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

October 30, 2013

Mr. C. R. Pierce
Regulatory Affairs Director
Southern Nuclear Operating Company, Inc.
Post Office Box 1295, Bin - 038
Birmingham, AL 35201-1295

SUBJECT: INTERIM STAFF EVALUATION AND REQUEST FOR ADDITIONAL INFORMATION – FARLEY NUCLEAR PLANT, UNITS 1 AND 2 (FNP) REGARDING OVERALL INTEGRATED PLAN (OIP) FOR RELIABLE SPENT FUEL POOL INSTRUMENTATION (ORDER NUMBER EA-12-051) (TAC NOS. MF1429 and MF1430)

Dear Mr. Pierce:

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 27, 2013 (ADAMS Accession No. ML13059A388), the Southern Nuclear Operating Company (the licensee) provided the Overall Integrated Plan (OIP) for the Farley Nuclear Plant, Units 1 and 2, describing how it will achieve compliance with Attachment 2 of Order EA-12-051. By letters dated August 20, 2013 (ADAMS Accession No. ML13233A111) and August 27, 2013 (ADAMS Accession No. ML13240A219), the licensee provided supplemental information.

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.

The enclosed interim staff evaluation provides preliminary NRC staff conclusions in areas where the licensee has provided sufficient information and identifies areas where additional information is needed. In order for the staff to review the final licensee's SFP instrumentation OIP and complete the staff evaluation, all the requested information must be provided no later than March 31, 2014, to ensure that any issues are resolved prior to the date by which the licensee

must complete full implementation of Order EA-12-051. The licensee should adjust its schedule for providing information to ensure that all this information is provided by the requested date.

A final NRC staff evaluation will be issued after the licensee has provided the information requested.

If you have any questions regarding this letter, please contact me at 301-415-1493 or via e-mail at Robert.Martin@nrc.gov.

Sincerely,

Robert Martin

Robert E. Martin, Senior, Project Manager
Plant Licensing Branch II-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket Nos. 50-348 and 50-364

Enclosure:
Interim Staff Evaluation and
Request for Information

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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 SOUTHERN NUCLEAR OPERATING COMPANY, INC. JOSEPH M. FARLEY NUCLEAR PLANT UNITS 1 AND 2 DOCKET NOS. 50-348 AND 50-364

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 27, 2013 (ADAMS Accession No. ML13059A388), Southern Nuclear Operating Company, Inc. (the licensee) provided the OIP for Joseph M. Farley, Units 1 and 2, describing how it will achieve compliance with Attachment 2 of Order EA-12-051 by spring 2015, for Unit 1 and fall 2014, for Unit 2. By letter dated August 1, 2013 (ADAMS Accession No. ML13203A210), the NRC staff sent a request for additional information (RAI) to the licensee. The licensee provided supplemental information by letters dated August 20, 2013 (ADAMS Accession No. ML13233A111), and August 27, 2013 (ADAMS Accession No. ML13240A219).

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

Each unit at Joseph M. Farley Nuclear Plant (FNP) has its own SFP. The SFP is located in the Auxiliary Building. The SFPs are similar in construction and are not interconnected in any way. Each pool is 45 feet (ft.) long by 27 feet (ft.) wide (nominal).

The licensee's OIP was submitted on February 27, 2013. The OIP states that installation of the SFP level instrumentation at FNP will be completed by spring 2015, for Unit 1, and fall 2014, for Unit 2, which is prior to startup from the second refueling outage after submittal of this OIP, for each unit.

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

3.2 Spent Fuel Pool Water Levels

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

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

NEI 12-02 states, in part, that

> Level 1 represents the HIGHER of the following two points:
>
> - The level at which reliable suction loss occurs due to uncovering of the coolant inlet pipe, weir or vacuum breaker (depending on the design), or
>
> - The level at which the water height, assuming saturated conditions, above the centerline of the cooling pump suction provides the required net positive suction head specified by the pump manufacturer or engineering analysis.

In its OIP, the licensee stated that, for both units, Level 1 would be set at elevation 153 ft. 4 inches (in.) which is the fuel pool level adequate to support spent fuel pump Net Positive Suction Head (NPSH) requirements.

In its letter dated August 20, 2013, the licensee stated, in part, that

> For compliance with NRC Order EA-12-051 for SFP Level indications, SNC selected Level 1 based on a specific basis as stated in the OIP of February 27, 2013. Level 1 is selected as the current low level system alarm set point for Plant Farley of elevation 153'-4". This is a higher elevation than the top of the suction pipe elevation for the normal SFP cooling system of 150'-1".

The NRC staff notes that Level 1 is located at elevation 153 ft. 4 in. and that this level is adequate for normal SFP cooling system operation and it is also adequate to ensure the required fuel pool cooling pump NPSH. The staff also notes that this level represents the higher of the two points described in NEI 12-02 for Level 1.

NEI 12-02 states, in part, that

> Level 2 represents the range of water level where any necessary operations in the vicinity of the spent fuel pool can be completed without significant dose consequences from direct gamma radiation from the stored spent fuel. Level 2 is based on either of the following:
>
> - 10 feet (+/- 1 foot) above the highest point of any fuel rack seated in the spent fuel pools, or
>
> - a designated level that provides adequate radiation shielding to maintain personnel radiological dose levels within acceptable limits while performing local operations in the vicinity of the pool. This level shall be based on either plant-specific or appropriate generic shielding calculations, considering the emergency conditions that may apply at the time and the scope of necessary local operations, including installation of portable SFP instrument channel components.

In its OIP, the licensee stated that, for both units, Level 2 would be set at elevation of 139 ft. 3/8 in., which corresponds to approximately 10 ft. above the highest point of the SFP fuel racks.

In its letter dated August 20, 2013, the licensee provided a sketch depicting the SFP elevations and levels. The NRC staff reviewed this sketch and notes that Level 2 is identified at elevation 139 ft. 2.5 in. above the top of the storage racks. The staff notes that there is a slight variation in the elevation provided for Level 2 in the OIP, at 139 ft. 3/8 in., and in letter dated, August 20, 2013, at 139 ft. 2.5 in. This item is addressed in RAI #1.

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 stated that, for both units, Level 3 would be set at elevation 129 ft. 3/8 in. which is the nominal level of the highest spent fuel rack.

In its letter dated August 20, 2013, the licensee provided a sketch depicting the SFP elevations and levels. The NRC staff reviewed this sketch and notes that Level 3 is identified at elevation 129 ft. 2.5 in. which is in alignment with the top of the storage racks. The staff notes that there is a slight variation in the elevation provided for Level 3 in the OIP, at 129 ft. 3/8 in., and in letter dated, August 20, 2013, at 129 ft. 2.5 in. The staff has identified this request as follows:

RAI #1

Please provide clarification on the elevation identified as Level 2, the elevation of the highest point of any fuel rack seated in the SFP, and the elevation identified as Level 3.

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 states that the primary and backup instrument channels will consist of fixed components and that the measured range will be continuous from the high pool level elevation 153 ft. 10 in. to the top of the spent fuel racks at elevation 129 ft. 3/8 in.

In its letter dated August 20, 2013, the licensee provided a sketch that depicts an elevation view of the Unit 1 and 2 SFPs. This sketch shows that the top of the measuring span would be at elevation 154 ft. 1 in. and the bottom would be at elevation 129 ft. 5.5 in. In addition, in its letter dated August 20, 2013, the licensee stated that the level sensor sensitive measurement range would span from a minimum of 3 inches above the high SFP level alarm setpoint to 3 in. above the top of the SFP rack.

The NRC staff notes that there is a slight variation in the SFP level instrumentation measurement range to cover the elevations identified Levels 1, 2 and 3. The staff has identified this request as follows:

RAI #2

Please identify the final SFP level instrumentation measurement range appropriate to the resolution of the Levels identified in the response to RAI #1 above.

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

> SFP level probes will be installed separate from each other in the SFP...
>
> Specific channel level sensing components physical properties and installation details will be provided later after the engineering and design phase is completed.
>
> The probe support (including stilling well) will be designed to shield the probe from event generated missiles (falling debris). The design of the probe and probe support will allow the fuel handling machine to pass over it without interference.

> Cabling for power supplies and indications for each channel will be separated for missile protection (falling debris) and routed in separate conduits from cabling for the other channel.

In its letter dated August 20, 2013, the licensee included marked up plant drawings showing a plan view of the SFP area of each unit. These drawings showed the anticipated areas the sensors might be located. In this letter, the licensee indicated that the routing of the instrument cables from the sensors to the display device would be determined after a location for the display unit has been finalized. The licensee also stated that SNC intends to provide additional information regarding SFP level instrumentation arrangement in the February 2014, OIP 6-month update.

The NRC staff notes that the information regarding arrangement is not currently available for review and that the licensee intends to provide this information to the staff in the February 2014, OIP six month update. The staff has identified this request as follows:

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 sensor, and the proposed routing of the cables that will extend from these sensors toward the location of the read-out/display device.

(This information was previously requested as RAI-2 in NRC letter dated August 1, 2013)

3.5 Design Features: Mounting

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

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

NEI 12-02 states, in part, that

> The mounting shall be designed to be consistent with the highest seismic or safety classification of the SFP. An evaluation of other hardware stored in the SFP shall be conducted to ensure it will not create adverse interaction with the fixed instrument location(s).
>
> The basis for the seismic design for mountings in the SFP shall be the plant seismic design basis at the time of submittal of the Integrated Plan for implementing NRC Order EA-12-051.

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

> Per NEI 12-02 Section 3.3, Mounting, the new equipment will be mounted to maintain the current Seismic Class of the Spent Fuel Pool which is Seismic Class

I (Reference 10 -Section 3.8.4). Thus, the new equipment will be seismically qualified to Class I. In addition, the mounting of the primary and backup channel components throughout the plant will meet the criteria of the structure it will be routed through or attached to.

In its letter dated August 20, 2013, the licensee stated, in part, that

SNC Response to RAI-3a

The methodology that will be used to estimate the total loading for the mounting devices will be based upon the seismic analytical methods and test results performed in accordance with IEEE 344. Computational Fluid Dynamics (CFD) analysis will be performed to estimate the total hydrodynamic forces. The total loading on the mounting devices includes static weight, seismic, hydrodynamic, and other applicable loads in accordance with Plant Farley design criteria. The detailed design will be contained in the completed mounting documentation package. Sloshing will be addressed by the vendor's analysis methods, typically by increasing the resultant forces by an acceptable percentage.

SNC Response to RAI-3b

Details of the level sensor and stilling well mounting design will be determined by the SFP mechanical and operational requirements. SFP walk down activities have recently been performed and the design activities associated with the level sensor mounts began in June 2013. Completion and acceptance of the design is currently scheduled prior to the February 2014 Overall Integrated Plan 6 month update. SNC intends to provide specific sensor mounting design information in the February 2014 Overall Integrated Plan 6-month update.

SNC Response to RAI-3c

Details 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 are determined by the SFP mechanical design and operational requirements. SFP walk down activities have recently been performed and the design activities associated with the manner by which the mechanical connection will attach the level instrument to permanent SFP structures began in June 2013. These details will be designed in accordance with Plant Farley design criteria. Completion and acceptance of the design is currently scheduled prior to the February 2014 Overall Integrated Plan 6 month update. SNC intends to provide specific sensor mounting design information in the February 2014 Overall Integrated Plan 6 month update.

The NRC staff notes that the information regarding mounting of each instrument channel is not currently available for review and that the licensee intents to provide this information to the staff in the February 2014, six month update. The staff has identified these requests as follows:

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 1, 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 RAIs.

RAI #6

For RAI 5(a) above, please provide 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 and (3.6.2) Qualification and Reliability.

3.6.1 Augmented Quality Process

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

In its OIP, the licensee stated that augmented quality requirements, similar to those applied to fire protection, would be applied to the components installed in response to this Order.

The licensee's proposed augmented quality assurance process appears to be consistent with NEI 12-02, as endorsed by the ISG.

3.6.2 Qualification and Reliability

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.

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

> The components/cables/connections for both primary and backup channels will be reliable at the temperature, humidity, and radiation levels consistent with the spent fuel pool water at saturation conditions for seven (7) days. Saturation temperature at the bottom of the SFP assuming normal water level will be approximately 250°F. Post event temperature at sensors located above the SFP is assumed to be 212°F. Post event humidity in the SFP room is assumed to be 100% with condensing steam. The components/cables/connections will be qualified for expected conditions at the installed location assuming the SFP has been at saturation for an extended period. The components/cables/connections located in the vicinity of the SFP will be qualified to withstand peak and total integrated dose radiation levels for their installed location assuming that post event SFP water level is equal to the top of irradiated fuel for a time no greater than six (6) hours. It is anticipated that the station personnel can align one of the three (3) SFP Cooling Strategies as detailed in NEI 12-06 if conditions are degrading as indicted by decreasing SFP level.

Related to post-event conditions, in its letter dated August 20, 2013, the licensee stated, in part, that

> The equipment will be qualified seismically (IEEE 344) and environmentally (IEEE 323). The "in-pool" components and transmitter will be qualified to ANSIIISA-S71.03 Class SA 1 (Shock) and ANSI/ISA-S71.03 Class VC2 (Vibration). These qualifications will be performed to bounding conditions. As part of the design change process, the seismic qualification for the equipment will be reviewed by SNC for the specific location at Plant Farley to ensure that the bounding conditions envelope the specific plant conditions. An instrument/ equipment qualification calculation will be prepared to document the radiation as a function of the water level covered on the top of spent fuel during normal operation and [beyond design basis] BDB conditions.

Related to seismic reliability, in its letter dated August 20, 2013, the licensee stated, in part, that

> Equipment robustness and reliability will be assured through the use of conservative design margins and a seismic qualification process that will confirm accurate instrumentation performance during and following a seismic event. However, the specific method or combination of methods that would be used to confirm the reliability of the permanently installed equipment has not yet been determined by the instrumentation manufacturer.

The NRC staff notes that the information regarding qualification and reliability of the SFP level instrumentation is not currently available for review. The staff has identified these requests as follows:

RAI #8

Please provide the following:

a) **A description of the specific method or combination of methods you intend to apply to demonstrate the reliability of the permanently installed equipment under BDB ambient temperature, humidity, shock, vibration, and radiation conditions.**

b) **A description of the testing and/or analyses that will be conducted to provide assurance that the equipment will perform reliably under the worst-case credible design basis loading at the location where the equipment will be mounted. Include a discussion of this seismic reliability demonstration as it applies to a) the level sensor mounted in the SFP area, and b) any control boxes, electronics, or read-out and 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.**

(This information was previously requested as RAI-4 in the NRC letter dated August 1, 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 #9

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

3.6.3 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 that the primary and backup instrument channels are of the same technology, are permanently installed, separated by distance or barriers, and use independent power supplies from different buses/switchgear.

In its letter dated August 20, 2013, the licensee stated, in part, that

> Each level measurement system will be designed and installed to achieve physical and spatial separation and electrical independence. Independent power sources will be provided from separate 120V AC Distribution Panels, for both SFP level monitoring channels for each Farley Unit. Dedicated conduit will be used to provide physical separation between the probes and the transmitters. From the transmitters to the readouts, the separation will be in accordance with Plant Farley UFSAR Appendix 3A (RG 1.75). It is anticipated that different penetrations in the SFP room wall and other walls will be used for the level signals from the sensors to the readout devices, which will be mounted in separate enclosures.

The NRC staff notes that with this arrangement, the loss of one backup power supply will not affect the operation of the independent channel under BDB event conditions. The implementation of such design provisions appears to be consistent with NEI 12-02, as endorsed by the ISG, and the electrical functional performance of each level measurement channel would be considered independent of the other channel. However, the NRC staff plans to verify the final electrical power supply design information when it is provided. The NRC staff has identified this request as follows:

RAI #11

Please provide the NRC staff with the final configuration of the power supply source for each channel 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[.]

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

> Each channel will normally be powered from independent (different buses/switchgear) 120V AC power sources and will have a dedicated battery backup. The battery backup will be dedicated to each channel, should have the capability of automatically switching and operating on backup batteries and will have manual switching as a minimum. A minimum battery life of 24 hours will be provided to allow for power restoration from portable equipment (refer to attachment 2 for a typical sketch). Refer to Safety Function Support section of the SNC Integrated Plan February 28, 2013, submittal for NRC Order EA-12-049 for details on the power strategy from portable FLEX Diesel Generators (DGs).

In its letter dated August 20, 2013, the licensee stated, in part, that

> Each level measurement channel will be powered from a dedicated Uninterruptible Power Supply (UPS) and battery system supplied by the vendor.

> Each battery and UPS will be sized with margin by the vendor to power the load at its respective level monitoring channel for a minimum of one day (24 hours) under Station Blackout (SBO) conditions. The sizing criteria will be based on the ambient conditions expected during BDB/SBO, for the location(s) selected for the UPS/battery. In the detailed design, the vendor will provide the design basis sizing criteria which will be used for the battery, battery charger, and UPS. This design basis sizing criteria will be reviewed for margin and to ensure that each channel will be available to run reliably and continuously following the onset of the Beyond Design Basis (BDB) event for the minimum duration needed, consistent with plant FLEX program plans.

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 follows:

RAI #12

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

> Instrument channels will be designed such that they will maintain their design accuracy without recalibration following a power interruption or change in power source. SNC plans for the instrument design accuracy to be within ± 1 inch, or as close as reasonably achievable, over the entire range for the expected environmental and process conditions. Accuracy will consider SFP post event conditions, e.g., saturated water, steam environment, or concentrated borated water. Additionally, the instrument accuracy of the GWR technology will be sufficient to allow trained personnel to determine when the actual level exceeds

> the specified level of each indicating range (levels 1, 2 and 3) without conflicting or ambiguous indication. The accuracy will be within the resolution requirements of Figure 1 of NEI 12-02.

In its letter dated August 20, 2013, the licensee stated, in part, that

> The level sensor is designed to operate under the worst case postulated BDB operating conditions. The accuracy of the system will be +/-3 inches (+/-1 % of span) under all operating conditions which includes both normal SFP conditions and worst case conditions and encompasses the SFP level values at the Level 1, Level 2, and Level 3 datum points.
>
> The methodology will consist of utilizing test components provided by the vendor that will simulate a signal into the transmitter and performing a calibration on an annual basis in accordance with plant procedures which will utilize vendor recommendations. The calibration will certify the equipment end-to-end accuracy of +/-1 inch. A deviation of more than 2 inches between channel displays and/or any other pool level monitoring device constitutes reason to recalibrate all level monitoring channels.

The NRC staff notes that the estimated instrument channel design accuracies and methodology appear to be sufficient to maintain the instrument channels to within their designed accuracies before significant drift can occur. The NRC staff plans to verify that the licensee's proposed instrument performance is consistent with these estimated accuracy values. Further, the NRC staff plans to verify that the channels will retain these accuracy performance values following a loss of power and subsequent restoration of power. The staff has identified these requests as follows:

RAI #13

Please provide analysis verifying that the proposed instrument performance is consistent with these 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.

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

> Instrument channel design will provide for routine testing and calibration consistent with Order EA-12-051 and the guidance in NEI 12-02.
>
> - SNC plans for the design to facilitate in-situ testing and/or calibration of the Static or non-active installed (fixed) sensors
>
> - SNC plans for the design to facilitate the microprocessor based channel features to be capable of testing while mounted in the pool.
>
> - Existing work control processes will be used to control maintenance and testing. (e.g., Preventive Maintenance Program, Surveillance Program, Vendor Contracts, or work orders)
>
> - Other testing and calibration requirements are located in Program Controls testing sub section below.

In its letter dated August 20, 2013, the licensee stated, in part, that

> Guided wave radar level measurement systems determine pool depth by measuring the time of flight of a pulse from the transmitter to the water interface and back to the transmitter's receiver. A calibration device, provided by the manufacturer, incorporates time of flight delays equal to various pool levels. The device is connected to the transmitter and is exercised for each test level. Plant procedures will provide instructions to enable in-situ testing and calibration of the equipment.
>
> A post-calibration channel check between the two channels for the SFP level instruments will be completed per plant procedures. Existing permanently-installed SFP level indication is provided by a ruled scale mounted on the liner of the SFP. The two channels from the SFP level instruments may, at times, be cross-checked against this visual indication. An evaluation of the output from available level instrumentation will be used when determining the frequency of calibration activities on SFP level instruments.

The NRC staff notes that by comparing the levels in the instrument channels and the maximum level allowed deviation for the instrument channel design accuracy, the operators could determine if recalibration or troubleshooting is needed. Also, the staff notes that the licensee's proposed design, with respect to routine in-situ instrument channel functional and calibration tests, appears to be consistent with NEI 12-02, as endorsed by the ISG.

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 that the primary and backup indication will be provided in the Main Control Room, at the alternate shutdown panel, or another appropriate and accessible location that complies with the NEI 12-02 characteristics.

In its letter dated August 20, 2013, the licensee indicated it intends to provide information regarding the location of the SFP level instrumentation displays in the February 2014, six month OIP update. The staff has identified this request as follows:

RAI #15

Please provide the following:

a) **The specific location for the primary and backup instrument channel displays.**

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

3.12 Programmatic Controls: Training

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

> Personnel shall be trained in the use and the provision of alternate power to the primary and backup instrument channels.

NEI 12-02 states, in part, that

> The personnel performing functions associated with these SFP level instrumentation channels shall be trained to perform the job specific functions necessary for their assigned tasks (maintenance, calibration, surveillance, etc.). SFP instrumentation should be installed via the normal modification processes. In some cases, utilities may choose to utilize portable instrumentation as a portion of their SFP instrumentation response. In either case utilities should use the Systematic Approach to Training (SAT) to identify the population to be trained. The SAT process should also determine both the initial and continuing elements of the required training.

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

> A systematic approach will be used to identify the population to be trained and to determine both the initial and continuing elements of the required training. Personnel will complete training prior to being assigned responsibilities associated with this instrument.

The licensee's proposed plan, with respect to the training personnel in the use and the provision of alternate power to the primary and backup instrument channels, including the approach to identifying 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, 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 consistent with NEI 12-02. In its letter dated August 20, 2013, the licensee stated, in part, that

> Procedures for inspection, maintenance, repair, operation, abnormal response, and administrative controls associated with the SFP level instrumentation will be developed in accordance with existing controlled station administrative and technical procedures that govern procedure development. These procedures ensure standardization of format and terminology and ease of use along with assurance of a consistent level of quality.

The NRC staff has concerns with the licensee's lack of information about its plans to develop procedures. The staff previously requested this information as RAI-10 in NRC letter dated August 1, 2013. However, based on feedback from licensees, the staff revised this RAI as follows:

RAI #16

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 SFP instrumentation. The licensee is requested to include a brief description of the specific technical objectives to be achieved within each procedure.

3.14 Programmatic Controls: Testing and Calibration

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

> Processes shall be established and maintained for scheduling and implementing necessary testing and calibration of the primary and backup spent fuel pool level instrument channels to maintain the instrument channels at the design accuracy.

NEI 12-02 states, in part, that

> Processes shall be established and maintained for scheduling and implementing necessary testing and calibration of the primary and backup SFP level instrument channels to maintain the instrument channels at the design accuracy. The testing and calibration of the instrumentation shall be consistent with vendor recommendations or other documented basis.

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

> Processes will 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. Testing and calibration of the instrumentation will be consistent with vendor recommendations and any other documented basis. Calibration will be specific to the mounted instrument and the monitor. Out of service time as identified in NEI 12-02 will be incorporated consistent with the programmatic process used for compliance with NRC Order EA-12-049 (Order to Modify Licenses With Regard to Requirements for Mitigation Strategies for Beyond Design Basis External Events).

In its letter dated August 20, 2013, the licensee stated, in part, that

> In the event a channel of SFP level instrumentation is out of service for any reason, a condition report will be entered to restore the channel to service within 90 days. Functionality of the other channel will be confirmed via appropriate surveillance measures within the following 7 days and every 90 days thereafter until the non-functioning channel is restored to service. If both channels are determined to be non-functional, SNC will initiate appropriate actions within 24 hours.

In addition, in its letter dated August 20, 2013, the licensee indicated that further information regarding testing and calibration would be provided during the August 2014, 6-month integrated plan update.

The licensee's proposed plan, with respect to compensatory actions when a channel is out of service or when one of the instrument channels cannot be restored to functional status within 90 days appears to be consistent with NEI 12-02, as endorsed by the ISG. However, the staff has concerns regarding the lack of information regarding processes for testing and calibration of the SFP level instrumentation. The staff notes that the licensee anticipates submitting this information to the staff in the August 2014, six-month status report. The staff has identified this request as follows:

RAI #17

Please provide 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.

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 or NEI12-02, as discussed in Section 3.4, Qualification and 3.8, Testing.

Upon acceptable resolution of the RAIs noted above, the NRC staff will be able to reach 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.

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.

A final NRC staff evaluation will be issued after the licensee has provided the information requested.

If you have any questions regarding this letter, please contact me at 301-415-1493 or via e-mail at Robert.Martin@nrc.gov.

Sincerely,
/RA/
Robert E. Martin, Senior, Project Manager
Plant Licensing Branch II-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket Nos. 50-348 and 50-364

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Interim Staff Evaluation and
Request for Information

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