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

June 18, 2013

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

SUBJECT: BROWNS FERRY NUCLEAR PLANT, UNITS 1, 2, AND 3 - REQUEST FOR ADDITIONAL INFORMATION REGARDING OVERALL INTEGRATED PLAN IN RESPONSE TO THE COMMISSION ORDER MODIFYING LICENSES WITH REGARD TO REQUIREMENTS FOR RELIABLE SPENT FUEL POOL INSTRUMENTATION (ORDER NUMBER EA-12-051) (TAC NOS. MF0881, MF0882, AND MF0883)

Dear Mr. Shea:

By letter dated February 28, 2013 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML13063A437), Tennessee Valley Authority submitted an Overall Integrated Plan in response to the March 12, 2012, Commission Order modifying licenses with regard to requirements for reliable spent fuel pool Instrumentation (Order Number EA-12-051) for Browns Ferry Nuclear Plant, Units 1, 2, and 3. Further, the staff endorsed Nuclear Energy Institute (NEI) document 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, with exceptions, as documented in Interim Staff Guidance JLD-ISG-2012-03, "Compliance with Order EA-12-051, Reliable Spent Fuel Pool Instrumentation," Revision 0, dated August 29, 2012.

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. Tom Hess of your staff on June 14, 2013, and it was agreed that a response to the enclosed request for additional information would be provided within 30 days of the date of this letter.

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

Sincerely,

Sara P. Lingam for

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

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

Enclosure:
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

BROWNS FERRY NUCLEAR PLANT UNITS 1, 2, AND 3

DOCKET NOS. 50-259, 50-260, AND 50-296

## 1.0 INTRODUCTION

By letter dated February 28, 2013 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML13063A437), Tennessee Valley Authority (TVA, the licensee) 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 Browns Ferry Nuclear Plant (BFN), Units 1, 2, and 3. 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 Spent Fuel Pool Instrumentation," Revision 1, dated August 2012 (ADAMS Accession No. ML12240A307), with exceptions as documented in Interim Staff Guidance JLD-ISG-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, provide the date this information will be submitted.

## 2.0 LEVELS OF REQUIRED MONITORING

The OIP states, in part, that:

> Level 1 - The water level where either the primary or backup instrument channel of greater than 23.7 feet above the top of active fuel seated in the storage racks based on uncovering the weir that provides the flow path into the surge tank.
>
> Level 2 - The water level where either the primary or backup instrument channel of greater than 10 feet (plus or minus 1 foot) above the top of the 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 3 - The water level where 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 13 inches below the top of the rack. An instrument channel accuracy calculation, which includes all instrument channel components, is not complete at this time."

RAI-1

Provide the following:

a) 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:

> 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.

RAI-2

Provide a clearly labeled sketch or marked-up plant drawing of the plan view of the SFP area, depicting the SFP inside dimensions, the planned locations/placement of the primary and backup SFP level probes, and the proposed routing of the cables that will extend from the probes toward the location of the readout/display device.

3.3 Mounting

The OIP states, in part, that:

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

RAI-3

Provide the following:

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

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

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

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, 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.
>
> 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*, 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

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

RAI-5

Provide the following:

a) A description of how the two channels of the proposed level measurement system 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 on how each level measurement system, consisting of level probe, electronics, cabling, and readout devices will be designed and installed to address independence through the application and selection of independent power sources, the use of 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 primary instrument channel components will be powered by batteries maintained in a charged state by station 120 Vac which is derived from a reliable source. Primary instrument channel battery size is anticipated to provide continuous indication for a period of at least 96 hours.
>
> The backup instrument channel components will be powered by batteries maintained in a charged state by station 120 Vac which is derived from a reliable source. A different station 120 Vac power source will be utilized than that chosen for the primary instrument channel. Secondary instrument channel battery size is anticipated to provide continuous indication for a period of at least 96 hours.
>
> Both the primary and backup channel on each unit will be designed to allow an alternate AC source to be readily connected. The alternate AC source routing and connection strategy will be defined as part of the SFP level channel design package, but, it is anticipated to utilize cabling that is independent of normal distribution of AC to the battery charger and be supplied from the FLEX 225 Kilo Volt-Ampere (kVA) diesel generator (D/G). The FLEX 225 kVA D/G and associated connections will be stored in accordance with reasonable protection guidance of NEI 12-06 as defined by NEI 12-02.

RAI-6

If the level measurement channels are to be powered through a battery system (either directly or through an uninterruptible power supply), 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 FLEX Program plans.

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 the full pool to the top of the fuel rack. Top of active fuel is 13 inches below the top of the rack. The instrument channel accuracy calculation, which includes all of the instrument channel components, is not complete at this time; however, TVA anticipates the instrument channel uncertainty to be less than 12 inches. The primary and backup instrument channels will be designed to maintain their design accuracy following a power interruption or change in power source without recalibration.

RAI-7

Provide the following:

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

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

3.8 Testing

The OIP states, in part, that:

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

RAI-8

Provide the following:

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

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

c) A description of how functional checks will be performed, and the frequency at which they will be conducted. Describe how calibration tests will be performed, and the frequency at which they will be conducted. Provide a discussion on the measures that will be taken to detect when the instrumentation is operable but degraded. Provide a discussion as to how these surveillances will be incorporated into the plant surveillance program.

d) A description of what 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 for each unit will be located in the Main Control Room. The other instrument channel display for each unit is anticipated to be located in close proximity to the Backup Control Room. The specific locations will be determined during detailed design. Both indicator locations are promptly accessible to plant operations staff and do not require personnel to enter the area surrounding the SFP.

RAI-9

Provide responses to the following:

a) The location for the backup instrument. If location is other than the main control room, then provide justification for prompt accessibility to display including primary and alternate route evaluation, habitability at display location(s), continual resource availability for personnel responsible to promptly read displays, and provisions for communications with decision makers for the various SFP drain-down scenarios and external events.

b) The reasons justifying why the locations selected enable the information from these instruments to be "promptly accessible" with consideration to 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."

RAI-10

Provide a description of the standards, guidelines and/or criteria that will be utilized to develop procedures for inspection, maintenance, repair, operation, abnormal response, and administrative controls associated with the SFP level instrumentation, as well as storage and installation of portable instruments.

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 instrument channel design will include provisions for routine testing and calibration. The instrumentation will allow for in-situ testing and calibration to minimize calibration effort and instrument downtime.
>
> Existing work control processes such as Calibration Surveillance Instructions (SIs), Preventative Maintenance procedures and Work Orders will be utilized to perform testing and maintenance on the instrument channels. The SIs or periodic instructions will validate the functionality of the installed instrument channels within 60 days of a planned refueling outage considering normal testing scheduling allowances (e.g., plus or minus 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

Provide the following:

a) Further information describing the maintenance and testing program the licensee will establish and implement to ensure that regular testing and calibration is performed and verified by inspection and audit to demonstrate conformance with design and system readiness requirements. Include a description of your plans for ensuring that necessary channel checks, functional tests, periodic calibration, and maintenance will be conducted for the level measurement system and its supporting equipment.

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

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

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

Sincerely,

***/RA by SLingam for/***

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

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

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