



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

December 11, 2013

Mr. Raymond A. Lieb
Site Vice-President
FirstEnergy Nuclear Operating Company
Mail Stop A-DB-3080
5501 North State, Route 2
Oak Harbor, OH 43449-9760

SUBJECT: DAVIS-BESSE NUCLEAR POWER PLANT UNIT NO. 1 - INTERIM STAFF EVALUATION AND REQUEST FOR ADDITIONAL INFORMATION REGARDING THE OVERALL INTEGRATED PLAN FOR IMPLEMENTATION OF ORDER EA-12-051, RELIABLE SPENT FUEL POOL INSTRUMENTATION (TAC NO. MF0960)

Dear Mr. Lieb:

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 [SFP] 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 SFPI 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. ML13059A495), FirstEnergy Nuclear Operating Company (the licensee) provided the Overall Integrated Plan (OIP) for Davis-Besse Nuclear Power Station, describing how it will achieve compliance with Attachment 2 of Order EA-12-51 by Spring 2016. By letter dated July 17, 2013 (ADAMS Accession No. ML13197A381), the NRC staff sent a Request for Additional Information (RAI) to the licensee. The licensee provided supplemental information by letters dated August 12, 2013 (ADAMS Accession No. ML13226A357), and August 26, 2013 (ADAMS Accession No. ML13238A259).

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

The interim staff evaluation also includes RAIs, response to which the NRC staff needs to complete its review. The licensee should provide the information requested in the 6-month status updates, as the information becomes available. However, the staff requests that all information be provided by September 30, 2015, to ensure that any issues are resolved prior to

R. Lieb

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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.

If you have any questions regarding this letter, please contact Eva Brown at 301-415-2315 or via e-mail at Eva.Brown@nrc.gov.

Sincerely,

A handwritten signature in cursive script, appearing to read "Travis L. Tate".

Travis L. Tate, Chief
Plant Licensing Branch III-2
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-346

Enclosure:
Interim Staff Evaluation and
Request for Additional Information

cc w/encl: Distribution via Listserv



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

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

FIRSTENERGY NUCLEAR OPERATING COMPANY

DAVIS-BESSE NUCLEAR POWER STATION, UNIT NO.1

DOCKET NO. 50-346

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 [SFP] 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. ML13059A495), FirstEnergy Nuclear Operating Company (the licensee) provided the OIP for Davis-Besse Nuclear Power Station (DBNPS), describing how it will achieve compliance with Attachment 2 of Order EA-12-51 by Spring 2016. By letter dated July 17, 2013 (ADAMS Accession No. ML13197A381), the NRC staff sent a Request for Additional Information (RAI) to the licensee. The licensee provided supplemental information by letters dated August 12, 2013 (ADAMS Accession No. ML13226A357), and August 26, 2013 (ADAMS Accession No. ML13238A259).

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 NRC 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.

Enclosure

Order EA-12-051 required the licensee, by February 28, 2013, to submit to the NRC 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 licensees 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 (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

DBNPS, Unit No. 1, discharges irradiated fuel to a single spent fuel storage pool. With the exception of limited time periods for maintenance or non-refueling operations, administrative controls maintain gates in the open position between the following pools: SFP, fuel transfer canal and cask loading pit. Thus, these pools are normally inter-connected and at the same water level when the water level in the SFP is greater than 1 foot above the top of stored fuel seated in the storage racks.

The licensee submitted its OIP on February 27, 2013. The OIP states that the installation of the SFP level instrumentation at DBNPS is scheduled for completion in spring 2016 based on the end of the second refueling outage following the submittal of this integrated plan.

The NRC staff has reviewed the licensee's schedule for implementation of SFP level instrumentation. 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 did not provide a specific elevation for level 1, but stated that the indicated level on either the primary or backup instrument channel would be greater than a

to-be-determined elevation plus the accuracy of the SFP level instrument channel.

In its letter dated August 12, 2013, the licensee stated, in part, that

As stated in letter dated February 27, 2013, the OIPs are based on conceptual design information. Progress made, proposed changes in compliance methods, updates to the schedule, and if needed, requests for relief and the bases will be provided in the six-month integrated plan updates. As indicated in the DBNPS OIP, spent fuel pool water levels that are yet to be determined will be established by the complete SFP Instrumentation Design milestone in Section 2. The information to support response to this request would be available after final design is complete. Therefore, FENOC intends to submit the response to this request in the February 2014 six-month update.

The NRC staff notes that the licensee did not provide a specific elevation for level 1, but stated that the indicated level on either the primary or backup instrument channel would be greater than a to-be-determined. The staff also notes that in its letter dated August 26, 2013, the licensee identified the status of this activity as "Not Started," and that it intends to submit the information to the staff in the February 2014, six-month update. The staff has identified this request as:

RAI #1

Please specify for Level 1 how the identified location represents the higher of the two points described in the NEI 12-02 guidance for this level.

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 Level 2 is the indicated level on either primary or backup instrument channel greater than 587 feet (ft.) 8 inches (in.) plus the accuracy of the SFP level instrument channel, which is to be determined.

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 the Level 3 is the indicated level on either the primary or backup instrument channel greater than 577 ft. 8 in. (which is the top of the highest point on the spent fuel pool racks).

In NRC's staff letter dated July 17, 2013, the staff requested a clearly labeled sketch depicting the elevation view of the SFP and indicating the datum values representing Levels 1, 2 and 3, as well as the top of the fuel rack. In its letter dated August 12, 2013, the licensee stated, in part, that

As stated in letter dated February 27, 2013, the OIPs are based on conceptual design information. Progress made, proposed changes in compliance methods, updates to the schedule, and if needed, requests for relief and the bases will be provided in the six-month integrated plan updates. The information to support response to this request would be available after final design is complete. Therefore, FENOC intends to submit the response to this request in the February 2014 six-month update.

The NRC staff notes that further information regarding the identification of Levels 1, 2 and 3 is not currently available for review and that in its letter dated August 26, 2013, the licensee identified the status of this activity as "Not Started." The licensee indicated that it intends to submit the information to the staff in the February 2014, six-month update. The staff has identified this request as:

RAI #2

Please provide a clearly labeled sketch depicting the elevation view of the proposed typical mounting arrangement for the portions of the instrument channel consisting of permanent measurement channel equipment (e.g., fixed level sensors and/or stilling wells, and mounting brackets). Indicate on this sketch the datum values representing Level 1, Level 2, and Level 3, as well as the top of the fuel racks. Indicate on this sketch the portion of the level sensor measurement range that is sensitive to measurement of the fuel pool level, with respect to the Level 1, Level 2, and Level 3, datum points.

(This information was previously requested as RAI-1b in the NRC letter dated July 17, 2013.)

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 instrumentation will consist of permanent, fixed primary and backup instrument channels and that the measured range will be continuous from the top of the SFP to the top of the spent fuel racks.

In its letter dated August 12, 2013, the licensee stated, in part, that

As stated in letter dated February 27, 2013, the OIPs are based on conceptual design information. Progress made, proposed changes in compliance methods, updates to the schedule, and if needed, requests for relief and the bases will be provided in the six-month integrated plan updates. The information to support response to this request would be available after final design is complete. Therefore, FENOC [the licensee] intends to submit the response to this request in the February 2014 six-month update.

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.

The NRC staff notes that the information regarding the specific measurement range of the SFP level instrumentation to cover Levels 1, 2, and 3 is not currently available for review and that in its letter dated August 26, 2013, the licensee identified the status of this activity as "Not Started." The licensee indicated that it intends to submit the information to the staff in the February 2014, six-month update. The staff has addressed this request in RAI #2 above.

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 states, in part, that

The planned design of this system will consist of two measurement channels, one primary and one backup. Each channel consists of a level sensor, an electronics unit and an indicator. The primary and backup instrument channel sensors would be protected against missiles that may result from damage to the structure over the SFP. The sensors will be mounted as close to the different SFP corners as possible to minimize the possibility of a single event or missile damaging both channels. The sensor arrangement has been proposed in a manner limiting any interference with existing equipment in or around the SFP. This proposed design would not pose any potential hazard to personnel working around the pool or on the level instrumentation itself.

The proposed design locates the electronics enclosures in an area removed from the SFP environment, which would be accessible in the event of a beyond-design basis external event that would restrict access to the SFP. The enclosures for the two instrument channels will be separated to minimize the possibility of a single event damaging both channels. Cabling for each channel will be run in separate conduit and/or cable tray to the control room indicators.

In its letter dated August 12, 2013, the licensee stated, in part, that

As stated in letter dated February 27, 2013, the OIPs are based on conceptual design information. Progress made, proposed changes in compliance methods, updates to the schedule, and if needed, requests for relief and the bases will be provided in the six-month integrated plan updates. The information to support response to this request would be available after final design is complete. Therefore, FENOC intends to submit the response to this request in the February 2014 six-month update.

The NRC staff notes that the information regarding the arrangement of the SFP level instrumentation is not currently available for review and that in its letter dated August 26, 2013, the licensee identified the status of this activity as "Not Started." The licensee indicated that it intends to submit the information to the staff in the February 2014, six-month update. The staff has identified this request as:

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 the NRC letter dated July 17, 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 that the installed primary and back up SFP level instrument channel equipment within the SFP would be mounted to retain its design configuration during and following the maximum seismic ground motion considered in the design of the SFP structure.

In its letter dated, August 12, 2013, the licensee stated, in part, that

As stated in letter dated February 27, 2013, the OIPs are based on conceptual design information. Progress made, proposed changes in compliance methods, updates to the schedule, and if needed, requests for relief and the bases will be provided in the six-month integrated plan updates. The information to support response to this request would be available after final design is complete. Therefore, FENOC intends to submit the response to this request in the February 2014 six-month update.

The NRC staff notes that the information regarding mounting of the SFP level instrumentation is not currently available for review and that in its letter dated August 26, 2013, the licensee identified the status of this activity as "Not Started." The licensee indicated that it intends to submit the information to the staff in the February 2014, six-month update. The staff has identified these requests as:

RAI #4

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 July 17, 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:

RAI #5

For RAI 4(a) above, please provide the results of 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 #6

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

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 reliability will be established through the use of an augmented quality assurance process.

The licensee's proposed commitment to an 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, consistent with NEI 12-02, in part, that

The design will consider the environmental conditions as discussed by NEI 12-02, Rev. 1 which recommends considering temperature, humidity, and radiation levels during normal operation and after a beyond-design basis external event for no fewer than seven days post- event or until off-site resources can be deployed by the mitigating strategies. Conditions to be considered are the radiological conditions for a normal refueling quantity of freshly discharged (100 hours) fuel with SFP water level at Level 3 as defined by NRC Order EA-12-051, temperatures of 212°F and 100% relative humidity, boiling water and/or steam, and concentrated borated water.

Related to qualification and reliability, in its letter dated August 12, 2013, the licensee stated, in part, that

As stated in letter dated February 27, 2013, the OIPs are based on conceptual design information. Progress made, proposed changes in compliance methods, updates to the schedule, and if needed, requests for relief and the bases will be provided in the six-month integrated plan updates. The information to support response to this request would be available after final design is complete. Therefore, FENOC intends to submit the response to this request in the February 2014 six-month update.

The NRC staff notes that the information regarding qualification and reliability of the SFP level instrumentation is not currently available for review and that in its letter dated August 26, 2013, the licensee identified the status of this activity as "Not Started." The licensee indicated that it intends to submit the information to the staff in the February 2014, six-month update. The staff has identified these requests as:

RAI #7

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 July 17, 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 #8

For RAI #7 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, in part, that

The primary instrument channel will be independent of the backup instrument channel. The primary and backup instrument channels will be physically and electrically separated to maintain channel independence. The sensors will be separated as far apart as practical within the constraints of existing pool geometry and equipment. Electronics enclosures will be separated by a suitable distance or may utilize structural features of the room in which they are located as a barrier to provide protection against a single event (missile, explosion, etc.) from damaging the electronics of both instrument channels. Power will be supplied from two separate power buses at a minimum, with a preference of different power divisions or channels as available. Cabling will be run in separate

conduit and/or cable tray. The same technology will be used for both the primary and backup instrument channels.

In its letter dated, August 12, 2013, the licensee stated, in part, that

As stated in letter dated February 27, 2013, the OIPs are based on conceptual design information. Progress made, proposed changes in compliance methods, updates to the schedule, and if needed, requests for relief and the bases will be provided in the six-month integrated plan updates. The information to support response to this request would be available after final design is complete. Therefore, FENOC intends to submit the response to this request in the February 2014 six-month update.

The NRC staff notes that the information regarding independence of the SFP level instrumentation is not currently available for review and that in its letter dated August 26, 2013, the licensee identified the status of this activity as "Not Started." The licensee indicated that it intends to submit the information to the staff in the February 2014, 6-month update. The staff has identified this request as:

RAI #9

Please provide the following:

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

(This information was previously requested as RAI-5 in NRC letter dated July 17, 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 that each channel will normally be powered from independent 120 VAC [volts-alternating current] power sources and will have a dedicated battery backup. The licensee also stated that a minimum battery life of 24 hours will be provided to allow for power restoration from portable equipment.

In its letter dated August 12, 2013, the licensee stated, in part, that

As stated in letter dated February 27, 2013, the OIPs are based on conceptual design information. Progress made, proposed changes in compliance methods, updates to the schedule, and if needed, requests for relief and the bases will be provided in the six-month integrated plan updates. The information to support response to this request would be available after final design is complete. Therefore, FENOC intends to submit the response to this request in the February 2014 six-month update.

The NRC staff notes that the information regarding the power supply for the SFP level instrumentation is not currently available for review and that in its letter dated August 26, 2013, the licensee identified the status of this activity as "Not Started." The licensee indicated that it intends to submit the information to the staff in the February 2014, six-month update. The staff has identified this request as:

RAI #10

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 NRC letter dated July 17, 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 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 that the guided wave radar design provides continuous monitoring of the SFP water level and that the instrument channels will be designed to maintain their design accuracy without recalibration following a power interruption or change in power source.

In its letter dated August 12, 2013, the licensee stated, in part, that

As stated in letter dated February 27, 2013, the OIPs are based on conceptual design information. Progress made, proposed changes in compliance methods, updates to the schedule, and if needed, requests for relief and the bases will be provided in the six-month integrated plan updates. The information to support response to this request would be available after final design is complete. Therefore, FENOC intends to submit the response to this request in the February 2014 six-month update.

The NRC staff notes that the information regarding the accuracy of the SFP level instrumentation is not currently available for review and that in its letter dated August 26, 2013, the licensee identified the status of this activity as "Not Started." The licensee indicated that it intends to submit the information to the staff in the February 2014, six-month update. The staff has identified this request as:

RAI #11

Please provide the following:

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

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 NRC letter dated July 17, 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 that the instrument channel design will include provisions for routine testing and calibration and that the instrumentation will allow for in-situ testing and calibration of the level instrumentation to minimize calibration effort and instrument downtime.

In its letter dated August 12, 2013, the licensee stated, in part, that

As stated in letter dated February 27, 2013, the OIPs are based on conceptual design information. Progress made, proposed changes in compliance methods, updates to the schedule, and if needed, requests for relief and the bases will be provided in the six-month integrated plan updates. The information to support response to this request would be available after final design is complete and the FENOC engineering change process has progressed to the point of determining procedure details needed for testing and calibration. Therefore, FENOC intends to submit the response to this request in the August 2014 six-month update.

The NRC staff notes that the information regarding the design of the SFP level instrumentation to provide for routine testing and calibration is not currently available for review and that in its letter dated August 26, 2013, the licensee identified the status of this activity as "Not Started."

The licensee indicated that it intends to submit the information to the staff in the August 2014, six-month update. The staff has identified this request as:

RAI #12

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 the testing and calibration necessary to 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 the calibration tests and functional checks processes to be performed, and their frequency. Discuss the steps to be taken to ensure these surveillances will be incorporated into the plant surveillance program.**
- d) A description of the preventive maintenance tasks are required to be performed during normal operation, and the planned maximum surveillance interval necessary to ensure that the channels are fully conditioned to accurately and reliably perform their functions when needed.**

(This information was previously requested as RAI-8 in NRC letter dated July 17, 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 states, the licensee stated that the SFP level instrumentation will provide for display of fuel pool level using an indicator located in the main control room (MCR).

In its letter dated August 12, 2013, the licensee restated that the SFP level instrumentation, primary and backup instrument channel display, will be located in the MCR.

The NRC staff notes that the NEI guidance for “Display” specifically mentions the control room as an acceptable location for SFP instrumentation displays as it is occupied or promptly accessible, outside the area surrounding 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. The licensee’s proposed location for the primary and backup SFP instrumentation displays appears to be consistent with NEI 12-02, as endorsed by the ISG.

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

The Systematic Approach to Training will be utilized when developing and implementing training. Training for maintenance and operations personnel will be developed and provided. Training will be provided for the personnel in the use of and provision of alternate power to, primary and backup instrument channels in compliance with the NRC Order EA-12-051 Attachment 2, Section 2.1.

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 established and maintained for the testing, calibration, operation and abnormal response issues associated with the primary and backup spent fuel pool instrumentation channels.

In its letter dated August 12, 2013, the licensee stated, in part, that

As stated in letter dated February 27, 2013, the OIPs are based on conceptual design information. Progress made, proposed changes in compliance methods, updates to the schedule, and if needed, requests for relief and the bases will be

provided in the six-month integrated plan updates. The information to support response to this request would be available after final design is complete and the FENOC engineering change process has progressed to the point of determining procedure details needed for testing and calibration. Therefore, FENOC intends to submit the response to this request in the August 2014 six-month update.

The NRC staff notes that the information regarding the procedures to address the maintenance, operation and abnormal response issues associated with the new SFP level instrumentation is not currently available for review and that in its letter dated August 26, 2013, the licensee identified the status of this activity as "Not Started." The licensee indicated that it intends to submit the information to the staff in the August 2014, six-month update. The staff has identified this request as:

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 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 that processes will be established and maintained for scheduling and implementing necessary testing and calibration of primary and backup SFP level instrument channels in order to maintain the design accuracy.

In its letter dated August 12, 2013, the licensee stated, in part, that

As stated in letter dated February 27, 2013, the OIPs are based on conceptual design information. Progress made, proposed changes in compliance methods, updates to the schedule, and if needed, requests for relief and the bases will be provided in the six-month integrated plan updates. The information to support response to this request would be available after final design is complete and the FENOC engineering change process has progressed to the point of determining

procedure details needed for testing and calibration. Therefore, FENOC intends to submit the response to this request in the August 2014 six-month update.

The NRC staff notes that the information regarding testing and calibration of the SFP level instrumentation is not currently available for review and that in its letter dated August 26, 2013, the licensee identified the status of this activity as "Not Started." The licensee indicated that it intends to submit the information to the staff in the August 2014, six-month update. The staff has identified this request as:

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. Include a description of your plans for ensuring that necessary channel checks, functional tests, periodic calibration, and maintenance will be conducted for the level measurement system and its supporting equipment.**
- b) **A description of the approach and process to be used by the licensee to follow guidance in NEI 12-02 Section 4.3 regarding compensatory actions for one or both non-functioning channels.**
- c) **A description of the compensatory actions to be taken in the event that one of the instrument channels cannot be restored to functional status within 90 days.**

(This information was previously requested as RAI-11 in NRC letter dated July 17, 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 SFP instrument channels will be assured by conformance with the guidelines of NRC JLD-ISG -2012-03 and NEI 12-02, Revision 1.

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.

R. Lieb

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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.

If you have any questions regarding this letter, please contact Eva Brown at 301-415-2315 or via e-mail at Eva.Brown@nrc.gov.

Sincerely,

/ RA /

Travis L. Tate, Chief
Plant Licensing Branch III-2
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-346

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Interim Staff Evaluation and
Request for Additional Information

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