracked related to conditions adverse to quality. PSEG initiated NOTF 20828612 for the concern and found 16 items in the engineering backlog that were not on equipment autopsy failure analysis tracking form in accordance with ER-AA-230-1004.

The inspectors evaluated all of the issues above in accordance with the guidance in IMC 0612, Appendix B, "Issue Screening," and Appendix E, "Examples of Minor Issues," and determined the issues were of minor significance because the inspectors did not identify any CAQs that were not appropriately corrected or scheduled for correction in a reasonable period of time as a result of the failure to implement the CAP process appropriately. Consequently, these issues were not subject to enforcement action in accordance with the NRC's enforcement policy.

Observation: LER 2019-001-00 for Salem Nuclear Generating Station Unit 2, Manual Reactor Trip Due to Circulating Water Intake frazil Ice Blockage.	71152

The inspectors reviewed PSEG's corrective actions regarding a manual trip of Salem Unit 2 on January 31, 2019, when four of six circulators were manually tripped on high traveling water screen differential pressures due to the accumulation of frazil ice on the traveling water screens. PSEG performed a root cause evaluation (RCE 70205613). The inspectors reviewed the evaluation and other similar events at Salem. PSEG's evaluation found that the station's frazil ice predictor (a program called 'Snowflake' that is updated using data from the plant computer) was not predictive in nature nor provided guidance on shutting down the unit during icing conditions. The inspectors determined that PSEG conducted an appropriate review of the issue, including an adequate extent of condition review and has implemented timely corrective actions (CAs) to address the causes of the Unit 2 trip. However, the inspectors found that previous corrective actions related to the development of a frazil ice predictor or prediction tool had either not been completed (CRCA 70029296-0160 from a RCE for inadequate winter preparations in 2003) or were not fully effective because the result was not predictive (CRCA 70106627-0270 from a RCE for a Salem Unit 2 trip caused by frazil ice"). The inspectors determined this performance deficiency was minor because it did not adversely affect the Initiating Event cornerstone objective, protection against external factors attribute, of limiting the likelihood of events that upset plant stability and challenge critical safety functions during shutdown as well as power operations.

Enforcement Discretion	Enforcement Action EA-19-074: LER 2018-001-00 for Salem Nuclear Generating Station, Unit 1, Inadequate Protection from Tornado Missiles Due to Nonconforming Design Conditions.	71153

Description: On June 1, 2018, during development of a design change to minimize rainwater intrusion into the Unit 2 underground service water pipe tunnel, PSEG identified various structures, systems, and components (SSCs) that were in non-conformance with the required tornado missile protection for safety-related SSCs. On June 18, 2018, PSEG identified multiple Unit 1 SSCs that were in non-conformance with the required tornado missile protection for safety-related SSCs. Additional non-conformances on both units have since been identified by PSEG. As a result of these discoveries, the affected equipment on each unit was initially declared inoperable, but following implementation of compensatory measures, the equipment was returned to an operable but non-conforming status.

Corrective Actions:
In accordance with the guidance in Regulatory Issues Summary 2015-06, "Tornado Missile Protection," and EGM 15-002, "Enforcement Discretion for Tornado-Generated Missile Protection Non-Compliance," Revision 1, PSEG implemented compensatory measures to maintain the equipment in a non-conforming but operable condition. These actions included verifying that procedures, training, and equipment were in place to take appropriate action in the event of a tornado watch or warning and establishing a heightened level of awareness and preparedness to tornado missile vulnerabilities. To restore full compliance, PSEG is evaluating actions in accordance with the station CAP and EGM 15-002.

Corrective Action References: 20796648, 20807130, 20828308, 20828818, 70200981, 70203542, and 80119978

Enforcement:

Violation: Title 10 CFR Part 50, Appendix B, Criterion III, "Design Control," requires, in part, that measures shall be established to assure that the applicable regulatory requirements and the design basis for structures, systems, and components are correctly translated into specifications, drawings, procedures, and instructions.

Contrary to the above, since as early as 1976, PSEG failed to correctly translate the design basis for protection against tornado-generated missiles into specifications and procedures. Specifically, PSEG did not adequately protect various Unit 1 and Unit 2 equipment from tornado-generated missiles.

Basis for Discretion: The NRC exercised enforcement discretion in accordance with Section 2.3.9 of the NRC Enforcement Policy because this finding and violation was identified during the discretion period covered by Enforcement Guidance Memorandum 15-002, Revision 1, "Enforcement Discretion for Tornado-Generated Missile Protection Non-compliance," and because PSEG has implemented appropriate compensatory measures. Consequently, the NRC is not issuing an enforcement action and is allowing continued reactor operation. (EA-19-074)

For violations warranting enforcement discretion, Inspection Manual Chapter 0612 does not require a detailed risk evaluation, however, safety significance characterization is appropriate. The NRC Enforcement Policy, Section 2.2.1 states, in part, that, whenever possible, the NRC uses risk information in assessing the safety significance of violations. In accordance with the EGM, the staff's study established that the CDF associated with tornado missile related non-compliances is well below a CDF requiring immediate regulatory action.

The disposition of this violation closes LER 05000272; 311/2018-001-00, Inadequate Protection from Tornado Missiles Due to Nonconforming Design Conditions.

Inadequate Procedures for the Removal of Baffle Bolts			
Cornerstone	Significance	Cross-Cutting Aspect	Report Section
Occupational Radiation Safety	Green FIN 05000272,05000311/2019002-02 Open/Closed	[H.5] - Work Management	71153

A Green self-revealing finding was identified for PSEG having inadequate procedures related to the movement of irradiated material in and around the reactor cavity during refueling operations and maintenance. Specifically, the procedures governing the control and use of air operated vice grippers (tool) used for the extraction and replacement of degraded baffle-former bolts (BFBs) did not adequately control the tool when not in use or properly verify the tool's configuration prior to reuse. This resulted in PSEG inadvertently and unknowingly re-engaging a discarded BFB in the tool and moving the highly irradiated BFB over the reactor cavity and core barrel causing an individual to receive an unexpected dose rate alarm on May 9, 2019.

Description: On Thursday May 9, 2019, a PSEG vendor employee received a dose rate alarm at 648 mRem/hr versus a setpoint of 500 mRem/hr while working on the Salem Unit 1 refueling outage (1R26) BFB replacement project. BFB A71 was removed and placed in the trash tray located inside the core barrel. The BFB was released from the tool, which was

verified by the vendor and documented in the vendor's Baffle Bolt Removal Log Sheet. The air line for the tool was disconnected so it could be used for other activities and the tool placed in the trash tray. This air line was later plugged back into the tool in the trash tray which caused the tool to re-engage the discarded BFB. PSEG vendor personnel then moved the tool over the reactor cavity and core barrel unaware that the tool had re-engaged this highly irradiated discarded BFB.

In the short time it took an individual to move the tool over the core barrel (approximately 3 – 4 seconds), the stationed radiation protection (RP) technician noted elevated dose rates in the area (highest reading on water was 7 Rem/hr) and heard a dose rate alarm on an individual working on the bridge over the water above the reactor cavity. Immediate actions were taken and involved putting the tool in a safe condition and moving it well below the surface of the water and investigating the dose rate alarm. Workers placed the baffle bolt in a safe condition via placing the baffle bolt in a bucket and lowering the bucket to the bottom of the reactor cavity. Through investigation, PSEG determined that the BFB, that was verified to be disengaged from the tool and in the trash tray, had been re-engaged by the tool causing higher than expected dose rates near the surface of the water when the tool was being moved over the core barrel.

The inspectors reviewed PSEG's completed evaluation for the event (70207422) and PSEG's dose assessment for the individual who received the dose rate alarm. PSEG determined that the maximum dose rate received was 648 mRem/hr versus a 500 mRem/hr setpoint. The duration of the dose rate alarm was less than 1 second and no additional unintended exposure was received. Through interviews with the crew performing the BFB work, PSEG found that the tool was lying in the BFB disposal trash tray and was typically left in there when it was disengaged from its air line. PSEG found that the previous shift had used the tool per vendor procedure GBRA-104651, "Collection of Protocols for Baffle Bolt Replacement," which directs a quality control individual to sign for disposing of the BFB in Step 1c. However, this procedure does not have a defined location to place the tool when it is not in use or any precautions to avoid the inadvertent re-engagement of discarded BFBs or other material by the tool. Additionally, this procedure did not require an additional quality control or independent verification of the tool after re-connecting the tool's air supply, when potential re-engagement could occur. Because of this, the inspectors determined that PSEG's procedures governing the control and use of the tool used for the extraction and replacement of degraded BFBs did not adequately control the tool when not in use or properly verify the tool's configuration prior to reuse.

Corrective Actions: PSEG's corrective actions included conducting a stand-down, rolling out revised expectations during BFB work and a revision to the ALARA plan. PSEG ensured, GBRA-104651, "Collection of Protocols for Baffle Bolt Replacement," was revised to include a concurrent verification of the tool's status prior to, during and following use.

Corrective Action References: Work Order 70207422

Performance Assessment:

Performance Deficiency: PSEG's procedures governing the control and use of the tool used for the extraction and replacement of degraded BFBs were inadequate in that they did not adequately control the tool when not in use or properly verify the tool's configuration prior to reuse. This represented a performance deficiency that was reasonably within the licensee's ability to foresee and correct and should have been prevented.

Screening: The inspectors determined the performance deficiency was more than minor because it was associated with the Program & Process attribute of the Occupational Radiation Safety cornerstone. The inspectors determined the performance deficiency was more than minor because it adversely affected the program and process attribute of the Occupational Radiation Cornerstone to ensure adequate protection of the worker health and safety from exposure to radiation from radioactive material during routine civilian nuclear reactor operation. Specifically, PSEG did not have adequate procedures in place as a barrier to prevent the inadvertent movement of highly irradiated material resulting in unexpected dose rate alarm and the potential for individuals to receive an overexposure above administrative limits. PSEG did have controls in place to prevent the BFB from breaking the surface of the water via a radiation protection technician with a radiation surveying wand at the surface of the water. This would minimize unexpected radiation increases, which it did, in order to stop the work and put it in a safe condition.

Significance: The inspectors assessed the significance of the finding using Appendix C, "Occupational Radiation Safety SDP." The inspectors determined that this finding was of very low safety significance (Green) using NRC IMC 0609, Appendix C, "Occupational Radiation Safety Significance Determination Process," dated August 19, 2008, because the finding (1) was not related to the licensee's ALARA plan, (2) did not involve an overexposure, only the potential for overexposure, (3) there was no substantial potential for an overexposure, and (4) the licensee's ability to assess dose was not compromised.

Cross-Cutting Aspect: H.5 - Work Management: The organization implements a process of planning, controlling, and executing work activities such that nuclear safety is the overriding priority. The work process includes the identification and management of risk commensurate to the work and the need for coordination with different groups or job activities. The finding had a cross-cutting aspect of Human Performance, Work Management because PSEG did not adequately implement a work process that identified and managed the risk commensurate to the work and need to coordinate with different work groups or job activities. Specifically, PSEG did not identify through the procedures or work process the potential risk involved with storing the tool in the trash tray and the potential effects of removing and re-engaging the air supply to the tool.

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

Fuel Handling Procedures Not Followed			
Cornerstone	Significance	Cross-Cutting Aspect	Report Section
Barrier Integrity	Green FIN 05000311,05000272/2019002-01 Open/Closed	[H.12] - Avoid Complacency	71152

A self-revealing Green finding (FIN) was identified because PSEG did not follow their procedures for the movement of spent fuel. Specifically, PSEG did not follow their Fuel Handling procedure, SC.RE-FR.ZZ-0001, to ensure that spent fuel assemblies (FAs) with top-nozzle-separation susceptibility to intergranular stress corrosion cracking (IGSCC) have either their supporting rods inspected or an instrument tube tie rod (ITTR) installed prior to being moved. This led to PSEG inappropriately moving two FAs susceptible to this condition without the required inspection or installed ITTR, which had the potential for top-nozzle-separation and a dropped FA.

Description: During the last few operating cycles, PSEG has been performing ITTR and vacuum can sipping processes in order to facilitate moving FAs from the spent fuel pool (SFP) to dry cask storage. Many of the FAs at Salem are susceptible to IGSCC of the supporting rods which could lead to a separation of the FA from the top nozzle. The ITTR process machines a small hole in the top nozzle, then installs a tie rod into the instrument tube of a FA to provide an alternate load support between the top and bottom nozzles. Susceptible FAs can be moved without ITTR, however a pre-requisite inspection of the supporting rods must take place. Following ITTR installation, the FA can be moved using normal means and is eligible for dry cask storage. Additionally, there are several assemblies that have not previously been inspected for fuel failures. The vacuum can sipping process places a suspect FA into an enclosed tube which is evacuated, analyzed for potential fuel leaks, and determines the FA's eligibility for dry cask storage. Without performing these two processes, a significant number of PSEG's FAs currently stored in the SFP would be ineligible for dry cask storage. Sipping requires movement of the FA and, therefore, requires fuel movement sheets.

On February 21, 2019, while performing FA sipping in the Salem Unit 2 SFP, PSEG moved two top-nozzle-separation-susceptible FAs (P05 and P09) that had not yet had the required inspection or ITTRs installed on them. Once recognized, PSEG stopped the fuel moves, inspected the moved FAs for damage, and conducted a causal analysis (*ACE 70205775; approved 4/10/19*). PSEG's evaluation determined that their reactor engineering (RE) and job supervisors did not validate the bases used to generate the FA movement sheets after ITTR implementation due to inadequate program guidance. Specifically, RE expected that all of the scheduled FAs would receive ITTR, thus making them movable without a top nozzle inspection, but a few of the FAs could not receive ITTR and the fuel movement sheets for sipping were not updated to reflect this change.

The inspectors reviewed PSEG's causal evaluation and supporting documentation. The inspectors noted that Westinghouse, the vendor who conducted the ITTR installations, sent PSEG the 'Salem Unit 2 ITTR Installation Report' on Friday, February 22, 2019, the day after the event. This report specifically listed FAs P05 and P09 as not having tie rods (ITTR) installed on them. The inspectors also noted that PSEG's procedure governing the fuel moves in the SFP restricts movement of susceptible fuel without either a tie rod installed or a prior inspection of the top nozzle validating no degradation exists. Specifically, PSEG's Fuel Handling procedure, SC.RE-FR.ZZ-0001, states:

- Steps 2.2.5 and 2.2.6, if moving fuel in the SFP THEN **ENSURE** appropriate top-nozzle inspection or Special tool is used in accordance with Step 5.3.2.
- Step 5.3.2, if a susceptible FA (prerequisite 2.2.5 and 2.2.6) is to be handled, THEN **INSPECT** the FA in accordance with Att. 11 Section 3.0, FAs – Inspection Guidelines, **PRIOR** to lifting completely out of its cell.
- Att. 11 Section 3.0 – 1.0, all assemblies susceptible to top nozzle separation must be visually inspected prior to handling. If evidence of corrosion or cracking is observed special handling precautions must be taken. The precautions currently available are fuel anchors and the nozzle less handling tool.

The inspectors also noted that PSEG procedure NF-AA-310, Special Nuclear Material and Core Component Movement, Attachment 4, Move Sheet Package Verification Checklist for PWRs, Section C – SFP Move Sheets and Variations, does not provide a check for ITTR installed FAs prior to issuance of the fuel move sheet.

Based on the information above, the inspectors determined that although NF-AA-310 did not provide a check for ITTR installed FAs prior to issuance of fuel move sheets, SC.RE-FR.ZZ-0001 does provide adequate guidance in the prerequisites and procedural steps to restrict the movement of susceptible fuel without either a tie rod installed or a prior inspection of the top nozzle validating no degradation exists. Because of this, the inspectors determined that PSEG did not follow their Fuel Handling procedure, SC.RE-FR.ZZ-0001, in that PSEG inappropriately moved two susceptible FAs which had the potential for top-nozzle-separation and a dropped FA.

Corrective Actions: PSEG's corrective actions included revising their fuel handling procedures to include more specific guidance regarding ITTR and the prerequisites to move susceptible FAs, inspecting the top-nozzles of the two moved FAs and performing an extent of condition review of all prepared move sheets.

Corrective Action References: 70205775

Performance Assessment:

Performance Deficiency: PSEG did not follow their procedures for the movement of spent fuel. Specifically, PSEG did not follow their Fuel Handling procedure, SC.RE-FR.ZZ-0001, to ensure that susceptible spent FAs had either their supporting rods inspected or an instrument tube tie rod (ITTR) installed prior to being moved. This was a performance deficiency which was reasonably within the PSEG's ability to foresee and correct and should have been prevented.

Screening: The inspectors determined the performance deficiency was more than minor because it was associated with the Human Performance attribute of the Barrier Integrity cornerstone. This finding was more than minor in accordance with IMC 0612, "Power Reactor Inspection Reports," Appendix B, "Issue Screening," dated January 1, 2018, because it adversely affected the Human Performance attribute of the Barrier Integrity cornerstone objective to provide reasonable assurance that physical design barriers (fuel cladding, reactor coolant system, and containment) protect the public from radionuclide releases caused by accidents or events. Specifically, PSEG not following their procedures to ensure adequate inspection or installation of special tooling prior to handling IGSCC susceptible FAs had the potential for top-nozzle-separation, a dropped FA, and damage to a FA which could have challenged the ability of the fuel cladding to remain intact.

Significance: The inspectors assessed the significance of the finding using Appendix A, "The Significance Determination Process (SDP) for Findings At-Power." The inspectors assessed significance of this condition using IMC 0609, Appendix A, Exhibit 3, "Barrier Integrity Screening Questions", Section D, "Spent Fuel Pool." The finding was determined to be of very low safety significance (Green), because the performance deficiency did not affect fuel pool temperature or level, did not affect neutron absorber capability or result in a fuel bundle being misplaced, and although the performance deficiency resulted in fuel handling errors, it did not cause mechanical damage to fuel clad AND a detectible release of radionuclides.

Cross-Cutting Aspect: H.12 - Avoid Complacency: Individuals recognize and plan for the possibility of mistakes, latent issues, and inherent risk, even while expecting successful outcomes. Individuals implement appropriate error reduction tools. This finding in accordance with IMC 0310, "Aspects within the Cross-Cutting Areas," dated December 04, 2014, has a cross-cutting aspect in the Human Performance cross-cutting area associated with Avoid Complacency, in that PSEG did not recognize and plan for the possibility of latent

issues associated with fuel handling. Specifically, prior to authorizing fuel handling, PSEG did not verify that all procedural prerequisites were met. (H.12)
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 July 11, 2019, the inspectors presented the integrated inspection results to
- Mr. Charles McFeaters, Salem Site Vice President and other members of the licensee staff.
- On April 30, 2019, the inspectors presented the preliminary inservice inspection results to Jean Fleming, Director of Site Regulatory Compliance, and other members of the licensee staff.