



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

October 28, 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 – HATCH NUCLEAR PLANT, UNITS 1 AND 2 (HNP) REGARDING OVERALL INTEGRATED PLAN (OIP) FOR RELIABLE SPENT FUEL POOL INSTRUMENTATION (ORDER NUMBER EA-12-051) (TAC NOS. MF0721 and MF0722)

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. ML13059A389), the Southern Nuclear Operating Company (the licensee) provided the Overall Integrated Plan (OIP) for the Hatch Nuclear Plant, Units 1 and 2, describing how it will achieve compliance with Attachment 2 of Order EA-12-051. By letters dated August 29, 2013 (ADAMS Accession No. ML13242A293) and August 27, 2013 (ADAMS Accession No. ML13240A236), 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 September 30, 2015, 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

C. Pierce

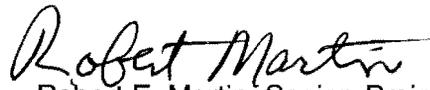
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schedule for providing information to ensure that all this information is provided by the requested date.

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

Docket Nos. 50-321 and 50-366

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
HATCH NUCLEAR PLANT, UNITS 1 AND 2
DOCKET NOS. 50-321 AND 50-366

1.0 INTRODUCTION

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, 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. ML13059A389), Southern Nuclear Operating Company (SNC) (the licensee) provided the OIP for Edwin I. Hatch Nuclear Plant Units 1 and 2, describing how it will achieve compliance with Attachment 2 of Order EA-12-051 by spring 2016, for Unit 1, and by December 31, 2016, for Unit 2. By letter dated August 1, 2013 (ADAMS Accession No. ML13203A118), the NRC staff sent a Request for Additional Information (RAI) to the licensee. The licensee provided supplemental information by letters dated August 29, 2013 (ADAMS Accession No. ML13242A293) and August 27, 2013 (ADAMS Accession No. ML13240A236).

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 this 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

Edwin I. Hatch Nuclear Plant (HNP) Units 1 and 2, have two independent SFPs located on the common refueling floor in secondary containment. The SFP for Unit 1 is 40 feet long by 33 feet wide (nominal); and the SFP for Unit 2 is 40 feet long by 28.5 feet wide (nominal).

The licensee's OIP was submitted on February 27, 2013. The OIP states that installation of the SFP level instrumentation at HNP will be completed by spring 2016 for Unit 1 based on the second refueling outage following submittal of this integrated plan. For Unit 2, the completion dated is by December 31, 2016, since the second refueling outage is after December 31, 2016.

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 Level 1 is the low level alarm setpoint which is at elevation 225 feet (ft.) 9 inches (in.) for Unit 1 and 226 ft. 2.5 in. for Unit 2. The licensee stated that this elevation is above the elevation where the pumps lose suction from a low level in the skimmer surge tank.

In its letter dated August 29, 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 Hatch at elevation 225'-9" for Unit 1 and 226'-2.5" for Unit 2, which is higher than the elevation of the Fuel Pool Cooling (FPC) System Skimmer Surge Tank low level alarm of 222'-0". These surge tanks supply the FPC pumps for both units. HNP selected Level 1 elevation meets Order EA-12 051 Level 1 criteria and not necessarily the criteria established in ISG-JLD-12-03, which endorsed NEI 12-02.

The NRC staff notes that Level 1 at 225 ft. 9 in., for Unit 1 and 226 ft. 2.5 in., for Unit 2 is adequate for normal SFP cooling system operation; it is also sufficient for net positive suction head (NPSH) and represents the higher of the two points described above.

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 1 and 2, Level 2 would be set at elevation 214 ft. 0 in., approximately 10 ft. 0 in. above the highest point of the fuel racks which are at elevation 204 ft. 0 in.

In its letter dated August 29, 2013, the licensee provided a sketch depicting the SFP elevations identified as Levels 1, 2 and 3 and the SFP level instrumentation measurement range. The NRC staff reviewed this sketch and notes that Level 2 is identified at elevation 214 ft. 0 in. which is approximately 10 ft. above the top of the storage racks. The staff also notes that the licensee designated Level 2 using the first of the two options described in NEI 12-02 for Level 2.

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 1 and 2, Level 3 would be set at elevation 204 ft. 0 in., which corresponds to the highest point of any rack seated in the SFP.

In its letter dated August 29, 2013, the licensee provided a sketch depicting the SFP elevations identified as Levels 1, 2 and 3 and the SFP level instrumentation measurement range. The

NRC staff reviewed this sketch and notes that Level 3 identified at elevation 204 ft. 0 in. is above the highest point of any spent fuel storage rack seated in the SFP.

The licensee's proposed plan, with respect to identification of Levels 1, 2, and 3, appears to be consistent with NEI 12-02, as endorsed by the ISG.

3.3 Design Features: Instruments

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

The instrumentation shall consist of a permanent, fixed primary instrument channel and a backup instrument channel. The backup instrument channel may be fixed or portable. Portable instruments shall have capabilities that enhance the ability of trained personnel to monitor spent fuel pool water level under conditions that restrict direct personnel access to the pool, such as partial structural damage, high radiation levels, or heat and humidity from a boiling pool.

NEI 12-02 states, in part, that

A spent fuel pool level instrument channel is considered reliable when the instrument channel satisfies the design elements listed in Section 3 [Instrumentation Design Features] of this guidance and the plant operator has fully implemented the programmatic features listed in Section 4 [Program Features].

In its OIP, the licensee stated that the primary and backup instrument channel level sensing components would be located and permanently mounted in the SFP, and would use Guided Wave Radar technology. According to the licensee, the primary and backup instrument channels would provide continuous level indication from the high pool level elevation (227 ft. 5 in.) to the top of the spent fuel racks at elevation (204 ft.).

In its letter dated August 29, 2013, the licensee provided a sketch depicting the SFP elevations identified as Levels 1, 2 and 3 and the SFP level instrumentation measurement range. This sketch shows that the level instrument would provide level indication from the high level alarm at 227 ft. 0.5 in. elevation to the top of the spent fuel racks at 204 ft. elevation. In this same letter the licensee clarified that the elevation for the high pool level elevation was inadvertently referenced as 227 ft. 5 in., and it should have been 227 ft. 0.5 in.

In addition, in its letter dated August 29, 2013, the licensee stated that the final level sensor sensitive measurement range and mounting arrangement would be provided in the February 2015 OIP six-month update.

The NRC staff notes that the range specified for the licensee's instrumentation will cover Levels 1, 2, and 3 as described in Section 3.2 above. The licensee's proposed plan, with respect to the number of channels for 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 license stated that SFP level probes will be installed separate from each other in the SFP. In its OIP, the licensee also stated, in part, that

Probes will consist of a small diameter stainless steel cable mounted within a protective sleeve (stilling well). The cable will end just above the fuel racks. Based on the light weight of the probe, it is assumed that the probe will survive the event with little or no damage. Likewise, the pool wall or spent fuel will not be damaged by any interaction with the protective sleeve during the event.

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.

The licensee's OIP included a sketch indicating the location of the level sensors. This sketch shows the indicators in the northwest and southwest corners of the SFPs for both Units 1 and 2.

In its letter dated August 29, 2013, the licensee provided marked up plant drawings for Units 1 and 2. These drawings show a plan view of the SFP area for each unit and the anticipated areas for locating level sensors.

The NRC staff noted that this sketch depicts a significant portion of the cables from the primary and back-up sensors for each unit to be run side by side from the redundant level probes to a common penetration on the refueling floor elevation before exiting the spent fuel pool area. The NRC staff has concerns regarding the routing of these two channels in accordance with the guidance on channel separation as described in NEI 12-02. Additional information is needed to enable the staff to complete its evaluation. The staff has identified this request as follows:

RAI #1

Please provide additional information describing how the proposed arrangement of the routing of the cabling between the level probes and the electronics cabinets that process the signal meets the Order requirement to arrange the SFP level instrument channels in a manner that provides reasonable protection of the level indication function against missiles that may result from damage to the structure over the SFP.

In its letter dated August, 29 2013, the licensee stated, in part, that

The routing of the instrument cables from the sensors to the display device will be determined after a location for the display unit has been finalized. The probe, mount, and cable, will not be accessible when the SFP area is not accessible. The electronics package and display will be accessible and habitable via non-heroic means during the response to event as required even when the SFP area is not accessible and habitable. SNC intends to provide the information concerning specific SFP sensor locations and SFP area cable routing in the February 2015 Overall Integrated Plan 6 month update.

The NRC staff notes that the information concerning specific SFP sensor locations and SFP area cable routing is not currently available for review and that the licensee intends to provide information in the February 2015, six-month OIP update. The staff has identified this request as follows:

RAI #2

Please provide additional information describing how the proposed arrangement of the SFP level instrumentation meets the Order requirement to arrange the SFP level instrument channels in a manner that provides reasonable protection of the level indication function against missiles that may result from damage to the structure over the SFP.

3.5 Design Features: Mounting

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

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

NEI 12-02 states, in part, that

The mounting shall be designed to be consistent with the highest seismic or safety classification of the SFP. An evaluation of other hardware stored in the

SFP shall be conducted to ensure it will not create adverse interaction with the fixed instrument location(s).

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

In its OIP, the licensee stated that the new equipment will be seismically qualified to Class I and that 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 29, 2013, the licensee stated, in part, that

The design phase of the SFP level instrumentation system will begin in January of 2014, with the design completion and plant organization acceptance of the design scheduled for October of 2014. SNC intends to provide the requested information in the February 2015 Overall Integrated Plan 6 month update.

The NRC staff notes that the information concerning mounting of the SFP level instrumentation is not currently available for review and that the licensee intends to provide the information in the February 2015, six-month OIP update. The staff has identified these requests as follows:

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.**

(This information was previously requested as RAI-3 in the 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 #4

For RAI 3(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 #5

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: (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, will 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, and...

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 fuel pool floor near and above the SFP 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 NEI12-06 if conditions are degrading as indicated by decreasing SFP level.

Related to qualification and reliability, in its letter dated August 29, 2013, the licensee stated, in part, that

The design phase of the SFP level instrumentation system will begin in January of 2014, with the design completion and plant organization acceptance of the

design scheduled for October of 2014. SNC intends to provide the requested information in the February 2015 Overall Integrated Plan 6 month update.

The NRC staff notes that information concerning qualification and reliability of the SFP level instrumentation is not currently available for review and that the licensee intends to provide information in the February 2015, six-month OIP update. The staff has identified these requests as follows:

RAI #6

Please provide the following:

- a) A description of the specific method or combination of methods that will be applied 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 #7

For RAI #6 above, please provide the results from 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 utilize independent power supplies from different buses/switchgear.

In its August 29, 2013, letter, the licensee stated, in part, that

The design phase of the SFP level instrumentation system will begin in January of 2014, with the design completion and plant organization acceptance of the design scheduled for October of 2014. SNC intends to provide the requested information in the February 2015 Overall Integrated Plan 6 month update.

The NRC staff notes that information concerning SFP level instrumentation channel independence is not currently available for review and that the licensee intends to provide the information in the February 2015, six-month OIP update. The staff has identified this request as follows:

RAI #8

Please 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 sensor 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.**

(This information was previously requested as RAI-5 in the NRC letter dated August 1, 2013)

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.

In addition, in its OIP, the licensee provided preliminary sketches showing electrical connections and possible AC power sources for SFP level instruments for Units 1 and 2.

In its letter dated August 29, 2013, the licensee stated that the normal electrical AC power will be provided by different sources from the 120V AC Distribution System for each level measurement channel. In this same letter, the licensee stated, in part, that

The design phase of the SFP level instrumentation system will begin in January of 2014, with the design completion and plant organization acceptance of the design scheduled for October of 2014. SNC intends to provide the requested information in the February 2015 Overall Integrated Plan 6 month update.

The NRC staff notes that information concerning power supply for the SFP level instrumentation is not currently available for review and that the licensee intends to provide the information in the February 2015, six-month OIP update. The staff has identified this request as follows:

RAI #9

Please provide the following:

- a) A description of the electrical ac power sources and capabilities for the primary and backup channels.**
- b) 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.**

(This information was previously requested as RAI-6 in the NRC letter dated August 1, 2013. However, based on feedback from the licensees, it was revised as above.)

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 boric 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 NEI12-02.

In its letter dated August 29, 2013, the licensee stated, in part, that

The design phase of the SFP level instrumentation system will begin in January of 2014, with the design completion and plant organization acceptance of the design scheduled for October of 2014. SNC intends to provide the requested information in the February 2015 Overall Integrated Plan 6 month update.

The NRC staff notes that information concerning the accuracy of the SFP level instrumentation channels is not currently available for review and that the licensee intends to provide the information in the February 2015, six-month OIP update. The staff has identified this request as:

RAI #10

Please 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, post-seismic and post- shock conditions) that would be present if the SFP level were at the Level 2 and Level 3 datum points.**
- b) **A description of the methodology that will be used for determining the maximum allowed deviation from the instrument channel design accuracy that will be employed under normal operating conditions as an acceptance criterion for a calibration procedure to flag to operators and to technicians that the channel requires adjustment to within the normal condition design accuracy.**

(This information was previously requested as RAI-7 in the NRC letter dated August 1, 2013)

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 the instrument channel while mounted in the pool.
- Existing work control processes will be used to control maintenance and testing. (e.g., Preventive Maintenance (PM) Program, Surveillance Program, Vendor Contracts, or work orders)
- Other testing and calibration requirements are located in Program Controls testing sub section below.

In its August 29, 2013, letter the licensee stated, in part, that

The design phase of the SFP level instrumentation system will begin in January of 2014, with the design completion and plant organization acceptance of the design scheduled for October of 2014. SNC intends to provide the requested information in the February 2015 Overall Integrated Plan 6 month update.

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 side 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 information concerning the design of the SFP level instrumentation to provide for routine testing and calibration is not currently available for review and that the licensee intends to provide the information in the February 2015, six-month OIP update. The staff has identified this request as follows:

RAI #11

Please provide the following:

- a) A description of the capability and provisions the proposed level sensing equipment will have to enable periodic testing and calibration, including how this capability enables the equipment to be tested in-situ.**
- b) A description of how such testing and calibration will enable the conduct of regular channel checks of each independent channel against the**

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

(This information was previously requested as RAI-8 in the NRC letter dated August 1, 2013)

3.11 Design Features: Display

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

Trained personnel shall be able to monitor the spent fuel pool water level from the control room, alternate shutdown panel, or other appropriate and accessible location. The display shall provide on-demand or continuous indication of spent fuel pool water level.

NEI 12-02 states, in part, that

The intent of this guidance is to ensure that information on SFP level is reasonably available to the plant staff and decision makers. Ideally there will be an indication from at least one channel of instrumentation in the control room. While it is generally recognized (as demonstrated by the events at Fukushima Daiichi) that SFP level will not change rapidly during a loss of spent fuel pool cooling scenario more rapid SFP drain down cannot be entirely discounted. Therefore, the fact that plant personnel are able to determine the SFP level will satisfy this requirement, provided the personnel are available and trained in the use of the SFP level instrumentation (see Section 4.1) and that they can accomplish the task when required without unreasonable delay.

SFP level indication from the installed channel shall be displayed in the control room, at the alternate shutdown panel, or another appropriate and accessible location (reference NEI 12-06). An appropriate and accessible location shall have the following characteristics:

- occupied or promptly accessible to the appropriate plant staff giving appropriate consideration to various drain down scenarios,
- outside of the area surrounding the SFP floor, e.g., an appropriate distance from the radiological sources resulting from an event impacting the SFP,
- inside a structure providing protection against adverse weather, and

- outside of any very high radiation areas or LOCKED HIGH RAD AREA during normal operation.

If multiple display locations beyond the required "appropriate and accessible location" are desired, then the instrument channel shall be designed with the capability to drive the multiple display locations without impacting the primary "appropriate and accessible" display.

In its OIP, the licensee stated 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.

In its letter dated August 29, 2013, the licensee stated:

The design phase of the SFP level instrumentation system will begin in January of 2014, with the design completion and plant organization acceptance of the design scheduled for October of 2014. SNC intends to provide the requested information in the February 2015 Overall Integrated Plan 6 month update.

The NRC staff notes that information concerning the location of the SFP level instrumentation displays is not currently available for review and that the licensee intends to provide the information in the February 2015, six-month OIP update. The staff has identified this request as follows:

RAI #12

Please provide the following:

- a) The specific location for the primary and backup instrument channel displays.**
- b) For any 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, is 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 29, 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 June 7, 2013. However, based on feedback from licensees, the staff revised this RAI as follows:

RAI #13

Please provide a list of the procedures addressing operation (both normal and abnormal response), calibration, test, maintenance, and inspection procedures that will be developed for use of the spent SFP instrumentation. Please provide 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 29, 2013, the licensee stated, in part, that

SNC Response to RAI-11a)

The maintenance and testing of the SFP level instrumentation system will be incorporated into the normal station surveillance and work control processes based on vendor recommendations for maintenance and periodic testing. The preventive maintenance, test and calibration program will be developed consistent with the vendor's recommendations.

The design phase of the SFP level instrumentation system will begin in January of 2014, with the design completion and plant organization acceptance of the design scheduled for October of 2014. Following the issue of the design, procedures will start being developed. SNC intends to provide the description of plans for ensuring necessary channel checks, functional tests, periodic calibration, and maintenance to be conducted for the level measurement system and its supporting equipment in the February 2015 Overall Integrated Plan 6 month update.

SNC Response to RAI-11 b)

... 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.

SNC Response to RAI-11 c)

The appropriate compensatory actions have not yet been specified. Procedures will be developed following the guidance of NEI 12-02, including the requirements associated with compensatory actions, after the issuance of the design. SNC intends to provide the requested detail in the February 2015 Overall Integrated Plan 6 month update.

The NRC staff notes that further information concerning testing, calibration and compensatory measures for the SFP level instrumentation is not currently available for review and that the licensee intends to provide additional information in the February 2015, six-month OIP update. The staff has identified this request as follows:

RAI #14

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. Please 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) Further information on 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.**

(This information was previously requested as RAI-11 in the NRC letter dated August 1, 2013)

RAI #15

Please provide a description of the in-situ calibration process at the SFP location that will result in the channel calibration being maintained at its design accuracy.

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 that the reliability of the primary and backup instrument channels will be assured by conformance with the guidelines of NRC JLD-ISG-2012-03 and NEI 12-02.

Upon acceptable resolution of the RAIs noted above, the NRC staff will be able to make a conclusion regarding the reliability of the SFP instrumentation.

4.0 CONCLUSION

The NRC staff is unable to complete its evaluation regarding the acceptability of the licensee's plans for implementing the requirements of Order EA-12-051 due to the need for additional information as described above. The staff will issue an evaluation with its conclusion after the licensee has provided the requested information.

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. 50-321 and 50-366

Enclosure: Interim Staff Evaluation and Request for Information

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