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

November 25, 2013

Mr. Louis P. Cortopassi
Site Vice President and Chief Nuclear Officer
Omaha Public Power District
Fort Calhoun Station
9610 Power Lane, Mail Stop FC-2-4
Omaha, NE 68008

SUBJECT: FORT CALHOUN STATION, UNIT NO. 1 – INTERIM STAFF EVALUATION AND REQUEST FOR ADDITIONAL INFORMATION REGARDING THE OVERALL INTEGRATED PLAN FOR IMPLEMENTATION OF ORDER EA-12-051, RELIABLE SPENT FUEL POOL INSTRUMENTATION (TAC NO. MF0968)

Dear Mr. Cortopassi:

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.

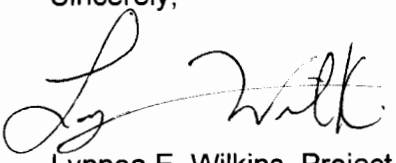
By letter dated February 28, 2013 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML13059A268), Omaha Public Power District (the licensee) provided the Overall Integrated Plan (OIP) for Fort Calhoun Station, Unit 1, describing how it will achieve compliance with Attachment 2 of Order EA-12-051 by spring 2016. By electronic transmittal dated August 23, 2013 (ADAMS Accession No. ML13235A168), the NRC staff sent a request for additional information (RAI) to the licensee. The licensee provided supplemental information by letters dated August 28 and October 18, 2013 (ADAMS Accession Nos. ML13241A411 and ML13294A338, 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 September 30, 2015, to ensure that any issues are resolved prior to the date by which the licensee must complete full implementation of Order EA-12-051. The licensee should adjust its 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.

Sincerely,



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

Docket No. 50-285

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

OMAHA PUBLIC POWER DISTRICT

FORT CALHOUN STATION, UNIT 1

DOCKET NO. 50-285

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. ML13059A268), Omaha Public Power District (OPPD, the licensee) provided the OIP for Fort Calhoun Station, Unit 1 (FCS) describing how it will achieve compliance with Attachment 2 of Order EA-12-051 by spring 2016. By electronic transmittal dated August 23, 2013 (ADAMS Accession No. ML13235A168), the NRC staff sent a request for additional information (RAI) to the licensee. The licensee provided supplemental information by letters dated August 28 and October 18, 2013 (ADAMS Accession Nos. ML13241A411 and ML13294A338, respectively).

2.0 REGULATORY EVALUATION

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

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

Attachment 2 of Order EA-12-051 requires the 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

FCS has one SFP, which is approximately 21 feet (ft.) 7 inches (in.) wide by 33 ft. 3 in. long and 41 ft. 6 in. deep.

The licensee submitted its OIP on February 28, 2013. The installation of the SFP level instrumentation is scheduled for completion two refueling outages after FCS starts up from its current shutdown, which would be prior to startup from the refueling outage scheduled to begin in the spring 2016.

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, in part, that

> Indicated level on either the primary or backup instrument channel will be approximately elevation 1034.6' (existing low level alarm LIA-2846, 39.1 feet above pool floor) plus the accuracy of the SFP level instrument channel and the current LIA-2846 low water level alarm. The Level 1 elevation is approximately

> 23 feet above the lowest spent fuel pool cooling suction line, and is a conservative elevation that has been established above the lowest spent fuel pool cooling suction line. The exact elevation for Level 1 will be determined during the detailed design and engineering phase, but will be approximately the same as the low-level alarm elevation of the current LIA-2846 instrument.

In its letter dated October 18, 2013, the licensee stated, in part, that

> The proposed Level 1 elevation is to coincide with the existing low level spent fuel pool instrument alarm setpoint. Details regarding this elevation selection related to the two points described in the NEI 12-02 guidance have not been completed and will be part of the detailed design modification process. The elevation selected will be consistent with the guidance in NEI 12-02.
>
> The Fort Calhoun Station (FCS) spent fuel pool (SFP) has two (2) cooling suction inlet locations, upper and lower. The upper suction inlet is at 1,034' centerline and the lower suction inlet centerline is at 1,011'-4". The FCS SFP cooling pumps are located near the 989' floor elevation, with the pump suction centerline at 991'-3" elevation. The distance from the pump centerline to the upper inlet suction centerline is 42.75'. The Level 1 elevation will be set near the existing low level alarm, which is approximately 43.25' above the SFP pump suction centerline. This elevation meets the guidance identified in NEI 12-02, but formal verification has not been completed. The cooling discharge line to the SFP is at 1,031'-7" and is an open-ended pipe. Details regarding the exact Level 1 location in regards to the guidance of NEI 12-02 will be provided in a future Omaha Public Power District (OPPD) six-month update.

The NRC staff notes that the proposed Level 1 will be set near the existing low level alarm, which is approximately 43.25 ft. above the SFP pump suction centerline. The staff also notes that the details regarding the exact Level 1 location will be provided in a future OPPD 6-month update. The staff has identified this request as:

RAI #1

Please provide the results of the calculation to be performed to determine the water elevation necessary for the SFP cooling pump required net positive suction head (NPSH) to confirm that Level 1 has been adequately identified.

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, in part, that

> Indicated level on either the primary or backup instrument channel will be approximately elevation 1020' plus the accuracy of the SFP level instrument channel, which is to be determined. This elevation is approximately 10' above the top of the spent fuel storage racks (Reference 7). The top of the spent fuel storage racks is approximately at elevation 1009'-7" (per Reference 7). The top of the active fuel area is approximately elevation 1007'-5" and as such approximately an additional 2.5' of water shielding is available through setting the Level 2 elevation at 1020'. The Level 2 elevation of 1020' is approximately 12'-7" above the top of the active fuel. This water level should provide substantial radiation shielding for personnel to respond to Beyond-Design-Basis external events and initiate any SFP makeup strategies.

In its letter dated October 18, 2013, the licensee provided a sketch depicting the level elevation datum points. The NRC staff reviewed this sketch and notes that Level 2 at an elevation of 1020 ft., is approximately 10 ft. above the top of the fuel rack which is at elevation 1010 ft. The staff also notes that the licensee designated Level 2 using the first of the two options described in NEI 12-02 for this level.

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, in part, that

> Indicated level on either the primary or backup instrument channel will be approximately elevation 1011' (approximately one foot above the top of the highest spent fuel rack) plus the accuracy of the SFP level instrument channel, which is to be determined. This elevation is approximately 1' above the top of the spent fuel rack. This monitoring level assures that there is adequate water level above the stored fuel seated in the rack. Setting Level 3 elevation at 1011' provides a water level of approximately 3.5' over the top of the active fuel region.

In its letter dated October 18, 2013, the licensee provided a sketch depicting the level elevation datum points. The NRC staff reviewed this sketch and notes that the proposed Level 3

elevation (1010 ft. to 1011 ft. elevation) is approximately 1 ft. above the top of the fuel rack at 1009 ft. 6 in. elevation).

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

3.3 Design Features: Instruments

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

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

NEI 12-02 states, in part, that

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

In its OIP, the licensee stated that the primary and backup instrument channels will consist of fixed components and that the measured range will be continuous over the range of the length of the probe starting at normal operating level.

In its letter dated October 18, 2013, the licensee provided a sketch depicting the level elevation datum points. However, this sketch did not provide the SFP level instrumentation sensor measurement range. The licensee stated that the final datum values will be provided in a future OPPD 6-month update as part of the detailed design modification phase.

The licensee's proposed plan, with respect to the number of channels for its SFP, appears to be consistent with NEI 12-02, as endorsed by the ISG. The NRC staff has concerns with the licensee's lack of information regarding the capability of the SFP level instrumentation sensor measurement range to cover Levels 1, 2, and 3 as described in Section 3.2 above. The staff has identified this request as:

RAI #2

Please provide the specific SFP level instrumentation sensor measurement range.

3.4 Design Features: Arrangement

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

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

NEI 12-02 states, in part, that

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

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

> SFP level probes are proposed to be installed in the southwest and northeast corners of the SFP (diagonally opposite corners). Details of the probe locations will be finalized in the design and engineering phase. Details related to location of the transmitters and the cabling have not been finalized at this point in time and will be part of the design and engineering phase of the project.
>
> Supports for the probes will be designed to shield the components from event-generated missiles. In the conceptual design, the SFP probes bolt to a mounting plate for installation at the corner of the SFP, or a plate for mounting near the side of the SFP. This mounting option will allow the probe to be installed within a few inches of the SFP liner, minimizing the chances of interference with other structures, and occupying limited space on the SFP deck. To the greatest extent possible, the supports will allow the fuel-handling machine to pass over them without interference. Details of the supports will be addressed in the design and

> engineering phase of the project. The location of the probes will not interfere with fuel cask handling transfers.
>
> Cabling for power supplies and indications for each channel will be routed in separate conduits from cabling for the other channels.

In its letter dated October 18, 2013, the licensee stated, in part, that

> The SFP inside dimensions and anticipated probe locations were transmitted in OPPD's OIP (Reference 1). The sketch provided in Section XVIII of the OIP, indicates the width of the SFP is 20'-7", and the length of the pool is 33'-3". The exact routing of the cables has not been determined.

The licensee's proposed location of the primary and backup level instruments for its SFP appears to be consistent with NEI 12-02, as endorsed by the ISG. However, the NRC staff notes that details related to location of the transmitters, the cabling, and the exact routing of the cables have not been finalized at this point in time. In its letter dated October 18, 2013, the licensee stated that this information will be provided to the staff in a future OPPD 6-month update. The staff has identified this request as:

RAI #3

Please provide a clearly labeled sketch or marked-up plant drawing of the plan view of the SFP area, depicting the SFP inside dimensions, the planned locations/placement of the primary and back-up SFP level sensor, and the proposed routing of the cables that will extend from these sensors toward the location of the read-out/display device.

3.5 Design Features: Mounting

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

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

NEI 12-02 states, in part, that

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

In its OIP, the licensee stated that

> Both the primary and backup system will be installed as Seismic Class I to meet the NRC JLD-ISG-2012-03 and NEI 12-02 guidance requirements.

In its letter dated October 18, 2013, the licensee stated, in part, that

> The loading on the probe mount and probe body includes both seismic and hydrodynamic loading using seismic response spectra that bounds the site design basis maximum seismic loads applicable to the installation location(s). The static weight load is also accounted for in the modeling described below but is insignificant in comparison to seismic and hydrodynamic loads. Analytic modeling is being performed by the instrument vendor using Institute of Electrical and Electronic Engineers (IEEE)-344:2004 methodology.
>
> The simple unibody structure of the probe assembly make it a candidate for analytic modeling and the dimensions of the probe and complex hydrodynamic loading terms in any case preclude meaningful physical testing.
>
> A detailed computational SFP hydrodynamic model has been developed for the instrument vendor by Numerical Applications, Inc., author of the GOTHIC computational fluid dynamics code. The computational model accounts for multi-dimensional fluid motion, pool sloshing, and loss of water from the pool.
>
> Seismic loading response of the probe and mount is separately modeled using finite element modeling software. The GOTHIC-derived fluid motion profile in the pool at the installation site and resultant distributed hydrodynamic loading terms are added to the calculated seismic loading terms in the finite element model to provide a conservative estimate of the combined seismic and hydrodynamic loading terms for the probe and probe mount, specific to the chosen installation location for the probe.
>
> The proximal portion of the level probe is designed to be attached to a Seismic Category I mounting bracket configured to suit the requirements of the FCS SFP. The bracket may be bolted and/or welded to the SFP deck and/or SFP liner/wall according to the requirements of the detailed design and modification process. At this time, detailed information is not available but will be provided in a future OPPD six-month update.

The NRC staff notes the licensee's proposed plan, with respect to the seismic design of the mounting, appears to be consistent with NEI 12-02, as endorsed by the ISG. The staff plans to verify the results of the licensee's seismic analysis report when it is completed based on the licensee's response to the following RAIs.

RAI #4

Please provide the results of the analyses used to verify the design criteria and methodology for seismic testing of the SFP instrumentation and the electronics units,

including design basis maximum seismic loads and the hydrodynamic loads that could result from pool sloshing or other effects that could accompany such seismic forces.

RAI #5

For each of the mounting attachments required to fasten 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, (3.6.2) Post Event Conditions, (3.6.3) Shock and Vibration, and (3.6.4) Seismic Reliability.

3.6.1 Augmented Quality Process

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

In its OIP, the licensee stated that augmented quality requirements, similar to those applied to fire protection, would be applied to 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 Post Event Conditions

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

> 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 will be addressed in the engineering and design phase. Examples of post-event (beyond-design-basis) conditions that will be considered are:
>
> - radiological conditions for a normal refueling quantity of fuel in the pool.
> - temperatures of 212°F and 100% relative humidity environment,
> - boiling water and/or steam environment,
> - a concentrated borated water environment.

Related to radiological conditions, in its OIP, the licensee stated, in part, that

> Equipment located in the vicinity of the SFP will be qualified to withstand peak and total integrated dose radiation levels for its installed location assuming that post event SFP water level is equal to SFP Level 3 for an extended period.

In its letter dated October 18, 2013, the licensee stated, in part, that

> Radiation: Signal processor: The Electrical Field Perturbation (EFP) guided radar technology signal processor is installed in a mild environment with radiation levels similar to background radiation, with the acknowledgement that the radiation limit for the signal processor is similar to other commercial-grade complementary-metal-oxide-semiconductor (CMOS)-based electronics. Radiation testing is not planned. It should be noted that the instrument performs self-diagnostics before measurements are obtained and the electronics are easily accessible for periodic replacement.
>
> Probe assembly: Materials properties qualification is used.

The NRC staff has concerns with the licensee's lack of information regarding its analysis of the maximum expected radiological conditions for the location of the sensor electronics. The staff has identified this request as:

RAI #6

Please provide analysis of the maximum expected radiological conditions (dose rate and total integrated dose) to which the sensor electronics (including power boxes, signal processors, and display panels) will be exposed. Also, provide documentation indicating the maximum total integrated dose the sensor electronics can withstand and how it was determined. Discuss the time period over which the analyzed total integrated dose was applied.

While addressing post-event temperature and humidity conditions, in its letter dated October 18, 2013, the licensee stated, in part, that

> Temperature: Signal processor: Designed for mild environment installation. Physical testing in an environmental chamber to demonstrate normal operation at the operating temperatures specified for the instrument.
>
> Probe assembly: Qualification by materials properties and use history of substantially similar probe designs in steam generator applications at significantly higher temperatures and pressures and saturated steam environments.
>
> Humidity: Signal processor: Designed for mild environment installation. Physical testing in an environmental chamber to demonstrate normal operation at the operating temperatures specified for the instrument.
>
> Probe assembly: Qualification by materials properties and use history as noted above.

The NRC staff notes that information related to the qualification and test program to confirm the reliability of the permanently installed equipment during and following BDB events are not available for review. The staff has identified these requests as:

RAI #7

Please provide information indicating the maximum expected ambient temperature in the room in which the sensor electronics will be located under BDB conditions, in which there is no ac power available to run heating, ventilation, and air conditioning (HVAC) systems, and whether the sensor electronics are capable of continuously performing required functions under this expected temperature condition.

RAI #8

Please provide information indicating the maximum expected relative humidity in the room in which the sensor electronics will be located under BDB conditions, in which there is no ac power available to run HVAC systems, and whether the sensor electronics are capable of continuously performing required functions under this expected humidity condition.

3.6.3 Shock and Vibration

NEI 12-02 states, in part, that

> Applicable components of the instrument channels are rated by the manufacturer (or otherwise tested) for shock and vibration at levels commensurate with those of postulated design basis event conditions in the area of instrument channel component use using one or more of the following methods:
>
> - instrument channel components use known operating principles, are supplied by manufacturers with commercial quality programs (such as ISO9001) with shock and vibration requirements included in the purchase specification and/or instrument design, and commercial design and testing for operation in environments where significant shock and vibration loadings are common, such as for portable hand-held devices or transportation applications;
>
> - substantial history of operational reliability in environments with significant shock and vibration loading, such as transportation applications, or
>
> - use of component inherently resistant to shock and vibration loadings or are seismically reliable such as cables.

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

> Components of the instrument channels will be qualified for shock and vibration using one or more of the following methods:
>
> - Components are supplied by manufacturers using quality programs with shock and vibration requirements included in the purchase specification at levels commensurate with portable hand-held devices or transportation applications;
>
> - Components have a history of operational reliability in environments with significant shock and vibration loading, such as portable hand-held device or transportation applications; or
>
> - Components are inherently resistant to shock and vibration loadings, such as cables.

In its letter dated October 18, 2013, the licensee stated, in part, that

> Shock: Signal processor: Physical testing to commercial and/or military standards using shake-table and drop testing.
>
> Probe assembly: Finite element analysis in conjunction with seismic modeling described in RAI-3a response.
>
> Vibration: Signal processor: Physical testing to applicable commercial and/or military standards using shake-table and drop testing.
>
> Probe assembly: The probe assembly and bracket together form a simple static unibody structure with intrinsic vibration resistance that is additionally subject to substantial damping due to the surrounding water medium. This is planned to be modeled using finite element modeling in conjunction with seismic modeling described above.

The NRC staff has concerns with the licensee's lack of information regarding qualification of the level instruments for shock and vibration and the description of the manufacturer's shock and vibration ratings for the electronics cabinet equipment and the results of any testing performed by the manufacturer to achieve those ratings. The staff plans to verify the licensee's comparison of the magnitude of the manufacturer's ratings against postulated plant conditions under design basis events. The staff has identified this request as:

RAI #9

Please provide information describing the evaluation of the comparative local electronics cabinet and display panel ratings against postulated plant conditions. Also, please provide results of the manufacturer's shock and vibration test methods, test results, and the forces and their frequency ranges and directions applied to the display panel associated with its successful tests. Include a description of the specific method or

combination of methods to be applied to demonstrate the reliability of the permanently installed local and electronics cabinet equipment under BDB shock and vibration conditions.

RAI #10

For RAI #9 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.

3.6.4 Seismic Reliability

The ISG recommends the use of Sections 7, 8, 9, and 10 of IEEE 344-2004 for seismic qualification of the SFP level instrumentation.

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

> For seismic effects on instrument channel components used after a potential seismic event for only installed components (with the exception of battery chargers and replaceable batteries), the following measures will be used to verify that the design and installation is adequate. Applicable components of the instrument channels are rated by the manufacturer (or otherwise tested) for seismic effects at levels commensurate with those of postulated design basis event conditions in the area of instrument channel component use...

In its letter dated October 18, 2013, the licensee stated, in part, that

> These instruments are not required for design basis accidents and as such are not to be designed to worst-case credible design basis loading. They are designed to be reliable as augmented quality systems in accordance with NEI 12-02 guidance.
>
> Signal processor (electronics):
>
> Triaxial shake-table testing is to be performed by the vendor to envelope Seismic Category 1 safe shutdown earthquake (SSE) conditions or site design basis maximum seismic loads (relative to the location where the equipment is mounted) using IEEE-344:2004 methodology.
>
> Probe assembly (level sensor):
>
> Seismic and hydrodynamic finite element analysis is performed by the vendor using relevant IEEE-344:2004 methodology (using enveloping Seismic Category 1 SSE conditions or site design basis maximum seismic loads relative to the location where the equipment is mounted), as described in the RAI-3 response.

> With respect to the probe assembly, combined seismic and hydrodynamic analysis will be used to demonstrate that the probe waveguide's geometric dimensions do not change significantly as a result of the seismic conditions. In the absence of alteration to the geometric configuration of the probe waveguide there is no mechanism for seismic excitation of the probe assembly to alter system accuracy.

The NRC staff notes that the licensee will demonstrate the reliability of the seismic design and installation in accordance with NEI 12-02, as endorsed by the ISG. The licensee's planned approach with respect to the seismic reliability of the instrumentation appears to be consistent NEI 12-02, as endorsed by the ISG. However, the staff plans to verify the results of the licensee's seismic testing and analysis when it is completed. The staff has identified this request as:

RAI #11

Please provide analysis of the vendor analysis and seismic testing results and show that SFP level instrument performance reliability, following exposure to simulated seismic conditions representative of the environment anticipated for the SFP structures at FCS, has been adequately demonstrated.

3.6.5 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 the primary and backup instrument channels would be of the same technology, permanently installed, and separated by distance, with independent power supplies.

In its letter dated October 18, 2013, the licensee stated, in part, that

> FCS has a single spent fuel pool. As shown in Section XVIII of the OIP (Reference 1), the FCS spent fuel pool is between column line 5d and approximately column line 4b. The area noted on the right hand side of the sketch "New Fuel Storage & Crating" is an open area used only for new fuel receipt/storage and is not flooded. As such, the probes will be installed in only one pool, and are planned to be set at the furthest distance possible from each other in the pool, (i.e., diagonal corners). This anticipated location for each probe is intended to minimize to the greatest extent possible, the potential for falling debris to impact both probes. The vendor will perform additional detailed failures modes and event analysis, and the information will be provided in a future OPPD six-month update.
>
> Detailed information is not available regarding the independent power sources since the modification design process has not been started. The information will be provided in a future OPPD six-month update.

The NRC staff notes that further information regarding the SFP level instrumentation channel independence is not currently available for review. In its letter dated October 18, 2013, the licensee indicated the information will be provided to the staff in a future OPPD 6-month update. The staff has identified this request as:

RAI #12

Please provide the following:

a) A description of the manner in which the two channels of the proposed level measurement system meet this 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 23, 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 two instrumentation channels will each be powered normally by a separate power supply and will have dedicated batteries and local battery chargers. Minimum battery life of 72 hours will be provided. The battery systems will include provision for battery replacement should the battery charger be unavailable following the event. Spare batteries will be available. In the event of a loss of normal power, the battery chargers could be connected to another suitable power source.

In its letter dated October 18, 2013, the licensee stated, in part, that

> Since the modification design process has not been started, OPPD does not have details regarding electrical AC power sources and capacities for the primary

and backup channels. That information will be provided in a future OPPD six-month update.

When the instrument is powered through the battery, the instrument configuration is to be established with an automated sample rate consistent with seven days continuous operation. The sample rate estimates have been developed by the vendor using conservative instrument power requirements and measured battery capacity with drawdowns during and following exposure of the batteries to their maximum operating temperature for up to seven days. Permanent installed battery capacity for seven days continuous operation is planned consistent with NEI 12-02 duration without reliance on or crediting of potentially more rapid FLEX Program power restoration. Batteries are readily replaceable via spare stock without the need for recalibration to maintain instrument accuracy.

The NRC staff notes that further information regarding power supply configuration and battery backup for the SFP level instrumentation is not currently available for review. In in its letter dated October 18, 2013, the licensee indicated that the information will be provided to the staff in a future OPPD 6-month update. The staff has identified this request as:

RAI #13

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 NRC letter dated August 23, 2013. However, based on feedback from the licensees, it was revised as above.)

3.9 Design Features: Accuracy

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

> The instrument channels shall maintain their designed accuracy following a power interruption or change in power source without recalibration.

NEI 12-02 states, in part, that

> Accuracy should consider operations while under SFP conditions, e.g., saturated water, steam environment, or concentrated borated water. Additionally, instrument accuracy should be sufficient to allow trained personnel to determine when the actual level exceeds the specified lower level of each indicating range (levels 1, 2 and 3) without conflicting or ambiguous indication.

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

> Instrument channels will be designed such that they will maintain their design accuracy following a power interruption or change in power source without recalibration.
>
> Accuracy will consider SFP conditions, e.g., saturated water, steam environment, or concentrated borated water. Additionally, instrument accuracy will be sufficient to allow trained personnel using plant procedures 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. The accuracy will be within the resolution requirements of Figure 1 of NEI 12-02.

In its letter dated October 18, 2013, the licensee stated that expected instrument channel absolute accuracy under normal level conditions (Level 1 or higher) is approximately +/- 0.3% of the span. The licensee also stated the expected absolute accuracy under BDB conditions is approximately +/- 0.3% of the span at Level 2 and 3 datum points.

In addition, in its letter dated October 18, 2013, the licensee commented on the methodology to determine deviation from the instrument channel design accuracy, stating in part, that

> In general, relative to normal operating conditions, any applicable calibration procedure tolerances (or acceptance criterion) are planned to be established based on manufacturer's stated/recommended reference accuracy (or design accuracy). The methodology used is planned to be captured in plant procedures and/or programs that are yet to be developed. More information will be provided in a future OPPD six-month update regarding plant procedures and/or programs related to channel design accuracy.

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

RAI #14

Please provide analysis verifying that the proposed instrument performance is consistent with these estimated accuracy normal and BDB values. Demonstrate that the channels will retain these accuracy performance values following a loss of power and subsequent restoration of power.

RAI #15

Please provide a description of the methodology to 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 alert operators and technicians that the channel requires adjustment to within normal design accuracy.

3.10 Design Features: Testing

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

> The instrument channel design shall provide for routine testing and calibration.

NEI 12-02 states, in part, that

> Static or non-active installed (fixed) sensors can be used and should be designed such that testing and/or calibration can be performed in-situ. For microprocessor based channels the instrument channel design shall be capable of testing while mounted in the pool.

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

> Instrument channel design will provide for routine testing and calibration consistent with Order EA-12-051 and the guidance in NEI 12-02.

In its letter dated October 18, 2013, the licensee stated, in part, that

> The instrument automatically monitors the integrity of its level measurement system using in-situ capability. Deviation of measured test parameters from manufactured or as-installed configuration beyond a configurable threshold prompts operator intervention.
>
> Periodic calibration checks of the signal processor electronics to extrinsic National Metrology Institute (NMI) traceable standards can be achieved with standard measurement and test equipment.
>
> The probe itself is a perforated tubular coaxial waveguide with defined geometry and is not calibrated. It is to be periodically inspected electromagnetically using Time Domain Reflectometry (TDR) to demonstrate that the probe assembly meets manufactured specification and visually to demonstrate that there has been no mechanical deformation or fouling.
>
> Each instrument electronically logs a record of measurement values over time in non-volatile memory that can be compared to demonstrate constancy, including any changes in pool level, such as that associated with the normal evaporative loss/refilling cycle. The channel level measurements can be directly compared to each other (i.e., regular cross-channel comparisons). Existing permanently installed SFP level instrumentation or other direct measurements of SFP level may be used for diagnostic purposes if cross-channel comparisons are anomalous.

> ...The channel level measurements can be directly compared to each other (i.e., regular cross-channel comparisons). Existing permanently installed SFP level instrumentation or other direct measurements of SFP level may be used for diagnostic purposes if cross-channel comparisons are anomalous.

The NRC staff notes the SFP level instrument channels can be compared with the acceptance criteria described in Section 3.9 above to determine if recalibration or troubleshooting is needed. However, the NRC staff has concerns with the lack of information regarding the feasibility of the licensee's process for in-situ calibration to ensure that the design accuracy will be maintained. The staff has identified this request as:

RAI #16

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

3.11 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 states, in part, that

Remote indication will be provided in the alternate safe shutdown panel in the Auxiliary Building Upper Electrical Penetration Room. The other remote indication will be provided with portable equipment located near FLEX equipment along the north wall of the Ventilation Equipment Room. It has not been determined at this point in time if a readout will be provided in the control room or with the plant computer display system. That determination will be made during the design and engineering phase.

The display in the alternate shutdown panel Upper Electrical Penetration Room will be:

- 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.

Each instrument channel (Primary and Backup) will have the capability to drive an external remote 4 – 20 milliamp (ma) loop that can be used to provide level indication at a second display location or be used as an input to the plant computer. Failure of the external remote 4 – 20 ma signal will not adversely impact the primary display located in the transmitter (electronics) enclosure.

In its letter dated October 18, 2013, the licensee stated, in part

> The primary and backup display locations were selected because those locations are in close proximity to where the personnel primarily responsible for FLEX equipment deployment and operation will be located. Spent fuel pool level control will be the responsibility of the Auxiliary Building Operator also known as the Equipment Operator Nuclear Auxiliary (EONA) position, who will normally be stationed at the location where the primary display will be mounted. A preliminary walkdown was performed to ensure that short-term (< 24 hour) FLEX deployment actions could be accomplished using existing personnel. The primary and secondary displays are located in FLEX equipment deployment paths, located entirely within Seismic Class 1 structures and are either adjacent to or closer to the location where local makeup flow to the spent fuel pool will be controlled than is the control room. This improves resource availability and response time for monitoring SFP level. Primary and alternate access and egress paths to the display locations are provided in the FCS FLEX Overall Integrated Plan (Reference 2, Enclosure, Attachment 3, Section A).
>
> The primary display location will be located on the upper level of the auxiliary building adjacent to the proposed location of the manifold that will be used to control the distribution of water from FLEX pumps to the emergency feedwater storage tank (EFWST), the reactor coolant system (RCS) and the spent fuel pool (SFP). This location was selected due to its proximity to a current Appendix R access path (inside a Seismic Class 1 structure) and the intended FLEX water supply (the safety injection refueling water tank – SIRWT). The exact location for the secondary display is on the wall north of the "FLEX Valve Station Deployment Location," which can be seen in Reference 2, Enclosure, Attachment 3, Figure A-4, Section B-8. OPPD is evaluating habitability of this location as part of the FLEX implementation project and will perform modifications if necessary to ensure prompt access will be maintained throughout any postulated event where flow control and monitoring of SFP level is necessary.
>
> The secondary display location is adjacent to the electrical switchgear room where installed electrical equipment would be manually operated in support of FLEX deployment and implementation. This location at the remote shutdown panel in the upper electrical penetration room is in an area that is physically separated from the primary monitoring location, to allow for scenarios where continuous manning of the primary control location is not warranted or desirable. The secondary monitoring location allows rapid access to and egress from the control room (CR) and the primary FLEX control station in the auxiliary building via pathways that are enclosed within seismically qualified structures. The location for the secondary display is near panel AI-185 which can be seen in Reference 2, Enclosure, Attachment 3, Figure A-3, Section E-6. OPPD is evaluating habitability of this location as part of the FLEX implementation project. Due to the separation of this location from hot components and fluid systems, OPPD does not expect that any modifications will be necessary to ensure habitability in this area.

It is not anticipated that the SFP level would change rapidly enough to demand the need for rapid communications. The operators would first employ radio communications or the Spectralink system as a means of communication. If the radio communications or Spectralink systems are non-functional, the gai-tronics system is assumed available because it is powered from the station batteries and is located in Seismic Class 1 structures.

The operators can walk to the CR if they need to talk to Command and Control personnel. Since the EONA will be the person primarily responsible for maintaining SFP level and will have procedural direction for maintaining said level within a certain band, there is no need for immediate direction from the CR. If the secondary location has to be used, the EONA and Turbine Building Operator also known as the Equipment Operator Nuclear Turbine (EONT) can communicate face-to-face at the radiologically controlled area (RCA) access point, which is easily reachable from the switchgear room via the "back door" next to the FCS radiological area. There are at least three (3) exit points: two (2) within a Seismic Class 1 structure that has access to the alternate shutdown panel.

If, during FLEX project development, OPPD determines that habitability of either the primary or secondary SFP monitoring location cannot be supported, a suitable alternate location will be selected. Should that happen, the new location will be provided in a future OPPD six-month update.

The NRC staff notes the proposed location for the primary and backup SFP level instrumentation displays were selected because those locations are in close proximity to where the personnel primarily responsible for FLEX equipment deployment and operation will be located. For the primary SFP level instrumentation display, the specific location is in the upper level of the auxiliary building adjacent to the proposed location of the manifold that will be used to control the distribution of water from FLEX pumps to the emergency feedwater storage tank (EFWST), the reactor coolant system (RCS) and the SFP. For the secondary display, the specific location is adjacent to the electrical switchgear room where installed electrical equipment would be manually operated in support of FLEX deployment and implementation. The staff also notes that further information related to the habitability of these locations is in development and that if OPPD determines the habitability of either the primary or secondary SFP monitoring location cannot be supported, a suitable alternate location will be selected and the information will be provided to the staff in a future OPPD 6-month update. The staff has identified this request as:

RAI #17

Please describe the evaluation used to validate that display locations can be accessed without unreasonable delay following a BDB event. Include the time available for personnel to access the display as credited in the evaluation, as well as the actual time (e.g., based on walk-throughs) that it will take for personnel to access the display. Additionally, please include a description of the radiological and environmental conditions on the paths personnel might take. Describe whether the display location remains habitable for radiological, heat and humidity, and other environmental

conditions following a BDB event. Describe whether personnel are continuously stationed at the display or monitor the display periodically.

3.12 Programmatic Controls: Training

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

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

NEI 12-02 states, in part, that

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

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

> FCS training programs and processes will be used to identify the population to be trained and to determine both the initial and continuing elements of the required training. Training will be completed prior to placing the instrumentation in service.

The NRC staff has concerns with the licensee's lack of information regarding the training of personnel for activities such as use of the instrument channels, provision for alternate power, and calibration and surveillance of the SFP instrumentation. Another staff concern is the lack of information on the licensee's approach to training with respect to the SFP instrumentation. The staff has identified this request as:

RAI #18

Please describe the activities for which personnel will be trained, such as use of the instrument channels, provision of alternate power, calibration and surveillance. Describe the approach to training used to identify the population to be trained and determined the initial and continuing elements of the required training for the SFP instrumentation.

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 using guidelines and vendor instructions to address the maintenance, operation, and abnormal response issues associated with the new SFP instrumentation consistent with NEI 12-02.
>
> Procedures will address a strategy to ensure SFP water level addition is initiated at an appropriate time consistent with implementation of NEI 12-06, Diverse and Flexible Coping Strategies (FLEX) Implementation Guide (Reference 6). The details of the procedure implementation will be linked to NRC Order 12-049, Issuance of Order to Modify Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events (Reference 8) ...

In its letter dated October 18, 2013, the licensee stated, in part

> Development of operating, calibration/test, maintenance, and inspection procedures will be performed as part of the detailed design process. The procedures will be subject to the programmatic controls of the FCS FLEX Program as described in the FCS FLEX OIP (Reference 2).
>
> Specific technical objectives for the above procedures will be developed as part of the detailed design process. OPPD does not anticipate using portable spent fuel level monitoring equipment. A description of the objectives and a brief outline of the procedures to be developed will be provided in a future OPPD six-month update.

The NRC staff has concerns with the licensee's lack of information regarding the procedures that should be established and maintained for the testing, calibration, and use of the primary and backup SFP instrument channels. The NRC staff has identified this request as:

RAI #19

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

3.14 Programmatic Controls: Testing and Calibration

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

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

NEI 12-02 states, in part, that

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

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

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

In its letter dated October 18, 2013, the licensee stated, in part, that

> Operator performance tests (functional checks) are automated and/or semi-automated (i.e., require limited operator interaction) and are performed through the instrument menu software as initiated by the operator. There are a number of other internal system tests that are performed by system software on an essentially continuous basis without user intervention but can also be performed on an on-demand basis with diagnostic output to the display for the operator to review. Other tests such as menu button tests, level alarm, and alarm relay tests are initiated manually by the operator. Operator performance checks are described in detail in the Vendor Operator's Manual, and the applicable information will be transferred to plant operating procedures.
>
> Operator performance tests are planned to be performed periodically as recommended by the equipment vendor, (e.g., quarterly) but no less often than the calibration interval of two years.
>
> Channel functional tests with limits established in consideration of vendor equipment specifications are to be performed using Operations procedures at appropriate frequencies established equivalent to or more frequently than existing spent fuel pool instrumentation (SFPI). Details regarding the frequency of channel functional testing will be established as part of the detailed design process and will be provided in a future OPPD six-month update.

Manual calibration and operator performance checks are to be performed in a periodic scheduled fashion with additional maintenance as needed when flagged by the system's automated diagnostic testing features. Details regarding the manual calibration and operator performance checks will be established as part of the detailed design process and will be provided in a future OPPD six-month update.

Channel calibration tests per maintenance procedures with limits established in consideration of vendor equipment specifications are to be performed at frequencies established in consideration of vendor recommendations.

Periodic (e.g., quarterly or monthly) review of the system level history and log files and routine attention to any warning message on the system display is recommended by the vendor. Formal calibration checks are recommended by the vendor on a two-year interval to demonstrate calibration to external National Institute of Standards and Technology (NIST) traceable standards. Formal calibration check surveillance interval and timing would be established consistent with applicable guidance [i.e., NEI 12-02 Section 4.3, on a refueling outage interval basis and within 60 days of a planned refueling outage considering normal testing scheduling allowances (e.g., +/- 25%)]. Items such as system batteries are to be assessed under the Preventive Maintenance (PM) Program for establishment of replacement frequency with PM timing/performance being controlled via tasks in the PM Program.

In addition, in its letter dated October 18, 2013, the licensee stated, in part

SFPI channel/equipment maintenance/preventative maintenance and testing program requirements to ensure design and system readiness are to be established in accordance with utility processes and procedures and in consideration of vendor recommendations to ensure that appropriate regular testing, channel checks, functional tests, periodic calibration, and maintenance is performed. Subject maintenance and testing program requirements are to be developed during the SFPI modification design process. Specific details regarding the maintenance and testing program will be provided in a future OPPD six-month update when the information becomes available.

Detailed information [regarding compensatory actions for one or both non-functioning channels] is not available at this time but will be provided in a future OPPD six-month update.

Both primary and backup SFPI channels incorporate permanent installation (with no reliance on portable, post-event installation) of relatively simple and robust augmented quality equipment. Permanent installation coupled with the stocking of adequate spare parts reasonably diminishes the likelihood that a single channel is out of service for an extended period. It follows that this also greatly diminishes the likelihood that both channels are out-of-service for an extended period.

The NRC staff notes that the licensee proposed approach regarding compensatory actions with respect to testing and calibration appears to be consistent with NEI 12-02, as endorsed by the ISG. However, the staff has concerns regarding the scheduling and implementation of necessary testing and calibration of the primary and backup SFP level instrument channels to maintain their design accuracy. The staff has identified this request as:

RAI #20

Please provide the following:

a) **Further information describing the maintenance and testing program to be established and implemented 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 compensatory actions that will be taken in the event that one or both channels are non-functioning, as described in the guidance in NEI 12-02 Section 4.3.**

3.15 Instrument Reliability

NEI 12-02 states, in part, that

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

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

> Reliability of the primary and backup instrument channels will be assured by conformance with the guidelines of NRC JLD-ISG-2012-03 and NEI 12-02, as discussed in Section IX, Qualification.

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 September 30, 2015, to ensure that any issues are resolved prior to the date by which the licensee must complete full implementation of Order EA-12-051. The licensee should adjust its 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.

Sincerely,

/RA/

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

Docket No. 50-285

Enclosure:
Interim Staff Evaluation and RAI

cc w/encl: Distribution via Listserv

DISTRIBUTION:
PUBLIC
LPL4-1 Reading
RidsAcrsAcnw_MailCTR Resource
RidsNrrDeEicb Resource
RidsNrrDorlLpl4-1 Resource
RidsNrrDssSbpb Resource
RidsNrrLAJBurkhardt Resource
RidsNrrPMFortCalhoun Resource
RidsRgn4MailCenter Resource
CRoque-Cruz, NRR
DRahn, NRR
GCasto, NRR
MMitchell, NRR
RKuntz, NRR
CHunt, NRR
BPurnell, NRR

ADAMS Accession No. ML13317A583 ***via memo**

OFFICE	NRR/DORL/LPL4-1/PM	NRR/DORL/LPL4-1/LA	NRR/DSS/SBPB/BC*
NAME	LWilkins	JBurkhardt	GCasto
DATE	11/20/13	11/19/13	10/29/13
OFFICE	NRR/DE/EICB/BC*	NRR/DORL/LPL4-1/BC	NRR/DORL/LPL4-1/PM
NAME	JThorp	MMarkley (FLyon for)	LWilkins
DATE	10/29/13	11/22/13	11/25/13

OFFICIAL RECORD COPY