



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

August 2, 2013

Mr. Joseph W. Shea  
Vice President, Nuclear Licensing  
Tennessee Valley Authority  
6A Lookout Place  
1101 Market Street  
Chattanooga, TN 37402-2801

**SUBJECT: WATTS BAR NUCLEAR STATION, UNIT 1 AND UNIT 2 – REQUEST FOR  
ADDITIONAL INFORMATION RELATED TO OVERALL INTEGRATED PLAN  
FOR RELIABLE SPENT FUEL POOL INSTRUMENTATION (ORDER NUMBER  
EA-12-051) (TAC NOS. MF0951 AND MF1178)**

Dear Mr. Shea:

By letter dated February 28, 2013, Tennessee Valley Authority submitted an Overall Integrated Plan in response to the March 12, 2012 (Agencywide Documents Access and Management System Accession No. ML13063A440), Commission Order to modify licenses with regard to requirements for Reliable Spent Fuel Pool Instrumentation (Order EA-12-051) for Watts Bar Nuclear Plant, Units 1 and 2.

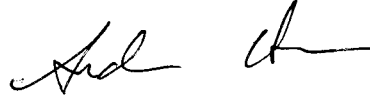
The U.S. Nuclear Regulatory Commission (NRC) staff is assessing your submittal and has determined that additional information is required to complete the assessment. The specific information requested is addressed in the enclosure to this letter. The proposed questions were discussed with your staff on July 18, 2013. Your staff confirmed that these questions did not include proprietary or security-related information and agreed to provide a response within 30 days from the date of this request for additional information (RAI).

J. Shea

- 2 -

The NRC staff considers that timely responses to RAIs help ensure sufficient time is available for staff review and contribute toward the NRC's goal of efficient and effective use of staff resources. If circumstances result in the need to revise the requested response date, please contact me at (301) 415-8480 or via e-mail [Andrew.Hon@nrc.gov](mailto:Andrew.Hon@nrc.gov).

Sincerely,

A handwritten signature in black ink, appearing to read "Andrew Hon", written in a cursive style.

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

Docket Nos. 50-390 and 50-391

Enclosure:  
Request for Additional Information

cc w/encl: Distribution via ListServ

REQUEST FOR ADDITIONAL INFORMATION  
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 NUMBERS 50-390 AND 50-391

**1.0 INTRODUCTION**

By letter dated February 28, 2013, (Agencywide Documents Access and Management System (ADAMS) Accession No. ML13063A440), Tennessee Valley Authority (TVA) submitted an Overall Integrated Plan (OIP) in response to the March 12, 2012, U.S. Nuclear Regulatory Commission (NRC) Order modifying licenses with regard to requirements for Reliable Spent Fuel Pool (SFP) Instrumentation (Order No. EA-12-051; ADAMS Accession No. ML12054A679) for Watts Bar Nuclear Plant, Units 1 and 2. The NRC staff endorsed Nuclear Energy Institute (NEI) 12-02 "Industry Guidance for Compliance with U.S. Nuclear Regulatory Commission (NRC) Order EA-12-051, to Modify Licenses with Regard to Reliable Spent Fuel Pool Instrumentation," Revision 1, dated August 2012 (ADAMS Accession No. ML12240A307), with exceptions as documented in Interim Staff Guidance 2012-03, "Compliance with Order EA-12-051, Reliable SFP Instrumentation," Revision 0, dated August 29, 2012 (ADAMS Accession No. ML12221A339).

The NRC staff has reviewed TVA's February 28, 2013, response and determined the following Request for Additional Information (RAI) is needed to complete its Technical Review.

**2.0 LEVELS OF REQUIRED MONITORING**

The OIP states, in part, that key SFP water levels will be identified as follows:

- Level adequate to support operation of the normal fuel pool cooling system - Indicated level on either the primary or backup instrument channel of greater than 26.3 feet above the top of active fuel seated in the storage racks 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.
- Level adequate to provide substantial radiation shielding for a person standing on the SFP operating deck - Indicated level on either the primary or backup instrument channel of greater than 10 feet (+/- 1 foot) above the top of stored fuel seated in the storage racks based on NEI 12-02 Section 2.3.2, bullet 1. This monitoring level ensures there is an adequate water level to provide substantial radiation shielding for a person standing on the SFP operating deck.

Enclosure

- Level where fuel remains covered - Indicated level on either the primary or backup instrument channel of greater than 0 feet above top of fuel storage rack. The primary and backup instrument channel sensing components are monitoring the fuel storage area. The design is not complete at this time, but TVA plans to scale instrument channels from full pool to top of fuel rack. The top of active fuel is 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. This monitoring level assures that there is adequate water level above the stored fuel seated in the rack.

### **RAI-1**

Please provide the following:

- a) The specific elevations within the SFP as Levels 1, 2, and 3. For Level 1, specify how the identified location represents the HIGHER of the two points described in the NEI 12-02 guidance for this level.
- b) A clearly labeled sketch depicting the elevation view of the proposed typical mounting arrangement for the portions of instrument channel consisting of permanent measurement channel equipment (e.g., fixed level sensors and/or stilling wells, and mounting brackets). Indicate on this sketch the datum values representing Level 1, Level 2, and Level 3 as well as the top of the fuel. Indicate on this sketch the portion of the level sensor measurement range that is sensitive to measurement of the fuel pool level, with respect to the Level 1, Level 2, and Level 3 datum points.

## **3.0 INSTRUMENTATION DESIGN FEATURES**

### **3.2 Arrangement**

The OIP states, in part, that:

Primary (fixed) instrument channel: The primary instrument channel level sensor will be located in northwest corner of the SFP (close to Unit 1). The electronics for signal conditioning will be located inside the Unit 1 upper containment access room. The primary instrument channel will provide continuous level indication from maximum operating level (26.6 feet above top of active fuel or 25.1 feet above top of fuel storage racks) to the top of the fuel storage racks (zero feet). The continuous indication will be provided by a Guided Wave Radar transmitter utilizing a remote sensor mounted above the SFP with a flexible cable extending down to the top of the fuel storage racks. TVA defines the top of the fuel storage rack to be the level within one foot above the rack.

Backup instrument channel: The backup instrument channel level sensor will be located in northeast corner of the SFP (close to Unit 2). The electronics for signal conditioning will be located inside the Unit 2 upper containment access room. The backup instrument channel will provide continuous level indication

from maximum operating level (26.6 feet above top of active fuel or 25.1 feet above top of fuel storage racks) to the top of the fuel storage racks (zero feet). The continuous indication will be provided by a Guided Wave Radar transmitter utilizing a remote sensor mounted above the SFP with a flexible cable extending down to top of fuel storage racks. TVA defines the top of the fuel storage rack to be the level within one foot above the rack.

## **RAI-2**

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.

### **3.3 Mounting**

The OIP states, 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.

## **RAI-3**

Please provide the following:

- a) The design criteria that will be used to estimate the total loading on the mounting device(s), including static weight loads and dynamic loads. Describe the methodology that will be used to estimate the total loading, inclusive of design basis maximum seismic loads and the hydrodynamic loads that could result from pool sloshing or other effects that could accompany such seismic forces.
- b) A description of the manner in which the level sensor (and stilling well, if appropriate) will be attached to the refueling floor and/or other support structures for each planned point of attachment of the probe assembly. Indicate in a schematic the portions of the level sensor that will serve as points of attachment for mechanical/mounting or electrical connections.
- c) A description of the manner by which the mechanical connections will attach the level instrument to permanent SFP structures so as to support the level sensor assembly.

### **3.4 Qualification**

The OIP states, 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. The NEI 12-06, "Diverse and Flexible Coping Strategies (FLEX) Implementation Guide" (References 5 and 7), defines requirements for availability of FLEX equipment. FLEX equipment necessary to mitigate the event will be available on site to ensure deployment can be accomplished in a timely manner.

#### **RAI-4**

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 beyond-design-basis (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.

### **3.5 Independence**

The OIP states, 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.

## RAI-5

Please provide the following:

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

### 3.6 Power supplies

The OIP states, 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.

#### **RAI-5**

Please provide the following:

- a) A description of the electrical AC power sources and capacities for the primary and backup channels.
- b) If the level measurement channels are to be powered through a battery system (either directly or through an Uninterruptible Power Supply), 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, consistent with the plant mitigation strategies for BDB external events (Order EA-12-049).

#### **3.7 Accuracy**

The OIP states, 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].

#### **RAI-6**

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 beyond-design-basis 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.



### 3.8 Testing

The OIP states, in part, that:

The instrument channel design will provide for routine testing and calibration consistent with the guidelines of NRC JLD-ISG-2012-03 and NEI 12-02.

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

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

#### RAI-7

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

### **3.9 Display**

The OIP states, in part, that:

The displays will be consistent with the guidelines of NRC JLD-ISG-2012-03 and NEI 12-02. 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.

#### **RAI-8**

Please provide the following:

- a) Since one of the display locations is not in the main control room, provide a description of the display location that addresses primary and alternate access route evaluation, continuous habitability at display location(s), continual resource availability for personnel responsible to promptly read displays, and provisions for verbal communications with decision makers for the various SFP drain-down scenarios and external events.
- b) The reasons justifying why the location selected will enable the information from these instruments to be considered "promptly accessible." Include consideration of various drain-down scenarios.

### **4.0 PROGRAM FEATURES**

#### **4.2 Procedures**

The OIP states, 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).

#### **RAI-10**

Please provide the following:

- a) A list of the operating (both normal and abnormal response) procedures, calibration/test procedures, maintenance procedures, and inspection procedures that will be developed for use of the SFP instrumentation in a manner that addresses the order requirements.

- b) A brief description of the specific technical objectives to be achieved within each procedure. If your plan incorporates the use of portable spent fuel level monitoring components, please include a description of the objectives to be achieved with regard to the storage location and provisions for installation of the portable components when needed.

#### **4.3 Testing and Calibration**

The OIP states, in part, that:

The instrument channel design will provide for routine testing and calibration consistent with the guidelines of NRC JLD-ISG-2012-03 and NEI 12-02.

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

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

#### **RAI-11**

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 nonfunctioning channels will be addressed.

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

J. Shea

- 2 -

The NRC staff considers that timely responses to RAIs help ensure sufficient time is available for staff review and contribute toward the NRC's goal of efficient and effective use of staff resources. If circumstances result in the need to revise the requested response date, please contact me at (301) 415-8480 or via e-mail [Andrew.Hon@nrc.gov](mailto:Andrew.Hon@nrc.gov).

Sincerely,

*/RA/*

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

Docket Nos. 50-390 and 50-391

Enclosure:  
Request for Additional Information

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