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PSEG
Nuclear LLC

10 CFR 50.90

LR-N18-0108
LAR S18-02

OCT 18 2018

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

Salem Generating Station, Units 1 and 2
Renewed Facility Operating License Nos. DPR-70 and DPR-75
NRC Docket Nos. 50-272 and 50-311

Subject: Response to Request for Additional Information, Re: License Amendment Request: Inverter Allowed Outage Time (AOT) Extension

References:
1. PSEG letter to NRC, "License Amendment Request: Vital Instrument Bus Inverter Allowed Outage Time (AOT) Extension," dated May 16, 2018 (ADAMS Accession No. ML18136A866)
2. NRC email to PSEG, "Salem 1 and 2 - Final RAI RE: Inverter AOT Extension," dated September 6, 2018 (ADAMS Accession No. ML18250A313)

In the Reference 1 letter, PSEG Nuclear LLC (PSEG) submitted a license amendment request for Salem Generating Station Unit 1 and Unit 2. The proposed amendment would increase the Vital Instrument Bus (VIB) Inverters allowed outage time (AOT) from 24 hours for the A, B and C inverters to 7 days and from 72 hours for the D inverter to 7 days. In Reference 2, the Nuclear Regulatory Commission (NRC) requested PSEG to provide additional information in order to evaluate the proposed License Amendment Request to revise Technical Specifications. The response due date was subsequently extended to October 22, 2018 at PSEG's request.

Attachment 1 to this letter provides a restatement of the RAI questions followed by our responses. PSEG has determined that the information provided in this submittal does not alter the conclusions reached in the 10 CFR 50.92 no significant hazards determination previously submitted. In addition, the information provided in this submittal does not affect the bases for concluding that neither an environmental impact statement nor an environmental assessment needs to be prepared in connection with the proposed amendment.

There are no regulatory commitments contained in this letter.

In accordance with 10 CFR 50.91, "Notice for public comment; State consultation," paragraph (b), PSEG is providing a copy of this response, with attachments, to the designated State of New Jersey Official.

Should you have any questions regarding this submittal, please contact Mr. Lee Marabella at 856-339-1208.

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I declare under penalty of perjury that the foregoing is true and correct.

Executed on 10/18/18
(Date)

Sincerely,

Charles V. McFeaters
Site Vice President
Salem Generating Station

Attachments:
1. Response to Request for Additional Information - License Amendment Request to Revise Technical Specification 3.8.2.1 Regarding Alternating Current Inverters

cc: Administrator, Region I, NRC
Mr. J. Kim, Project Manager, NRC
NRC Senior Resident Inspector, Salem
Mr. P. Mulligan, Chief, NJBNE
Hope Creek Commitment Tracking Coordinator
Corporate Commitment Tracking Coordinator

Attachment 1

Response to Request for Additional Information - License Amendment Request to Revise Technical Specification 3.8.2.1 Regarding Alternating Current Inverters

By letter dated May 16, 2018 (Agencywide Documents Access management System (ADAMS) Accession No. ML18136A866), PSEG Nuclear LLC (PSEG, the licensee), requested an amendment to Renewed Facility Operating License Nos. DPR-70 and DPR-75 for Salem Generating Station (Salem) Units 1 and 2. This license amendment request proposes changes to Technical Specification (TS) 3.8.2.1, "A. C. Distribution - Operating." The proposed change would increase the Vital Instrument Bus (VIB) Inverters allowed outage time (AOT) from 24 hours for the A, B and C inverters to 7 days and from 72 hours for the D inverter to 7 days. Below is a restatement of the questions followed by our responses.

Question 1 (EEOB RAI–1)

LAR Section 2.3, “Reason for the Proposed Change,” states:

> Salem performs preventative maintenance on the VIB inverters during refueling outages. There are no current plans to perform routine preventive maintenance on a scheduled basis at power. Should the need for such maintenance be identified as a result of component performance, the necessary preventive maintenance would be planned and scheduled in accordance with PSEG procedures for on-line work management.
>
> Experience both at Salem and at other nuclear power plants has shown that the current AOTs for restoration of an inoperable VIB inverter are insufficient in certain instances to support on-line troubleshooting, corrective maintenance, and post-maintenance testing while the unit is at power. Specifically, Salem has entered TS 3.8.2.1 LCO due to an inoperable inverter 5 times since 2009. The actual times in the LCO were 9 hours 28 minutes in 2009, 16 hours 39 minutes in 2014, 23 hours 33 minutes in 2016, 16 hours 47 minutes in 2017 and 32 hours 50 minutes in 2018 (for the D inverter): however in these instances, the cause of the failures was readily evident. This allowed the troubleshooting process to be minimized thereby allowing for a quick repair and subsequent testing.

The LAR requests changes to Technical Specification (TS) 3.8.2.1, "A. C. Distribution - Operating." The proposed change would increase the Vital Instrument Bus (VIB) Inverters allowed outage time (AOT) from 24 hours for the A, B and C inverters to 7 days and from 72 hours for the D inverter to 7 days. Based on the above operating experience that needed a maximum of 33 hours, the licensee has not justified the duration of the AOT extension requested for either preventive or corrective maintenance for the inverters at Salem. Therefore, the licensee is requested to provide technical justification for the duration of the requested AOT (actual hours plus margin based on plant-specific past operating experience and vendor recommendations).

Response:

Plant-specific operating experience does not include instances in which more than 33 hours was required to return an inoperable inverter to operable status. However, as noted in the LAR, in one case an inoperable inverter was restored to operable status with less than 30 minutes before plant shutdown would have been required. Conditions that resulted in an unplanned inoperability of a required inverter were promptly identified, replacement parts were readily available and extensive post-maintenance testing and component tuning was not required. In any of the instances of unplanned inverter inoperability in the Salem plant-specific operating experience, the current allowed outage time would likely have been exceeded if burned-in replacement parts had not been readily available, or if the emergent issue had required complex troubleshooting, or more extensive post-maintenance testing. The extended AOT will provide

the time that would be required to properly develop and implement a troubleshooting plan; perform corrective maintenance, and complete operability testing in the event of an inverter failure that required complex troubleshooting or extensive component replacement.

In the event of an inverter failure that requires complex troubleshooting, the required time to resolve the issue could be well over the current allowable outage time. The inverter would first need to be tagged out by operations personnel in order to ensure the safety of both workers and the inverter. A multi-discipline troubleshooting team would have to be assembled consisting of maintenance, engineering, and operations personnel to diagnose and resolve the equipment malfunction. This team would then create a troubleshooting plan which requires a proper level of risk review and would be subject to independent challenge or possibly independent third party review before implementation. Once approved, the troubleshooting plan would then have to be executed through an emergent work order. This entire process of assembling a team, developing a plan, and planning the work order could realistically take over the current allowed outage time depending on the nature of the inverter failure. Following the work order planning, maintenance would need to implement the troubleshooting plan.

In the event that the failed component is an electrolytic capacitor, the possibility for multiple failed components due to short-circuit leading to leakage of electrolytes is possible. In this situation, the work that needs to be done to fix the inverter may require both the removal and replacement of circuit cards and capacitors, as well as a full cleaning of the inside of the cabinet of electrolyte residue. In order to perform the troubleshooting, plan a work order, and remove and replace failed cards and capacitors, this could take maintenance more than 5 complete shifts. After the replacement of the failed components, calibration of the gate cards is required. Once the gate cards are calibrated, the next steps revolve around ensuring the inverter can be returned to service. De-energized tests on the inverter are to be performed in order to ensure proper maintenance was performed. Once the de-energized tests are complete, operations can release tags to energize the inverter. Once the inverter has warmed up, post maintenance energized testing must be performed as a final check to ensure that the inverter can be returned to service.

A postulated timeline for failure of a VIB inverter is provided below. Additional time could be required if corrective maintenance required replacement of cards for which burned-in spares were not immediately available:

Activity	Activity duration (hours)
Assemble troubleshooting team	4
Staff outage control center (OCC) and review situation	4
Tag-out equipment	4
Develop complex troubleshooting plan	12
Plan troubleshooting work order	2
Implement troubleshooting plan	12
Plan corrective maintenance work order	4
Perform corrective maintenance	36
Calibrate gate cards	12
Perform de-energized test	12
Release tags	4
Energize inverter	2

Activity	Activity duration (hours)
Post maintenance test	8
Total duration	116

Preventive maintenance is performed during refueling outages. There are no current plans to perform routine preventive maintenance on a scheduled basis at power. Should the need for such maintenance be identified as a result of component performance, the necessary preventive maintenance would be planned and scheduled in accordance with PSEG procedures for on-line work management.

Vendor recommended maintenance includes air filter inspections and cleaning (if necessary), and periodic inspections and cleaning of the inverter, rectifier, static switch and regulator. Vendor recommended cleaning and inspection and critical parts replacements based on operational experience are performed during refueling outages for various uninterruptible power supply (UPS) components.

Question 2 (EEOB RAI-2)

LAR Section 2.1, "System Design and Operation," states:

> The safety related 115V A.C. instrument and control power system is divided into four independent power supply channels (A, B, C, and D) for each unit, designed to provide reliable uninterrupted source of power for reactor control instrumentation, reactor protection instrumentation and safety-related equipment. Each channel supplies its associated safety related electrical load group. Vital instrument bus loads are assigned to load groups such that a loss of any one vital instrument bus will not will prevent the operation of the required safety systems during a postulated design basis event.

The NRC staff's guidance in BTP 8-8 for reviewing LARs for AOT extensions for electrical power sources recommends the provision of a supplemental power source capable of performing the function of the inoperable equipment during the extended AOT. The NRC staff notes that the licensee did not discuss the provision of a supplemental power source during the extended AOT. To allow the NRC staff to evaluate the technical adequacy of the extended AOT for inoperable inverters, provide the following information:

In case another inverter would fail in a redundant channel during the proposed extended AOT for restoring inoperable inverters in one channel to operable status, provide a discussion that describes:

a. The plant configuration, response, and effects on the plant safety-related systems required to mitigate a design basis event (DBE) and their safety functions after the second inverter fails.

Response:

In the event another inverter would fail in a redundant channel during the proposed extended AOT, the Static Switch senses a loss of Inverter output voltage and automatically fast transfers the associated vital instrument bus loads to the A.C. Line Regulator 115V A.C. output. Operating procedures provide direction for manual transfer of a VIB to the A.C. line regulator if

required. With the vital instrument bus associated with the second failed inverter powered through the A.C. Line Regulator from the 230V A.C. Alternate Power Source, plant safety-related systems required to mitigate a design basis event (DBE) would remain OPERABLE. If failure of a second inverter while in the extended AOT resulted in loss of power to the associated vital instrument bus, plant response would be as described in section 2.1 of the LAR. In either case, having two inverters inoperable would require entry into LCO 3.0.3 requiring action to be initiated within one hour to be in HOT STANDBY within the next six hours, HOT SHUTDOWN within the following six hours and in COLD SHUTDOWN within the subsequent 24 hours.

For a DBE coincident with a loss of offsite power, the effects of a second inverter failure on the plant safety-related systems and their safety functions would depend upon which two inverters were inoperable. Any combination of inverter losses would be dealt with by their individual procedures on a priority basis (S1/2-OP.AB-115-0001-4). The emergency diesel generators would be started and loaded to their respective buses to restore power and control function to the affected busses. The abnormal operating procedure for a loss of offsite power, S1/2.OP-AB.LOOP-0001, has procedural sections to setup and start all non-running EDGs.

The time required to re-energize a VIB is not being changed.

b. The use of a supplemental 115 V AC power source such as a spare inverter or a UPS, the compensatory measures, equipment alignment, and the procedures in place to address the potential consequences to the plant in the event of a DBE or an anticipated operational occurrence if there would be a potential loss of safety functions or reduction in defense in depth of affected safety systems. If there is not a need to use a supplemental 115 V AC power source, please provide a justification.

Response:

The Protected Equipment Program incorporates compensatory measures which control what equipment or systems will not be allowed to be taken out of service concurrent with an inverter out of service for planned or unplanned maintenance. With one inverter inoperable, the inverters, vital instrument buses and emergency diesel generators in the redundant channels are protected. The associated EDG can be manually started and loaded in accordance with existing operating procedures if required to restore power to a vital instrument bus. The operator response time program documents that an EDG can be aligned with the associated 4Kv bus within the time recommended in BTP 8-8 for supplemental power sources.