UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

October 17, 2013

Mr. Thomas Joyce
President and Chief Nuclear Officer
PSEG Nuclear LLC
P.O. Box 236, N09
Hancocks Bridge, NJ 08032

SUBJECT: SALEM NUCLEAR GENERATING STATION, UNITS 1 AND 2 - INTERIM STAFF EVALUATION AND REQUEST FOR ADDITIONAL INFORMATION REGARDING THE OVERALL INTEGRATED PLAN FOR IMPLEMENTATION OF ORDER EA-12-051, RELIABLE SPENT FUEL POOL INSTRUMENTATION (TAC NOS. MF0913 AND MF0914)

Dear Mr. Joyce:

On March 12, 2012, the U.S. Nuclear Regulatory Commission (NRC) issued Order EA-12-051, "Order Modifying Licenses with Regard to Reliable Spent Fuel Pool Instrumentation" (Agencywide Documents Access and Management System (ADAMS) Accession No. ML12054A679), to all power reactor licensees and holders of construction permits in active or deferred status. This order requires the licensee to have a reliable indication of the water level in associated spent fuel storage pools capable of supporting identification of the following pool water level conditions by trained personnel: (1) level that is adequate to support operation of the normal fuel pool cooling system, (2) level that is adequate to provide substantial radiation shielding for a person standing on the spent fuel pool operating deck, and (3) level where fuel remains covered and actions to implement make-up water addition should no longer be deferred.

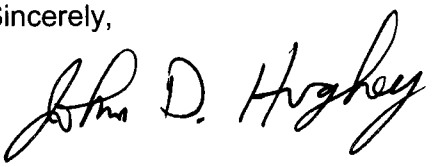
By letter dated February 28, 2013 (ADAMS Accession No. ML130640502), PSEG Nuclear, LLC, (the licensee) provided the Overall Integrated Plan (OIP) for Salem Nuclear Generating Station, Units 1 and 2. The letter described how PSEG will achieve compliance with Attachment 2 of Order EA-12-051 by the fourth quarter of 2014, for Salem Unit 1, and the fourth quarter of 2015, for Salem Unit 2. By letter dated July 11, 2013 (ADAMS Accession No. ML13186A167), the NRC staff sent a request for additional information (RAI) to the licensee. The licensee provided supplemental information by letters dated August 12, 2013 (ADAMS Accession No. ML13225A363), and August 25, 2013 (ADAMS Accession No. ML13239A095).

The NRC staff has reviewed these submittals with the understanding that the licensee will update its OIP as implementation of the Order progresses. With this in mind, the staff has included an interim staff evaluation with this letter to provide feedback on the OIP. The staff's findings in the interim staff evaluation are considered preliminary and will be revised as the OIP is updated. As such, none of the staff's conclusions are to be considered final. A final NRC staff evaluation will be issued after the licensee has provided the information requested. The interim staff evaluation also includes RAIs, response to which the NRC staff needs to complete its review. The licensee should provide the information requested in the 6-month

status updates, as the information becomes available. However, the staff requests that all information be provided by March 31, 2014, to ensure that any issues are resolved prior to the date by which the licensee must complete full implementation of Order EA-12-051. The licensee should adjust its schedule for providing information to ensure that all this information is provided by the requested date.

If you have any questions, please contact me at 301-415-3204 or by e-mail at john.hughey@nrc.gov.

Sincerely,



John D. Hughey, Project Manager
Projects Licensing Branch I-2
Division of Operating Reactor Regulation
Office of Nuclear Reactor Regulation

Docket Nos. 50-272 and 50-311

Enclosure:
Interim Staff Evaluation and
Request for Additional Information

cc w/encl: Distribution via Listserv

INTERIM STAFF EVALUATION AND REQUEST FOR ADDITIONAL INFORMATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION RELATED TO THE OVERALL INTEGRATED PLAN IN RESPONSE TO ORDER EA-12-051, RELIABLE SPENT FUEL POOL INSTRUMENTATION

PSEG NUCLEAR, LLC

SALEM NUCLEAR GENERATING STATION, UNITS 1 AND 2

DOCKET NOS. 50-272 AND 50-311

1.0 INTRODUCTION

On March 12, 2012, the U.S. Nuclear Regulatory Commission (NRC) issued Order EA-12-051, "Issuance of Order to Modify Licenses with Regard to Reliable Spent Fuel Pool Instrumentation" (Agencywide Documents Access and Management System (ADAMS) Accession No. ML12054A679), to all power reactor licensees and holders of construction permits in active or deferred status. This order requires, in part, that all operating reactor sites have a reliable means of remotely monitoring wide-range spent fuel pool (SFP) levels to support effective prioritization of event mitigation and recovery actions in the event of a beyond-design-basis (BDB) external event. The order required all holders of operating licenses issued under Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, "Domestic Licensing of Production and Utilization Facilities," to submit to the NRC an Overall Integrated Plan (OIP) by February 28, 2013.

By letter dated February 28, 2013 (ADAMS Accession No. ML130640502), PSEG Nuclear, LLC (the licensee) provided the OIP for Salem Nuclear Generating Station (Salem), Units 1 and 2, describing how it will achieve compliance with Attachment 2 of Order EA-12-51 by the fourth quarter of 2014, for Unit 1, and the fourth quarter of 2015, for Unit 2. By letter dated July 11, 2013 (ADAMS Accession No. ML13186A167), the NRC staff sent a request for additional information (RAI) to the licensee. The licensee provided supplemental information by letters dated August 12, 2013 (ADAMS Accession No. ML13225A363), and August 25, 2013 (ADAMS Accession No. ML13239A095).

2.0 REGULATORY EVALUATION

Order EA-12-051 requires all holders of operating licenses issued under 10 CFR Part 50, notwithstanding the provisions of any Commission regulation or license to the contrary, to comply with the requirements described in Attachment 2 to the Order except to the extent that a more stringent requirement is set forth in the license. Licensees shall promptly start implementation of the requirements in Attachment 2 to the Order and shall complete full implementation no later than two refueling cycles after submittal of the OIP or December 31, 2016, whichever comes first.

Order EA-12-051 required the licensee, by February 28, 2013, to submit to the Commission an OIP, including a description of how compliance with the requirements described in Attachment 2 of the Order will be achieved.

Attachment 2 of Order EA-12-051 requires the licensee to have a reliable indication of the water level in associated spent fuel storage pools capable of supporting identification of the following pool water level conditions by trained personnel: (1) level that is adequate to support operation of the normal fuel pool cooling system, (2) level that is adequate to provide substantial radiation shielding for a person standing on the SFP operating deck, and (3) level where fuel remains covered and actions to implement make-up water addition should no longer be deferred.

Attachment 2 of Order EA-12-051, states that the SFP level instrumentation shall include the following design features:

1.1 Instruments: The instrumentation shall consist of a permanent, fixed primary instrument channel and a backup instrument channel. The backup instrument channel may be fixed or portable. Portable instruments shall have capabilities that enhance the ability of trained personnel to monitor spent fuel pool water level under conditions that restrict direct personnel access to the pool, such as partial structural damage, high radiation levels, or heat and humidity from a boiling pool.

1.2 Arrangement: The spent fuel pool level instrument channels shall be arranged in a manner that provides reasonable protection of the level indication function against missiles that may result from damage to the structure over the spent fuel pool. This protection may be provided by locating the primary instrument channel and fixed portions of the backup instrument channel, if applicable, to maintain instrument channel separation within the spent fuel pool area, and to utilize inherent shielding from missiles provided by existing recesses and corners in the spent fuel pool structure.

1.3 Mounting: Installed instrument channel equipment within the spent fuel pool shall be mounted to retain its design configuration during and following the maximum seismic ground motion considered in the design of the spent fuel pool structure.

1.4 Qualification: The primary and backup instrument channels shall be reliable at temperature, humidity, and radiation levels consistent with the spent fuel pool water at saturation conditions for an extended period. This reliability shall be established through use of an augmented quality assurance process (e.g., a process similar to that applied to the site fire protection program).

1.5 Independence: The primary instrument channel shall be independent of the backup instrument channel.

1.6 Power supplies: Permanently installed instrumentation channels shall each be powered by a separate power supply. Permanently installed and portable instrumentation channels shall provide for power connections from sources independent of the plant [alternating current (ac)] and [direct current (dc)] power distribution systems, such as portable generators or replaceable batteries. Onsite generators used as an alternate power source and replaceable batteries used for instrument channel power shall have sufficient capacity to maintain the level indication function until offsite resource availability is reasonably assured.

1.7 Accuracy: The instrument channels shall maintain their designed accuracy following a power interruption or change in power source without recalibration.

1.8 Testing: The instrument channel design shall provide for routine testing and calibration.

1.9 Display: Trained personnel shall be able to monitor the spent fuel pool water level from the control room, alternate shutdown panel, or other appropriate and accessible location. The display shall provide on-demand or continuous indication of spent fuel pool water level.

Attachment 2 of Order EA-12-051, states that the SFP instrumentation shall be maintained available and reliable through appropriate development and implementation of the following programs:

2.1 Training: Personnel shall be trained in the use and the provision of alternate power to the primary and backup instrument channels.

2.2 Procedures: Procedures shall be established and maintained for the testing, calibration, and use of the primary and backup spent fuel pool instrument channels.

2.3 Testing and Calibration: Processes shall be established and maintained for scheduling and implementing necessary testing and calibration of the primary and backup spent fuel pool level instrument channels to maintain the instrument channels at the design accuracy.

On August 29, 2012, the NRC issued an Interim Staff Guidance document (the ISG), JLD-ISG-2012-03, "Compliance with Order EA-12-051, Reliable Spent Fuel Pool Instrumentation" (ADAMS Accession No. ML12221A339), to describe methods acceptable to the NRC staff for complying with Order EA-12-051. The ISG endorses, with exceptions and clarifications, the methods described in the Nuclear Energy Institute (NEI) guidance document NEI 12-02, Revision 1, "Industry Guidance for Compliance with NRC Order EA-12-051, 'to Modify Licenses with Regard to Reliable Spent Fuel Pool Instrumentation,'" dated August 2012 (ADAMS Accession No. ML12240A307). Specifically, the ISG states:

> The NRC staff considers that the methodologies and guidance in conformance with the guidelines provided in NEI 12-02, Revision 1, subject to the clarifications and exceptions in Attachment 1 to this ISG, are an acceptable means of meeting the requirements of Order EA-12-051.

3.0 TECHNICAL EVALUATION

3.1 Background and Schedule

Salem, Units 1 and 2, has two separate SFPs; each pool is approximately 37-feet long by 28 feet 6 inches-wide, and 44-feet deep.

The licensee submitted its OIP on February 28, 2013. The OIP states that installation of the SFP level instrumentation at Salem will be completed by the end of the fourth quarter of 2014, for Unit 1 and the end of the fourth quarter of 2015, for Unit 2, which is before startup from the second refueling outage for each unit.

The NRC staff has reviewed the licensee's schedule for implementation of SFP level instrumentation provided in its OIP. If the licensee completes implementation in accordance with this schedule, it would appear to achieve compliance with Order EA-12-051 within two refueling cycles after submittal of the OIP and before December 31, 2016.

3.2 Spent Fuel Pool Water Levels

Attachment 2 of Order EA-12-051 states, in part, that

> All licensees identified in Attachment 1 to this Order shall have a reliable indication of the water level in associated spent fuel storage pools capable of supporting identification of the following pool water level conditions by trained personnel: (1) level that is adequate to support operation of the normal fuel pool cooling system [Level 1], (2) level that is adequate to provide substantial radiation shielding for a person standing on the SFP operating deck [Level 2], and (3) level where fuel remains covered and actions to implement make-up water addition should no longer be deferred [Level 3].

NEI 12-02 states, in part, that

> Level 1 represents the HIGHER of the following two points:
>
> - The level at which reliable suction loss occurs due to uncovering of the coolant inlet pipe, weir or vacuum breaker (depending on the design), or
>
> - The level at which the water height, assuming saturated conditions, above the centerline of the cooling pump suction provides the required net positive suction head specified by the pump manufacturer or engineering analysis.

In its OIP, the licensee stated that Level 1 is the indicated SFP level on either the Primary or Back-up instrument channel of greater than an elevation of approximately 124 feet (ft.) 8 inches

(in.). The licensee also stated that the cooling water return lines include anti-siphoning design features to prevent inadvertent drainage below this elevation.

In its letter dated August 12, 2013, the licensee stated, in part, that

> For Salem Generating Station (SGS) Units 1 and 2, the level at which reliable suction loss occurs is due to uncovering of the coolant suction pipe. The centerline of the suction pipe is at elevation 124' – 8" of the SFP. This is the level at which reliable suction loss occurs.
>
> The $NPSH_R$ [required net positive suction head] specified by the pump manufacturer assuming saturated conditions is 16 ft. At the SFP suction elevation of 124' – 8" and saturated conditions, the lowest available NPSH ($NPSH_A$) is greater than the $NPSH_R$ of 16ft., as specified by the pump manufacturer (Reference 8 for NPSH calculation details).
>
> For Level 1, the centerline of the suction pipe (124' – 8") is greater than the level where the $NPSH_A$ equals $NPSH_R$ and therefore represents the higher of the two points described in the NEI 12-02 guidance for this level.

The NRC staff notes that the licensee provided information indicating that the selection of Level 1 at 124 ft. 8 in. is the level at which reliable suction loss occurs. The staff also notes that the licensee stated that the current elevation for Level 1 is greater than the level where the $NPSH_A$ equals $NPSH_R$, which is sufficient for ensuring NPSH for the coolant pumps. However, the licensee did not provide the basis for its assertion that 124 ft. 8 in. represents an elevation that is greater than the elevation corresponding to the 16 ft. of net positive suction head required at saturated conditions for these pumps. The staff has identified this request as:

RAI #1

Please provide the elevation obtained as a result of the $NPSH_A$ calculation derived from Reference 8 to the August 12, 2013, letter (S-C-SF-MDC-1040 – "NPSH for Spent Fuel Pool Pumps - SF [spent fuel] System (Salem 1 and 2)").

NEI 12-02 states, in part, that

> Level 2 represents the range of water level where any necessary operations in the vicinity of the spent fuel pool can be completed without significant dose consequences from direct gamma radiation from the stored spent fuel. Level 2 is based on either of the following:
>
> - 10 feet (+/- 1 foot) above the highest point of any fuel rack seated in the spent fuel pools, or
>
> - a designated level that provides adequate radiation shielding to maintain personnel radiological dose levels within acceptable limits while performing local operations in the vicinity of the pool. This level shall be based on either plant-specific or appropriate generic shielding calculations, considering the

> emergency conditions that may apply at the time and the scope of necessary local operations, including installation of portable SFP instrument channel components.

In its OIP, the licensee stated that level 2 is the indicated SFP level on either instrument channel of greater than elevation of approximately 114 ft. 11 ¾ in. (+/- 1 ft. – 0 in.). According to the licensee, this elevation is approximately 10 ft. above the top of the fuel racks and ensures a minimum of 10 ft. above the top of the fuel.

The NRC notes that the licensee designated Level 2 using the first of the two options described in NEI 12-02 for Level 2.

NEI 12-02 states, in part, that

> Level 3 corresponds nominally (i.e., +/- 1 foot) to the highest point of any fuel rack seated in the spent fuel pool. Level 3 is defined in this manner to provide the maximum range of information to operators, decision makers and emergency response personnel.

In its OIP, the licensee stated that Level 3 is the indicated SFP level on either instrument channel of greater than elevation of approximately 104 ft. – 11 ¾ in. (+/- 1 foot).

In its letter dated August 25, 2013, the licensee provided a sketch of the elevation view of the SFP showing the Level 1, 2, and 3 elevations and other elevation related to the SFP. The NRC staff notes that the elevation for Level 3 is the highest point of any spent fuel storage rack seated in the SFP.

The licensee's proposed plan, with respect to identification of Levels 2 and 3, appears to be consistent with NEI 12-02, as endorsed by the ISG.

3.3 Design Features: Instruments

Attachment 2 of Order EA-12-051, states, in part, that

> The instrumentation shall consist of a permanent, fixed primary instrument channel and a backup instrument channel. The backup instrument channel may be fixed or portable. Portable instruments shall have capabilities that enhance the ability of trained personnel to monitor spent fuel pool water level under conditions that restrict direct personnel access to the pool, such as partial structural damage, high radiation levels, or heat and humidity from a boiling pool.

NEI 12-02 states, in part, that

> A spent fuel pool level instrument channel is considered reliable when the instrument channel satisfies the design elements listed in Section 3 [Instrumentation Design Features] of this guidance and the plant operator has fully implemented the programmatic features listed in Section 4 [Program Features].

In its OIP, the licensee stated, in part, that

> Both the primary and backup channels will utilize a fixed instrument providing continuous level measurement over the entire range. The measured range will be from approximately elevation 104' – 11 ¾" to approximately elevation 130' – 0" for a total indicated range of approximately 25' – ¼" (300 ¼" ± 12"). The exact range will be determined during the detailed engineering design.

The NRC staff notes that the range specified for the licensee's instrumentation will cover Levels 1, 2, and 3 as described in Section 3.2 above. The licensee's proposed plan, with respect to the number of channels for both of its SFPs, appears to be consistent with NEI 12-02, as endorsed by the ISG.

3.4 Design Features: Arrangement

Attachment 2 of Order EA-12-051, states, in part, that

> The spent fuel pool level instrument channels shall be arranged in a manner that provides reasonable protection of the level indication function against missiles that may result from damage to the structure over the spent fuel pool. This protection may be provided by locating the primary instrument channel and the fixed portions of the backup instrument channel, if applicable, to maintain instrument channel separation within the spent fuel pool area, and to utilize inherent shielding from missiles provided by existing recesses and corners in the spent fuel pool structure.

NEI 12-02 states, in part, that

> The intent of the arrangement requirement is to specify reasonable separation and missile protection requirements for permanently installed instrumentation used to meet this order. Although additional missile barriers are not required to be installed, separation and shielding can help minimize the probability that damage due to an explosion or extreme natural phenomena (e.g., falling or wind-driven missiles) will render fixed channels of SFP instrumentation unavailable. Installation of the SFP instrument channels shall be consistent with the plant-specific SFP design requirements and should not impair normal SFP function.
>
> Channel separation should be maintained by locating the installed sensors in different places in the SFP area.

In its OIP, the licensee stated, in part, that

> The primary and backup channel level sensor probes will be installed in different locations of the SFP for a maximum separation within the limits of the existing SFP design. The primary and backup channels will be physically separated in accordance with the guidelines provided in NEI 12-02 Revision 1. In the conceptual design, the SFP probes bolt to mounting plates for installation at the

> corner of the SFP, or along the side of the SFP. This mounting will allow the probe to be installed within a few inches of the SFP liner without penetrating the liner thereby minimizing the chances of interference with other structures, and occupying limited space of the SFP deck. Existing barriers will be used to provide a level of protection for the sensor and interconnecting cable located along the SFP wall or on the refueling floor. These physical barriers will protect the instrument sensors and cables from potential missile hazards generated by an event. The final sensor mounting design and cable routing will maintain a low profile to ensure that there is no interference with the existing fuel handling equipment. Specific details will be developed during the detailed design phase.

In addition, in its OIP, the licensee stated that all cabling associated with each channel's sensor, power supply and indicator will be independently routed in separate raceways from cabling associated with the other channel.

In its letter dated August 12, 2013, the licensee stated, in part, that

> As stated in the OIP for SGS Units 1 and 2, both the primary and backup channels will be physically separated in accordance with the guidelines provided in NEI 12-02 Revision 1. Specifically, the sensors will be in different corners of the SFP and separated by a distance comparable to the shortest side of the pool. The interconnecting cables that extend from the sensors toward the location of the electronics enclosures will be installed using separate routes and separate conduit to transition from the SFP curb. Existing conduit embedded in the fuel handling floor concrete will be utilized to the extent practical, providing a physical barrier to protect from potential missile hazards until the cable leaves the Fuel Handling Building and transitions into the Auxiliary Building. In the Auxiliary Building, the cables will be routed using SGS Units 1 and 2 "Technical Standard for Physical Separation Requirements (Electrical)" (Reference 10) over the entire length of the cable.

The licensee's proposed location of the primary and backup level instruments for both of its SFPs appears to be consistent with the guidance.

In its letter dated August 12, 2013, the licensee provided a figure RAI-2, "Salem Unit 2 Spent Fuel Pool Level Sketch Plan View," depicting the approximate locations for both the primary and backup channel level sensors and the routing of the cables from the SPF to the Main Control Room (MCR). The licensee stated in this letter that Salem Unit 1 is similar to Unit 2. Based on the review of this figure, the NRC staff has concerns regarding the routing of these two channels in accordance with the guidance on channel separation as described in NEI 12-02. The routing of the cables within one corner of the SFP area appears to be in close proximity to one another. The staff has identified this request as:

RAI #2

Please provide additional information describing how the proposed arrangement of the SFP instrumentation and routing of the cabling between the level instruments, the electronics, and the displays in the MCR meets the Order requirement to arrange the SFP

level instrument channels in a manner that provides reasonable protection of the level indication function against missiles that may result from damage to the structure over the SFP.

3.5 Design Features: Mounting

Attachment 2 of Order EA-12-051 states, in part, that

> Installed instrument channel equipment within the spent fuel pool shall be mounted to retain its design configuration during and following the maximum seismic ground motion considered in the design of the spent fuel pool structure.

NEI 12-02 states, in part, that

> The mounting shall be designed to be consistent with the highest seismic or safety classification of the SFP. An evaluation of other hardware stored in the SFP shall be conducted to ensure it will not create adverse interaction with the fixed instrument location(s).
>
> The basis for the seismic design for mountings in the SFP shall be the plant seismic design basis at the time of submittal of the Integrated Plan for implementing NRC Order EA-12-051.

In its OIP, the licensee stated, in part, that

> Installed equipment will be qualified to withstand the maximum seismic ground motion considered in the design of the plant area where the equipment will be installed. The basis for the seismically designed mountings will be the plant seismic design basis at the time of the submittal of this integrated plan. The instrument sensors mounted in the SFP will be designed to Seismic Category I.

In its letter dated August 12, 2013, the licensee stated, in part, that

a) The design criteria used to estimate total loading, including static and dynamic loads is in accordance with PSEG Technical Standard "Salem Structural Design Criteria" (Reference 12). The SGS Units 1 and 2 Structural Design Criteria provide both the design criteria and the methodology used for determining total loading. Final static and dynamic (seismic and hydrodynamic) loads will be provided by the manufacturer based on their final design and the testing and/or analysis results. The final static, dynamic and hydrodynamic loads will be available upon completion of the final design that is scheduled for completion by the end of the first quarter 2014. Details will be provided to the NRC in the August 2014, six-month OIP update.

b) The SGS Units 1 and 2 SFP Level Instrumentation Guided Wave Radar (GWR) sensor design does not include a stilling well. The low sensor mass and the sensor's reaction to seismic loading permit the sensor assembly

mount to be very simple, lightweight, and require a very small footprint. The sensor can be mounted on the curb's horizontal surface or curb face. The sensor is designed to mount in close proximity to the liner without penetrating it. Therefore, there are no points of attachment to the SFP liner.

The final mounting details will be available upon completion of the final design that is scheduled for completion by the end of the first quarter 2014. Details will be provided to the NRC in the August 2014, six-month OIP update.

The NRC staff notes that the licensee's final design is not available for review and that the licensee will provide further information during the August 2014, six-month OIP update. The staff has identified these requests as:

RAI #3

Please provide the following:

a) **The design criteria that will be used to estimate the total loading on the mounting device(s), including static weight loads and dynamic loads. Describe the methodology that will be used to estimate the total loading, inclusive of design basis maximum seismic loads and the hydrodynamic loads that could result from pool sloshing or other effects that could accompany such seismic forces.**

b) **A description of the manner in which the level sensor (and stilling well, if appropriate) will be attached to the refueling floor and/or other support structures for each planned point of attachment of the probe assembly. Indicate in a schematic the portions of the level sensor that will serve as points of attachment for mechanical/mounting or electrical connections.**

c) **A description of the manner by which the mechanical connections will attach the level instrument to permanent SFP structures so as to support the level sensor assembly.**

(This information was previously requested as RAI-3 in NRC letter dated July 11, 2013)

In addition, the staff plans to verify the results of the licensee's seismic testing and analysis when it is completed based on the licensee's response to the following RAI.

RAI #4

For RAI 3(a) above, please provide the analyses used to verify the design criteria and methodology for seismic testing of the SFP instrumentation and the electronics units, including, design basis maximum seismic loads and the hydrodynamic loads that

could result from pool sloshing or other effects that could accompany such seismic forces.

RAI #5

For each of the mounting attachments required to attach SFP Level equipment to plant structures, please describe the design inputs, and the methodology that was used to qualify the structural integrity of the affected structures/equipment.

3.6 Design Features: Qualification

Attachment 2 of Order EA-12-051 states, in part, that

> The primary and backup instrument channels shall be reliable at temperature, humidity, and radiation levels consistent with the spent fuel pool water at saturation conditions for an extended period. This reliability shall be established through use of an augmented quality assurance process (e.g. a process similar to that applied to the site fire protection program).

NEI 12-02 states, in part, that

> The instrument channel reliability shall be demonstrated via an appropriate combination of design, analyses, operating experience, and/or testing of channel components for the following sets of parameters, as described in the paragraphs below:
>
> - conditions in the area of instrument channel component use for all instrument components,
>
> - effects of shock and vibration on instrument channel components used during any applicable event for only installed components, and
>
> - seismic effects on instrument channel components used during and following a potential seismic event for only installed components...

The NRC staff assessment of the instrument qualification is discussed in the following subsections below: (3.6.1) Augmented Quality Process, (3.6.2) Post Event Conditions, (3.6.3) Shock and Vibration, and (3.6.4) Seismic Reliability.

3.6.1 Augmented Quality Process

Appendix A-1 of the guidance in NEI 12-02 describes a quality assurance process for non-safety systems and equipment that is not already covered by existing quality assurance requirements. Within the ISG, the NRC staff found the use of this quality assurance process to be an acceptable means of meeting the augmented quality requirements of Order EA-12-051.

In its OIP, the licensee stated, in part, that

> Non-safety related Commercial-Off-The-Shelf (COTS) components will be used to meet the requirements of the order. All non-safety related equipment installed will be implemented so that they do not degrade existing safety related functions. Augmented quality requirements will be applied to the project for the installation of new components, conduit and cable. If safety related Structures Systems or Components (SSC) are interfaced or affected, then the appropriate quality requirements will be applied.

The licensee's proposed augmented quality assurance process appears to be consistent with NEI 12-02, as endorsed by the ISG.

3.6.2 Post Event Conditions

NEI 12-02 states, in part, that

> The temperature, humidity and radiation levels consistent with conditions in the vicinity of the [SFP] and the area of use considering normal operational, event and post-event conditions for no fewer than seven days post-event or until off-site resources can be deployed by the mitigating strategies resulting from Order EA-12-049 should be considered. Examples of post-event (beyond-design-basis) conditions to be considered are:
>
> - radiological conditions for a normal refueling quantity of freshly discharged (100 hours) fuel with the SFP water level 3 as described in this order,
> - temperatures of 212 degrees F and 100% relative humidity environment,
> - boiling water and/or steam environment
> - a concentrated borated water environment, and...

In its OIP, the licensee stated, consistent with NEI 12-02, in part, that

> Temperature, humidity, and radiation levels consistent with conditions in the vicinity of the SFP and the area of use considering normal operational, event and post-event conditions for no fewer than seven days post event or until off-site resources can be deployed by the mitigating strategies resulting from Order EA-12-049 (Reference 2) will be addressed in the engineering and design phase. Examples of post event BDB conditions that will be considered are:
>
> - Radiological conditions for a normal refueling quantity of freshly discharged (100 hours) fuel with the SFP water level 3 as described in this order,
> - Temperatures of 212°F and 100% relative humidity environment,
> - Boiling water and/or steam environment,

- A concentrated borated water environment . . .

Related to radiological conditions, in its OIP, the licensee stated, in part, that

> The sensors and cables located in the vicinity of the SFP will be qualified to withstand peak and total integrated dose radiation levels for their installed location based on post event SFP water level equal to Level 3.

In its letter dated August 12, 2013, the licensee stated, in part, that

> All equipment located in the fuel handling building will be certified for use by the manufacturer for survivability under post-event conditions including temperatures of at least 100° Centigrade (212° Fahrenheit), 100 percent condensing atmosphere, submerged operation for components located in the SFP at elevated chemical concentrations, and exposure to postulated radiation levels with the SFP water levels at the top of the fuel storage rack for an extended period of time. ...
>
> In addition to the above, the electronic enclosures will be qualified by the manufacturer for use at temperatures, humidity and integrated radiation doses consistent with other electronic devices containing digital components and located in mild environments. The inherent shielding of the structures between the fuel handling building and the transmitter will result in negligible doses to the transmitter located in the Auxiliary Building.

The NRC staff has concerns with the licensee's lack of information regarding radiological conditions where the instrument and its electronic components are going to be installed. The staff has identified this request as:

RAI #6

Please provide a description of the specific method or combination of methods that will be used to demonstrate the reliability of the permanently installed equipment under BDB radiation conditions. Also, please provide analysis of the maximum expected radiological conditions (dose rate and total integrated dose) to which the equipment located within the Auxiliary Building will be exposed.

While addressing post-event temperature conditions, the licensee stated in its OIP that post event temperature at sensors and for cabling located above the SFP is assumed to be 212°F. In its letter dated August 12, 2013, the licensee stated that all equipment located in the fuel handling building will be certified for use, by the manufacturer, for survivability under post-event conditions including temperatures of at least 100°C (212°F). The licensee also stated on this letter that new electronics enclosures will be installed in the Auxiliary Building Relay Room, which is considered a mild environment.

The NRC staff has concerns with the lack of information regarding the ambient temperature in the vicinity where the electronics equipment will be located under normal and worst case postulated conditions. The staff has identified this request as:

RAI #7

Please provide information addressing the maximum expected ambient temperature in the room in which the sensor electronics will be located under BDB conditions in which there is no ac power available to run heating ventilation and air conditioning (HVAC) systems.

In its OIP, the licensee stated that post event humidity in the fuel pool floor area near and above the SFP is assumed to be 100% with condensing steam. In its letter dated August 12, 2013, the licensee stated that all equipment located in the fuel handling building will be certified for use, by the manufacturer, for survivability under post-event conditions including 100 percent condensing atmosphere. Additionally, the licensee stated in this letter that the electronic enclosures will be qualified by the manufacturer for use at temperatures, humidity and integrated radiation doses consistent with other electronic devices containing digital components and located in mild environments.

The NRC staff has concerns with the lack of information regarding whether the sensor electronics is capable of continuously performing its required functions under the expected humidity condition. The staff has identified this request as:

RAI #8

Please provide information indicating the maximum expected relative humidity in the room in which the sensor electronics will be located under BDB conditions, in which there is no ac power available to run HVAC systems, and whether the sensor electronics is capable of continuously performing its required functions under this expected humidity condition.

3.6.3 Shock and Vibration

NEI 12-02 states, in part, that

> Applicable components of the instrument channels are rated by the manufacturer (or otherwise tested) for shock and vibration at levels commensurate with those of postulated design basis event conditions in the area of instrument channel component use using one or more of the following methods:
>
> - instrument channel components use known operating principles, are supplied by manufacturers with commercial quality programs (such as ISO9001) with shock and vibration requirements included in the purchase specification and/or instrument design, and commercial design and testing for operation in environments where significant shock and vibration loadings are common, such as for portable hand-held devices or transportation applications;

- substantial history of operational reliability in environments with significant shock and vibration loading, such as transportation applications, or

- use of component inherently resistant to shock and vibration loadings or are seismically reliable such as cables.

In its OIP, the licensee stated, in part, that

> Components of the instrument channels installed in the SFP area will be qualified for shock and vibration using one or more of the following methods:
>
> - Components are supplied by manufacturers using commercial quality programs (such as ISO9001, *Quality management systems – Requirements* (Reference 6)) with shock and vibration requirements included in the purchase specification at levels commensurate with portable hand-held device or transportation applications;
>
> - Components have a substantial history of operational reliability in environments with significant shock and vibration loading, such as portable hand-held device or transportation applications; or
>
> - Components are inherently resistant to shock and vibration loadings, such as cables.
>
> These requirements will be used as design input for the detailed design, final equipment and vendor selection, and final implementation.

In its letter dated August 12, 2013, the licensee stated, in part, that

> Reliability of the permanently installed equipment under BDB ambient temperature, humidity, shock, vibration, and radiation conditions will be demonstrated by the manufacturer through their equipment design, testing, or analysis as specified in the PSEG procurement specification. Section 7 of the procurement specification (Reference 9) provides performance requirements for temperature, humidity, pressure, radiation, chemistry, shock and vibration, EMI/RFI [electromagnetic interference/radio frequency interference], and seismic based on the environmental and seismic design criteria from NEI 12-02 Revision 1.

The NRC staff notes the results of the testing and/or analysis of the installed equipment's reliability under BDB conditions is not currently available for review. As stated by the licensee, the reliability of the permanently installed equipment under BDB conditions will be demonstrated by the manufacturer, as specified in the licensee's procurement specifications. The NRC staff has identified this request as:

RAI #9

Please provide the results of the testing and/or analysis of the installed equipment's reliability under BDB ambient temperature, humidity, shock, vibration, and radiation conditions as specified in the PSEG procurement specification. Provide the results of your analysis that demonstrates that the vendor's qualification testing and analysis envelopes the plant environmental conditions considered for the specific locations where the equipment will be installed.

3.6.4 Seismic Reliability

The ISG recommends the use of Sections 7, 8, 9, and 10 of IEEE 344-2004 for seismic qualification of the SFP level instrumentation.

In its OIP, the licensee stated, in part, that

> For seismic effects on instrument channel components used after a potential seismic event for only installed components, the following measures will be used to verify that the design and installation is adequate. Applicable components of the instrument channels are rated by the manufacturer (or otherwise tested) for seismic effects at levels commensurate with those of postulated design basis event conditions in the area of instrument channel component use using one or more of the following methods:
>
> - Adequacy of seismic design and installation is demonstrated based on the guidance in Sections 7, 8, 9, and 10 of IEEE Standard 344-2004, *IEEE Recommended Practice for Seismic Qualification of Class 1E Equipment for Nuclear Power Generating Stations*, (Reference 7), or a substantially similar industrial standard;
>
> - Demonstration that proposed devices are substantially similar in design to models that have been previously tested for seismic effects in excess of the plant design basis at the location where the instrument is to be installed (g-levels and frequency ranges); or
>
> - Seismic qualification using seismic motion consistent with that of existing design basis loading at the installation location.
>
> These requirements will be used as design input for the detailed design, final equipment, vendor selection, and final implementation.

In its letter dated August 12, 2013, the licensee stated, in part, that

> The new SFP electronic enclosures will be qualified by test in accordance with the seismic qualification requirements outlined in IEEE-344 2004 (Reference 6) using a bounding set of criteria that will envelope the SGS Units 1 and 2 Auxiliary Building Required Response Spectra (RRS). The electronic enclosure mounts

> will be seismically qualified to reflect the specific plant configuration determined by the final design.
>
> Dynamic analysis, including the applicable seismic and hydrodynamic loads, will be used to determine the total loads on the sensor and its mounting. Site specific analysis will be performed to demonstrate the mount's structural adequacy at the selected location.

Additionally, in its letter dated August 12, 2013, the licensee stated, in part, that

> The new SFP level instrumentation system will be tested and/or analyzed using a bounding set of seismic response spectra that will meet the Seismic Design and Qualification requirements for SGS Units 1 and 2. Testing and analysis will confirm that the system maintains its required accuracy following a seismic event.
>
> Further details of the qualification by test and/or analysis used to confirm the reliability of the permanently installed equipment during and following seismic event will be available upon completion of the final design that is scheduled for completion by the end of the first quarter 2014. Details will be provided to the NRC in the August 2014, six-month OIP update.

The NRC staff notes that the licensee plans to demonstrate the reliability of the seismic design and installation in accordance with the guidance in the ISG. The licensee's planned approach with respect to the seismic reliability of the instrumentation appears to be consistent the guidance. However, the staff plans to verify the results of the licensee's seismic test when it is completed. The staff has identified this request as:

RAI #10

Please provide the results and the basis of your analysis of the seismic testing results showing that the instrument performance reliability, following exposure to simulated seismic conditions representative of the environment anticipated for the SFP structures at SGS, has been adequately demonstrated.

3.6.5 Qualification Evaluation Summary

Upon acceptable resolution of the RAIs in Section 3.6, the NRC staff will be able to make a conclusion regarding the instrument qualification.

3.7 Design Features: Independence

Attachment 2 of Order EA-12-051 states, in part, that

> The primary instrument channel shall be independent of the backup instrument channel.

> transfer from the normal AC power source to the battery back-up source upon a loss of the AC supply.

The NRC staff has determined that the licensee's planned implementation of such provisions with respect to independence appears to be consistent with the NEI 12-02, as endorsed by the ISG. The staff also notes that implementing this design would allow the electrical functional performance of each level measurement channel to be independent of the other channel. If completed as described, this independence would result in a reliable SFP level measurement. However, the NRC staff plans to review the final electrical power supply design information to complete its review. The NRC staff has identified this request as:

RAI #11

Please provide the NRC staff with the final configuration of the power supply source for each channel so that the staff may conclude that the two channels are independent from a power supply assignment perspective.

The physical separation of the instruments was previously discussed in Section 3.4, "Arrangement." As stated in Section 3.4, the licensee appears to have routed the cables for each of the independent SFP level sensors within the corner of the SFP area in close proximity to one another, thus jeopardizing the independence between primary and backup instrument channels that could have been gained from the application of physical separation. The licensee's response to RAI #2 above will be evaluated by the staff to address this issue and complete the evaluation.

3.8 Design Features: Power Supplies

Attachment 2 of Order EA-12-051, states in part, that

> Permanently installed instrumentation channels shall each be powered by a separate power supply. Permanently installed and portable instrumentation channels shall provide for power connections from sources independent of the plant ac and dc power distribution systems, such as portable generators or replaceable batteries. Onsite generators used as an alternate power source and replaceable batteries used for instrument channel power shall have sufficient capacity to maintain the level indication function until offsite resource availability is reasonably assured.

NEI 12-02 states, in part, that

> The normal electrical power supply for each channel shall be provided by different sources such that the loss of one of the channels primary power supply will not result in a loss of power supply function to both channels of SFP level instrumentation.
>
> All channels of SFP level instrumentation shall provide the capability of connecting the channel to a source of power (e.g., portable generators or replaceable batteries) independent of the normal plant AC and DC power

systems. For fixed channels this alternate capability shall include the ability to isolate the installed channel from its normal power supply or supplies. The portable power sources for the portable and installed channels shall be stored at separate locations, consistent with the reasonable protection requirements associated with NEI 12-06 (Order EA-12-049). The portable generator or replaceable batteries should be accessible and have sufficient capacity to support reliable instrument channel operation until off-site resources can be deployed by the mitigating strategies resulting from Order EA-12-049.

If adequate power supply for either an installed or portable level instrument credits intermittent operation, then the provisions shall be made for quickly and reliably taking the channel out of service and restoring it to service. For example, a switch on the power supply to the channel is adequate provided the power can be periodically interrupted without significantly affecting the accuracy and reliability of the instrument reading. Continuous indication of SFP level is acceptable only if the power for such indication is demonstrably adequate for the time duration specified in section 3.1[.]

In its OIP, the licensee stated, in part, that

The normal power supply for each channel will be provided by independent AC or DC power sources such that loss of one power source will not result in the loss of both channels. In addition to the normal plant AC or DC power supply to each channel, a back-up power source will also be provided in the form of a back-up battery independent of the normal AC or DC power sources. The back-up power will have sufficient capacity to support reliable instrument channel operation through the use of replaceable batteries until appropriate off-site resource availability is reasonably assured.

Specific details will be developed during the detailed design phase.

In its letter dated August 12, 2013, the licensee stated, in part, that

a) The normal power supply for each channel will be provided using separate station 120VAC power sources that are fed from battery-backed inverters (vital supplies) such that loss of one power source will not result in the loss of both channels. The station batteries providing power to the SFP instrument channels will remain operational through an initial coping period as defined by the SGS FLEX strategies.

b) As stated in the response to a), the level measurement channels use separate station 120VAC power sources that are fed from battery-backed inverters (vital supplies) as the normal supply. Back-up power is provided by means of batteries internal to the electronics enclosure. The design criteria applied to the instrument specification is for continuous system operation for 72 hours following loss of ac power. System power consumption is based on the specified values provided by the manufacturer, which will be available upon completion of the final design

> that is scheduled for completion by the end of the first quarter 2014. Details will be provided to the NRC in the August 2014, six-month OIP update.

The NRC staff notes that information on system power consumption is not available for review and will be provided to the staff in the August 2014, six-month OIP update. The staff has identified this request as:

RAI #12

Please provide the result of the calculation depicting the battery backup duty cycle requirements demonstrating that its capacity is sufficient to maintain the level indication function until offsite resource availability is reasonably assured.

3.9 Design Features: Accuracy

Attachment 2 of Order EA-12-051 states, in part, that

> The instrument channels shall maintain their designed accuracy following a power interruption or change in power source without recalibration.

NEI 12-02 states, in part, that

> Accuracy should consider operations while under SFP conditions, e.g., saturated water, steam environment, or concentrated borated water. Additionally, instrument accuracy should be sufficient to allow trained personnel to determine when the actual level exceeds the specified lower level of each indicating range (levels 1, 2 and 3) without conflicting or ambiguous indication.

In its OIP, the licensee stated, in part, that

> The instrument channels will maintain their designed accuracy following a power interruption or change in power source without requiring recalibration. The instrumentation channels utilize COTS components and, therefore, the final design will ensure vendor published instrument design accuracies are acceptable in accordance with the guidelines of NEI 12-02 Revision 1. ...
>
> Specific details regarding instrument accuracy will be obtained from the supplier during the procurement and detailed design phases.

In its letter dated August 12, 2013, the licensee stated, in part, that

a) The selected SFP level instrumentation system is expected to have a design reference accuracy better than +/- 1% of span and will maintain this accuracy over the entire range of operating conditions, including BDB conditions. It will maintain its design accuracy following a power interruption without the need for recalibration. The final design accuracy information will be provided by the manufacturer and will be available upon

completion of the final design that is scheduled for completion by the end of the first quarter 2014. Details will be provided to the NRC in the August 2014, six-month OIP update.

b) The maximum allowed deviation from the channel design accuracy for channel check and calibration tolerances will be developed as part of the detailed design using the standard SGS Units 1 and 2 Setpoint Methodology Technical Standard (Reference 11). The final tolerances will be developed from design accuracy information provided by the manufacturer and will be available upon completion of the final design that is scheduled for completion by the end of the first quarter 2014. Details will be provided to the NRC in the August 2014, six-month OIP update.

The NRC staff notes that additional information on design accuracy for the SFP instrumentation is not available for review and will be provided to the staff in the August 2014, six-month OIP update. The staff has identified this request as:

RAI #13

Provide the following information:

a) An estimate of the expected instrument channel accuracy performance (e.g., in % of span) under both a) normal SFP level conditions (approximately Level 1 or higher) and b) at the BDB conditions (i.e., radiation, temperature humidity, post-seismic and post-shock conditions) that would be present if the SFP level were at the Level 2 and Level 3 datum points.

b) A description of the methodology that will be used for determining the maximum allowed deviation from the instrument channel design accuracy that will be employed under normal operating conditions as an acceptance criterion for a calibration procedure to flag to operators and to technicians that the channel requires adjustment to within the normal condition design accuracy.

Further, the NRC staff plans to verify that the channels will retain these accuracy performance values following a loss of power and subsequent restoration of power. The staff has identified this request as:

RAI #14

Please provide analysis verifying that the proposed instrument performance is consistent with these estimated accuracy normal and BDB values. Please demonstrate that the channels will retain these accuracy performance values following a loss of power and subsequent restoration of power.

3.10 Design Features: Testing

Attachment 2 of Order EA-12-051 states, in part, that

> The instrument channel design shall provide for routine testing and calibration.

NEI 12-02 states, in part, that

> Static or non-active installed (fixed) sensors can be used and should be designed such that testing and/or calibration can be performed in-situ. For microprocessor based channels the instrument channel design shall be capable of testing while mounted in the pool.

In its OIP, the licensee stated, in part, that

> The instrument channel design will provide for routine testing and calibration. Installed sensors will be designed to allow testing and/or calibration via in-situ methods while mounted in the SFP. Removal of the sensor from the SFP will not be required for calibration.
>
> Instrument channel design will provide for routine testing and calibration consistent with Order EA-12-051 and the guidance in NEI 12-02 Revision 1. Details will be finalized upon receipt of final vendor information during the detailed design phase.
>
> Specific details regarding testing procedures and requirements will be reviewed and determined with the supplier during the detailed design phase.

In its letter dated August 12, 2013, the licensee stated that the description of the capability and provisions for the proposed level sensing equipment, as well as specific periodic testing and calibration capabilities enabling the equipment to be tested in-situ; the specific details of the functional and calibration test program, including frequencies; and, the specific details of the preventative maintenance program, including maximum frequencies, will be available upon completion of the final design that is scheduled for completion by the end of the first quarter 2014.

The NRC staff notes that the information regarding the capability and provisions for the proposed level sensing equipment as well as specific periodic testing and calibration capabilities enabling the equipment to be tested in-situ; the specific details of the functional and calibration test program, including frequencies; and, the specific details of the preventative maintenance program, including maximum frequencies is not available for review and will be provided to the staff during the August 2014, six-moth OIP update. The NRC staff has identified this request as:

RAI #15

Please provide the following:

a) **A description of the capability and provisions the proposed level sensing equipment will have to enable periodic testing and calibration, including how this capability enables the equipment to be tested in-situ.**

b) **A description of how such testing and calibration will enable the conduct of regular channel checks of each independent channel against the other, and against any other permanently-installed spent fuel pool level instrumentation.**

c) **A description how functional checks will be performed and the frequency at which they will be conducted. Describe how calibration tests will be performed, and the frequency at which they will be conducted. Provide a discussion as to how these surveillances will be incorporated into the plant surveillance program.**

d) **A description what preventative maintenance tasks are required to be performed during normal operation, and the planned maximum surveillance interval that is necessary to ensure that the channels are fully conditioned to accurately and reliably perform their functions when needed.**

(This information was previously requested as RAI-8 in NRC letter dated July 11, 2013)

3.11 Design Features: Display

Attachment 2 of Order EA-12-051 states, in part, that

> Trained personnel shall be able to monitor the spent fuel pool water level from the control room, alternate shutdown panel, or other appropriate and accessible location. The display shall provide on-demand or continuous indication of spent fuel pool water level.

NEI 12-02 states, in part, that

> The intent of this guidance is to ensure that information on SFP level is reasonably available to the plant staff and decision makers. Ideally there will be an indication from at least one channel of instrumentation in the control room. While it is generally recognized (as demonstrated by the events at Fukushima Daiichi) that SFP level will not change rapidly during a loss of spent fuel pool cooling scenario more rapid SFP drain down cannot be entirely discounted. Therefore, the fact that plant personnel are able to determine the SFP level will satisfy this requirement, provided the personnel are available and trained in the use of the SFP level instrumentation (see Section 4.1) and that they can accomplish the task when required without unreasonable delay.
>
> SFP level indication from the installed channel shall be displayed in the control room, at the alternate shutdown panel, or another appropriate and accessible

location (reference NEI 12-06). An appropriate and accessible location shall have the following characteristics:

- occupied or promptly accessible to the appropriate plant staff giving appropriate consideration to various drain down scenarios,
- outside of the area surrounding the SFP floor, e.g., an appropriate distance from the radiological sources resulting from an event impacting the SFP,
- inside a structure providing protection against adverse weather, and
- outside of any very high radiation areas or LOCKED HIGH RAD AREA during normal operation.

If multiple display locations beyond the required "appropriate and accessible location" are desired, then the instrument channel shall be designed with the capability to drive the multiple display locations without impacting the primary "appropriate and accessible" display.

In its OIP, the licensee stated that the conceptual design located the electronic enclosure and primary display in the Relay Room located within the Auxiliary Building. The OIP also stated that specific details regarding the display and display location(s) will be finalized during the detailed design phase.

In its letter dated August 12, 2013, the licensee stated, in part, that

a) The electronic units for both primary and back-up channels are located in the Auxiliary Building Relay Room which is a Seismic Category 1 structure designed to withstand flooding, wind and seismic events. The electronics enclosures provide both a local display and a retransmitted signal to a remote display located in the main control room, one elevation above the Relay Room. Refer to the sketch attached in response to RAI-2.

b) Final design details for the display units, including justification for prompt accessibility from the main control room, habitability, resource availability and communications with decision makers is scheduled to be completed as part of the BDB mitigating strategies assessments and included in applicable processes and procedures. Final details of the display location(s) will be developed as part of the final instrument design that is scheduled for completion by the end of the first quarter 2014. Details will be provided to the NRC in the August 2014, six-month OIP update.

The NRC staff reviewed the figure included in the letter dated August 12, 2013, and noted that the primary level instrument and the backup level instrument level indications are to be displayed in the MCR. However, in its letter dated August 12, 2013, the licensee stated that the electronics enclosure provide both a local display and a retransmitted signal to a remote display located in the main control room. The staff had concerns with the lack of specificity regarding the location of the instrument displays. The staff has identified this request as:

RAI #16

Please provide the following:

a) **The specific location for the primary and backup instrument channel display.**

b) **Please describe the evaluation used to validate that the display location can be accessed without unreasonable delay following a BDB event. Include the time available for personnel to access the display as credited in the evaluation, as well as the actual time (e.g., based on walk-throughs) that it will take for personnel to access the display. Additionally, please include a description of the radiological and environmental conditions on the paths personnel might take. Describe whether the display location remains habitable for radiological, heat and humidity, and other environmental conditions following a BDB event. Describe whether personnel are continuously stationed at the display or monitor the display periodically.**

(This information was previously requested as RAI-9 in NRC letter dated July 11, 2013)

3.12 Programmatic Controls: Training

Attachment 2 of Order EA-12-051 states, in part, that

> Personnel shall be trained in the use and the provision of alternate power to the primary and backup instrument channels.

NEI 12-02 states, in part, that

> The personnel performing functions associated with these SFP level instrumentation channels shall be trained to perform the job specific functions necessary for their assigned tasks (maintenance, calibration, surveillance, etc.). SFP instrumentation should be installed via the normal modification processes. In some cases, utilities may choose to utilize portable instrumentation as a portion of their SFP instrumentation response. In either case utilities should use the Systematic Approach to Training (SAT) to identify the population to be trained. The SAT process should also determine both the initial and continuing elements of the required training.

In its OIP, the licensee stated, in part, that

> Standard plant training processes will be used to identify the population to be trained and to determine both the initial and continuing elements of the required training. Training will be completed prior to placing the instrumentation in service.

> Specific details regarding training will be reviewed and determined between the plant and the supplier as part of the procurement process for the new instruments.

The NRC staff has concerns regarding the lack of information on the training of personnel for activities such as use of the instrument channels, provisions for alternate power, and calibration and surveillance of the SFP instrumentation. Another staff concern is the lack of information on the licensee's approach to training on the use of the SFP instrumentation. The staff has identified this request as:

RAI #17

Please describe the activities for which personnel will be trained, such as use of the instrument channels, provision of alternate power, calibration and surveillance. Describe the approach to training used to identify the population to be trained and determined the initial and continuing elements of the required training.

3.13 Programmatic Controls: Procedures

Attachment 2 of Order EA-12-051 states, in part, that

> Procedures shall be established and maintained for the testing, calibration, and use of the primary and backup spent fuel pool instrument channels.

NEI 12-02 states, in part, that

> Procedures will be developed using guidelines and vendor instructions to address the maintenance, operation and abnormal response issues associated with the new SFP instrumentation.

In its OIP, the licensee stated that procedures will be developed using guidelines and vendor instructions to address the maintenance, operation, and abnormal response issues associated with the new SFP instrumentation. The licensee stated that these procedures will be completed following completion of the detailed design package.

In its letter dated August 12, 2013, the licensee stated, in part, that

> Procedures for operation (both normal and abnormal response), calibration, testing, maintenance, inspection, and administrative controls associated with the SFP level instrumentation will be developed in accordance with existing controlled station administrative and technical procedures that govern procedure development. These procedures ensure standardization of format and terminology and ease of use along with assurance of a consistent level of quality. Specific details of the procedures for inspection, maintenance, repair, operation, abnormal response, and administrative controls will be developed as part of the final instrument design package, scheduled for completion by the end of the first quarter 2014. Details will be provided to the NRC in the August 2014, six-month OIP update.

The NRC staff notes that the information regarding procedures for operation (both normal and abnormal response), calibration, testing, maintenance, inspection, and administrative controls associated with the SFP level instrumentation are not available for review and will be provided to the staff during the August 2014, six-moth OIP update. The NRC staff has identified this request as:

RAI #18

Please provide a list of the procedures addressing operation (both normal and abnormal response), calibration, test, maintenance, and inspection procedures that will be developed for use of the SFP instrumentation. The licensee is requested to include a brief description of the specific technical objectives to be achieved within each procedure.

3.14 Programmatic Controls: Testing and Calibration

Attachment 2 of Order EA-12-051 states, in part, that

> Processes shall be established and maintained for scheduling and implementing necessary testing and calibration of the primary and backup spent fuel pool level instrument channels to maintain the instrument channels at the design accuracy.

NEI 12-02 states, in part, that

> Processes shall be established and maintained for scheduling and implementing necessary testing and calibration of the primary and backup SFP level instrument channels to maintain the instrument channels at the design accuracy. The testing and calibration of the instrumentation shall be consistent with vendor recommendations or other documented basis.

In its OIP, the licensee stated, in part, that

> Processes will be established and maintained for scheduling and implementing necessary testing and calibration of the primary and backup SFP level instrument channels to maintain the instrument channels as described in JLD-ISG-2012-03 and the guidance in NEI 12-02 Revision 1. Testing and calibration of the instrumentation will be consistent with vendor recommendations and any other documented basis.

In its letter dated August 12, 2013, the licensee stated, in part, that

a) The maintenance and testing of the SFP level instrumentation system will be incorporated into the normal station preventative maintenance and work control processes based on manufacturer recommendations for maintenance and periodic testing. The calibration and maintenance program will include testing to validate the functionality of each instrument channel within 60 days of a planned refueling outage considering normal

testing scheduling allowances as outlined in NEI 12-02 Revision 1. The new system will receive unique identification numbers and will be entered into the PSEG preventative maintenance program. A recurring task for the required maintenance frequency will be established. Normal station administrative controls will be used to schedule regular testing and calibration to demonstrate conformance with design and system limits.

b) The preventative maintenance, test and calibration program will be developed consistent with manufacturer recommendations. This information will be available following completion of the final design that is scheduled for completion by the end of the first quarter 2014. Details will be provided to the NRC in the August 2014, six-month OIP update.

c) In the event that either a primary or backup SFP level instrumentation channel must be taken out of service or is inoperable for any reason, a notification will be entered into PSEG corrective action program to restore the channel to service within 90 days. The determination of required compensatory actions is part of the overall effort to develop the FLEX program administrative controls and implementing procedures. The FLEX program will incorporate the guidance of NEI 12-02 Revision 1, including the requirements associated with out of service times and compensatory actions. The FLEX program is expected to be sufficiently developed to provide details to the NRC in the August 2014, six-month OIP update.

In the event that a channel cannot be restored to service within the 90 day period, expedited actions to restore the channel would be initiated and tracked via PSEG's Corrective Action Program. If both channels are determined to be non-functional, PSEG will initiate appropriate actions within 24 hours to restore one of the instrument channels and implement compensatory actions within 72 hours.

Since the sensor and interconnecting cables are passive devices, their simultaneous failure is not considered credible and therefore compensatory actions are not expected to be required for failure of both sensors. PSEG intends to purchase a portable version of the level instrument electronics to use for testing and for monitoring of a single channel whenever necessary for compensatory measures; however, the appropriate compensatory actions have yet to be defined and the determination of these actions is part of the overall effort to develop the FLEX program administrative controls and implementing procedures. The FLEX program will incorporate the guidance of NEI 12-02 Revision1, including the requirements associated with out of service time. The FLEX program is expected to be sufficiently developed to provide details to the NRC in the August 2014, six-month OIP update.

The NRC staff notes that further information regarding the testing and calibration of the equipment associated with the SFP level instrumentation is not available for review and will be provided to the staff during the August 2014, six-moth OIP update. The staff has identified these requests as:

RAI #19

Please provide a description of the preventive maintenance, testing and calibration program, and the provisions associated with out of service or inoperable equipment including out of service times and compensatory actions.

3.15 Instrument Reliability

NEI 12-02 states, in part, that

> A spent fuel pool level instrument channel is considered reliable when the instrument channel satisfies the design elements listed in Section 3 [Instrument Design Features] of this guidance and the plant operator has fully implemented the programmatic features listed in Section 4 [Program Features].

In its OIP, the licensee stated that reliability of both the primary and back-up instrument channels will be assured through conformance with the guidelines of JLD-ISG-2012-03, Revision 1 and NEI 12-02, Revision 1.

Upon acceptable resolution of the RAIs noted above, the NRC staff will be able to make a conclusion regarding the reliability of the SFP instrumentation.

4.0 CONCLUSION

The NRC staff is unable to complete its evaluation regarding the acceptability of the licensee's plans for implementing the requirements of Order EA-12-051 due to the need for additional information as described above. The staff will issue an evaluation with its conclusion after the licensee has provided the requested information.

information be provided by March 31, 2014, to ensure that any issues are resolved prior to the date by which the licensee must complete full implementation of Order EA-12-051. The licensee should adjust its schedule for providing information to ensure that all this information is provided by the requested date.

If you have any questions, please contact me at 301-415-3204 or by e-mail at john.hughey@nrc.gov.

Sincerely,

/ra/

John D. Hughey, Project Manager
Projects Licensing Branch I-2
Division of Operating Reactor Regulation
Office of Nuclear Reactor Regulation

Docket Nos. 50-272 and 50-311

Enclosure:
Interim Staff Evaluation and
Request for Additional Information

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DATE	10/17/2013		

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