



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

November 13, 2013

Mr. Lawrence J. Weber  
Senior Vice President and  
Chief Nuclear Officer  
Indiana Michigan Power Company  
Nuclear Generation Group  
One Cook Place  
Bridgman, MI 49106

SUBJECT: DONALD C. COOK NUCLEAR PLANT, UNITS 1 AND 2 - 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 NOS. MF0761 AND MF0762)

Dear Mr. Weber:

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.

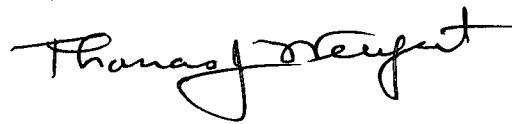
By letter dated February 27, 2013 (ADAMS Accession No. ML13071A323), Indiana Michigan Power Company (the licensee) provided the Overall Integrated Plan (OIP) for Donald C. Cook Nuclear Plant, Units 1 and 2, describing how it will achieve compliance with Attachment 2 of Order EA-12-051 by the fall of 2014. By letter dated June 19, 2013 (ADAMS Accession No. ML13164A381), the NRC staff sent a request for additional information (RAI) to the licensee. The licensee provided supplemental information by letters dated July 11, 2013 (ADAMS Accession No. ML13196A250), and August 26, 2013 (ADAMS Accession No. ML13247A050).

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 March 31, 2014, to ensure that any issues are resolved prior to the date by which the licensee must complete full implementation of Order EA-12-051. The licensee should adjust its schedule for providing information to ensure that all this information is provided by the requested date.

If you have any questions regarding this letter, please contact me at 301-415-4037 or via e-mail at [Thomas.wengert@nrc.gov](mailto:Thomas.wengert@nrc.gov).

Sincerely,

A handwritten signature in black ink, appearing to read "Thomas J. Wengert". The signature is written in a cursive style with a large, prominent initial "T".

Thomas J. Wengert, Senior Project Manager  
Plant Licensing Branch III-1  
Division of Operating Reactor Licensing  
Office of Nuclear Reactor Regulation

Docket Nos. 50-315 and 50-316

Enclosure:  
Interim Staff Evaluation and  
Request for Additional Information

cc w/encl: Distribution via Listserv

**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**  
**INDIANA MICHIGAN POWER COMPANY**  
**DONALD C. COOK NUCLEAR PLANT, UNITS 1 AND 2**  
**DOCKET NOS. 50-315 AND 50-316**

**1.0 INTRODUCTION**

On March 12, 2012, the U.S. Nuclear Regulatory Commission (NRC) issued Order EA-12-051, "Issuance of Order to Modify Licenses with Regard to Reliable Spent Fuel Pool Instrumentation" (Agencywide Documents Access and Management System (ADAMS) Accession No. ML12054A679), to all power reactor licensees and holders of construction permits in active or deferred status. This order requires, in part, that all operating reactor sites have a reliable means of remotely monitoring wide-range spent fuel pool (SFP) levels to support effective prioritization of event mitigation and recovery actions in the event of a beyond-design-basis (BDB) external event. The order required all holders of operating licenses issued under Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, "Domestic Licensing of Production and Utilization Facilities," to submit to the NRC an Overall Integrated Plan (OIP) by February 28, 2013.

By letter dated February 27, 2013 (ADAMS Accession No. ML13063A323), Indiana Michigan Power Company (I&M, the licensee) provided the OIP for Donald C. Cook Nuclear Plant, Units 1 and 2, describing how it will achieve compliance with Attachment 2 of Order EA-12-51 by the fall of 2014 for Units 1 and 2. By letter dated June 19, 2013 (ADAMS Accession No. ML13164A381), the NRC staff sent a request for additional information (RAI) to the licensee. The licensee provided supplemental information by letters dated July 11, 2013 (ADAMS Accession No. ML13196A250), and August 26, 2013 (ADAMS Accession No. ML13247A050).

**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.

Enclosure

Attachment 2 of Order EA-12-051 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 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

Donald C. Cook Nuclear Plant (CNP), Units 1 and 2, share a common SFP located in the Auxiliary Building.

The licensee submitted its OIP on February 27, 2013. The OIP states that installation of the SFP level instrumentation at CNP will be completed by the fall of 2014 based on the end of the second refueling outage for Unit 1 following submittal of this integrated plan.

The NRC staff has reviewed the licensee's schedules 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 the OIP, the licensee stated that Level 1 would be set at the normal SFP level of 645 feet (ft.) 1½ inches (in.).

In its letter dated July 11, 2013, the licensee stated, in part, that

NEI 12-02 Point 1 for CNP is 643'11". Per Reference 1, the centerline of the intake pipe for the Spent Fuel Pit Cooling System is located at 643'6". Because

the inside diameter of that intake pipe is (conservatively) 10", the intake pipe for the Spent Fuel Pit Cooling System will begin to be uncovered at a nominal elevation of 643'11". As a result, NEI 12-02 Point 1 for CNP is 643'11".

NEI 12-02 Point 2 for CNP is similarly below the normal spent fuel pool level of 645'1.5". According to Reference 3, at 160 degrees Fahrenheit, the required Net Positive Suction Head for the Spent Fuel Pit Cooling Pumps (when operating at normal discharge rate of 2300 gallons per minute) is 10', the centerline of each of the Spent Fuel Pit Cooling Pumps is 610.52', and the friction loss in the associated suction piping for the Spent Fuel Pit Cooling Pump with the greater friction loss is approximately 8.06'. Summing these elevations, NEI 12-02 Point 2 for CNP would be approximately 628.58'. This value is nearly 16.57' below the normal spent fuel level of 645'1.5".

In the letters dated July 11, 2013, and August 26, 2013, the licensee provided sketches depicting the elevations identified as Levels 1, 2, and 3, as well as the top of the fuel rack. This sketches show Level 1 at an elevation of 645 ft. 1½ in.

The NRC staff notes that Level 1 at an elevation of 645 ft. 1½ in. is adequate for normal SFP cooling system operation; it is also sufficient for NPSH and it is higher than the two points described in NEI 12-02 for Level 1.

NEI 12-02 states, in part, that

Level 2 represents the range of water level where any necessary operations in the vicinity of the spent fuel pool can be completed without significant dose consequences from direct gamma radiation from the stored spent fuel. Level 2 is based on either of the following:

- 10 feet (+/- 1 foot) above the highest point of any fuel rack seated in the spent fuel pools, or
- a designated level that provides adequate radiation shielding to maintain personnel radiological dose levels within acceptable limits while performing local operations in the vicinity of the pool. This level shall be based on either plant-specific or appropriate generic shielding calculations, considering the emergency conditions that may apply at the time and the scope of necessary local operations, including installation of portable SFP instrument channel components.

In its OIP, the licensee stated that Level 2 would be set at an elevation 630 ft. 3½ in., which is approximately 10 ft. 0 in. above the highest point of the fuel racks.

In its letters dated July 11, 2013, the licensee provided a sketch depicting the elevations identified as Levels 1, 2, and 3, as well as the top of the fuel. This sketch shows Level 2 at an elevation of 630 ft. 3½ in. and the top of the fuel rack at an elevation of 620 ft. 3½ in. However, in the sketch provided in the licensee's letter dated August 26, 2013, the sketch shows Level 2 at an elevation of 632 ft. 3½ in. This sketch also shows the top of the fuel rack at an elevation

of 620 ft. 10½ in. This variation in the elevation identified as Level 2 and the top of the fuel rack will be addressed in RAI #1 below.

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 Level 3 would be set at an elevation of 620 ft. 3½ in., which corresponds to the nominal level of the highest fuel rack seated in the SFP.

In its letters dated July 11, 2013, the licensee provided a sketch depicting the elevations identified as Levels 1, 2, and 3, as well as the top of the fuel. This sketch shows Level 3 align with the top of fuel racks, at an elevation of 620 ft. 3½ in. However, in the sketch provided in the licensee's letter dated August 26, 2013, the sketch shows a lower Level 3 at an elevation of 619 ft. 10½ in. and an upper Level 3 at an elevation of 621 ft. 10½ in.

The NRC staff notes that there is a slight variation in the elevations identified for Levels 2, and 3, as well as the elevation for the top of the fuel rack. The staff has identified this request as:

#### **RAI #1**

**Please identify the final elevations identified as Levels 2 and 3 as well as the top of the fuel rack elevation.**

#### **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 SFP channels will consist of fixed components. The licensee also stated that the measured range will provide continuous



indication from normal water level (645 ft. ½ in. elevation) to the top of the fuel racks (620 in. 3.5 in. elevation) and encompass NEI 12-02 monitoring Levels 1 to Level 3.

In its letter dated July 11, 2013, the licensee provided a sketch depicting the elevations identified as Levels 1, 2, and 3. This figure shows the instrument range in accordance with the measurement range indicated by the licensee in its OIP. However, in its letter dated August 26, 2013, the licensee provided an updated sketch of the datum values representing Levels 1, 2, and 3, as well as the top of the fuel and this sketch shows that the maximum measured level would be from an elevation of 649 ft. to the minimum measured level at an elevation of 621 ft. 4.5 in.

The NRC staff notes that there is a slight variation from the SFP level instrumentation measurement range provided in the OIP and the value provided in the licensee's letter dated July 11, 2013. The staff has identified this request as:

#### **RAI #2**

**Please identify the final SFP level instrumentation measurement range.**

The licensee's proposed plan, with respect to the number of channels for both of its SFPs, appears to be consistent with NEI 12-02, as endorsed by the ISG.

#### 3.4 Design Features: Arrangement

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

The spent fuel pool level instrument channels shall be arranged in a manner that provides reasonable protection of the level indication function against missiles that may result from damage to the structure over the spent fuel pool. This protection may be provided by locating the primary instrument channel and the fixed portions of the backup instrument channel, if applicable, to maintain instrument channel separation within the spent fuel pool area, and to utilize inherent shielding from missiles provided by existing recesses and corners in the spent fuel pool structure.

NEI 12-02 states, in part, that

The intent of the arrangement requirement is to specify reasonable separation and missile protection requirements for permanently installed instrumentation used to meet this order. Although additional missile barriers are not required to be installed, separation and shielding can help minimize the probability that damage due to an explosion or extreme natural phenomena (e.g., falling or wind driven missiles) will render fixed channels of SFP instrumentation unavailable. Installation of the SFP instrument channels shall be consistent with the plant-specific SFP design requirements and should not impair normal SFP function.

Channel separation should be maintained by locating the installed sensors in different places in the SFP area.

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

SFP level sensors will be installed near the Northwest and Northeast corners of the SFP to maintain separation within the SFP area. These locations will provide reasonable protection against missiles. The primary and backup channels signal processors will be located in the Auxiliary Building in independent locations and installed with seismic supports. I&M has not determined the exact location for the level sensors at this time.

The design of the sensor and sensor support will allow the fuel handling machine to pass over it without interference. Cabling for the primary and backup channel instruments will be routed in separate raceways and seismically mounted. Cables from the sensors in the SFP area will be routed in dedicated rigid steel conduits and routed to minimize interference with fuel handling activities.

In its letter dated July 11, 2013, the licensee stated that conceptual design work was still ongoing and that information would be provided, at the earliest, during submission of CNP's six-month update due on August 28, 2013.

In its letter dated, August 26, 2013, the licensee provided additional sketches showing the location of the level sensors and proposed routing of the cables that will extend from the sensors toward the location of the readout/display device. These drawings show the location of the level sensors, which would be installed in the Northwest and Northeast corners of the SFP. In addition, the drawings showed the proposed cable routing from the SFP to the control rooms for Units 1 and 2. In particular, the instrument channel for the probe in the northwest corner of the SFP would be routed to the display to be installed in Unit 1 control room; and the instrument channel for the probe in the northeast corner of the SFP would be routed to the display to be installed in Unit 2 control room.

The NRC staff notes that the sketches provided in the licensee's letter dated August 26, 2013, depict the location and routing of the instrument probes and cabling for the instrument channels, which would be run in opposite directions. The licensee's proposed routing of the SFP level instrument channels for its SFP appears to be consistent with the NEI 12-02, as endorsed by the ISG.

#### 3.4 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 mounting of the primary and backup channel instruments will be Seismic Class I and that the installed equipment will be seismically qualified to withstand the maximum seismic ground motion considered in the design of the plant area in which it is installed.

In its letter dated July 11, 2013, the licensee stated that conceptual design work was still ongoing and that information would be provided, at the earliest, during submission of CNP's six-month update due on February 28, 2014.

The NRC staff notes that the information regarding mounting for the SFP level instrumentation is not currently available for review and that in its letter dated August 26, 2013, the licensee stated that it plans to provide this information to the staff in the February 2014, update. The staff has identified these requests as:

### **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 June 19, 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 below: (3.6.1) Augmented Quality Process, and (3.6.2) Qualification and Reliability.

*3.6.1 Augmented Quality Process*

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

In the OIP, the licensee stated that augmented quality requirements, similar to those applied to fire protection, would be applied for this project.

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, consistent with NEI 12-02, 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 (Reference 2) will be addressed in the engineering design phase. Examples of post-event (beyond-design-basis) conditions that will be considered are:

- a) radiological conditions for a normal refueling quantity of freshly discharged (100 hours) fuel with the SFP water level at Level 3 as described in Order 12-EA-051 (Reference 1);
- b) temperatures of 212 degrees F and 100% relative humidity environment;
- c) boiling water and/or steam environment;
- d) a concentrated borated water environment; and...

In its letter dated July 11, 2013, the licensee stated that conceptual design work was still ongoing and that information would be provided, at the earliest, during submission of CNP's six-month update due on February 28, 2014.

The NRC staff notes that the information regarding reliability and qualification of the SFP level instrumentation is not currently available for review and that in its letter dated August 26, 2013, the licensee stated that it plans to provide this information to the staff in the February 2014, update. The staff has identified these requests as:

#### **RAI #6**

**Please provide the following:**

- a) **A description of the specific method or combination of methods you intend to apply to demonstrate the reliability of the permanently installed equipment under BDB ambient temperature, humidity, shock, vibration, and radiation conditions.**
- b) **A description of the testing and/or analyses that will be conducted to provide assurance that the equipment will perform reliably under the worst-case credible design basis loading at the location where the equipment will be mounted. Include a discussion of this seismic reliability demonstration as it applies to: 1) the level sensor mounted in the SFP area, and 2) 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 June 19, 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 for the selected methods, tests and analyses used to demonstrate the qualification and reliability of the installed equipment in accordance with the Order requirements.**

#### *3.6.3 Qualification Evaluation Summary*

Upon acceptable resolution of the RAIs in Section 3.6, the NRC staff will be able to make a conclusion regarding the instrument qualification.

### 3.7 Design Features: Independence

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

The primary instrument channel shall be independent of the backup instrument channel.

NEI 12-02 states, in part, that

Independence of permanently installed instrumentation, and primary and backup channels, is obtained by physical and power separation commensurate with the hazard and electrical isolation needs. If plant AC or DC power sources are used then the power sources shall be from different buses and preferably different divisions/channels depending on available sources of power.

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

The primary instrument channel will be independent of the backup instrument channel. The primary and backup instrument channel sensors will be located near separate corners of the SFP and the signal processors will be located in separate locations of the Auxiliary Building, placed to optimize access by personnel in normal, event, or post-event conditions. Cabling for the primary and backup instrument channels will be routed separately. The power sources for the primary and backup channels will be from separate 120VAC buses/switchgear.

In its letter dated July 11, 2013, the licensee stated that conceptual design work was still ongoing and that information would be provided, at the earliest, during submission of CNP's six-month update due on February 28, 2014.

The NRC staff notes that the information regarding SFP level instrumentation channel independence is not currently available for review and that in its letter dated August 26, 2013, the licensee stated that it plans to provide this information to the staff in the February 2014, update. The staff has identified this request as:

#### **RAI #8**

**Please provide the following:**

- a) A description of how the two channels of the proposed level measurement system meet this requirement [for separation] 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 June 19, 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 the primary and backup instrument channels will each be powered from independent 120V AC power sources and will have a dedicated battery backup.



The licensee also stated that a minimum battery life of 72 hours will be provided to allow for power restoration from portable equipment.

In its letter dated July 11, 2013, the licensee stated that conceptual design work was still ongoing and that information would be provided, at the earliest, during submission of CNP's six-month update due on February 28, 2014.

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 stated that it plans to provide this information to the staff in the February 2014, update. The staff has identified this request as:

**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 June 19, 2013. However, based on feedback from the licensees, this RAI has been 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 primary and backup instrument channels will be designed such that they will maintain their design accuracy without recalibration following a power interruption or change in power source.

In its letter dated July 11, 2013, the licensee stated that conceptual design work was still ongoing and that information would be provided, at the earliest, during submission of CNP's six-month update due on February 28, 2014.

The NRC staff notes that the information regarding the SFP level instrumentation channel accuracy is not currently available for review and that in its letter dated August 26, 2013, the licensee stated that it plans to provide this information to the staff in the February 2014, 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 June 19, 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 provide for routine testing and calibration consistent with the guidelines of JLD-ISG-2012-03 and NEI 12-02 and provide for in situ testing.

In its letter dated July 11, 2013, the licensee stated that conceptual design work was still ongoing and that information would be provided, at the earliest, during submission of CNP's six-month update due on February 28, 2014.

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 stated that it plans to provide this information to the staff in the February 2014, update. The staff has identified this request as:

**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. Provide a discussion as to how these surveillances will be incorporated into the plant surveillance program.**
- d) A description of what preventive maintenance tasks are required to be performed during normal operation, and the planned maximum surveillance interval that is necessary to ensure that the channels are fully conditioned to accurately and reliably perform their functions when needed.**

*(This information was previously requested as RAI-8 in the NRC letter dated June 19, 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 SFP level displays will be continuously provided at the associated Signal processing units.

In its letter dated July 11, 2013, the licensee stated that conceptual design work was still ongoing and that information would be provided, at the earliest, during submission of CNP's six-month updates due on August 28, 2013 and February 28, 2014.

In its letter dated August 26, 2013, the licensee stated that one instrument channel display would be located in the Unit 1 control room, and the second channel display would be located in the Unit 2 control room. In addition, the licensee stated that the channels would be identical, and both are suitable for a primary or backup function.

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 level 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

A systematic approach to training 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 the new SFP level instrumentation instruments.

The licensee's proposed plan, with respect to the training personnel in the use and the provision of alternate power to the primary and backup instrument channels, including the approach to identifying the population to be trained, appears to be consistent with NEI 12-02, as endorsed by the ISG.

### 3.13 Programmatic Controls: Procedures

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

Procedures shall be established and maintained for the testing, calibration, and use of the primary and backup spent fuel pool instrument channels.

NEI 12-02 states, in part, that

Procedures will be developed using guidelines and vendor instructions to address the maintenance, operation and abnormal response issues associated with the new SFP instrumentation.

In its OIP, the licensee stated that procedures will be developed using guidelines and vendor instructions to address the maintenance, operation, and abnormal response issues associated with the new SFP level instrumentation.

In its letter dated July 11, 2013, the licensee stated that conceptual design work was still ongoing and that information would be provided, at the earliest, during submission of CNP's six-month update due on February 28, 2014.

The NRC staff notes that the information regarding development and maintenance of procedures for the testing, calibration, and use of the primary and backup SFP instrument channels is not currently available for review and that in its letter dated

August 26, 2013, the licensee stated that it plans to provide this information to the staff in the February 2014, update. The staff has identified this request as:

**RAI #12**

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

3.14 Programmatic Controls: Testing and Calibration

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

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

NEI 12-02 states, in part, that

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

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

Processes will be established and maintained for scheduling and implementing necessary testing and calibration of the primary and backup SFP level instrument channels to maintain the instrument channels at the design accuracy. Testing and calibration of the instrumentation will be consistent with vendor recommendations or other documented basis. Calibration will be specific to the mounted instrument and the monitor.

In its letter dated July 11, 2013, the licensee stated that conceptual design work was still ongoing and that information would be provided, at the earliest, during submission of CNP's six-month update due on February 28, 2014.

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 stated that it plans to provide this information to the staff in the February 2014, update. The staff has identified this request as:

**RAI #13**

**Please provide the following:**

- a) **Further information describing the maintenance and testing program the licensee will establish and implement to ensure that regular testing and calibration is performed and verified by inspection and audit to demonstrate conformance with design and system readiness requirements. Include a description of your plans for ensuring that necessary channel checks, functional tests, periodic calibration, and maintenance will be conducted for the level measurement system and its supporting equipment.**
- b) **A description of how the guidance in NEI 12-02 Section 4.3 regarding compensatory actions for one or both non-functioning channels will be addressed.**
- c) **A description of the compensatory actions to be taken in the event that one of the instrument channels cannot be restored to functional status within 90 days.**

*(This information was previously requested as RAI-11 in the NRC letter dated June 19, 2013.)*

### 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 primary and backup instrument channels would 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.

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 March 31, 2014, to ensure that any issues are resolved prior to the date by which the licensee must complete full implementation of Order EA-12-051. The licensee should adjust its schedule for providing information to ensure that all this information is provided by the requested date.

If you have any questions regarding this letter, please contact me at 301-415-4037 or via e-mail at [Thomas.wengert@nrc.gov](mailto:Thomas.wengert@nrc.gov).

Sincerely,

**/RA/**

Thomas J. Wengert, Senior Project Manager  
Plant Licensing Branch III-1  
Division of Operating Reactor Licensing  
Office of Nuclear Reactor Regulation

Docket Nos. 50-315 and 50-316

Enclosure:  
Interim Staff Evaluation and  
Request for Additional Information

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