



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

December 4, 2013

Mr. Oscar A. Limpias  
Vice President-Nuclear and CNO  
Nebraska Public Power District  
72676 648A Avenue  
Brownville, NE 68321

SUBJECT: COOPER NUCLEAR STATION – 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. MF0971)

Dear Mr. Limpias:

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 28, 2013 (ADAMS Accession No. ML13070A007), Nebraska Public Power District (the licensee) provided the Overall Integrated Plan (OIP) for Cooper Nuclear Station describing how it will achieve compliance with Attachment 2 of Order EA-12-051 by November 2016. By letter dated August 29, 2013 (ADAMS Accession No. ML13246A348), the NRC staff sent a request for additional information (RAI) to the licensee. The licensee provided supplemental information by letters dated August 27 and October 14, 2013 (ADAMS Accession Nos. ML13247A281 and ML13294A027, respectively).

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 May 31, 2016, to ensure that any issues are resolved prior to the

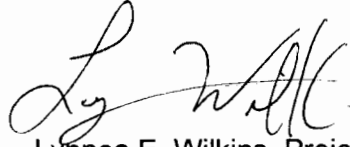
O. Limpias

- 2 -

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, please contact me at 301-415-1377 or via e-mail at [lynnea.wilkins@nrc.gov](mailto:lynnea.wilkins@nrc.gov).

Sincerely,

A handwritten signature in black ink, appearing to read "Lynnea E. Wilkins". The signature is fluid and cursive, with a large initial "L" and "W".

Lynnea E. Wilkins, Project Manager  
Plant Licensing Branch IV-1  
Division of Operating Reactor Licensing  
Office of Nuclear Reactor Regulation

Docket No. 50-298

Enclosure:  
Interim Staff Evaluation and RAI

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

NEBRASKA PUBLIC POWER DISTRICT

COOPER NUCLEAR STATION

DOCKET NO. 50-298

**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 28, 2013 (ADAMS Accession No. ML13070A007), Nebraska Public Power District (NPPD, the licensee) provided the OIP for Cooper Nuclear Station describing how it will achieve compliance with Attachment 2 of Order EA-12-051 by November 2016. By letter dated August 29, 2013 (ADAMS Accession No. ML13246A348), the NRC staff sent a request for additional information (RAI) to the licensee. The licensee provided supplemental information by letters dated August 27, 2013 (ADAMS Accession No. ML13247A281), and October 14, 2013 (ADAMS Accession No. ML13294A027).

**2.0 REGULATORY EVALUATION**

Order EA-12-051 requires all holders of operating licenses issued under 10 CFR Part 50, notwithstanding the provisions of any Commission regulation or license to the contrary, to comply with the requirements described in Attachment 2 to the Order except to the extent that a more stringent requirement is set forth in the license. Licensees shall promptly start implementation of the requirements in Attachment 2 to the Order and shall complete full implementation no later than two refueling cycles after submittal of the OIP or December 31, 2016, whichever comes first.

Order EA-12-051 required the licensee, by February 28, 2013, to submit to the Commission an OIP, including a description of how compliance with the requirements described in Attachment 2 of the Order will be achieved.

Enclosure

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 (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**

Cooper Nuclear Station has a single SFP.

The licensee's OIP was submitted on February 28, 2013. The OIP states that installation of the SFP level instrumentation is schedule for completion by November 2016, based on the end of the second refueling outage following submittal of this OIP.

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 stated that Level 1 would be set at an elevation of 999 feet (ft.) 7 inches (in.) based on the bottom of the weir that lead to the skimmer surge tanks.

The NRC staff notes that Level 1 at an elevation of 999 ft. 7 in. is adequate for normal SFP cooling system operation and it is also adequate to ensure the required fuel pool cooling pump net positive suction head (NPSH) as the skimmer surge tanks supply the SFP cooling pumps. This level represents the higher of the two points described in NEI 12-02 for Level 1.

NEI 12-02 states, in part, that

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

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

In its OIP, the licensee stated that Level 2 would be set at an elevation of 987 ft. 5-3/8 in. based on a water level of 10 ft. above the top of the fuel racks in the SFP.

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 977 ft. 5-3/8 in. based on a water level that is even with the top of the fuel racks.

In NRC letter dated August 29, 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 October 14, 2013, the licensee stated, in part, that

NPPD has started the design phase for the SFPI [SFP Instrumentation] Order and expects to have final design completion by July 2014. The requested information will be provided with the August 2014, six-month status report, or sooner if available.

The NRC staff notes that further information to confirm the identification of Levels 2 and 3 is not currently available for review. In its letter dated October 14, 2013, the licensee indicated that it will provide the information to the staff in the August 2014 6-month status report, or sooner if available. The staff has identified this request as:

**RAI #1**

**Please provide a clearly labeled sketch depicting the elevation view of the proposed typical mounting arrangement for the portions of instrument channel consisting of permanent measurement channel equipment (e.g., fixed level sensors and/or stilling wells, and mounting brackets). Indicate on this sketch the datum values representing Level 1, Level 2, and Level 3 as well as the top of the fuel 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-1 in the NRC letter dated August 29, 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 both the primary and backup instrument channels would be of identical design and will consist of fixed components. The licensee also stated that the range will extend from approximately one ft. below the top of the fuel racks to approximately 1 ft. above the normal level of the pool; a minimum range of 24 ft.

In its letter dated August 27, 2013, the licensee stated, in part, that

Section 4.1 [Primary and Backup Instrument Channels] of the overall integrated plan submitted on February 28, 2013, described the measurement range of the system from one foot above normal level of the pool to one foot below the top of the fuel rack. In discussion with the system supplier, it has been determined that extension of the level system below the top of the fuel rack could create the risk



of physical contact between the system probe and the rack. For this reason, the system probe will stop approximately six inches above the top of the rack. This will still allow the system to conservatively measure to level three within  $\pm 12$  inch accuracy required by NEI 12-02, Industry Guidance for Compliance with Nuclear Regulatory Commission (NRC) Order EA-12-051, "To Modify Licenses with Regard to Reliable Spent Fuel Pool Instrumentation."

The NRC staff notes that the range specified for the licensee's instrumentation will cover Levels 1, 2, and 3 as described in Section 3.2 above. The licensee's proposed plan, with respect to the number of channels and the range of the instrumentation 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 license stated, in part, that

##### *Probes:*

The primary and backup level sensing probes will be located in the SFP separated by a distance that is comparable to the shortest side of the pool. These locations will provide the needed separation of the channels to provide reasonable protection against a single missile damaging both the primary and backup SFP indication. This is in accordance with the guidance provided in

NEI 12-02 Section 3.2 which provides as one of the example arrangements, "separated by a distance comparable to the shortest length of side of the pool."

*Signal Processors and Indication:*

The primary and backup channel's signal processors will be located within the control building. As a result, SFP level indication will be accessible without requiring entry into the reactor building. The signal processors will be separated by a sufficient distance and/or barrier(s) in order to prevent physical damage due to a common cause. Also, the control building is designed to protect equipment within it from external missiles.

*Cable Routing:*

The power and signal cable required for each channel will be routed separately from the other channel. Conduit supports that are qualified for seismic class I applications will be used for routing all conduit in both the reactor and the control buildings. The conduit in the reactor building will be installed to ensure that it will not interfere with fuel handling activities or other activities in the SFP.

In its letter dated October 14, 2013, the licensee stated, in part, that

NPPD has started the design phase for the SFPI Order and expects to have final design completion by July 2014. The requested information will be provided with the August 2014, six-month status report, or sooner if available.

The NRC staff notes the information regarding final sensor locations and cable routings for the SFP level instrumentation is not currently available for review. In its letter dated October 14, 2013, the licensee indicated it will provide the information to the staff in the August 2014 6-month status report, or sooner if available. The staff has identified this request as:

**RAI #2**

**Please provide the following:**

- a) **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 sensors, and the proposed routing of the cables that will extend from the sensors toward the location of the local electronics cabinets and read-out/display devices in the main control room or alternate accessible location.**
- b) **In Figure 1 of your submittal, it appears the sensors will be separated by a distance comparable to the longest side of the pool; however, your text states that they will be "separated by a distance that is comparable to the shortest side of the pool." Please clarify.**

*(This information was previously requested as RAI-2 in the NRC letter dated August 29, 2013.)*

### 3.5 Design Features: Mounting

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

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

NEI 12-02 states, in part, that

The mounting shall be designed to be consistent with the highest seismic or safety classification of the SFP. An evaluation of other hardware stored in the SFP shall be conducted to ensure it will not create adverse interaction with the fixed instrument location(s).

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

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

Mounting of the primary and secondary channel signal processors and probes will be seismic class I. The equipment will be installed in its designated plant area to be seismically qualified to withstand the maximum seismic ground motion considered in the design of that area.

In its letter dated October 14, 2013, the licensee stated, in part, that,

NPPD has started the design phase for the SFPI Order and expects to have final design completion by July 2014. The requested information will be provided with the August 2014, six-month status report, or sooner if available.

The NRC staff notes the information regarding mounting device total loading and attachments for the SFP level instrumentation is not currently available for review. In its letter dated October 14, 2013, the licensee indicated that it will provide the information to the staff in the August 2014 6-month status report, or sooner if available. 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 August 29, 2013.)*

In addition, the NRC 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.

#### **RAI #4**

**For RAI 3(a) above, please provide the analyses used to verify the design criteria and methodology for seismic testing of the SFP instrumentation and the electronics units, including design basis maximum seismic loads and the hydrodynamic loads that could result from pool sloshing or other effects that could accompany such seismic forces.**

#### **RAI #5**

**For each of the mounting attachments required to attach SFP level equipment to plant structures, please describe the design inputs and the methodology that was used to qualify the structural integrity of the affected structures/equipment.**

### **3.6 Design Features: Qualification**

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

The primary and backup instrument channels shall be reliable at temperature, humidity, and radiation levels consistent with the spent fuel pool water at saturation conditions for an extended period. This reliability shall be established through use of an augmented quality assurance process (e.g. a process similar to that applied to the site fire protection program).

NEI 12-02 states, in part, that

The instrument channel reliability shall be demonstrated via an appropriate combination of design, analyses, operating experience, and/or testing of channel components for the following sets of parameters, as described in the paragraphs below:

- conditions in the area of instrument channel component use for all instrument components,
- effects of shock and vibration on instrument channel components used during any applicable event for only installed components, and
- seismic effects on instrument channel components used during and following a potential seismic event for only installed components...

The NRC staff assessment of the instrument qualification is discussed in the following subsections: (3.6.1) Augmented Quality Process and (3.6.2) Qualification and Reliability.

#### *3.6.1 Augmented Quality Process*

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

In its OIP, the licensee stated that the reliability of the instrumentation would be established through the use of an augmented quality assurance process similar to that applied to the site fire protection program.

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

#### *3.6.2 Qualification and Reliability*

NEI 12-02 states, in part, that

The temperature, humidity and radiation levels consistent with conditions in the vicinity of the [SFP] and the area of use considering normal operational, event and post-event conditions for no fewer than seven days post-event or until off-site resources can be deployed by the mitigating strategies resulting from Order EA-12-049 should be considered. Examples of post-event (beyond-design-basis) conditions to be considered are:

- radiological conditions for a normal refueling quantity of freshly discharged (100 hours) fuel with the SFP water level 3 as described in this order,

- temperatures of 212 degrees °F and 100% relative humidity environment,
- boiling water and/or steam environment
- a concentrated borated water environment.

In its OIP, the licensee stated, consistent with NEI 12-02, in part, that

During the engineering design phase, the environmental conditions that are necessary for qualification of all equipment will be addressed. These environmental conditions will include the temperature, humidity, and radiation levels that are consistent with conditions in the vicinity of the SFP and the area of use during normal operations, abnormal events, and post-events. The duration required for qualification will be for no fewer than seven (7) days post-event or until off-site resources can be deployed by the mitigating strategies resulting from Order EA-12-049 (Ref. 9.1). Examples of post-event (beyond-design-basis) conditions that will be considered are:

- Radiological conditions for a normal refueling quantity of freshly discharged (100 hours) fuel with the SFP water level at level 3 as described in Section 3.3,
- Temperatures of 212°F and 100% relative humidity environment,
- Boiling water and/or steam environment,...

Related to qualification and reliability, in its letter dated October 14, 2013, the licensee stated, in part, that

NPPD has started the design phase for the SFPI Order and expects to have final design completion by July 2014. The requested information will be provided with the August 2014, six-month status report, or sooner if available.

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 October 14, 2013, the licensee indicated that it will provide the information to the staff in the August 2014 6-month status report, or sooner if available. The staff has identified these requests as:

**RAI #6**

**Please provide the following:**

- a) A description of the specific method or combination of methods to be used 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 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:**
  - i. **the level sensor mounted in the SFP area, and**
  - ii. **any control boxes, electronics, or read-out and re-transmitting devices that will be employed to convey level information from the level sensor to the plant operators or emergency responders.**
- c) **A description of the specific method or combination of methods that will be used to confirm the reliability of the permanently installed equipment such that following a seismic event the instrument will maintain its required accuracy.**

*(This information was previously requested as RAI-4 in the NRC letter dated August 29, 2013.)*

In addition, the NRC 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 probes for the two channels will be located near the edge of the SFP and separated by a distance that is comparable to the length of the shortest side of the pool.

The signal processors for both the primary and backup instrument channels will be located in the control building. These signal processors will be separated by a distance of at least 20 feet in order to prevent simultaneous physical damage due to a common cause.

Conduit and cable for the primary channel will be routed separately from the conduit and cable for the backup channel. The normal power for the primary and backup channels will be from different divisions of non-essential AC power.

In its October 14, 2013, letter, the licensee stated, in part, that

NPPD has started the design phase for the SFPI Order and expects to have final design completion by July 2014. The requested information will be provided with the August 2014, six-month status report, or sooner if available.

The NRC staff notes the information regarding channel independence of the SFP level instrumentation is not currently available for review. In its letter dated October 14, 2013, the licensee indicated that it will provide information to the staff in the August 2014 6-month status report, or sooner if available. The staff has identified this request as:

**RAI #8**

**Please provide the following:**

- a) **A description of the manner in which the two channels of the proposed level measurement system meets 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 how each level measurement system, consisting of level sensor electronics, cabling, and readout devices will be designed and installed to address independence through the application and selection of independent power sources, the use of physical and spatial separation, independence of signals sent to the location(s) of the readout devices, and the independence of the displays.**

*(This information was previously requested as RAI-5 in the NRC letter dated August 29, 2013.)*



### 3.8 Design Features: Power Supplies

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

Permanently installed instrumentation channels shall each be powered by a separate power supply. Permanently installed and portable instrumentation channels shall provide for power connections from sources independent of the plant ac and dc power distribution systems, such as portable generators or replaceable batteries. Onsite generators used as an alternate power source and replaceable batteries used for instrument channel power shall have sufficient capacity to maintain the level indication function until offsite resource availability is reasonably assured.

NEI 12-02 states, in part, that

The normal electrical power supply for each channel shall be provided by different sources such that the loss of one of the channels primary power supply will not result in a loss of power supply function to both channels of SFP level instrumentation.

All channels of SFP level instrumentation shall provide the capability of connecting the channel to a source of power (e.g., portable generators or replaceable batteries) independent of the normal plant AC and DC power systems. For fixed channels this alternate capability shall include the ability to isolate the installed channel from its normal power supply or supplies. The portable power sources for the portable and installed channels shall be stored at separate locations, consistent with the reasonable protection requirements associated with NEI 12-06 (Order EA-12-049). The portable generator or replaceable batteries should be accessible and have sufficient capacity to support reliable instrument channel operation until off-site resources can be deployed by the mitigating strategies resulting from Order EA-12-049.

If adequate power supply for either an installed or portable level instrument credits intermittent operation, then the provisions shall be made for quickly and reliably taking the channel out of service and restoring it to service. For example, a switch on the power supply to the channel is adequate provided the power can be periodically interrupted without significantly affecting the accuracy and reliability of the instrument reading. Continuous indication of SFP level is acceptable only if the power for such indication is demonstrably adequate for the time duration specified in section 3.1[.]

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

The power supplies for the instrument channels will be arranged as follows:

The primary instrument channel will normally receive power from a non-essential, Division I, 120 VAC [Volts AC] circuit. In the event of a failure of this circuit, an internal battery for the signal processor will supply the instrument for between 4

and 24 hours. This time can be extended by utilizing an on-demand measurement feature of the processor where indication will be provided only when requested by the operator. An external battery will also be provided which can provide power for up to seven (7) days of continuous use.

The backup instrument channel will normally receive power from a non-essential Division II, 120 VAC circuit. Since the backup channel is identical to the primary channel, it also has an internal battery for the signal processor which will supply the instrument for between 4 and 24 hours. This time can be extended by utilizing the same on-demand measurement feature as the primary channel. An external battery will also be provided which can provide power for up to seven (7) days of continuous use.

For both the primary and the backup channels, an external 120 VAC connection will be provided that can be used to supply power to the signal processors. This connection can be used to connect a portable generator or any other 120 VAC source to the signal processors.

The provisions described above will permit the operation of the SFP level instrumentation until off-site resources can be deployed by the mitigating strategies resulting from Order EA-12-049 (Ref. 9.1).

In its letter dated August 27, 2013, the licensee stated, in part, that

Section 6.5 of the overall integrated plan submitted on February 28, 2013, described the various power supply options for the primary and backup instrument channels, including an internal battery for each channel that will supply power for between four and twenty-four hours, and an external battery that will provide power up to seven days. During the system development process, Mohr has eliminated the internal battery, but the seven day external battery remains for each channel.

In its letter dated October 14, 2013, the licensee stated, in part, that,

NPPD has started the design phase for the SFPI Order and expects to have final design completion by July 2014. The requested information will be provided with the August 2014, six-month status report, or sooner if available.

The NRC staff notes the information regarding total power supply configuration and characteristics for the SFP level instrumentation is not currently available for review. In its letter dated October 14, 2013, the licensee indicated it will provide the information to the staff in the August 2014 6-month status report, or sooner if available. 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) The results of the calculation depicting battery backup duty cycle requirements, demonstrating battery capacity is sufficient to maintain the level indication function until offsite resource availability is reasonably assured.**

*(This information was previously requested as RAI-6 in the NRC letter dated August 29, 2013. However, based on feedback from the licensees, it 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, in part, that

The primary and backup instrument channels will be designed to maintain their design accuracy following a power interruption or change in power source without recalibration. The accuracy of the instrument channels, including display accuracy, will be consistent with the guidelines of NRC JLD-ISG-2012-03 & NEI 12-02...

Both channels will be calibrated with the same range limits. Since the two channels will be identical in design and will be exposed to the same environment, they will provide the same readings within their limits of accuracy at all times. This will prevent the two indications from conflicting with each other.

In its letter dated October 14, 2013, the licensee stated, in part, that

NPPD has started the design phase for the SFPI Order and expects to have final design completion by July 2014. The requested information will be provided with the August 2014, six-month status report, or sooner if available.

The NRC staff notes the information regarding accuracy of the SFP level instrumentation is not currently available for review. In its letter dated October 14, 2013, the licensee indicated it will provide the information to the staff in the August 2014 6-month status report, or sooner if available. The staff has identified this request as:

**RAI #11**

**Please provide the following:**

- a) **An estimate of the expected instrument channel accuracy performance under both:**
  - i. **normal SFP level conditions (approximately Level 1 or higher) and**
  - ii. **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 to be used for determining the maximum allowed deviation from the instrument channel design accuracy under normal operating conditions.**

*(This information was previously requested as RAI-7 in the NRC letter dated August 29, 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 instrument channel design will provide for routine testing and calibration consistent with Order EA-12-051 and the guidance in NEI 12-02.

In its letter dated October 14, 2013, the licensee stated, in part, that

NPPD has started the design phase for the SFPI Order and expects to have final design completion by July 2014. The final design will include aspects such as procedure guidance, maintenance, and testing requirements. The requested information will be provided with the August 2014, six-month status report, or sooner if available.

The NRC staff notes the information on the design of the SFP level instrumentation to provide for routine testing and calibration is not currently available for review. In its letter dated October 14, 2013, the licensee indicated it will provide the information to the staff in the August 2014 6-month status report, or sooner if available. 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 way 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 the functional checks to 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. Discuss how these surveillances will be incorporated into the plant surveillance program.**
- d) **A description of the preventive maintenance tasks required to be performed during normal operation, and the planned maximum surveillance interval that is necessary to 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 August 29, 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, in part, that

Both the primary and backup instrument channels will have accessible displays available in the control building. Each signal processor has a local display which may be used during normal operations or in the event of a control room evacuation.

In its letter dated October 14, 2013, the licensee stated, in part, that

NPPD has started the design phase for the SFPI Order and expects to have final design completion by July 2014. The requested information will be provided with the August 2014, six-month status report, or sooner if available.

The NRC staff notes the information on the location of the SFP level instrumentation displays is not currently available for review. In its letter dated October 14, 2013, the licensee indicated that it will provide the information to the staff in the August 2014 6-month status report, or sooner if available. The staff has identified this request as:

**RAI #13**

**Please provide the following:**

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

3.12 Programmatic Controls: Training

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

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

NEI 12-02 states, in part, that

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

trained. The SAT process should also determine both the initial and continuing elements of the required training.

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

Systematic Approach to Training (SAT) methods will be used to identify the population to be trained and to determine both the initial and continuing elements of the required training.

The licensee's proposed plan to train personnel in the use and the provision of alternate power to the primary and backup instrument channels, including the approach to identify 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, in part, that

Procedures will be developed or revised, as necessary, using guidelines and vendor instructions to address the maintenance, operation and abnormal response issues associated with the primary and backup channels of SFP instrumentation.

In its letter dated October 14, 2013, the licensee stated, in part, that

NPPD has started the design phase for the SFPI Order and expects to have final design completion by July 2014. The final design will include aspects such as procedure guidance, maintenance, and testing requirements. The requested information will be provided with the August 2014, six-month status report, or sooner if available.



The NRC staff notes the information regarding the procedures that should be established and maintained for the testing, calibration, and use of the primary and backup SFP instrument channels is not currently available for review. In its letter dated October 14, 2013, the licensee indicated it will provide the information to the staff in the August 2014 6-month status report, or sooner if available. The staff has identified this request as:

**RAI #14**

**Please provide a list of the procedures addressing operation (both normal and abnormal response), calibration, test, maintenance, and inspection that will be developed for use of the SFP instrumentation. 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 consistent with the applicable NEI 12-02 guidelines (Ref. 9.4) 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 will be consistent with vendor recommendations or other documented basis. Calibration will be specific to the mounted signal processor and display.

In its letter dated October 14, 2013, the licensee stated, in part, that

NPPD has started the design phase for the SFPI Order and expects to have final design completion by July 2014. The final design will include aspects such as procedure guidance, maintenance, and testing requirements. The requested information will be provided with the August 2014, six-month status report, or sooner if available.

The NRC staff notes that the information regarding testing and calibration program requirements and compensatory actions for the SFP instrumentation is not currently available for review and that in its letter dated October 14, 2013, the licensee indicated that it will provide the information to the staff in the August 2014 6-month status report, or sooner if available. The staff has identified this request as:

**RAI #15**

**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 plans to ensure 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 guidance in NEI 12-02 Section 4.3 on compensatory actions for one or both non-functioning channels will be addressed.**
- c) **A description of the compensatory actions are planned in the event that one of the instrument channels cannot be restored to functional status within 90 days.**

*(This information was previously requested as RAI-11 in the NRC letter dated August 29, 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 the primary and backup instrument channels will be assured by conformance with the guidelines of NRC JLD-ISG-2012-03 and NEI 12-02 under Design Features and Program Features.

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.

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- 2 -

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, please contact me at 301-415-1377 or via e-mail at [lynnea.wilkins@nrc.gov](mailto:lynnea.wilkins@nrc.gov).

Sincerely,

*/RA/*

Lynnea E. Wilkins, Project Manager  
Plant Licensing Branch IV-1  
Division of Operating Reactor Licensing  
Office of Nuclear Reactor Regulation

Docket No. 50-298

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