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

July 17, 2013

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

SUBJECT: SEQUOYAH NUCLEAR PLANT, UNITS 1 AND 2 – REQUEST FOR ADDITIONAL INFORMATION REGARDING OVERALL INTEGRATED PLAN FOR RELIABLE SPENT FUEL POOL INSTRUMENTATION (ORDER NO. EA-12-051) (TAC NOS. MF0794 AND MF0795)

Dear Mr. Nazar:

By letter dated February 28, 2013, you submitted an Overall Integrated Plan 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 Instrumentation (Order No. EA-12-051) for Sequoyah Nuclear Plant, Units 1 and 2.

The NRC staff is reviewing the submittal and has determined that additional information is required to complete its evaluation. This request was discussed with Mr. Kevin Casey of your staff on July 16, 2013, and it was agreed that a response would be provided within 30 days from the date of this letter.

If you have any questions regarding this matter, I can be reached at 301-415-1447.

Sincerely,

Farideh E. Saba

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

Docket No. 50-327 and 50-328

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

SEQUOYAH NUCLEAR PLANT, UNITS 1 AND 2

DOCKET NUMBERS 50-327 AND 50-328

1.0 INTRODUCTION

By letter dated February 28, 2013 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML13063A011), Tennessee Valley Authority (TVA) submitted an Overall Integrated Plan (OIP) in response to the March 12, 2012, U.S. Nuclear Regulatory Commission (NRC), Commission Order modifying licenses with regard to requirements for Reliable Spent Fuel Pool (SFP) Instrumentation (Order Number EA-12-051; ADAMS Accession No. ML12054A679) for Sequoyah Nuclear Plant (SQN), Units 1 and 2. The NRC staff endorsed Nuclear Energy Institute (NEI) 12-02, "Industry Guidance for Compliance with NRC Order EA-12-051, to Modify Licenses with Regard to Reliable SFP 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 Spent Fuel Pool Instrumentation," Revision 0, dated August 29, 2012 (ADAMS Accession No. ML12221A339).

The NRC staff has reviewed the February 28, 2013, response by the licensee and determined that the following request for additional information (RAI) is needed to complete its Technical Review. If any part of this information is not available within the 30-day response period for this RAI, please provide the date this information will be submitted.

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 26.6 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.

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

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 top of fuel storage rack to be the level within one foot above the rack.

RAI-1

Please provide the following:

a) The specific elevations within the plant SPF corresponding to the three levels described in the guidance provided in NEI 12-02 Revision 1. For Level 1, specify how the identified elevation 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 the 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.

c) Clarification regarding your statement "TVA defines top of fuel storage rack to be the level within one foot above the rack." Elsewhere in your submittal it is stated:

> "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."

Please provide an accurate description of the how the instrument level measurement range will envelope the three required Levels to be monitored per the Order requirements and the guidance in NEI 12-02, including how the bottom of the level measurement range relates to the top of the fuel racks.

3.0 INSTRUMENTATION DESIGN FEATURES

3.1 Arrangement

The OIP states, in part, that:

> Primary (fixed) instrument channel: The primary instrument channel level sensor will be located in northeast 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 (27.2 feet above top of active fuel or 25.8 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 top of 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 southeast 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 (27.2 feet above top of active fuel or 25.8 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 sensor and mounting brackets, and the proposed routing of the cables that will extend from the sensors toward the location of the read-out/display devices.

3.2 Mounting

The OIP states, in part, that:

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

The sensing cable will consist of a small diameter stainless steel cable suspended from a mounting bracket above the SFP water level and extending to the top of the fuel racks. A small weight will be located at the bottom of the cable to keep it straight. The weight will not be provided with a lateral restraint. Failure of the cable is expected to result in it lying on the bottom of the SFP or across the top of the fuel storage rack, where it would not impact spent fuel or pool cooling. Interaction between the sensing cable and the SFP wall will be evaluated. Based on the light weight of the sensing cable assembly it is assumed that it would survive an impact with the SFP wall with little or no damage.

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.

3.3 Qualification

The OIP states, 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 ISO9001, 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.

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 (g)-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.

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 spent fuel pool area, and b) any control boxes, electronics, or read-out and re-transmitting devices that will be employed to convey the level information from the level sensor to the plant operators or emergency responders.

c) A description of the specific method or combination of methods that will be used to confirm the reliability of the permanently installed equipment such that following a seismic event the instrument will maintain its required accuracy.

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

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 read-out 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 read-out devices, and the independence of the displays.

3.5 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-1 2-049 and will provide power to the Vital Battery Chargers. See Reference 9 Chapter 8 for a detailed description of the existing Vital AC power distribution.

- The backup instrument channel components will be powered by batteries maintained in a charged state by station Vital 120 Vac which is derived from Safety Related Vital Batteries. A different station Vital 120 Vac power source will be utilized than that chosen for the primary instrument channel. Secondary instrument channel battery sizing will be completed as part of the design change, but is anticipated to provide continuous indication for a period of at least 96 hours. SFP instrument battery charger will have power available any time the vital batteries and Vital Inverters power source is available. Vital Batteries and Vital Inverters are anticipated to be continuously available because FLEX D/Gs are being added as part of Order EA-1 2-049 and will provide power to the Vital Battery Chargers. See Reference 9 Chapter 8 for a detailed description of the existing Vital AC power distribution.

- Both the primary and backup channels will be designed to allow an alternate AC source to be readily connected. The alternate AC source will be from the FLEX 225 Kilo Volt-Ampere (kVA) diesel generator (D/G) through a step down transformer. The FLEX 225 kVA D/G and associated connections will be stored in accordance with reasonable protection guidance of NEI 12-06 as defined by NEI 12-02.

RAI-6

Please provide the following:

a) A description of the normal 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).

3.6 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 17.1 inches below the top of the rack. The instrument channel accuracy calculation, which includes all instrument channel components, is not complete at this time; however, TVA anticipates the instrument channel uncertainty to be less than 12 inches [OI-1].

RAI-7

Please provide the following:

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

b) A description of the methodology 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.

3.7 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-8

Please provide the following:

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

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

c) A description of how 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.

3.8 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-9

Please provide the following:

a) A description of the specific location for the back-up display that is not located in the Main Control Room.

b) For display locations that are not within 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.

c) The reasons justifying why the locations selected enable the information from these instruments to be considered "promptly accessible" from a response time perspective. Discuss various drain-down scenarios.

4.0 PROGRAM FEATURES

4.1 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 responses to 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 spent fuel pool 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.

4.2 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.
>
> 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 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.

July 17, 2013

Mr. Joseph W. Shea
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Tennessee Valley Authority
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Chattanooga, TN 37402-2801

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If you have any questions regarding this matter, I can be reached at 301-415-1447.

Sincerely,

/RA/

Farideh E. Saba, Senior Project Manager
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