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

October 24, 2013

Mr. Joseph W. Shea
Vice President, Nuclear Licensing
Tennessee Valley Authority
1101 Market Street, LP 3D-C
Chattanooga, TN 37402-2801

SUBJECT: WATTS BAR NUCLEAR STATION UNITS 1 AND 2 - INTERIM STAFF EVALUATION AND REQUEST FOR ADDITIONAL INFORMATION REGARDING THE OVERALL INTEGRATED PLAN FOR IMPLEMENTATION OF ORDER EA-12-051, RELIABLE SPENT FUEL POOL INSTRUMENTATION (TAC NOS. MF0951 AND MF1178)

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. ML13063A440), Tennessee Valley Authority (TVA, the licensee) submitted the Overall Integrated Plan (OIP) describing how it will achieve compliance prior to November 5, 2015, for Unit 1, and prior to initial startup, for Unit 2. By letter dated August 2, 2013 (ADAMS Accession No. ML13204A231), the NRC staff sent a Request for Additional Information (RAI) to the licensee. TVA provided supplemental information by letters dated September 6, 2013 (ADAMS Accession No. ML13254A065), and August 28, 2013 (ADAMS Accession No.ML13254A297).

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. TVA 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 November 22, 2013, 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 301-415-8480 or e-mail at Andrew.Hon@nrc.gov.

Sincerely,

Andrew Hon, Project Manager
Licensing Projects Branch II-2
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-390

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
WATTS BAR NUCLEAR PLANT, UNITS 1 AND 2
DOCKET NOS. 50-390 AND 50-391

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. ML13063A440), Tennessee Valley Authority (TVA, the licensee) provided the OIP for Watts Bar Nuclear Plant, Units 1 and 2, describing how it will achieve compliance with Attachment 2 of Order EA-12-51 prior to November 5, 2015, for Unit 1, and prior to initial startup, for Unit 2. By letter dated August 2, 2013 (ADAMS Accession No. ML13204A231), the NRC staff sent a Request for Additional Information (RAI) to the licensee. The licensee provided supplemental information by letters dated September 6, 2013 (ADAMS Accession No. ML13254A065) and August 28, 2013 (ADAMS Accession No. ML13254A297). In its letter dated August 28, 2013, the licensee revised its target completion date to August 31, 2014, for full site implementation.

2.0 REGULATORY EVALUATION

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

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

Attachment 2 of Order EA-12-051 requires the 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 (the ISG), JLD-ISG-2012-03, "Compliance with Order EA-12-051, Reliable Spent Fuel Pool Instrumentation" (ADAMS Accession No. ML12221A339), to describe methods acceptable to the NRC staff for complying with Order EA-12-051. The ISG endorses, with exceptions and clarifications, the methods described in the Nuclear Energy Institute (NEI) guidance document NEI 12-02, Revision 1, "Industry Guidance for Compliance with NRC Order EA-12-051, 'To Modify Licenses with Regard to Reliable Spent Fuel Pool Instrumentation,'" dated August 2012 (ADAMS Accession No. ML12240A307). Specifically, the ISG states:

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

3.0 TECHNICAL EVALUATION

3.1 Background and Schedule

The Watts Bar Nuclear Plant (WBN), Units 1 and 2 share a common SFP. The SFP is approximately 31-feet wide by 40-feet long and 48-feet deep.

The licensee submitted its OIP on February 28, 2013. The OIP states that installation of the SFP level instrumentation for the shared SFP associated with Units 1 and 2 is scheduled for completion prior to November 5, 2015, for Unit 1 and prior to November 5, 2015, or Unit 2 initial startup, whichever occurs first, for Unit 2. In its letter dated August 28, 2013, the licensee revised its target completion date to August 31, 2014, for full site implementation.

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, such that it's within two refueling cycles after submittal of the OIP, but prior to December 31, 2016, for Unit 1, and prior to issuance of an operating license for Unit 2, which is not expected to occur prior to December 2014.

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 described Level 1 as the indicated level on either the primary or backup instrument channel of greater than 26.3 feet (ft.) above the top of active fuel seated in the storage racks. The licensee stated that 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 September 6, 2013, the licensee stated that TVA will use the normal SFP water level at WBN (749.125 ft. above mean sea level) as Level 1. According to the licensee, the normal SFP water level is higher than the top of the coolant inlet pipe, which is at elevation 745.125 ft.

Additionally, in its letter dated September 6, 2013, the licensee stated, in part, that

> WBN "Spent Fuel Pool Cooling System Flow and Temperature Calculations during Flood Mode and Normal Mode" has determined that adequate NPSH for SFP cooling pumps exists for temperatures up to 190 degrees Fahrenheit (F). However, this analysis does not ensure NPSH protection for temperatures that exceed 190 degrees F. TVA has entered the requirement to provide operational guidance for NPSH protection during saturated conditions in the Corrective Action Program. WBN will evaluate procedure changes and calculation changes to support operation during a beyond design basis saturated condition above 190 degrees F. TVA will provide an update to the resolution by October 31, 2013.

The NRC staff notes that the licensee has provided two different elevations for Level 1. In its OIP the licensee provided an indicated level in either instrument of 26.3 ft. from the top of active fuel seated in the storage racks (which corresponds to an elevation of 749.08 ft.). In its September 6, 2013, letter the licensee provided the normal water level elevation of 749.125 ft. as Level 1. This change occurred after the licensee performed calculation, "Spent Fuel Pool Cooling System Flow and Temperature Calculations During Flood Mode and Normal Mode" and the licensee identified that the result does not ensure adequate NPSH protection for temperatures that exceed 190 °F. As stated in NEI 12-02, Level 1 is to be established at the higher of the two SFP elevations described above. At this time, the elevation necessary to provide the required NPSH at saturated conditions specified by the pump manufacturer or engineering analysis is not available. The licensee stated that an update to the resolution of this issue will be provided to the NRC staff by October 31, 2013. The staff has concerns regarding the licensee's identification of Level 1. The staff has identified this request as:

RAI #1

Please provide the results of the calculation used to determine the water elevation necessary for the pump's required NPSH to confirm that Level 1 has been adequately identified.

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 the SFP Level 2 indicated level on either the primary or backup instrument channel would be greater than 10 ft. (+/- 1 foot) above the top of stored fuel seated in the storage racks.

In its letter dated September 6, 2013, the licensee provided a figure identifying various pool elevations and SFP instrumentation levels. In this figure, the licensee identified that Level 2 would be located at approximately 734.29 ft. with the top of the SFP rack at 724.29 ft.

The NRC staff notes that the level 2 elevation is 10 ft. above the top of stored fuel seated in the storage racks. The licensee designated Level 2 using the first of the two options described in NEI 12-02 for level.

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

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 states, in part, that

> 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 18.1 inches below the top of the fuel 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 [Open Item (OI)-1]. This monitoring level assures that there is adequate water level above the stored fuel seated in the rack.

In its letter dated September 6, 2013, the licensee stated, in part, that

> The Guided Wave Radar system can only sense level changes above the weight attached to the sensing cable 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. A sketch for Spent Fuel Pool Level is shown on page E1-3 which shows the locations of Levels 1, 2 and 3; the instrument full span range and top of fuel rack. 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 that the elevation for Level 3 is above the highest point of any spent fuel storage rack seated in the SFP. However, the staff has concerns regarding the distance above the SFP rack where level changes cannot be detected. The staff has identified this request as:

RAI #2

Please provide additional information regarding the distance defined by the manufacturer as the dead zone. Specifically, please provide the exact distance where there is the potential that level changes won't be detected, while accounting for instrument measurement uncertainty.

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 anticipated that both instruments will consist of fixed components. The licensee also stated that the primary instrument level sensor will be located in the northwest corner of the SFP (close to Unit 1) and the backup instrument level sensor will be located in the northeast corner of the SFP (close to Unit 2). Both instruments will provide continuous level indication from maximum operating level (26.6 ft. above the top of active fuel or 25.1 ft. above top of fuel storage racks) to the top of the fuel storage racks. The electronics for signal conditioning will be located inside the Unit 1 upper containment access room, for Unit 1, and the Unit 2 upper containment access room, for Unit 2.

The licensee's proposed plan, with respect to the number of channels for both of its SFPs, appears to be consistent with NEI 12-02, as endorsed by the ISG.

3.4 Design Features: Arrangement

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

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

NEI 12-02 states, in part, that

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

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

> Guided Wave Radar sensors will be mounted in the northwest corner and northeast 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 (northwest) 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 (northeast) 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 [OI-4]. In addition, the two channel sensors 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 September 6, 2013, the licensee stated, in part, that

> Engineering for the SFP Instrumentation Level channels has completed 10% design review. Design Change Notice (DCN) 59683 has been assigned for WBN Units 1 and 2 and is scheduled to be issued September 27, 2013. Details on actual mounting locations will be available after vendor mounting bracket design has been completed. TVA will provide these details by October 31, 2013.

The NRC staff notes that the detailed engineering design has not been completed at this time. The licensee indicated that details on actual mounting locations will be available after mounting bracket design is completed and details will be provide to the staff by October 31, 2013. The staff has identified these requests as:

RAI #3

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 sensors, and the proposed routing of the cables that will extend from the sensors toward the location of the local electronics cabinets and read-out/display devices in the main control room or alternate accessible location.

(This information was previously requested as RAI-2 in NRC letter dated August 2, 2013)

RAI #4

Please provide additional information describing how the proposed arrangement of the SFP Guided Wave radar sensing cables and routing of the instrumentation cabling between the SFP and final mounting location(s) of the monitoring read-out panels meets the Order requirements with respect to arrangement of the SFP level instrument channels in a manner that provides reasonable protection of the level indication function against missiles that may result from damage to the structure over the SFP.

3.5 Design Features: Mounting

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

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

NEI 12-02 states, in part, that

> The mounting shall be designed to be consistent with the highest seismic or safety classification of the SFP. An evaluation of other hardware stored in the SFP shall be conducted to ensure it will not create adverse interaction with the fixed instrument location(s).

> The basis for the seismic design for mountings in the SFP shall be the plant seismic design basis at the time of submittal of the Integrated Plan for implementing NRC Order EA-12-051.

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

> Level sensors will be mounted above the SFP, and qualified by analysis to the same requirements as Safety Related, Seismic Category I, as defined in the WBN seismic design basis. The remaining channel components and cable routing shall be mounted in accordance with the WBN Seismic Category 1 design requirements.

In its letter dated September 6, 2013, the licensee stated, in part, that

> Engineering for the Spent Fuel Pool Instrumentation (SFPI) Level channels has completed 10% design review. 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 these details by October 31, 2013.

The NRC staff notes that the design criteria and mounting details are not currently available. The licensee indicated that details will be provided to the staff by October 31, 2013. The staff has identified these requests as:

RAI #5

Please provide the following:

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

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

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

(This information was previously requested as RAI-3 in NRC letter dated August 2, 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 #6

For RAI 5(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 #7

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

3.6 Design Features: Qualification

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

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

NEI 12-02 states, in part, that

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

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

3.6.1 Augmented Quality Process

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

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

> Instrument channel reliability shall be established by use of an augmented quality assurance process. 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.

In its OIP, the licensee also stated that augmented quality requirements, similar to those applied to fire protection, will be applied to this project.

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;
- a concentrated borated water 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 sensor to the transmitter will be qualified for the SFP area environment.

The NRC staff has concerns with the licensee's lack of 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 #8

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 at the design location.

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 has concerns with the lack of 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 #9

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 Auxiliary Building near and above the SFP is assumed to be 100 percent with condensing steam.

The NRC staff has concerns with the lack of 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 #10

Please provide information confirming under BDB conditions, in which there is no ac power available to run HVAC systems, whether the sensor electronics is capable of continuously performing its required functions under the expected post event 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.

The staff notes that the details on qualification, including methodology and analysis to determine reliability of the SFPI level channels are not currently available and will be provided to the staff by October 31, 2013. This will be addressed in RAIs 11 and 12 below.

3.6.4 Seismic Reliability

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

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

> For seismic effects on 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.

The staff notes that the details on qualification, including methodology and analysis to determine reliability of the SFPI level channels are not currently available and will be provided to the staff by October 31, 2013. The staff has identified these requests as:

RAI #11

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 August 2, 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 #12

For RAI #11 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. The primary channel sensor will be mounted in the northwest corner of the SFP and the backup channel sensor will be mounted in the northeast 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 Currents (AC) buses.

In its letter dated September 6, 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. Conduit or other means of cable protection such as routing the cable inside the wall of the pool 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 Vital 120 Volt Alternating Current (VAC). In addition, station Vital 120 Vac 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.

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 with this arrangement, the loss of one backup power supply appears not to affect the operation of the independent channel under BDB event conditions. This independence would result in a reliable SFP level measurement. However, the NRC staff plans to review the final electrical power supply design information to complete its review. The staff has identified this request as:

RAI #13

Please provide the NRC staff with the final configuration of the power supply source for each channel, as well as cable and conduit separation, so that the staff may conclude that 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[.]

The licensee's proposed normal power supply is discussed in Section 3.7, "Design Features: Independence."

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-12-049 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 is in progress, 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-12-049 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) 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 September 6, 2013, the licensee stated, in part, that

a) A detailed description of Vital AC power system and its capacities has been provided in Chapter 8 of WBN Final Safety Analysis Report (FSAR) (Reference 9 in February 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 WBN installed electrical distribution system, including inverters and battery chargers are fully protected and seismically mounted inside a safety related structure and above flood elevation.

b) 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. TVA assumes a battery life of 84 hours which provides margin to the preliminary analysis of a 96 hour battery life. TVA revised 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 is noted in the WBN first 6-month update to the SFP OIP submitted August 28, 2013.

The NRC staff notes that the proposed criteria for sizing of the battery backup appears to be consistent with NEI 12-02, as endorsed by the ISG. However, the 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 staff has identified this request as:

RAI #14

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

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 accuracy will be consistent with the guidelines of NRC JLD-ISG-2012-03 and NEI 12-02.
>
> The instrument channel will be scaled from full pool to the top of the fuel rack. Top of active fuel is 18.1 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 [OI-1].

In its letter dated September 6, 2013, the licensee stated, in part, that

> Engineering for the SFPI Level channels has completed 10% design review. Details on accuracy and allowed deviation will be available after vendor design and calculations have been completed. TVA will provide these details by October 31, 2013.

The NRC staff has concerns with the licensee's lack of information regarding the effect on accuracy resulting from a loss and subsequent restoration of power. The staff notes that the details on accuracy and allowed deviation are not currently available and will be provided to the staff by October 31, 2013. The staff has identified these requests as:

RAI #15

Please provide the following:

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

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

(This information was previously requested as RAI-6 in NRC letter dated August 2, 2013)

In addition, the staff plans to verify that the channels will retain these accuracy performance values following a loss of power and subsequent restoration of power based on the licensee's response to the following RAI.

RAI #16

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

In its letter dated September 6, 2013, in the description of the SFP levels, the licensee indicated that the total distance above the SFP rack where level changes cannot be detected is less than 1 ft., and that the exact distance above the SFP rack has not been specified at this point.

RAI #17

Provide the SFP level instrumentation accuracy analysis results that confirm that level instrument accuracy is sufficient to read Level 3 with sufficient conservatism that ensures the fuel remains covered.

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.

In its letter dated September 6, 2013, the licensee stated that information regarding periodic testing and calibration, including how this capability enables the equipment to be tested in-situ will be available after vendor design, calculations and procedures have been completed. Further, this letter states that TVA will provide these details by October 31, 2013.

The NRC staff notes that the process described by the licensee for comparing full level indication of the SFP indicators to fixed marks within the SFP and the incorporation of a bracket into the sensor mounting design that provides a calibrated distance to raise the sensor appears to be reasonable. The staff notes that further information regarding periodic testing and calibration, including how this capability enables the equipment to be tested in-situ will be available for review by October 31, 2013. The staff has identified this request as:

RAI #18

Please provide the following:

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

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

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

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

(This information was previously requested as RAI-7 in NRC letter dated August 2, 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 September 6, 2013, the licensee stated, in part, that

> [The] WBN [Watts Bar] SFP is shared between both units and will have a total of two level instrument channels. One instrument channel display 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 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.

In addition, in its letter dated September 6, 2013, the licensee provided diagrams showing the location of the SFP display locations, and the route from the main control room to the electrical room, where the second instrument channel display will be located.

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 it will locate the backup SFP instrumentation display in the Electric Board Room, which is in close proximity to the Auxiliary Control Room. The staff is concerned with the lack of information regarding the specific location for the backup SFP instrumentation display. The staff has identified this request as:

RAI #19

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

b) **Please describe the evaluation used to validate that the backup 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 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" (References 5 and 7).

In its letter dated September 6, 2013, the licensee stated, in part, that

> Engineering for the SFPI Level channels has completed 10% design review. 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 these details by October 31, 2013.

The NRC staff notes that the details on inspection, maintenance, repair, operation, abnormal response and administrative control guidelines are not available for review at this time and will be provided to the staff by October 31, 2013. The staff has identified this request as:

RAI #20

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.

(This information was previously requested as RAI-7 in NRC letter dated August 2, 2013)

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 letter dated September 6, 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 these details by October 31, 2013.

The NRC staff notes that the details on routine testing guidelines, including channel checks, functional tests and periodic calibration verification are not available for review at this time and will be provided to the staff by October 31, 2013. The staff has identified this request as:

RAI #21

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 are performed and verified by inspection and audit to demonstrate conformance with**

design and system readiness requirements. Include a description of your plans for ensuring that necessary channel checks, functional tests, periodic calibration, and maintenance will be conducted for the level measurement system and its supporting equipment.

b) A description of how the guidance in NEI 12-02 Section 4.3 regarding compensatory actions for one or both non-functioning channels will be addressed.

c) A description of the compensatory actions to be taken in the event that one of the instrument channels cannot be restored to functional status within 90 days.

(This information was previously requested as RAI-11 in NRC letter dated August 2, 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." Reliable level indication will be functional during all modes of operation.

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.

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 301-415-8480 or e-mail at Andrew.Hon@nrc.gov.

Sincerely,

/RA/

Andrew Hon, Project Manager
Licensing Projects Branch II-2
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-390

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