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

November 14, 2013

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

SUBJECT: BROWNS FERRY NUCLEAR PLANT, UNITS 1, 2, AND 3 - 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. MF0881, MF0882, AND MF0883)

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. ML13063A437), Tennessee Valley Authority (the licensee) provided the Overall Integrated Plan (OIP) for Browns Ferry Nuclear Plant, Units 1, 2, and 3 describing how it will achieve compliance with Attachment 2 of Order EA-12-051 by November 15, 2016, for Unit 1, April 28, 2015 for Unit 2, and April 12, 2016, for Unit 3. By letter dated June 18, 2013 (ADAMS Accession No. ML13157A164), the NRC staff sent a request for additional information (RAI) to the licensee. The licensee provided supplemental information by letters dated July 18, 2013 (ADAMS Accession No. ML13206A005), and August 28, 2013 (ADAMS Accession No. ML13247A290).

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

The interim staff evaluation also includes RAIs, response to which the NRC staff needs to complete its review. The licensee should provide the information requested in the 6-month status updates, as the information becomes available. However, the staff requests that all information be provided by October 31, 2014, to ensure that any issues are resolved prior to the date by which the licensee must complete full implementation of Order EA-12-051. The licensee should adjust its schedule for providing information to ensure that all this information is provided by the requested date.

If you have any questions regarding this letter, please contact me at 301-415-1447 or via e-mail at farideh.saba@nrc.gov.

Sincerely,

Siva P. Lingam for

Farideh E. Saba, Senior Project Manager
Plant Licensing Branch II-2
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket Nos. 50-259, 50-260,
and 50-296

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 BROWNS FERRY NUCLEAR PLANT UNITS 1, 2, AND 3 DOCKET NOS. 50-259, 50-260, AND 50-296

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. ML13063A437), Tennessee Valley Authority (TVA, the licensee) provided the OIP for Browns Ferry Nuclear (BFN) Plant, Units 1, 2, and 3, describing how it will achieve compliance with Attachment 2 of Order EA-12-51 by November 15, 2016, for Unit 1, April 28, 2015, for Unit 2, and April 12, 2016, for Unit 3. By letter dated June 18, 2013 (ADAMS Accession No. ML13157A164), the NRC staff sent a Request for Additional Information (RAI) to the licensee. The licensee provided supplemental information by letters dated July 18, 2013 (ADAMS Accession No. ML13206A005), and August 28, 2013 (ADAMS Accession No. ML13247A290).

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 this Order except to the extent that a more stringent requirement is set forth in the license. Licensees shall promptly start implementation of the requirements in Attachment 2 to the order and shall complete full implementation no later than two refueling cycles after submittal of the OIP or December 31, 2016, whichever comes first.

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

Attachment 2 of Order EA-12-051 requires the 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 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

BFN has three SFP storage pools, one per reactor. Spent fuel storage facilities are shared only for Units 1 and 2, and the sharing feature is only the transfer canal that connects the two storage pools. A watertight gate is provided at each end of the transfer canal.

The licensee submitted its OIP on February 28, 2013. The OIP states that installation of the SFP level instrumentation is scheduled for completion by November 15, 2016, for Unit 1, April 28, 2015, for Unit 2, and April 12, 2016, for Unit 3. These dates are before startup from the second refueling outage for each unit.

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

3.2 Spent Fuel Pool Water Levels

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

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

NEI 12-02 states, in part, that

Level 1 represents the HIGHER of the following two points:

- The level at which reliable suction loss occurs due to uncovering of the coolant inlet pipe, weir or vacuum breaker (depending on the design), or

- The level at which the water height, assuming saturated conditions, above the centerline of the cooling pump suction provides the required net positive suction head specified by the pump manufacturer or engineering analysis.

In its OIP, the licensee stated that Level 1 is the indicated level on either the primary of backup instrument channel of greater than 23.7 feet (ft.) above the top of active fuel seated in the storage racks based on uncovering the weir that provides the flow path into the surge tank.

In its letter dated July 18, 2013, the licensee stated, in part, that

> TVA will use a more conservative value for Level 1 than either of the two points described in NEI 12-02 guidance - 663.0 feet above sea level, representing the normal spent fuel pool level at BFN. Level 1 for BFN Units 1, 2, and 3 is the level of the weir. If additional water is added to the SFP it will spill over the weir. Once the water level drops below the weir the Skimmer Surge tank begins to empty and the suction head to the Fuel Pool Cooling pumps begins to decrease. As the water level decreases in the Skimmer Surge tank, low water level alarms are initiated to alert the operator to add make up water.

In its letter dated July 18, 2013, the licensee also provided a sketch with the SFP levels and references. In this sketch the licensee identified Level 1 at 663.0 ft., which is the weir elevation. The NRC staff notes that Level 1 at 663.0 ft. is adequate for normal SFP cooling system operation and it is also sufficient to ensure adequate Net Positive Suction Head for the SFP cooling pumps.

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 greater than 10 ft. (+/- 1 foot) above the top of the stored fuel seated in the storage racks. In its letter dated July 18, 2013, the licensee provided a sketch with the SFP levels and references. In this sketch the licensee identified Level 2 at 650 ft. 4 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 as the elevation identified for Level 2 is 10 ft. above the top of the fuel storage rack.

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.

The licensee stated in its OIP that Level 3 is the indicated level on either the primary or backup instrument channel of greater than 0 ft. above the top of the fuel storage rack. In its letter dated July 18, 2013, the licensee provided a sketch with the SFP levels and references. In this sketch the licensee identified Level 3 at 641 ft. 4 in.

The NRC notes that this elevation is 12 in. above the highest point of any spent fuel storage rack seated in the SFP.

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 the primary and backup instruments will be located and permanently installed in each SFP. The OIP also states that both the primary and backup instrument channels will provide a continuous level indication over a minimum range from the normal pool level (23.7 ft above the top of the active fuel or 22.6 ft above the top of the fuel storage racks) to the top of the fuel storage racks on each unit.

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

3.4 Design Features: Arrangement

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

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

NEI 12-02 states, in part, that

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

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

> Guided Wave Radar sensors will be mounted in the northwest corner and northeast corner 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 each sensor to the transmitter that will be mounted in an area remote from the SFP environment. 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 [Open Item (OI)-4]. In addition, the two channel sensors and cable assemblies will be separated by approximately 30 feet which provides reasonable protection against missiles and debris impacting both channels.

In its letter dated July 18, 2013, the licensee stated, in part, that

> Details on actual mounting locations will be available after vendor walkdowns and mounting bracket design have been completed. TVA will provide a status update to this RAI in the February 2014, OIP 6-Month Update and estimates that all details will be provided by August 28, 2014.

The NRC staff notes that the licensee indicated that the information regarding actual mounting locations and mounting bracket design is not available for staff's review and that the licensee will provide a status update in the February 2014, OIP 6-month update. The staff also notes that the licensee estimates that all details will be provided to the staff by August 28, 2014. 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 back-up SFP level sensor, and the proposed routing of the cables that will extend from the sensors toward the location of the read-out/display device.

(This information was previously requested as RAI-2 in NRC letter dated June 18, 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 the level transducers will be mounted to the SFP in accordance with Safety Related, Seismic Category I, requirements as defined in the BFN seismic design basis. The licensee also stated that the remaining channel components and cable routing shall be mounted in accordance with the BFN Seismic Category I design requirements.

In its letter dated July 18, 2013, the licensee stated, in part, that

> Details on actual mounting locations will be available after vendor walkdowns and mounting bracket design have been completed. TVA will provide a status update to this RAI in the February 2014, OIP 6-Month Update and estimates that all details will be provided by August 28, 2014.

The NRC staff notes that the licensee indicated that the information regarding actual mounting locations and mounting bracket design is not available for staff's review and that the licensee will provide a status update in the February 2014, OIP 6-month update. The staff also notes that the licensee estimates that all details will be provided to the staff by August 28, 2014. The staff has identified these requests as:

RAI No. 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 effects that could accompany such seismic forces.**

b) **A description of the manner in which the level probe (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 probe 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 probe assembly.**

(This information was previously requested as RAI-3 in NRC letter dated June 18, 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 No. 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 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 that was used to qualify the structural integrity of the affected structures/equipment.

3.6 Design Features: Qualification

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

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

NEI 12-02 states, in part, that

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

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

3.6.1 Augmented Quality Process

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

In its OIP, the licensee stated that instrument channel reliability will be established by use of an augmented quality assurance process, similar to those applied to fire protection.

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 Post Event Conditions

NEI 12-02 states, in part, that

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

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

> Temperature, humidity and radiation levels consistent with conditions in the vicinity of the SFP and the area of use considering normal operational, event and post-event conditions for no fewer than seven days post-event or until off-site resources can be deployed by the mitigating strategies resulting from Order EA-12-049 (Reference 2) will be addressed in the engineering 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; and...

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

> 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.
>
> The sensor and cable mounted in the vicinity of the SFP are not sensitive to anticipated radiation, temperature and humidity. The associated transmitter (electronics package) will be mounted remote from the SFP to protect it from the radiation, temperature and humidity anticipated in the area around the SFP. The cable

that connects the transducer to the transmitter will be qualified for the SFP area environment.

The NRC staff notes that it does not have sufficient information regarding the expected radiological conditions for the location, where the associated transmitter (electronics package) will be mounted. The staff has identified this request as:

RAI No. 5

Please provide analysis of the maximum expected radiological conditions (dose rate and total integrated dose) to which the associated transmitter (electronics package) will be exposed.

While addressing post-event temperature conditions, in its OIP, the licensee stated, in part, that

> Post-event temperature at sensors located above the SFP is assumed to be 212 degrees Fahrenheit (° F).

The NRC staff notes that it does not have sufficient information regarding the ambient temperature in the location, where associated transmitter (electronics package) will be located under normal and worst case postulated conditions. The staff has identified this request as:

RAI No. 6

Please provide information indicating what will be the maximum expected ambient temperature in the room in which the associated transmitter (electronics package) will be located under BDB conditions in which there is no AC power available to run Heating Ventilation and Air Conditioning (HVAC) systems.

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

> Post-event humidity in the Reactor Building near and above the SFP is assumed to be 100 percent with condensing steam.

The NRC staff notes that it does not have sufficient information regarding the associated transmitter (electronics package) capability of continuously performing its required functions under the expected humidity condition. The staff has identified this request as:

RAI No. 7

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

3.6.3 Shock and Vibration

NEI 12-02 states, in part, that

Applicable components of the instrument channels are rated by the manufacturer (or otherwise tested) for shock and vibration at levels commensurate with those of postulated design basis event conditions in the area of instrument channel component use using one or more of the following methods:

- instrument channel components use known operating principles, are supplied by manufacturers with commercial quality programs (such as ISO 9001) with shock and vibration requirements included in the purchase specification and/or instrument design, and commercial design and testing for operation in environments where significant shock and vibration loadings are common, such as for portable hand-held devices or transportation applications;

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

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

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

> Components of the instrument channels will be qualified for shock and vibration using one or more of the following methods:
>
> - components are supplied by manufacturers using commercial quality programs (such as ISO 9001, "Quality Management Systems - Requirements") with shock and vibration requirements included in the purchase specification at levels commensurate with portable hand-held device or transportation applications;
>
> - components have a substantial history of operational reliability in environments with significant shock and vibration loading, such as portable hand-held device or transportation applications; or
>
> - components are inherently resistant to shock and vibration loadings, such as cables.

In its letter dated July 18, 2013, the licensee stated, in part, that

> Engineering for the SFPI [spent fuel pool instrumentation] Level channels has just commenced. 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 estimates that all details will be provided by August 28, 2014.

The NRC staff notes that the details on qualification, including methodology and analysis to determine reliability of the SFP instrumentation level channels are not currently available for staff's review and that a status update will be provided to the staff in the February 2014, OIP 6-Month Update. The staff also notes that the licensee estimates that all details will be provided to the staff by August 28, 2014. This will be addressed in RAIs 8 and 9.

3.6.4 Seismic Reliability

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

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

> 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 using one or more of the following methods:
>
> - demonstration of seismic motion will be consistent with that of existing design basis loads at the installed location;
>
> - substantial history of operational reliability in environments with significant vibration, such as for portable hand-held devices or transportation
>
> - applications (Such a vibration design envelope will be inclusive of the effects of seismic motion imparted to the components proposed at the location of the proposed installation.);
>
> - adequacy of seismic design and installation is demonstrated based on the guidance in Sections 7, 8, 9, and 10 of Institute of Electrical and Electronic Engineers (IEEE) Standard 344-2004, IEEE Recommended Practice for Seismic Qualification of Class 1E Equipment for Nuclear Power Generating Stations, (Reference 8) or a substantially similar industrial standard;
>
> - demonstration that proposed devices are substantially similar in design to models that have been previously tested for seismic effects in excess of the plant design basis at the location where the instrument is to be installed (acceleration of gravity (gr-levels and frequency ranges); or
>
> - seismic qualification using seismic motion consistent with that of two times existing Safe Shutdown Earthquake (SSE) loading at the installation location.

In its letter dated July 18, 2013, the licensee stated, in part, that

> Engineering for the SFPI Level channels has just commenced. 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 estimates that all details will be provided by August 28, 2014.

The NRC staff notes that the details on qualification, including methodology and analysis to determine reliability of the SFP instrumentation level channels are not currently available for staff's review and that a status update will be provided to the staff in the February 2014, OIP 6-Month Update. The staff also notes that the licensee estimates that all details will be provided to the staff by August 28, 2014. The staff has identified these requests as:

RAI No. 8

Please provide the following:

a) **A description of the specific method or combination of methods you intend to apply 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 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 retransmitting 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 NRC letter dated June 18, 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 No. 9

For RAI #8 above, please provide the results for the selected methods, tests and analyses utilized to demonstrate the qualification and reliability of the installed equipment in accordance with the Order requirements.

3.6.5 Qualification Evaluation Summary

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

3.7 Design Features: Independence

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

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

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 to the extent practical. The primary and backup sensors will be mounted as close as practical to different corners of the spent fuel pool. The channels will be powered from batteries maintained in a charged state by station 120 Volt Alternating Current (VAC) which is derived from a reliable source. Each channel will be maintained in a charged condition from different alternating current (AC) sources.

In its letter dated July 18, 2013, the licensee stated, in part, that

a) 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.

b) The channels of SFP Level instruments will be powered from independent batteries maintained in a charged state by station 120 Volt Alternating Current (VAC) which is derived from a reliable source. Each channel will be maintained in a charged condition from independent alternating current (AC) sources. 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.

c) 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 the implementation of such design provisions appears to be consistent with NEI 12-02, as endorsed by the ISG, and that the electrical functional performance of each level measurement channel would be considered independent of the other channel. This independence would result in a reliable SFP level measurement. However, the NRC staff plans to review the final design information to complete its review. The NRC staff has identified this request as:

RAI No. 10

Please provide the NRC staff with the final configuration and installation of the level measurement system, consisting of level sensor electronics, cabling, and readout devices. In addition, please provide additional information regarding the selection of independent power sources.

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 primary instrument channel components will be powered by batteries maintained in a charged state by station 120 VAC which is derived from a reliable source. Primary instrument channel battery size is anticipated to provide continuous indication for a period of at least 96 hours.

The backup instrument channel components will be powered by batteries maintained in a charged state by station 120 VAC which is derived from a reliable source. A different station 120 VAC power source will be utilized than that chosen for the primary instrument channel. Secondary instrument channel battery size is anticipated to provide continuous indication for a period of at least 96 hours.

Both the primary and backup channel on each unit will be designed to allow an alternate AC source to be readily connected. The alternate AC source routing and connection strategy will be defined as part of the SFP level channel design package, but, it is anticipated to utilize cabling that is independent of normal distribution of AC to the battery charger and be supplied from the FLEX [flexible coping strategies] 225 Kilo Volt-Ampere (kVA) diesel generator (D/G). 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 July 18, 2013, the licensee stated, in part, that

The SFP Level Channel battery calculations have not been finalized at this time because engineering on the design is just starting. The design criteria for compliance with the spent fuel pool level (SFPL) instrumentation Order requirements also 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 96 hours 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.

In its letter dated August 28, 2103, 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 that TVA has completed its preliminary battery life calculation for BFN, and determined that battery life would be 84 hours. The staff notes that additional information is needed regarding to the sizing of the batteries. The staff has identified this request as:

RAI No. 11

Please provide the design criteria that will be applied to size the battery in a manner that ensures, with margin, that the channel will be available to run reliably and continuously following the onset of the BDB event for the minimum duration needed, 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 the full pool to the top of the fuel rack. Top of active fuel is 13 inches below the top of the rack. The instrument channel accuracy calculation, which includes all of the instrument channel components, is not complete at this time; however, TVA anticipates the instrument channel uncertainty to be less than 12 inches. The primary and backup instrument channels will be designed to maintain their design accuracy following a power interruption or change in power source without recalibration.

In its letter dated July 18, 2013, the licensee stated, in part, that

> Engineering for the SFPI Level channels has just commenced. 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 estimates that all details will be provided by August 28, 2014.

The NRC staff notes that the details on accuracy and allowed deviation are not currently available for staff's review and that a status update will be provided to the staff in the February 2014, OIP 6-Month Update. The staff also notes that the licensee estimates that all details will be provided to the staff by August 28, 2014. The staff has identified this request as:

RAI No. 12

Please provide the following:

a) **An estimate of the expected instrument channel accuracy performance under both a) normal SFP level conditions (approximately Level 1 or higher) and b) at the BDB conditions (i.e., radiation, temperature, humidity, and 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 that the channel requires adjustment to within the normal condition design accuracy.**

(This information was previously requested as RAI-7 in NRC letter dated June 18, 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 instrument channel design will include provisions for routine testing and calibration. The instrumentation will allow for in-situ testing and calibration to minimize calibration effort and instrument downtime.
>
> 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 July 18, 2013, the licensee stated, in part, that

> Engineering for the SFPI Level channels has just commenced. 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 estimates that all details will be provided by August 28, 2014.

The NRC staff notes that the details on testability features and preventive maintenance are not currently available for staff's review and that a status update will be provided to the staff in the February 2014, OIP 6-Month Update. The staff also notes that the licensee estimates that all details will be provided to the staff by August 28, 2014. The staff has identified this request as:

RAI No. 13

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 SFP level instrumentation.**

c) **A description of how functional checks will be performed, and the frequency at which they will be conducted. Describe how calibration tests will be performed, and the frequency at which they will be conducted. Provide a discussion on the measures that will be taken to detect when the instrumentation is operable but degraded. Provide a discussion as to 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 June 18, 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 for each unit will be located in the Main Control Room. The other instrument channel display for each unit is anticipated to be located in close proximity to the Backup Control Room. The specific locations will be determined during detailed design. 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 July 18, 2013, the licensee stated that

a) One instrument channel display for each unit will be located in the Main Control Room. Engineering for the SFPI Level channels is in progress at this time, however, the exact location for the battery pack/display enclosure for both channels has yet not 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 Backup 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/Backup 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.

b) The Electric Board Room is in 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.

The NRC staff notes that 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 licensee's proposed location for the primary SFP instrumentation display appears to be consistent with NEI 12-02, as endorsed by the ISG. However, the staff notes that the licensee anticipates that they will locate the backup SFP instrumentation display in the Electric Board Room which is in close proximity to the Backup Control Room. The staff notes that additional information is needed regarding the specific location for the backup SFP instrumentation display. The staff has identified this request as:

RAI No. 14

a) **Please provide the specific location for the backup instrument channel display.**

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

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

> 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. This program criterion is consistent with the guidelines of NRC JLD-ISG-2012-03 and NEI 12-02.

The NRC staff notes that the licensee's proposed plan to train personnel in the use and the provision of alternate power to the primary and backup instrument channels, including the approach to identify 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."

In its letter dated July 18, 2013, the licensee stated, in part, that

> Engineering for the SFPI Level channels has just commenced. 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 estimates that all details will be provided by August 28, 2014.

The NRC staff notes that the information regarding inspection, maintenance, repair, operation, abnormal response and administrative control guidelines is not currently available for staff's review and that a status update will be provided to the staff in the February 2014, OIP 6-Month Update. The staff also notes that the licensee estimates that all details will be provided to the staff by August 28, 2014. The staff has identified this request as:

RAI No. 15

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, 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

> 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 July 18, 2013, the licensee stated, in part, that

> Engineering for the SFPI Level channels has just commenced. 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 estimates that all details will be provided by August 28, 2014.

The NRC staff notes that the information regarding routine testing guidelines, including channel checks, functional tests and periodic calibration verification is not currently available for staff's review and that a status update will be provided to the staff in the February 2014, OIP 6-Month Update. The staff also notes that the licensee estimates that all details will be provided to the staff by August 28, 2014. The staff has identified this request as:

RAI No. 16

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 what compensatory actions are planned 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 June 18, 2013)

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, in part, 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 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 by October 31, 2014.

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

If you have any questions regarding this letter, please contact me at 301-415-1447 or via e-mail at farideh.saba@nrc.gov.

Sincerely,

/RA by SLingam for/

Farideh E. Saba, Senior Project Manager
Plant Licensing Branch II-2
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket Nos. 50-259, 50-260,
and 50-296

Enclosure:
Interim Staff Evaluation and
Request for Additional Information

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