



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

November 19, 2013

Mr. Mano Nazar  
Executive Vice President  
and Chief Nuclear Officer  
NextEra Energy  
P. O. Box 14000  
Juno Beach, FL 33408-0420

SUBJECT: TURKEY POINT NUCLEAR GENERATING UNIT NOS. 3 AND 4 - 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. MF0988 AND MF0989)

Dear Mr. Nazar:

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 26, 2013 (ADAMS Accession No. ML130720690), Florida Power & Light Company (the licensee) provided the Overall Integrated Plan (OIP) for Turkey Point Nuclear Generating Unit Nos. 3 and 4 describing how it will achieve compliance with Attachment 2 of Order EA-12-051 by the second quarter of 2015 for Unit 3, and the second quarter of 2016 for Unit 4. By letter dated July 11, 2013 (ADAMS Accession No. ML13191A134), the NRC staff sent a request for additional information (RAI) to the licensee. The licensee provided supplemental information by letters dated July 30, 2013 (ADAMS Accession No. ML13224A160), and August 21, 2013 (ADAMS Accession No. ML13248A313).

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.

M. Nazar

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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 September 30, 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 regarding this letter, please contact me at (301) 415-0489.

Sincerely,



Audrey L. Klett, Project Manager  
Plant Licensing Branch II-2  
Division of Operating Reactor Licensing  
Office of Nuclear Reactor Regulation

Docket Nos. 50-250 and 50-251

Enclosure:  
Interim Staff Evaluation and  
Request for Additional Information

cc w/encl: 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**  
**FLORIDA POWER & LIGHT COMPANY**  
**TURKEY POINT NUCLEAR GENERATING UNIT NOS. 3 AND 4**  
**DOCKET NOS. 50-250 AND 50-251**

**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 26, 2013 (ADAMS Accession No. ML130720690), Florida Power & Light Company (the licensee) provided the OIP for Turkey Point Nuclear Generating Unit Nos. 3 and 4 (Turkey Point 3 and 4 or PTN, which is a licensee designation for the plant), describing how it will achieve compliance with Attachment 2 of Order EA-12-51 by the second quarter of 2015 for Unit 3, and the second quarter of 2016 for Unit 4. By letter dated July 11, 2013 (ADAMS Accession No. ML13191A134), the NRC staff sent a request for additional information (RAI) to the licensee. The licensee provided supplemental information by letters dated July 30, 2013 (ADAMS Accession No. ML13224A160), and August 21, 2013 (ADAMS Accession No. ML13248A313).

**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.

Enclosure

Attachment 2 of Order EA-12-051 requires the license 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 the Interim Staff Guidance (ISG) document, 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**

Turkey Point 3 and 4 have separate, independent SFPs. Each SFP is approximately 25 feet (ft. or ') 4 inches (in. or ") wide by 41 ft. 4 in. long and 40 ft. deep.

The licensee submitted its OIP on February 26, 2013. The installation of the SFP level instrumentation for the SFPs is scheduled for completion in the second quarter of 2015, for Unit 3, and the second quarter of 2016, for Unit 4.

The NRC staff has reviewed the licensee's schedule for implementation of SFP level instrumentation. If the licensee completes implementation in accordance with this schedule, it would appear the licensee would 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:

All licensees identified in Attachment 1 to this [o]rder 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:

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 would be set at elevation 51 ft. 4 in. based on the level adequate to support operation of the normal fuel pool cooling system.

In its letter dated July 30, 2013, the licensee stated:

To determine the higher of the two levels the following was taken into consideration:

(1) The level at which reliable suction loss occurs due to uncovering the coolant inlet pipe or any weirs or vacuum breakers associated with suction loss is established based on nominal coolant inlet pipe elevation. There are no siphon breakers in the suction lines at either unit at Turkey Point (PTN). There are two pump suction lines in each pool; an 8" line located at elevation 53'-7" and a 10" line located at elevation 51'-4". Normal cooling pump alignment has the A pump aligned to the 8" pool outlet pipe at elevation 53'-7" and the B pump aligned to the 10" pool outlet pipe at elevation 51'-4". If water were to decrease below the 53'-7" elevation the A pump would lose suction, but the B pump would continue to run.

(2) The existing plant NPSH [net positive suction head] calculation is based on a nominal pool water level of 56.8 feet (elevation 56'-9"). The recommended normal operating configuration is with both the suction and discharge cross-connections isolated. In this configuration the hydraulic model has the A pump aligned to the 8" pool outlet line and the B pump aligned to the 10" pool outlet line (i.e., the normal operation configuration). The A pumps are located at elevation 22'-1 ¼" (Unit 3) and 21'-6 ½" (Unit 4) and the B pumps are located at 21'-5" (Unit 3) and 22'-1 ¾" (Unit 4). At saturated conditions, the NPSH margin for this configuration is 2'-8" for the A pump and 7'-10" for the B pump. This means that adequate NPSH is no longer available for the A pump at 54'-1" (56' 9" - 2'-8"), which is above the pool outlet/pump suction line elevation of 53'-7". The B pump will lose suction at elevation 48'-11" (56'-9" - 7'-10"), which is below the pool outlet/pump suction line elevation of 51'-4".

Therefore, to summarize:

The A pump has inadequate NPSH available at elevation 54'-1" and loses suction at elevation 53'-7" by uncovering the suction line. The B pump has inadequate NPSH available at elevation 48'-11" and loses suction at elevation 51'-4" by uncovering the suction line.

In the OIP, the highest elevation that results in total loss of normal pool cooling capability was stated as 51'-4" based on the fact that one pump would continue to operate down to this level. At this elevation with the normal pump lineup, the A pump would not be available but the B pump would still be operational, providing some degree of pool cooling capability. With one pump in operation and the maximum design basis heat load, SFP maximum temperature would reach approximately 177 °F, which is less than boiling and therefore meets the PTN design basis UFSAR criteria for unplanned shutdowns. This meets the NEI 12-02 definition of "the actual point that supports adequate cooling system performance."

However, NEI 12-06 guidance requires assumption of the maximum design basis SFP heat loads. For PTN, this is up to 80 assemblies 36 days old and an additional full core offload 72 hours after shutdown. Given this heat load, both SFP heat exchangers and pumps are required to maintain the administrative limit of 150 °. In addition, it is not prudent to allow level to drop to the elevation where either SFP pump is allowed to run to its cavitation or runout point, which would

likely result in damage to the pump. After further review, it has been determined that a more appropriate and conservative approach would be to utilize the highest point at which either pump becomes unavailable as Level 1. This point is elevation 54'-1", where the A pump becomes unavailable assuming saturation conditions. PTN is revising Level 1 from what was provided in the OIP to be elevation 54'-1".

The NRC staff notes that the licensee changed the elevation for Level 1 from 51 ft. 4 in. to 54 ft. 1 in. based on the elevation necessary for both fuel pool cooling pumps to have reliable suction and adequate NPSH. The NRC staff also notes that this level represents the higher of the two points described in NEI 12-02 for Level 1.

NEI 12-02 states:

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 would be set at elevation 42 ft. 11 in., which is approximately 10 ft. above the top of the fuel racks.

In its letter dated July 30, 2013, the licensee provided a sketch showing the elevations identified as Levels 1, 2 and 3 and the top of the fuel racks. This sketch shows Level 2 at an elevation of 42 ft. 11 in., which is approximately 10 ft. above the top of the fuel rack, which is at elevation 32 ft. 11 in.

The NRC staff 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:

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 would be set at elevation 32 ft. 11 in., which is the nominal level of the highest fuel rack.

In its letter dated July 30, 2013, the licensee stated:

NEI 12-02 describes Level 3 as the level where fuel remains covered and actions to implement make-up water addition should no longer be deferred. 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.

PTN previously designated Level 3 as the actual top of the fuel storage racks. PTN is now designating Level 3 as the water level greater than 1 foot above the top of the fuel storage racks plus the accuracy of the SFP level instrument channel, which is yet to be determined. Designation of this level as Level 3 is conservative; its selection assures that the fuel will remain covered, and at that point there would be no functional or operational reason to defer action to implement the addition of make-up water to the pool.

Accordingly, the previous Level 3 elevation of 32'-11" for PTN (both Units) is being revised to 33'-11".

The NRC staff notes that the elevation for Level 3 is above the highest point of any spent fuel storage rack seated in the SFP and that the licensee has conservatively increased this elevation 12 in. higher.

The NRC staff notes that the licensee's proposed plan, with respect to identification of Levels 1, 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:

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:

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 that the primary and backup instrument channels will consist of fixed components and that the nominal measured range will be continuous from the normal pool level elevation of 57 ft. 0 in. to the top of the spent fuel racks at elevation 32 ft.11 in.

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 NRC staff notes that 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:

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:

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 states:

The two SFP level instrument channels will be installed in diverse locations, 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 SFP.

As indicated above, SFP level sensors will be installed in the [n]orth side of the Unit 3 SFP, and the [s]outh side of the Unit 4 SFP, with primary and backup channel sensors located as close to the opposite corners as practical to maintain maximum attainable separation. Sensor conditioning electronics and battery backup will be mounted in a remote location separated from the SFP by a

reinforced concrete wall(s) which will provide suitable radiation shielding for the electronics. The equipment will be protected from all design basis external events.

In its letter dated July 30, 2013, the licensee indicated that the information regarding arrangement of the SFP level instrument channels was not available, but that it would be provided at the 6-month update after the information has been obtained.

The NRC staff notes that the information regarding arrangement of the SFP level instrument channels is not currently available for review and that in its August 21, 2013, letter, the licensee identified the status of this activity as "In Progress." The licensee indicated that this information requires design information and that information will be provided in the February 2014 semiannual update. The staff has identified this request as:

**RAI #1**

**Please provide a clearly labeled sketch or marked-up plant drawing of the plan view of the SFP area, depicting the SFP inside dimensions, the planned locations/placement of the primary and back-up SFP level sensor, and the proposed routing of the cables that will extend from these sensors toward the location of the read-out/display device.**

*(This information was previously requested as RAI-2 in the NRC letter dated July 11, 2013.)*

3.5 Design Features: Mounting

Attachment 2 of Order EA-12-051 states:

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:

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:

Mounting will be Seismic Class I. Installed equipment will be seismically qualified to withstand the maximum seismic ground motion considered in the design of the plant area in which it is installed.

In its letter dated July 30, 2013, the licensee indicated that the information regarding mounting of the SFP level instrumentation was not available, but that it would be provided at the 6-month update after the information has been obtained.

The NRC staff notes that the information regarding mounting of the SFP level instrumentation is not currently available for review and that in its August 21, 2013, letter, the licensee identified the status of this activity as "In Progress." The licensee indicated that this information requires design information and that information will be provided in the February 2014 semiannual update. The staff has identified these requests as:

#### **RAI #2**

**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 #3**

**For RAI 2(a) above, please provide the results of 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 #4**

**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:

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:

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," and 3.6.2, "Qualification and 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 that augmented quality requirements, similar to those applied to fire protection, would be applied to this project.

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

### 3.6.2 Qualification and Reliability

NEI 12-02 states:

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 [Fahrenheit] and 100% [percent] relative humidity environment,
- boiling water and/or steam environment
- a concentrated borated water environment

In its OIP, the licensee stated, consistent with NEI 12-02:

Temperature, humidity and radiation levels consistent with conditions in the vicinity of the SPF 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 (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

In its letter dated July 30, 2013, the licensee indicated that the information regarding qualification and reliability of the SFP level instrumentation was not available, but that it would be provided at the 6-month update after the information has been obtained.

The NRC staff notes that the information regarding qualification and reliability of the SFP level instrumentation is not currently available for review and that in its August 21, 2013, letter, the licensee identified the status of this activity as "In Progress." The licensee indicated that this

information requires design information and that information will be provided in the February 2014 semiannual update. The staff has identified these requests as:

**RAI #5**

**Please provide the following:**

- a) **A description of the specific method or combination of methods that will be applied to demonstrate the reliability of the permanently installed equipment under beyond-design-basis ambient temperature, humidity, shock, vibration, and radiation conditions.**
- b) **A description of the testing and/or analyses that will be conducted to provide assurance that the equipment will perform reliably under the worst-case credible design basis loading at the location where the equipment will be mounted. Include a discussion of this seismic reliability demonstration as it applies to a) the level sensor mounted in the SFP area, and b) any control boxes, electronics, or read-out and re-transmitting devices that will be employed to convey the level information from the level sensor to the plant operators or emergency responders.**
- c) **A description of the specific method or combination of methods that will be used to confirm the reliability of the permanently installed equipment such that following a seismic event the instrument will maintain its required accuracy.**

*(This information was previously requested as RAI-4 in the NRC letter dated July 11, 2013.)*

In addition, the staff plans to verify the results of the licensee's testing and analysis used to demonstrate the qualification and reliability of the installed equipment when it is completed based on the licensee's response to the following RAI.

**RAI #6**

**For RAI #5 above, please provide the results from the selected methods, tests and analyses used to demonstrate the qualification and reliability of the installed equipment in accordance with Order EA-12-051 requirements.**

*3.6.3 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:

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

NEI 12-02 states:

Independence of permanently installed instrumentation, and primary and backup channels, is obtained by physical and power separation commensurate with the hazard and electrical isolation needs. If plant AC or DC power sources are used then the power sources shall be from different buses and preferably different divisions/channels depending on available sources of power.

In its OIP the licensee stated that the primary instrument channel will be redundant to and independent of the backup instrument channel. The licensee also stated that independence will be obtained through separation of the sensors, indication, backup battery power supplies, associated cabling and channel power feeds.

In its letter dated July 30, 2013, the licensee indicated that the information regarding independence of the SFP level instrumentation was not available, but that it would be provided at the 6-month update after the information has been obtained.

The NRC staff notes that the information regarding independence of the SFP level instrumentation is not currently available for review and that in its August 21, 2013, letter, the licensee identified the status of this activity as "In Progress." The licensee indicated that this information requires design information and that information will be provided in the February 2014 semiannual update. The staff has identified this request as:

**RAI #7**

**Please provide the following:**

- a) **A description of how the two channels of the proposed level measurement system in each pool meet this requirement so that the potential for a common cause event to adversely affect both channels is minimized to the extent practicable.**
- b) **Further information describing the design and installation of each level measurement system, consisting of level sensor electronics, cabling, and read-out devices. Address how independence of these components of the primary and back-up channels is achieved through the application of independent power sources, physical and spatial separation, independence of signals sent to the location(s) of the read-out devices, and the independence of the displays.**

*(This information was previously requested as RAI-5, in NRC letter dated July 11, 2013.)*

3.8 Design Features: Power Supplies

Attachment 2 of Order EA-12-051 states:

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:

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:

Both channels will be powered from dedicated batteries and local battery chargers. The battery chargers for both channels will normally be powered from separate sources of 120V AC power. Minimum battery life of 72 hours will be provided. The battery systems will include provision for battery replacement should the battery charger be unavailable following the event. Spare batteries will be readily available. In the event of a loss of normal power the battery chargers could be connected to another suitable power source.

In its letter dated July 30, 2013, the licensee indicated that the information regarding the power supply for the SFP level instrumentation was not available, but that it would be provided at the 6-month update after the information has been obtained.

The NRC staff notes that the information regarding the power supply for the SFP level instrumentation is not currently available for review and that in its August 21, 2013, letter, the licensee identified the status of this activity as "In Progress." The licensee indicated that this information requires design information and that information will be provided in the February 2014 semiannual update. The staff has identified this request as:

**RAI #8**

**Please provide the following:**

- a) A description of the electrical AC power sources and capacities for the primary and backup channels.**
- b) Please provide the results 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.**

*(This information was previously requested as RAI-6, in NRC letter dated July 11, 2013; however, based on feedback received by licensees; it has been revised as above.)*

**3.9 Design Features: Accuracy**

Attachment 2 of Order EA-12-051 states:

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

NEI 12-02 states:

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:

Instrument channels will be designed such that they will maintain their design accuracy following a power interruption or change in power source without recalibration.

Accuracy will consider SFP conditions, e.g., saturated water, steam environment, or concentrated borated water. Additionally, instrument accuracy will 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. The accuracy will be within the resolution requirements of Figure 1 of NEI 12-02.

In its letter dated July 30, 2013, the licensee indicated that the information regarding accuracy of the SFP level instrumentation was not available, but that it would be provided at the 6-month update after the information has been obtained.

The NRC staff notes that the information regarding the accuracy of the SFP level instrumentation is not currently available for review and that in its August 21, 2013, letter, the licensee identified the status of this activity as "In Progress." The licensee indicated that this information requires design information and that information will be provided in the February 2014 semiannual update. The staff has identified this request as:

**RAI #9**

**Please provide the following:**

- a) An estimate of the expected instrument channel accuracy performance (e.g., in percentage of span) under both a) normal spent fuel pool 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.**

*(This information was previously requested as RAI-6 in NRC letter dated July 11, 2013.)*

3.10 Design Features: Testing

Attachment 2 of Order EA-12-051 states:

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

NEI 12-02 states:

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:

Details will be determined during the engineering and design phase. Instrument channel testing and calibration will be performed using existing plant work control processes.

In its letter dated July 30, 2013, the licensee indicated that the information regarding the design of the SFP level instrumentation to provide for routine testing and calibration was not available, but that it would be provided at the 6-month update after the information has been obtained.

The NRC staff notes that the information regarding the design of the SFP level instrumentation to provide for routine testing and calibration is not currently available for review and that in its August 21, 2013, letter, the licensee identified the status of this activity as "In Progress." The licensee indicated that this information requires design information and that information will be provided in the February 2014 semiannual update. The staff has identified this request as:

**RAI #10**

**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 of how calibration tests and functional checks will be performed and the frequency at which they will be conducted. Discuss how these surveillances will be incorporated into the plant surveillance program.**
- d) A description of what preventive 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:

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:

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 design would include remote indication that would be accessible during post-event conditions.

In its letter dated July 30, 2013, the licensee indicated that the information regarding the location of the SFP level instrumentation displays was not available, but that it would be provided at the 6-month update after the information has been obtained.

The NRC staff notes that the information regarding the location of SFP level instrumentation displays is not currently available for review and that in its August 21, 2013, letter, the licensee identified the status of this activity as “In Progress.” The licensee indicated that this information requires design information and that information will be provided in the February 2014 semiannual update. The staff has identified this request as:

**RAI #11**

**Please provide the following:**

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

- b) **For any SFP level instrumentation displays located outside the main control room 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-through) 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.**

### 3.12 Programmatic Controls: Training

Attachment 2 of Order EA-12-051 states:

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

NEI 12-02 states:

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:

The Systematic Approach to Training (SAT) 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.

The NRC staff notes that the licensee's proposed plan, with respect to the training personnel in the use and the provision of alternate power to the primary and backup instrument channels, including the approach to identifying the population to be trained, appears to be consistent with NEI 12-02, as endorsed by the ISG.

### 3.13 Programmatic Controls: Procedures

Attachment 2 of Order EA-12-051 states:

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:

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:

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 letter dated July 30, 2013, the licensee indicated that the information regarding the procedures to address the maintenance, operation and abnormal response issues associated with the new SFP instrumentation was not available, but that it would be provided at the 6-month update after the information has been obtained.

The NRC staff notes that the information regarding the procedures to address the maintenance, operation and abnormal response issues associated with the new SFP level instrumentation is not currently available for review and that in its August 21, 2013, letter, the licensee identified the status of this activity as "In Progress." The licensee indicated that this information requires design information and that information will be provided in the February 2014 semiannual update. The staff has identified this request as:

#### **RAI #12**

**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 spent 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:

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:

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:

Processes will 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. Testing and calibration of the instrumentation will be consistent with vendor recommendations and any other documented basis. Calibration will be specific to the mounted instrument and the monitor.

In its letter dated July 30, 2013, the licensee indicated that the information regarding testing and calibration of the SFP level instrumentation was not available, but that it would be provided at the 6-month update after the information has been obtained.

The NRC staff notes that the information regarding testing and calibration of the SFP level instrumentation is not currently available for review and that in its August 21, 2013, letter, the licensee identified the status of this activity as "In Progress." The licensee indicated that this information requires design information and that information will be provided in the February 2014 semiannual update. The staff has identified this request as:

**RAI #13**

**Please provide the following:**

- a) Further information describing the maintenance and testing program the licensee will establish and implement to ensure that regular testing and calibration is performed and verified by inspection and audit to demonstrate conformance with design and system readiness requirements. Include a description of your plans for ensuring that necessary channel checks, functional tests, periodic calibration, and maintenance will be conducted for the level measurement system and its supporting equipment.**
- b) A description of how the guidance in NEI 12-02, Section 4.3 regarding compensatory actions for one or both non-functioning channels will be addressed.**
- c) A description of the compensatory actions to be taken in the event that one of the instrument channels cannot be restored to functional status within 90 days.**

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

**3.15 Instrument Reliability**

NEI 12-02 states:

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:

Reliability of the primary and backup instrument channels will be assured by conformance with the guidelines of NRC JID-ISG-2012-03 and NEI 12-02, as discussed in Section VII, Qualification.

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.

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- 2 -

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 September 30, 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 regarding this letter, please contact me at (301) 415-0489.

Sincerely,

*/RA/*

Audrey L. Klett, Project Manager  
Plant Licensing Branch II-2  
Division of Operating Reactor Licensing  
Office of Nuclear Reactor Regulation

Docket Nos. 50-250 and 50-251

Enclosure:  
Interim Staff Evaluation and  
Request for Additional Information

cc w/encl: Listserv

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**\*via memorandum dated October 2, 2013**

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