



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

November 21, 2013

Mr. Joseph W. Shea  
Vice President, Corporate Nuclear Licensing  
Tennessee Valley Authority  
3R Lookout Place  
1101 Market Street  
Chattanooga, TN 37402-2801

**SUBJECT: SEQUOYAH NUCLEAR PLANT, 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. MF0794 AND MF0795)**

Dear Mr. Shea:

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. ML13063A011), Tennessee Valley Authority (the licensee) provided the Overall Integrated Plan (OIP) for Sequoyah Nuclear Plant, Units 1 and 2 describing how it will achieve compliance with Attachment 2 of Order EA-12-051 by December 31, 2015. By letter dated July 17, 2013 (ADAMS Accession No. ML13198A354), the NRC staff sent a request for additional information (RAI) to the licensee. The licensee provided supplemental information by letters dated August 16, 2013 (ADAMS Accession No. ML13235A007), and August 28, 2013 (ADAMS Accession No. ML13247A291).

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.

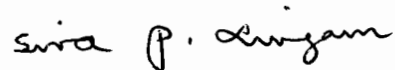
J. Shea

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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 June 30, 2015, 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 301-415-1564 or via e-mail at [siva.lingam@nrc.gov](mailto:siva.lingam@nrc.gov).

Sincerely,



Siva P. Lingam, Project Manager  
Plant Licensing Branch II-2  
Division of Operating Reactor Licensing  
Office of Nuclear Reactor Regulation

Docket Nos. 50-327 and 50-328

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**  
**TENNESSEE VALLEY AUTHORITY**  
**SEQUOYAH NUCLEAR PLANT, UNITS 1 AND 2**  
**DOCKET NOS. 50-327 AND 50-328**

**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. ML13063A011), Tennessee Valley Authority (TVA, the licensee) provided the OIP for Sequoyah Nuclear Plant (SQN), Units 1 and 2, describing how it will achieve compliance with Attachment 2 of Order EA-12-51 by December 31, 2015. By letter dated July 17, 2013 (ADAMS Accession No. ML13198A354), the NRC staff sent a request for additional information (RAI) to the licensee. The licensee provided supplemental information by letters dated August 16, 2013 (ADAMS Accession No. ML13235A007) and August 28, 2013 (ADAMS Accession No. ML13247A291).

**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 licensees 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 (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**

Sequoyah Nuclear Plant, Unit 1 and Unit 2 share a single SFP.

The licensee submitted its OIP on February 28, 2013. The OIP states that installation of reliable SFP level instrumentation for the shared SFP associated with Units 1 and 2 is scheduled for completion by December 31, 2015, which corresponds to the completion of the second refueling outage for Unit 2 that follows the submittal of this OIP.

In its letter dated August 28, 2013, the licensee stated that implementation of the SFP level instrumentation is currently scheduled to be performed on-line and provided revised target completion dates. The current proposed date for installation of the SFP level instrumentation is February 26, 2015, for both units.

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 for both for Units, 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 level on either the primary or backup instrument channel of greater than 26.6 feet (ft.) above the top of active fuel seated in the

storage racks. This level was based on a calculation demonstrating a water level that ensures pump net positive suction head (NPSH) is adequate for normal fuel pool cooling system operation.

In its letter dated August 16, 2013, the licensee stated, in part, that

The specific elevations corresponding to the three levels are indicated on the sketch on page E4. TVA will use the normal spent fuel pool level at SQN (726.125 feet) as Level 1. This complies with NEI 12-02 requirements as outlined below:

- Level at which reliable suction loss occurs due to uncovering of the coolant inlet pipe.

The SQN suction strainers are at elevation 722.125 feet.

- 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 (NPSH) specified by the pump manufacturer or engineering analysis.

The SQN Spent Fuel Pool Cooling System Hydraulic Analysis has determined that adequate NPSH for SFP cooling pumps exists for temperatures up to 192 degrees Fahrenheit (F). In addition, SQN procedure 0-SO-78-1, "Spent Fuel Pit Cooling System," contains instructions to throttle SFP cooling flow above 192 degrees F to ensure adequate NPSH.

The NRC staff notes Level 1 is at an elevation of 726.125 ft., which is adequate for normal SFP cooling system operation; it is also sufficient for NPSH and represents the higher of the two points described above.

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 level on either the primary or backup instrument channel of greater than 10 ft. (+/- 1 foot) above the top of stored fuel seated in the storage racks.

In its letter dated August 16, 2013, the licensee provided a sketch depicting the elevations identified as Levels 1, 2 and 3. The NRC staff reviewed this sketch and notes Level 2 is identified at elevation 710.94 ft., which is 10 ft. above the top of the fuel racks. The staff also notes 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, in part, that

Level where fuel remains covered - Indicated level on either the primary or backup instrument channel of greater than 0 feet above top of fuel storage rack. The primary and backup instrument channel sensing components are monitoring the fuel storage area. The design is not complete at this time, but TVA plans to scale instrument channels from full pool to top of fuel rack. The top of active fuel is 17.1 inches below the top of the rack. An instrument channel accuracy calculation, which includes all instrument channel components, is not complete at this time. However, TVA anticipates the instrument channel uncertainty to be less than 12 inches [01-1]. This monitoring level assures that there is adequate water level above the stored fuel seated in the rack.

In its letter dated August 16, 2013, the licensee stated, in part, that

The Guided Wave Radar system can only sense level changes above the weight and there is a small distance above the weight that the manufacturer defines as the dead zone. Preliminary discussions with the manufacturer have indicated that the total distance above the SFP rack where level changes cannot be detected is less than one foot. The exact distance has not been specified at this point. Refer to sketch for Spent Fuel Pool Level shown below. The space shown below Level 3 and above "Top of Fuel Rack" is the area where level changes would not be detected. TVA will utilize the top of the dead zone as Level 3 instead of Top of Fuel Storage Rack.

Additionally, in its letter dated August 16, 2013, the licensee provided a sketch clarifying that the top of the fuel rack is at elevation 700.94 ft. This sketch shows Level 3 at the top of the dead zone, which will be, at maximum, 1 ft. above the top of the fuel racks. The licensee identified Level 3 at an elevation of 701.94 ft.



The NRC staff notes that identifying Level 3 above the dead zone, as defined by the manufacturer, will result in a level that is within the measurable range, and that is also above the highest point of any fuel rack seated in the SFP.

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, 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 that it is anticipated that both the primary and backup instrument channels will consist of fixed components, and that the instrument channels would provide continuous level indication from the maximum operating level of 27.2 ft. above top of active fuel or 25.8 ft. above top of fuel storage racks. The licensee defined the top of the fuel storage rack to be the level within 1 ft. above the rack.

In its letter dated August 16, 2013, the licensee stated, in part, that

The Guided Wave Radar system can only sense level changes above the weight and there is a small distance above the weight that the manufacturer defines as the dead zone. Preliminary discussions with the manufacturer have indicated that the total distance above the SFP rack where level changes cannot be detected is less than one foot. The exact distance has not been specified at this point. Refer to sketch for Spent Fuel Pool Level shown below. The space shown below Level 3 and above "Top of Fuel Rack" is the area where level changes would not be detected. TVA will utilize the top of the dead zone as Level 3 instead of Top of Fuel Storage Rack.

The NRC staff notes 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 and the range of the instrumentation for 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

Guided Wave Radar sensors will be mounted in the northeast corner and southeast corner of the SFP to provide separation between channels. The sensor mount will be designed to suspend the sensing cable over the corner of the SFP at an elevation below the fuel handling machine traverse path which will add protection from missiles and debris in that it will be predominately below the operating deck around the SFP. A cable will be routed from the sensor on the Unit 1 (northeast) side of the pool to the transmitter that will be mounted in the upper containment access room on Unit 1. A cable will be routed from the sensor on the Unit 2 (southeast) side of the pool to the transmitter that will be mounted in the upper containment access room on Unit 2. Channel separation between channels will be maintained for cable routing. The detailed engineering design has not been completed at this time, but, TVA expects that all components and cable routing will be contained within seismic structures such that the installation will comply with the reasonable protection guidance of NEI 12-06 [01-4]. In addition, the two channel sensor and cable assemblies will be separated by approximately 38 feet which provides reasonable protection against missiles and debris impacting both channels. Indicators for both channels will be installed in areas remote from the SFP as discussed in Section XII, "Display."

In its letter dated August 16, 2013, the licensee stated, in part, that

Engineering for the SFP Instrumentation Level channels has started. Design Change Notice (DCN) 23195 has been assigned for SQN Units 1 and 2 and is scheduled to be issued August 29, 2014. Details on actual mounting locations will be available after vendor mounting bracket design has been completed. TVA will provide a status update to this RAI in the February 2014, OIP 6-Month Update and plans to provide these details by September 30, 2014.

The NRC staff notes that the licensee's proposed plan, with respect to the location of the primary and back-up level instruments appears to be consistent with NEI 12-02, as endorsed by the ISG.

The NRC staff notes the information regarding the arrangement of the SFP level instrumentation is not currently available for review. In its letter dated August 16, 2013, the licensee indicated it will provide a status update to the staff in the February 2014, OIP 6-Month Update and further details in the September 30, 2014, OIP 6-Month Update. The staff has identified this request as:

#### **RAI No. 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 backup SFP level sensor and mounting brackets, and the proposed routing of the cables that will extend from the sensors toward the location of the read-out/display devices.**

*(This information was previously requested as RAI-2 in the NRC letter dated July 17, 2013)*

#### **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 that level sensors will be mounted above the SFP in accordance with Safety Related, Seismic Category I, requirements as defined in the SQN seismic design basis. The licensee also stated the remaining channel components and cable routing would be mounted in accordance with the SQN Seismic Category 1 design requirements. The licensee further stated, in part, that

The sensing cable will consist of a small diameter stainless steel cable suspended from a mounting bracket above the SFP water level and extending to the top of the fuel racks. A small weight will be located at the bottom of the cable to keep it straight. The weight will not be provided with a lateral restraint. Failure of the cable is expected to result in it lying on the bottom of the SFP or across the top of the fuel storage rack, where it would not impact spent fuel or pool cooling. Interaction between the sensing cable and the SFP wall will be evaluated. Based on the light weight of the sensing cable assembly it is assumed that it would survive an impact with the SFP wall with little or no damage. Likewise the pool wall will not be damaged by any interaction with the sensing cable or the weight at the bottom of the sensing cable. This assumption will be confirmed by calculation or vendor analysis during the design phase [01-3]. Level indication may be anomalous during a seismic event as a result of sensing cable movement, but will return to its design accuracy after the seismic event when the sensing cable returns to its normal position.

In its letter dated August 16, 2013, the licensee stated, in part, that

Engineering for the Spent Fuel Pool Instrumentation (SFPI) Level channels has started. Design criteria for compliance with the SFPI Order requirements have not been finalized at this time. Design Criteria and mounting details will be available after mounting bracket design and associated calculations have been completed. TVA will provide a status update to this RAI in the February 2014, OIP 6-Month Update and plans to provide these details by September 30, 2014.

The NRC staff notes the information on mounting of the SFP level instrumentation is not currently available for review. In its letter dated August 16, 2013, the licensee indicated it will provide a status update to the staff in the February 2014, OIP 6-Month Update and provide further details in the September 30, 2014, OIP 6-Month Update. The NRC staff has identified these requests as:

**RAI No. 2**

**Please provide the following:**

- a) The design criteria 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 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 to support the level sensor assembly.**

*(This information was previously requested as RAI-3 in the NRC letter dated July 17, 2013)*

In addition, the NRC staff plans to verify the final design and the results of the licensee's seismic testing and analysis report. The staff has identified these requests as:

#### **RAI No. 3**

**For RAI 2a 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 No. 4**

**For each of the mounting attachments required to attach SFP Level equipment to plant structures, please describe the design inputs, and the methodology 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: (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, will be applied to this project.

The NRC staff notes that the licensee's proposed augmented quality assurance process appears to be consistent with the guidance.

### *3.6.2 Qualification and Reliability*

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 design phase. Examples of post-event (beyond-design-basis) conditions that will be considered are:

- radiological conditions for a normal refueling quantity of freshly discharged (100 hours) fuel with the SFP water level at level 3 as described in this Order;
- temperatures of 212 °F and 100 percent relative humidity environment;
- boiling water and/or steam environment;
- a concentrated borated water environment; and...

Related to qualification and reliability, in its OIP, the licensee stated, in part, that

Qualification of equipment mounted in the proximity of the SFP will be evaluated to survive operation in the temperature, humidity, seismic, shock/vibration, boron, and radiation levels anticipated for SFP operation, including the conditions encountered with SFP inventory at reduced levels for a minimum of seven (7) days post event. The NEI 12-06, "Diverse and Flexible Coping Strategies (FLEX) Implementation Guide" (References 5 and 7) defines requirements for availability of FLEX equipment. FLEX equipment necessary to mitigate the event will be available on site, to ensure deployment can be accomplished in a timely manner.

Post-event temperature at sensors located above the SFP is assumed to be 212 degrees Fahrenheit. Post-event humidity in the Auxiliary Building near and above the SFP is assumed to be 100 percent with condensing steam. Level instrumentation will be qualified for expected conditions at the installed location assuming that normal power is unavailable and that the SFP has been at saturation for an extended period. Level instrumentation located in the vicinity of the SFP will be qualified to withstand peak and total integrated dose radiation levels for its installed location assuming that post event SFP water level is equal to the top of the active fuel for an extended period of time....

For seismic effects on installed instrument channel components used after a potential seismic event (with the exception of battery chargers and replaceable batteries), 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...

In its letter dated August 16, 2013, the licensee stated, in part, that

Engineering for the SFPI Level channels has started. Details on qualification, including methodology and analysis to determine reliability, will be available after vendor testing and design have been completed. TVA will provide a status

update to this RAI in the February 2014, OIP 6-Month Update and plans to provide these details by September 30, 2014.

In addition, in its letter dated August 28, 2013, the licensee stated that after detailed engineering design is complete, the licensee will confirm that SFP level channel components and cable routing will be contained within seismic structures such that the installation will comply with the reasonable protection guidance of NEI 12-06.

The NRC staff notes the information regarding qualification and reliability of the SFP level instrumentation is not currently available for review. In its letter dated, August 16, 2013, the licensee indicated that it will provide a status update to the staff in the February 2014, OIP 6-Month Update and provide further details by September 30, 2014, OIP 6-Month Update. The NRC staff has identified these requests as:

#### **RAI No. 5**

**Please provide the following:**

- a) 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 ambient temperature, humidity, shock, vibration, and radiation conditions.**
- b) A description of the testing and/or analyses that will be conducted to provide assurance 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 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 17, 2013)*

In addition, the NRC 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 No. 6**

**For RAI No. 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 the Order 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, in part, that

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

NEI 12-02 states, in part, that

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, in part, that

Electrical independence of the primary and backup channels of the permanently installed instrumentation is obtained by separating the channels. The primary channel sensor will be mounted in the northeast corner of the SFP and the backup channel sensor will be mounted in the southeast corner. The channels will be powered from batteries maintained in a charged state by station Vital 120 Volt Alternating Current (Vac) which is derived from Safety Related Vital Batteries. Each channel will be maintained in a charged condition from different Vital Alternating Current (AC) buses.

In its letter dated August 16, 2013, the licensee stated, in part, that

The primary and backup sensors will be mounted as close as practical to different corners of the spent fuel pool to take advantage of natural protection provided by spatial separation. Sensor mounting bracket above the SFP water and conduit routing will be installed to criteria exceeding the design basis Safe Shutdown Earthquake. Conduit or other means of cable protection will be utilized in the area of SFP. Conduit and cabling in the SFP area will also be routed to take advantage of natural protection provided by spatial separation.

The channels of SFP Level instruments will be powered from independent batteries maintained in a charged state by station Vital 120 Volt Alternating Current (Vac) which is derived from Safety Related Vital Batteries. Each channel will be maintained in a charged condition from independent Vital 120 Vac sources. The power cable to each independent SFP level channel battery will be routed and separated in accordance with site design standards for redundant channels/trains of safety related instrumentation.

Conduit and cabling outside the SFP area for both channels will be routed and separated in accordance with site design standards for redundant channels/trains of safety related instrumentation. This conduit and cable separation and routing criteria will be utilized for all channel components including transmitter, battery enclosure, and main control room (MCR) indicator for the channel providing MCR indication.

The NRC staff notes that with this arrangement, the loss of one backup power supply will not affect the operation of the independent channel under BDB event conditions. The implementation of such design provisions for physical and electrical independence appears to be consistent with NEI 12-02, as endorsed by the ISG. The NRC staff plans to verify the final electrical power supply design information when it is provided. The NRC staff has identified this request as:

**RAI No. 7**

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

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 power supplies for the instrument channels are arranged as follows:

- The primary instrument channel components will be powered by batteries maintained in a charged state by station Vital 120 Vac which is derived from Safety Related Vital Batteries. Primary instrument channel battery sizing is in progress, but is anticipated to provide continuous indication for a period of at least 96 hours. The SFP instrument battery charger will have power available any time the Vital Batteries and Vital Inverters power source is available. Vital Batteries and Vital Inverters are anticipated to be continuously available because FLEX Diesel Generators (D/Gs) are being added as part of Order EA-1 2-049 and will provide power to the Vital Battery Chargers. See Reference 9 Chapter 8 for a detailed description of the existing Vital AC power distribution.
- The backup instrument channel components will be powered by batteries maintained in a charged state by station Vital 120 Vac which is derived from Safety Related Vital Batteries. A different station Vital 120 Vac power source will be utilized than that chosen for the primary instrument channel. Secondary instrument channel battery sizing will be completed as part of the design change, but is anticipated to provide continuous indication for a period of at least 96 hours. SFP instrument battery charger will have power available any time the vital batteries and Vital Inverters power source is available. Vital Batteries and Vital Inverters are anticipated to be continuously available because FLEX D/Gs are being added as part of Order EA-1 2-049 and will provide power to the Vital Battery Chargers. See Reference 9 Chapter 8 for a detailed description of the existing Vital AC power distribution.
- Both the primary and backup channels will be designed to allow an alternate AC source to be readily connected. The alternate AC source will be from the FLEX 225 Kilo Volt-Ampere (kVA) diesel generator (D/G) through a step down transformer. The FLEX 225 kVA D/G and associated connections will

be stored in accordance with reasonable protection guidance of NEI 12-06 as defined by NEI 12-02.

In its letter dated August 16, 2013, the licensee stated, in part, that

A detailed description of Vital AC power system and its capacities has been provided in Chapter 8 of SQN Final Safety Analysis Report (FSAR) (Reference 9 in February 28, 2013 submittal). NEI 12-06 section 3.2.1.3 initial condition 8 states "Installed electrical distribution system, including inverters and battery chargers, remain available provided they are protected consistent with current station design." The SQN installed electrical distribution system, including inverters and battery chargers, is fully protected and seismically mounted inside a safety related structure and above flood elevation.

The design criteria for compliance with the SFPI Order requirements have not been finalized at this time, however, it is anticipated that calculations will address Design Margin, Aging Margin and Temperature Correction Factors. Preliminary analysis has concluded that a battery life of at least 96 hours is appropriate, considering margin issues, but, preliminary analysis provides no margin for other factors that may be identified during the design process. TVA is revising the anticipated battery life to 84 hours to provide margin to address issues identified during the design process. FLEX Coping strategies will restore power to the battery charger or provide an alternate AC source well in advance of 84 hours. This change will be noted in the first 6-Month Update to the SFP OIP required to be submitted by August 28, 2013.

In its letter dated August 28, 2013, the licensee stated, in part, that

The primary and backup instrument channel battery life was anticipated to exceed 96 hours in the February 2013 Integrated Plan. A preliminary battery life calculation has been completed. TVA is updating the anticipated battery life to 84 hours to provide margin for issues that may arise during the design process.

The NRC staff notes the proposed criteria for electrical ac power sources and capabilities for the primary and backup channels as well as the sizing of the battery backups appear to be consistent with NEI 12-02, as endorsed by the ISG. The NRC staff plans to verify the results of the licensee's calculation for required duty cycle given the final design load of the instrument channel for its installed configuration. The NRC staff has identified this request as:

**RAI No. 8**

**Please provide the results of the calculation depicting the battery backup duty cycle requirements demonstrating battery 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 channel will be scaled from full pool to the top of the fuel rack. Top of active fuel is 17.1 inches below the top of the rack. The instrument channel accuracy calculation, which includes all instrument channel components, is not complete at this time; however, TVA anticipates the instrument channel uncertainty to be less than 12 inches [OI-1].

In its letter dated August 26, 2013, the licensee stated, in part, that

Engineering for the SFPI Level channels has started. Details on accuracy and allowed deviation will be available after vendor design and calculations have been completed. TVA will provide a status update to this RAI in the February 2014, OIP 6-Month Update and plans to provide these details by September 30, 2014.

The NRC staff notes the information on SFP level instrumentation channel accuracy is not currently available for review. In its letter dated, August 16, 2013, the licensee indicated that it will provide a status update to the staff in the February 2014, OIP 6-Month Update and provide further details by September 30, 2014, OIP 6-Month Update. The NRC staff has identified this request as:

#### **RAI No. 9**

**Please provide the following:**

- a) An estimate of the expected instrument channel accuracy performance (e.g., in % 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 to be used for determining the maximum allowed deviation from the instrument channel design accuracy under normal operating conditions. Staff understands this allowed deviation will serve as an acceptance criterion for a calibration procedure to alert operators and technicians that the channel requires adjustment to within normal design accuracy.**

*(This information was previously requested as RAI-7 in the NRC letter dated July 17, 2013)*

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 full level indication of the SFP indicator will be compared to fixed marks within the SFP to validate that the transmitter zero adjustment has not drifted. The sensor mounting design will incorporate a bracket that provides a calibrated distance to raise the sensor to confirm that the instrument system is performing within the channel accuracy calculation.

Existing work control processes such as Calibration Surveillance Instructions (SIs), Preventative Maintenance procedures and Work Orders will be utilized to perform testing and maintenance on the instrument channels. The SIs or periodic instructions will validate the functionality of the installed instrument channels within 60 days of a planned refueling outage considering normal testing scheduling allowances (e.g., +/- 25 percent), provided that the instruction has not been performed within the past 12 months. Allowable channel out of service times and associated actions will be consistent with the guidance provided in NEI 12-02.

In its letter dated August 16, 2013, the licensee stated, in part, that

Engineering for the SFPI Level channels has started. Details on testability features and preventive maintenance will be available after vendor design, calculations and procedures have been completed. TVA will provide a status update to this RAI in the February 2014, OIP 6-Month Update and plans to provide these details by September 30, 2014.

The NRC staff notes the information on the design of the SFP level instrumentation to provide for routine testing and calibration is not currently available for review. In its letter dated, August 16, 2013, the licensee indicated that it will provide a status update to the staff in the February 2014, OIP 6-Month Update and provide further details by September 30, 2014, OIP 6-Month Update. The NRC staff has identified this request:

**RAI no. 10**

**Please provide the following:**

- a) A further 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) Explain 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 SFP level instrumentation.**
- c) Explain the calibration tests and functional checks to be performed and the frequency at which they will be conducted. Discuss how these surveillances will be incorporated into the plant surveillance program.**
- d) Describe the preventive maintenance tasks 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 the NRC letter dated July 17, 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, in part, that

The detailed engineering design is not complete at this time. One instrument channel display will be located in the Main Control Room. The other instrument channel display will be located in close proximity to the Backup Control Room. Both indicator locations are promptly accessible to plant operations staff and do not require personnel to enter the area surrounding the SFP.

In its letter dated August 16, 2013, the licensee stated, in part, that

One instrument channel display for each unit is anticipated to be located in the Electric Board Room, which is in close proximity to the Auxiliary Control Room.

One instrument channel display for each unit will be located in the Main Control Room. Engineering for the SFPI Level channels is in progress; however, the exact location for the battery pack/display enclosure for both channels has not yet been determined. The second instrument channel display for each unit is anticipated to be located in the Electric Board Room, which is in close proximity to the Auxiliary Control Room. The Electric Board Room is a mild environment, is promptly accessible (2 minute walk) by main control room personnel and is not subject to the environmental conditions associated with boiling in the SFP. Communications by radio or telephone is available if needed. The route to the Electric Board Room/Auxiliary Control Room area from the Main Control Room will be the same route that is utilized during design basis events because the



route is within a safety related, seismic structure. The pathway is expected to remain intact following a seismic event. See the sketch below for the route from the Main Control Room to the Electric Board Room.

The Electric Board Room is in a mild environment and is promptly accessible (2 minute walk) by main control room personnel. Therefore, the environment is not affected by the environmental conditions associated with any drain down scenario.

The NRC staff notes the NEI guidance for "Display" specifically mentions the control room as an acceptable location for SFP instrumentation displays as it is occupied or promptly accessible, outside the area surrounding 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. The NRC staff notes that the licensee's proposed location for one of the SFP level instrumentation display appears to be consistent with NEI 12-02, as endorsed by the ISG.

The NRC staff notes that there is insufficient information on the accessibility, habitability, availability of personnel and communications as it relates to the location for the SFP level instrumentation display that will be outside the MCR. The NRC staff has identified this request as:

#### **RAI No. 11**

**For the display location outside the MCR, please describe the evaluation used to validate the secondary display location can be accessed without unreasonable delay following a BDB event. Include the time available for personnel to access the display location 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 locations. Additionally, include a description of the radiological and environmental conditions on the paths personnel might take. Describe whether the secondary 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 secondary display location or monitor the display periodically.**

#### 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

The primary and backup instrument channels will be installed utilizing current TVA design and modification processes. Training for operations and maintenance personnel is evaluated as part of the design process utilizing the Systematic Approach to Training (SAT). The SAT process will determine both the initial and continuing elements of training, if required.

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, 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, in part, that

Procedures will be developed using guidelines and vendor instructions to address the maintenance and operation issues associated with the new SFP instrumentation. Procedures will address a strategy for ensuring SFP water level addition is initiated at an appropriate time consistent with implementation of NEI 12-06, "Diverse and Flexible Coping Strategies (FLEX) Implementation Guide" (References 5 and 7).

In its letter dated August 16, 2013, the licensee stated, in part, that

Engineering for the SFPI Level channels has started. Maintenance requirements for Beyond-Design-Basis equipment are under development at this time by EPRI [Electric Power Research Institute]. Inspection, maintenance, repair, operation, abnormal response and administrative control guidelines will be available after industry guidelines have been completed. TVA will provide a status update to

this RAI in the February 2014, OIP 6-Month Update and plans to provide these details by September 30, 2014.

The NRC staff notes the information on procedures to be established and maintained for the testing, calibration, and use of the primary and backup SFP instrumentation is not currently available for review. In its letter dated, August 16, 2013, the licensee indicated that it will provide a status update to the staff in the February 2014, OIP 6-Month Update and provide further details by September 30, 2014, OIP 6-Month Update. The NRC staff has identified this request as:

#### **RAI No. 12**

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

*(This information was previously requested as RAI-10 in the NRC letter dated July 17, 2013. However, based on feedback from the licensees, it has been revised as above.)*

#### **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

Existing work control processes such as Calibration Surveillance Instructions (SIs), Preventative Maintenance procedures and Work Orders will be utilized to perform testing and maintenance on the instrument channels. The SIs or periodic instructions will validate the functionality of the installed instrument channels within 60 days of a planned refueling outage considering normal testing scheduling allowances (e.g., +/- 25 percent), provided that the instruction has not been performed within the past 12 months. Allowable channel out of service times and associated actions will be consistent with the guidance provided in NEI 12-02.

In its letter dated August 16, 2013, the licensee stated, in part, that

Engineering for the SFPI Level channels has completed 10% design review. Routine testing guidelines, including channel checks, functional tests, and periodic calibration verification have not been developed at this time. In addition, compensatory actions have not been finalized at this time. TVA will provide a status update to this RAI in the February 2014, OIP 6-Month Update and plans to provide these details by September 30, 2014.

The NRC staff notes the information on the processes for testing and calibration of the SFP level instrumentation is not currently available for review. In its letter dated August 16, 2013, the licensee indicated that it will provide a status update to the staff in the February 2014, OIP 6-Month Update and provide further details by September 30, 2014, OIP 6-Month Update. The NRC staff has identified this request as:

**RAI No. 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 plans to ensure 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 the guidance in NEI 12-02 section 4.3 on compensatory actions for one or both non-functioning channels.**
- 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 the NRC letter dated July 17, 2013)*

In addition, the NRC staff notes that there is insufficient information on the licensee's process for in situ calibration to ensure that the design accuracy will be maintained. The NRC staff has identified the following requests as:

**RAI No. 14**

**Please provide a description of the in situ calibration process at the SFP location that will result in the channel calibration being maintained at its design accuracy.**

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 the primary and backup instrument channels will be assured by conformance with the guidelines of NRC JLD-ISG-2012-03 and NEI 12-02.

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 NRC staff will issue an evaluation with its conclusion after the licensee has provided the requested information.

J. Shea

- 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 June 30, 2015, 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 301-415-1564 or via e-mail at siva.lingam@nrc.gov.

Sincerely,

*/RA/*

Siva P. Lingam, Project Manager  
Plant Licensing Branch II-2  
Division of Operating Reactor Licensing  
Office of Nuclear Reactor Regulation

Docket Nos. 50-327 and 50-328

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Interim Staff Evaluation and  
Request for Additional Information

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