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

November 15, 2013

Mr. James A. Spina, Vice President-Corporate Site Operations
Constellation Energy Nuclear Group, LLC
100 Constellation Way, Suite 200C
Baltimore, MD 21202

SUBJECT: CALVERT CLIFFS NUCLEAR POWER PLANT, UNIT NOS. 1 AND 2, AND NINE MILE POINT NUCLEAR STATION, UNIT NOS. 1 AND 2, INTERIM STAFF EVALUATION AND REQUEST FOR ADDITIONAL INFORMATION REGARDING THE OVERALL INTEGRATED PLAN FOR IMPLEMENTATION OF ORDER EA-12-051, RELIABLE SPENT FUEL POOL INSTRUMENTATION (TAC NOS. MF1131, MF1132, MF1140, AND MF1141)

Dear Mr. Spina:

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. ML13066A172), as supplemented by letters dated March 8, 2013 (ADAMS Accession No. ML13073A155), July 3, 2013 (ADAMS Accession No. ML13190A017), July 5, 2013 (ADAMS Accession No. ML13197A220), and August 27, 2013 (ADAMS Accession No. ML13254A279), Constellation Energy Nuclear Group, LLC, submitted its Overall Integrated Plans (OIPs) for Calvert Cliffs Nuclear Power Plant, Units 1 and 2, and Nine Mile Point Nuclear Station, Units 1 and 2. The OIPs were submitted in response to the March 12, 2012, Commission Order modifying licenses with regard to requirements for the licensees to install Reliable Spent Fuel Pool (SFP) Instrumentation (Nuclear Regulatory Commission Order Number EA-12-051)

The U.S. Nuclear Regulatory Commission (NRC) staff has completed its review of the OIPs and supplemental information. At this time, the NRC staff is unable to make any final conclusions regarding the acceptability of the licensee's OIPs. However, the enclosed interim staff evaluations provide the NRC staff's preliminary conclusions in areas where the licensee has provided sufficient information and identified areas where additional information is needed.

In order for the NRC staff to review the final licensee's SFP instrumentation OIPs and complete the NRC staff's evaluation, all the requested information must be provided no later than September 30, 2014. Our interim staff evaluation input for Calvert Cliffs Nuclear Power Plant is provided as Enclosure 1, and our interim staff evaluation for Nine Mile Point Nuclear Station, Units 1 and 2 is provided as Enclosure 2.

Please contact me at (301) 415-1476 or email Mohan.Thadani@nrc.gov, if you have any questions on this issue.

Sincerely,

Mohan C. Thadani, Senior Project Manager
Plant Licensing Branch I-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket Nos. 50-317, 50-318, 50-220, and 50-410

Cc w/enclosures:

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INTERIM STAFF EVALUATION AND REQUEST FOR ADDITIONAL INFORMATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION RELATED TO THE OVERALL INTEGRATED PLAN IN RESPONSE TO ORDER EA-12-051, "RELIABLE SPENT FUEL POOL INSTRUMENTATION" CONSTELLATION ENERGY NUCLEAR GROUP, LLC CALVERT CLIFFS NUCLEAR POWER PLANT, UNITS 1 AND 2 DOCKET NOS. 50-317 AND 50-318

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) water 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. ML13066A172), Constellation Energy Nuclear Group, LLC (the licensee) provided the OIP for Calvert Cliffs Nuclear Power Plant (CCNPP), Units 1 and 2, describing how it will achieve compliance with Attachment 2 of Order EA-12-051 by Spring 2015. By letter dated June 19, 2013 (ADAMS Accession No. ML13164A393), the NRC staff sent a Request for Additional Information (RAI) to the licensee. The licensee provided supplemental information by letters dated July 3, 2013 (ADAMS Accession No. ML13190A017), and August 27, 2013 (ADAMS Accession No. ML13254A279).

2.0 REGULATORY EVALUATION

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

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

Attachment 2 of Order EA-12-051 requires the 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) water level that is adequate to support operation of the normal fuel pool cooling system, (2) water level that is adequate to provide substantial radiation shielding for a person standing on the SFP operating deck, and (3) water 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 water 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 water 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

The CCNPP has a set of two interconnected SFPs. Each pool is approximately 25 feet wide by 43 feet long and 39 feet deep. The SFPs are normally interconnected and at the same water level.

The licensee's OIP was submitted on February 28, 2013. The OIP states that installation of the SFP level instrumentation at CCNPP is scheduled to be completed prior to startup from the Unit 2 Spring 2015 refueling outage, which is before startup from the second refueling outage for each unit.

The NRC staff has reviewed the licensee's schedule for implementation of SFP level instrumentation provided in its OIP. If the licensee completes implementation in accordance with this schedule, it would appear to achieve compliance with Order EA-12-051 within two refueling cycles after submittal of the OIP and before December 31, 2016.

3.2 Spent Fuel Pool Water Levels

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

> All licensees identified in Attachment 1 to this Order shall have a reliable indication of the water level in associated spent fuel storage pools capable of supporting identification of the following pool water level conditions by trained personnel: (1) level that is adequate to support operation of the normal fuel pool cooling system [Level 1], (2) level that is adequate to provide substantial radiation shielding for a person standing on the SFP operating deck [Level 2], and (3) level where fuel remains covered and actions to implement make-up water addition should no longer be deferred [Level 3].

NEI 12-02 states, in part, that

> Level 1 represents the HIGHER of the following two points:
>
> - The level at which reliable suction loss occurs due to uncovering of the coolant inlet pipe, weir or vacuum breaker (depending on the design), or
>
> - The level at which the water height, assuming saturated conditions, above the centerline of the cooling pump suction provides the required net positive suction head specified by the pump manufacturer or engineering analysis.

In its OIP, the licensee stated that Level 1 is the indicated water level on either the primary or backup instrument channel of greater than elevation 65 feet (ft.) 8.5 inches (in.), based on ensuring the open end of the normal suction lines will not become uncovered.

In its letter dated July 3, 2013, the licensee stated that the response to NRC staff's RAI 1(a) describing how the identified Level 1 location represents the HIGHER of the two points described in the NEI 12-02 guidance will be provided on February 28, 2014, with the second 6-month update.

The NRC staff notes that the information describing how the identified Level 1 location represents the HIGHER of the two points as described in the NEI 12-02 guidance is not available for review and that this information will be provided to the staff on the February 28, 2014, with the second 6-month update. The staff has identified this request as:

RAI #1

For Level 1, please specify how the identified location represents the HIGHER of the two points described in the NEI 12-02 guidance for this level.

(This information was previously requested as RAI-1(a) in NRC letter dated June 19, 2013)

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 water level on either the primary or backup instrument channel of greater than elevation 50'-2" plus the accuracy of the SFP water level instrument channel, which will be determined during the engineering and design phase. This elevation is approximately 5' above the top of the fuel racks and ensures a minimum water level of 5' above the top of the Fuel (Reference 10). CCNPP determined that with 5' of water above the top of the racks, the largest calculated

> dose rate near the edge of the SFP would be well below 100 mrem/hr [millirem per hour].

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

> This monitoring level ensures there is adequate water level to provide substantial radiation shielding for personnel to respond to Beyond-Design-Basis External Events and to initiate SFP makeup strategies.

The NRC staff notes that the licensee designated Level 2 using the second of the two options described in NEI 12-02 for Level 2. This method requires that sufficient level is in the SFP to provide adequate radiation shielding to maintain personnel radiological dose levels within acceptable limits while performing local operations in the vicinity of the pool. Further, NEI 12-02 states that guidance for performing plant-specific shielding calculations considering the emergency conditions that may apply at the time and the scope of necessary local operations may be found in EPA-400, "Manual of Protective Actions Guides and Protective Actions for Nuclear Incidents". The staff notes that the licensee performed calculations in accordance with EPA-400 guidance to determine dose rates near the edge of the SFP with 5' of water above the top of the fuel racks, and found that the dose rate would be lower than 100 mrem/hr. The staff notes that this dose rate is reasonable for licensees to perform actions in the vicinity of the SFP to maintain total dose within regulatory limits.

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 is the indicated water level on either the primary or backup instrument channel of greater than elevation 45 ft. 2 in.

In its letter dated July 3, 2013, the licensee provided a SFP elevation view sketch. In this figure, the licensee identified various pool elevations and SFP instrumentation levels.

The NRC staff notes that the elevation identified for Level 3 is above the highest point of any spent fuel storage rack seated in the SFP.

The licensee's proposed plan, with respect to identification of Levels 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, in part, that

> Primary and backup instrument channels will consist of fixed components. The primary and backup instrument channel level sensing components will be located and permanently mounted in the SFP. Measured range will be continuous from the high SFP alarm elevation 67'-2.75" plus the accuracy of the SFP water level instrument channel to the top of the spent fuel racks at elevation 45'-2" minus the accuracy of the SFP water level instrument channel.
>
> Primary instrument channel level sensing components will be located in the northeast corner of Unit 1 SFP (No. 11). Backup instrument channel level sensing components will be located in the southwest corner of Unit 2 SFP (No. 21).

The NRC staff notes that the range specified for the licensee's instrumentation will cover Levels 1, 2, and 3 as described in Section 3.2 above. The licensee's proposed plan, with respect to the number of channels for both of its SFPs, appears to be consistent with NEI 12-02, as endorsed by the ISG.

The NRC staff reviewed the sketch provided in the OIP identifying the proposed location for the primary and backup instrument channels. The staff notes that the licensee's proposed location of the instrument channels appears to be consistent with the guidance when the two pools are interconnected.

In its letter dated July 3, 2013, the licensee explained that if a breach occurs in one of the SFPs under severe accident conditions, they would install a bulkhead gate to isolate the SFPs, so water level could be maintained in the unaffected SFP. The NRC staff has concerns regarding this description within the licensee's response and the effects the installation of the bulkhead gate could have on the reliability of the SFP level instrumentation to meet the requirements of Order EA-12-051. The staff has identified this request as:

RAI #2

Please describe the impact of the installation of the bulkhead gate on the reliability of the SFP level instrumentation for each SFP, and what compensatory measures would be taken to ensure reliable level indication in each SFP when the bulkhead gate is installed.

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. Such protection may be provided by locating the primary instrument channel and the fixed portions of a portable backup channel, if applicable, to maintain instrument channel separation within the fuel pool area, and by utilizing 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 the 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 functions.
>
> Channel separation should be maintained by locating the installed sensors in different places in the spent fuel pool area.

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

> SFP water level sensors will be installed in the northeast corner of Unit 1 SFP (No. 11) and southwest corner of Unit 2 SFP (No. 21). Transmitters will be located on the 45' elevation of the Auxiliary Building, which is below the SFP operating level. This location will provide protection from external missiles and offer lower dose, temperature and humidity levels when compared to equipment located directly above the SFP (Elevation 69'). ...
>
> Based on the above, external missiles will not penetrate the SFP enclosure at the 69' or the 45' elevation. No event-generated missiles are postulated with the exception of items that could fail during a severe earthquake such as glass/plastic portions of light fixtures and pipe insulation. The design will provide adequate protection against these items.

> The sensor supports will be designed to shield the sensor from event-generated missiles. The sensors will be located such that they cannot interfere with movement of the spent fuel handling machine and the transfer system carriage.

In its letter dated July 3, 2013, the licensee stated, in part, that

> The proposed routing of the cables that will extend from the sensors toward the location of the read-out/display device has not been determined. The final system component locations and cable routing will be available upon completion of the final design. This information will be forwarded to the Nuclear Regulatory Commission (NRC) on February 28, 2014 with the second CCNPP Overall Integrated Plan status update.

The NRC staff notes that this arrangement provides for approximately 90 ft. of horizontal separation between the primary sensor and the backup sensor. The NRC staff also notes that the proposed routing of the cables that would extend from the sensors toward the location of the read-out/display device is not available for review and will be provided to the staff on February 28, 2014 with the second CCNPP Overall Integrated Plan status update. The staff has identified this request as:

RAI #3

Please provide additional information describing how the proposed arrangement of the conduit and routing of the cabling between the spent fuel and the location of the read-out/display device meet the guidance to arrange the SFP level instrument channels in a manner that provides reasonable protection of the level indication function against missiles that may result from damage to the structure over the SFP.

The licensee's proposed location of the primary and backup level instruments for both of its SFPs appears to be consistent with NEI 12-02, as endorsed by the ISG, when the two pools are not isolated from one another through the installation of a bulkhead gate. In Section 3.3 the NRC staff identified additional information that is required regarding reliability of the level instrument when the pools are isolated (RAI #2).

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 will be Seismic Class 1. Installed equipment will be seismically qualified to withstand the maximum seismic motion considered in the design of the plant area in which it is installed. An engineering analysis will be conducted during the design to ensure any other hardware stored in the SFP area will not create an adverse interaction with the fixed instrument location.

In its letter dated July 3, 2013, the licensee stated, in part, that

> The radar horn antenna is positioned above the SFP water surface. The loading on the mounting bracket includes the static weight loads and dynamic loads of the horn antenna, waveguide assembly and attached waveguide pipe up to the nearest pipe support. The dynamic loads on the mounting bracket consist of design basis maximum seismic loads of the bracket and the mounted components, along with hydrodynamic loads produced by impinging surface waves caused by seismically-induced pool sloshing. The design criteria to be used to estimate the total loading on the mounting devices will be based on the plant seismic design bases.
>
> The methodology for ensuring that the mounting bracket and attached equipment can withstand the seismic dynamic forces will be by analysis and/or test of the combined maximum seismic and hydrodynamic forces on the cantilevered portion of the waveguide assembly and horn antenna exposed to potential seismically induced wave action. In addition to the analysis described above, seismic qualification testing will be performed to seismic response spectra that envelope the maximum seismic ground motion for the installed location.
>
> Further details of the hydrodynamic/seismic evaluation will be provided by the vendor in accordance with the final procurement specification. It is anticipated that the full qualification will be available upon completion of the final design and will be forwarded to the NRC on February 28, 2014 with the second CCNPP Overall Integrated Plan status update.

Further, in its letter dated July 3, 2013, the licensee stated, in part, that

> The horn antenna is cantilevered over the edge of the pool and firmly fixed in a direction perpendicular to the pool water surface, although the horn assembly mounting bolts can be loosened and the horn rotated away from the pool surface for instrument calibration (see Response 9.a). The bracket provides the attachment point for the horn and waveguide assembly to the refueling floor. Four bolts at the base of the bracket fasten the bracket to the refueling floor. For mounting to a concrete floor, the bolts may be anchor bolts in a range of sizes from 3/8 inch to 3/4 inch. The distance of the two nearest bolts to the pool edge will be determined by the specific requirements of the anchor bolt size used. For mounting to metal floor, the bracket base may be fastened to the floor by welding. The horn can be away from or next to the pool liner without impacting the functionality of the level measurement.
>
> The final mounting details for the horn antenna and waveguide assembly will be available upon completion of the final design. They will be forwarded to the NRC on February 28, 2014 with the second CCNPP Overall Integrated Plan status update.

Additionally, in its letter dated July 3, 2013, the licensee stated, in part, that

> Figure 5 provides a standard conceptual arrangement of the elements of the AREVA VEGAPULS 62ER Through Air Radar system. The waveguide piping that is connected between the waveguide assembly at the pool edge and the remotely located sensor will be attached to building structures using the applicable site design standards for small bore pipe supports and small bore pipe in accordance with the design change process.
>
> The radar sensor is mounted on a mounting bracket that is fastened to seismically-qualified mounting points, either building structural steel or a concrete wall. Four bolts at the base of the bracket fasten the bracket to the building structure. The fastening method described for the pool edge mounting bracket applies also to the sensor mounting bracket. Electrical connections to the sensor are made using flexible conduit into one of two available ½ inch NPT threaded openings in the sensor housing.
>
> The final mounting details for the waveguide piping and radar sensor will be available upon completion of the final design. They will be forwarded to the NRC on February 28, 2014 with the second CCNPP Overall Integrated Plan status update.

The NRC staff notes that the licensee's proposed installation and mounting of the instrument appear to be consistent with NEI 12-02, as endorsed by the ISG and that the proposed mounting would meet the seismic design criteria described in the guidance. The staff notes that the final mounting design details are not available for review and will be provided to the staff on February 28, 2014 with the second CCNPP Overall Integrated Plan status update. The staff

plans to verify the final design and the results of the licensee's seismic testing and analysis report. The staff has identified these requests as:

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 attach SFP Level equipment to plant structures, please describe the design inputs, and the methodology that was used to qualify the structural integrity of the affected structures/equipment.

3.6 Design Features: Qualification

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

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

NEI 12-02 states, in part, that

> The instrument channel reliability shall be demonstrated via an appropriate combination of design, analyses, operating experience, and/or testing of channel components for the following sets of parameters, as described in the paragraphs below:
>
> - conditions in the area of instrument channel component use for all instrument components,
> - effects of shock and vibration on instrument channel components used during any applicable event for only installed components, and
> - seismic effects on instrument channel components used during and following a potential seismic event for only installed components...

The NRC staff assessment of the instrument qualification is discussed in the following subsections below: (3.6.1) Augmented Quality Process, (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 equipment will be applied to this project.

The licensee's proposed augmented quality assurance requirements appear 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 or until off-site resources can be deployed by the mitigating strategies resulting from Order EA-12-049 (Reference 2) will be addressed in the engineering and design phase. 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 at level 3 as described in this plan,
> - temperatures of 212'F and 100% relative humidity environment,

- boiling water and/or steam environment,
- a concentrated borated water environment, and...

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 radiation dose levels for its installed location assuming that post-event SFP water level is equal to the top of the spent fuel racks (Level 3) for an extended period of time.
>
> The radiation dose at the transmitter location will also be less as the concrete SFP walls will provide significant radiation shielding.

In its letter dated July 3, 2013, the licensee stated, in part, that

> The area above and around the pool will be subject to elevated levels of radiation in the event that the fuel becomes uncovered. The only parts of the measurement channel in the pool radiation environment are the metallic waveguide and horn, which are not susceptible to the expected levels of radiation. The electronics will be located in an area that does not exceed their $1x10^3$ rad analyzed limit.

The NRC staff has concerns with the licensee's lack of information regarding its analysis of the maximum expected radiological conditions where the electronics will be located. The staff is also concerned with the lack of documentation indicating how it was determined that the electronics can withstand a total integrated dose of $1X10^3$ Rads. 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 electronics will be exposed. Also, please provide documentation indicating how it was determined that the electronics for this equipment is capable of withstanding a total integrated dose of $1X10^3$ Rads. Please discuss the time period over which the analyzed total integrated dose was applied.

While addressing post-event temperature conditions, in its OIP, the licensee stated that saturation temperature at the bottom of the SFP assuming normal water level will be approximately 255 °F and Post-event temperature at sensors located above the SFP is assumed to be 212 °F.

In its letter dated July 3, 2013, the licensee stated, in part, that

> The postulated temperature in the SFP area that results from a boiling pool is 100°C (2l2°F). The electronics in the sensor are rated for a maximum ambient temperature of 80°C (176°F) on the condition that the process temperature (that which the flange connection is in contact with) is no greater than l30°C (266°F).

> The level sensor electronics will be located outside of the SFP area in an area where the temperature will not exceed the rated temperature.

The NRC staff has concerns with the licensee's lack of information regarding the ambient temperature in the vicinity where the electronics equipment will be located under normal and worst case postulated conditions. The staff has identified this request as:

RAI #7

Please provide information indicating (a) whether the 80°C rating for the sensor electronics is a continuous duty rating; and, (b) what the maximum expected ambient temperature will be 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.

In its OIP, the licensee stated that post-event humidity near and above the SFP is assumed to be 100% with condensing steam.

In its letter dated July 3, 2013, the licensee stated, in part, that

> The maximum humidity postulated for the SFP room is l00% RH, saturated steam. The VEGA electronics will be located outside of the SFP room in an area away from the steam atmosphere. The waveguide pipe can withstand condensation formed on the inside walls provided there is no pooling of the condensate in the waveguide pipe. This is ensured by installing a weep hole(s) at the low spots in the wave guide pipe.
>
> The ability of the radar to "see through" the steam has been demonstrated by testing performed by AREVA. In addition to the AREVA test, VEGA Through Air Radar has been used in numerous applications that involve measuring the level of boiling liquids. The VEGA Operating Instructions Manual contains a table that provides accuracy correction factors for superimposed gas or vapor including saturated steam at various pressures. Therefore, operating experience has shown that the Through Air Radar functions at high levels of steam saturation.

The NRC staff has concerns with the licensee's lack of information regarding whether the sensor electronics is capable of continuously performing its required functions under this expected humidity condition. The staff has identified this request as:

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 is capable of continuously performing its 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 will be supplied by manufacturers using commercial quality programs (such as IS09001, *Quality management systems - Requirements* (Reference 8)) with shock and vibration requirements included in the purchase specification at levels commensurate with portable handheld device or transportation applications;
>
> - Components will have a substantial history of operational reliability in environments with significant shock and vibration loading, such as portable hand-held device or transportation applications; or
>
> - Components will be inherently resistant to shock and vibration loadings, such as cables.

Sensor Shock

In its letter dated July 3, 2013, the licensee stated, in part, that

> The AREVA VEGAPULS 62ER Through Air Radar sensor is similar in form, fit, and function to the VEGAPULS 66 that was shock and vibration tested in accordance with MIL-STD-901D and MIL-STD-167-1. This shock and vibration

testing only applies to the sensor. The waveguide piping is not shock or vibration sensitive.

In its later dated July 3, 2013, the licensee also stated that the sensor is similar in form, fit, and function to a version of the sensor that was previously shock tested in accordance with MIL-STD-901D, "Requirements for High-Impact Shock Tests, Shipboard Machinery, Equipment, and Systems," dated March 17, 1989. The licensee also indicated that the proposed waveguide piping is not shock sensitive.

The NRC staff notes that the use of MIL-STD-901D is an acceptable method for shock testing. However, the staff has concerns regarding the lack of information describing the tests, applied forces, and the operability condition of the sensor after the tests were completed. The staff has identified this request as:

RAI #9

Please provide information describing the evaluation of the comparative sensor design, the shock test method, test results, and forces applied to the sensor applicable to its successful tests demonstrating that the referenced previous testing provides an appropriate means to demonstrate reliability of the sensor under the effects of severe shock.

Sensor Vibration

In its letter dated July 3, 2013, the licensee stated that the sensor is similar in form, fit, and function to a version of the sensor that was previously vibration tested in accordance with MIL-STD-167-1, ["Department of Defense Test Method Standard-Mechanical Vibrations of Shipboard Equipment (Type I – Environmental and Type II – Internally Excited), May 1, 1974."] This vibration testing only applies to the sensor. The licensee also indicated that the proposed waveguide piping is not vibration sensitive.

The NRC staff notes that the use of MIL-STD-167-1 is an acceptable method for vibration testing. However, the staff has concerns with the lack of information describing the tests, applied forces and their directions and frequency ranges, or the operability condition of the sensor after the tests were completed. The staff has identified this request as:

RAI #10

Please provide information describing the evaluation of the comparative sensor design, the vibration test method, test results, and the forces and their frequency ranges and directions applied to the sensor applicable to its successful tests, demonstrating that the referenced previous testing provides an appropriate means to demonstrate reliability of the sensor under the effects of high vibration.

Electronics Panel Shock and Vibration

In its letter dated July 3, 2013, licensee described the power and control panel it plans to install, which is similar in form, fit, and function to a mobile version of this product. The readout portion of the display for the mobile version was previously shock and vibration tested with the sensor

as described above. The display unit for the mobile version of this product is designed for mobile applications subject to shock and vibration resulting from normal handling, transportation, and setup.

The NRC staff has concerns with the licensee's lack of information regarding description of the manufacturer's shock and vibration ratings for this equipment and the results of any testing performed by the manufacturer to achieve those ratings. The staff also 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 #11

Please provide information describing the evaluation of the comparative display panel ratings against postulated plant conditions. Also 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.

Additionally, in its letter dated, July 3, 2013, the licensee stated, in part, that

> Further details of the qualification and test program used to confirm the reliability of the permanently installed equipment during and following BDB events will be available upon completion of the final design. They will be forwarded to the NRC staff on February 28, 2014 with the second CCNPP Overall Integrated Plan status update.

The NRC staff notes that further of the qualification and test program used to confirm the reliability of the permanently installed equipment during and following BDB events are not available for review and will be provided to the staff on the February 28, 2014 with the second CCNPP Overall Integrated Plan status update. The staff has identified this request as:

RAI #12

Please provide the following:

a) Description of the specific method or combination of methods you intend to apply to demonstrate the reliability of the permanently installed equipment under BDB ambient temperature, humidity, shock, vibration, and radiation conditions.

b) Results for the selected methods, tests and analyses utilized 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

> The following measures will be used to verify that the design and installation is adequate for seismic effects on instrument channel components used after a potential seismic event for installed components (with the exception of battery chargers and replaceable batteries). Applicable components of the instrument channels will be rated by the manufacturer (or otherwise tested) for seismic effects at levels commensurate with those of postulated design basis event conditions in the location of the instrument channel component using one or more of the following methods:
>
> - a substantial history of operational reliability in environments with significant vibration, such as for portable hand-held devices or transportation applications. Such a vibration design envelope will be inclusive of the effects of seismic motion imparted to the components proposed at the locations of the proposed installation;
>
> - adequacy of seismic design and installation will be demonstrated based on the guidance in Sections 7, 8, 9, and 10 of IEEE Standard 344-2004, IEEE Recommended Practice for Seismic Qualification of Class 1E Equipment for Nuclear Power Generating Stations, (Reference 9) or a substantially similar industrial standard;
>
> - proposed devices will be demonstrated to be substantially similar in design to models that have been previously tested for seismic effects in excess of the plant design basis at the locations where the instruments will be installed (g-levels and frequency ranges); or
>
> - the capability to withstand seismic motion consistent with that of existing design basis loads at the installed locations will be demonstrated.

In its letter dated July 3, 2013, the licensee stated, in part, that

> A seismic shake test will be performed to the requirements of Institute of Electrical and Electronics Engineers 344-2004 for elements of the AREVA VEGAPULS 62ER Through Air Radar to levels anticipated to envelop most, if not all plants in the United States. The equipment to be tested includes the readout and power control panel, and the level sensor electronics. The items will be tested to the Required Response Spectra (RRS) contained in Electric Power Research Institute TR-107330 to account for the potentially high seismic motion that could occur to the cabinet-mounted readout and power control panel. This RRS will also envelop the seismic ground motion for items mounted to the building structure, pool edge, etc.

Further, in its letter dated July 3, 2013, the licensee stated, in part, that

> The seismic testing described in Part b) [above] includes testing the AREVA VEGAPULS 62ER Through Air Radar for functionality prior to and post-seismic testing, which includes verification of the instrument accuracy.
>
> Further details of the qualification and test program used to confirm the reliability of the permanently installed equipment during and following seismic conditions will be available upon completion of the final design. They will be forwarded to the NRC on February 28, 2014 with the second CCNPP Overall Integrated Plan status update.

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 test when it is completed. The staff has identified this request as:

RAI #13

Please provide analysis of the seismic testing results and show that the instrument performance reliability, following exposure to simulated seismic conditions representative of the environment anticipated for the SFP structures at CCNPP, 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 that the primary instrument channel would be redundant to and independent of the backup instrument channel.

In its letter dated July 3, 2013, the licensee stated, in part, that

> The instrumentation power sources are provided with independent and battery backed-up supplies. The 120 VAC power sources will be determined in the final design process. Independence will be maintained throughout the entire train for each channel. Therefore, failure of one power source will not result in a loss of both instrument channels.

Further, in its letter dated July 3, 2013, the licensee stated, in part, that

> The two channels of the AREVA VEGAPULS 62ER Through Air Radar Spent Fuel Pool Level Measurement system meet the requirement for independence in accordance with the guidance in NRC JLD-ISG-2012-03 and NEI 12-02 through separation by distance and electrical independence of one another. The horn antenna for each level instrument will be installed on opposite corners of the SFP. This separation will be maintained for the routing of the stainless steel waveguide piping and each channel's sensor electronics. Wiring from the sensors and wiring to the power control panels and displays located in the Main Control Room for each channel will be routed in separate conduits and cable raceways to maintain separation.
>
> Further details on independence and channel separation of the permanently installed equipment will be available upon completion of the final design. They will be forwarded to the NRC on February 28, 2014 with the second CCNPP Overall Integrated Plan status update.

The NRC staff notes that the licensee's proposed independence and physical and power separation appears to be consistent with NEI 12-02, as endorsed by the ISG. This proposed arrangement would not affect the operation of the independent channel under BDB event conditions, and the electrical functional performance of each level measurement channel would be considered independent of the other channel. This independence would result in a reliable SFP level measurement. However, the NRC staff plans to review the final electrical power supply design information to complete its review. The NRC staff has identified this request as:

RAI #14

Please provide the NRC staff with the final configuration of the power supply source for each channel so that the staff may conclude that the two channels are independent from a power supply assignment perspective.

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 primary and backup channels will be powered from dedicated batteries and local battery chargers. The battery chargers for both channels will normally be powered from non-safety related 120 VAC power. 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.
>
> During the loss of normal power the battery chargers will be connectable to another 120 VAC power source. This will be from portable generators stored onsite, consistent with the reasonable protection requirements associated with NEI 12-06 (Reference 5), or from generators deployed from off-site by the mitigating strategies resulting from Order EA-12-049, at approximately 24 hours after the event.

In its letter dated July 3, 2013, the licensee stated, in part, that

> The primary power supply will be from station 120 VAC panels and will be connected to the display panel which will be located in the Main Control Room. As required in NEI 12-02, in the event of loss of primary power the instruments can be manually switched to backup power. The AREVA VEGAPULS 62ER Through Air Radar has a self-contained battery (eight standard AA lithium cells) backup source which is included in the display panel. It will support 2.5 years with 30 minutes of operation per day, or > 300 hours of continuous operation. During this time, it supplies the power to the whole system, i.e., sensor electronics and the display with a power consumption of < 0.5Watts.
>
> The sizing of the battery back-up for the AREV A VEGAPULS 62ER Through Air Radar is based on the ability of the sensor to supply full load (20mA) for the duration specified in the FLEX program of at least seven days after station blackout, with built-in safety margin. The sizing of the battery will be verified by calculation and/or test prior to installation. The self-contained battery system is independent from existing station batteries.
>
> Further details on the AC and DC power supplies of the permanently installed equipment will be available upon completion of the final design and will be forwarded to the NRC on February 28, 2014 with the second CCNPP Overall Integrated Plan status update.

The NRC staff notes that the proposed criteria for sizing of the battery backup appears to be consistent with NEI 12-02, as endorsed by the ISG. However, the staff plans to verify the results of the licensee's calculation for required duty cycle given the final design load of the instrument channel for its installed configuration. The staff has identified this request as:

RAI #15

Please provide the results of the calculation depicting the battery backup duty cycle requirements demonstrating that its capacity is sufficient to maintain the level indication function until offsite resource availability is reasonably assured.

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 accuracy will be consistent with the guidelines of NRC JLD-ISG-2012-03 and NEI 12-02. 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 to determine when the actual water level exceeds the specified lower level of each indicating range (levels 1, 2 and 3) without conflicting or ambiguous indication. The accuracy will consider the resolution requirements of Figure 1 of NEI 12-02. Actual accuracy for the indication under all required conditions will be determined during the engineering and design phase.

In its letter dated July 3, 2013, the licensee stated, in part, that

> The reference accuracy for the instrument defined by the manufacturer is ±2mm based on sensor horn without a waveguide using a metal target. However, with a waveguide and water as a target, accuracy under normal SFP level conditions has been demonstrated to be ±1 inch based on tests performed by AREVA. This is the design accuracy value that will be used for the SFP level instrument channels. This accuracy value is subject to change dependent on the actual performance with the installed waveguide constructed to support the desired installation location for each channel. The final instrument accuracy will be determined following installation testing implemented as part of the design change acceptance process.
>
> The accuracy of the instrument channel is little affected under BDB conditions (i.e., radiation, temperature, humidity, post-seismic and post-shock conditions). It will maintain its design accuracy following a power interruption without the need for recalibration. The stainless steel horn antenna and waveguide pipe that is exposed to BDB conditions is largely unaffected by radiation, temperature and humidity other than a minor effect of condensation forming on the waveguide inner walls which will have a slight slowing effect on the radar pulse velocity. Condensation is prevented from pooling in the waveguide and thus blocking the radar signal by placement of weep holes at low points in the waveguide pipe. A minor effect on the accuracy based on the length of the overall measurement path can occur due to temperature related expansion of the waveguide pipe. The waveguide pipe permits the sensor to be located on the elevation below the refuel floor in mild environment conditions so that the effect of elevated refuel floor temperatures on accuracy is also limited. A small correction factor is applied to account for the impact of saturated steam at atmospheric pressure on the radar beam velocity. Testing performed by AREVA using saturated steam

> and saturated steam combined with smoke indicate that the overall effect on the instrument accuracy is minimal. The overall accuracy during the BDB conditions described above is conservatively estimated to not exceed ±3 inches or 0.926% of the 27 foot instrument span, which is within the required ±1 foot described in NEI 12-02.

Further, in its letter dated July 3, 2013, the licensee stated, in part, that

> The maximum allowed deviation from the instrument channel design accuracy that will be employed under normal operating conditions as an acceptance criterion for a calibration procedure to flag to operators and to technicians that the channel requires adjustment to within the normal condition design accuracy will be based upon the difference between readings from the primary and backup level instruments. The estimated design accuracy for each instrument is ±1 inch. The combined maximum deviation between the two instruments after which calibration is needed is therefore ±2 inches based on a still water level in the pool. A change to design accuracy will likewise cause a proportionate change to the maximum allowable deviation value. The final instrument accuracy will be determined following installation testing implemented as part of the design change acceptance process.

The NRC staff notes that the estimated instrument channel design accuracies and methodology are reasonable since it would be expected to result in maintaining the instrument channels to within their design basis accuracies before significant drift can occur. This appears to be consistent with NEI 12-02, as endorsed by the ISG. 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 this request as:

RAI #16

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

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 that can, be performed in-situ consistent with Order EA-12-051 and the guidance in NEI 12-02. Details will be determined during the engineering and design phase. Additional testing and calibration information is provided in Section XV of this plan.

In its letter dated July 3, 2013, the licensee stated, in part, that

> Calibration of the SFP level system is performed in-situ. Channel check and calibration tolerances will be developed as part of the detailed design and incorporated into station maintenance procedures. The final calibration methodology will be available upon completion of the final design. It will be forwarded to the NRC on February 28, 2014 with the second CCNPP Overall Integrated Plan status update.

Further, in its letter dated July 3, 2013, the licensee stated, in part, that

> Multi-point testing is enabled by means of a radar horn antenna capable of being rotated away from the SFP water surface and aimed at a movable metal target that is positioned at known distances from the horn. This allows checking for correct readings of all indicators along a measurement range and validates the functionality of the installed system.

In its letter dated July 3, 2013, the licensee also explained that the instrument channels would have indicators to allow operators to compare the level indicated against other SFP level instrumentation currently installed. According to the licensee, with this information and the maximum level allowed deviation for the instrument channel design accuracy, the operators could determine if recalibration or troubleshooting is needed.

The NRC staff notes that the licensee's proposed design, with respect to routine in-situ instrument channel functional and calibration tests, appears to be consistent with NEI 12-02, as endorsed by the ISG.

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 promptly available to the plant staff and decision makers. Ideally there will be an indication from at least one channel of instrumentation in the control room. While it is generally recognized (as demonstrated by the events at Fukushima Daiichi) that SFP level will not change rapidly during a loss of spent fuel pool cooling scenario more rapid SFP drain down cannot be entirely discounted. Therefore, the fact that plant personnel are able to determine the SFP level will satisfy this requirement, provided the personnel are available and trained in the use of the SFP level instrumentation (see Section 4.1) and that they can accomplish the task when required without unreasonable delay.
>
> SFP level indication from the installed channel shall be displayed in the control room, at the alternate shutdown panel, or another appropriate and accessible location (reference NEI 12-06). An appropriate and accessible location shall have the following characteristics:
>
> - occupied or promptly accessible to the appropriate plant staff giving appropriate consideration to various drain down scenarios,
> - outside of the area surrounding the SFP floor, e.g., an appropriate distance from the radiological sources resulting from an event impacting the SFP,
> - inside a structure providing protection against adverse weather, and
> - outside of any very high radiation areas or LOCKED HIGH RAD AREA during normal operation.
>
> If multiple display locations beyond the required "appropriate and accessible location" are desired, then the instrument channel shall be designed with the capability to drive the multiple display locations without impacting the primary "appropriate and accessible" display.

In its OIP, the licensee stated that the credited SFP water level indication will be provided in the common Control Room. The licensee also explained how the control room met the characteristics identified in NEI 12-02 for an accessible location.

In its letter dated July 3, 2013, the licensee confirmed that the credited SFP level instrument displays will be located in the common Control Room.

The NRC staff notes that the NEI guidance for "Display" specifically mentions the control room as an acceptable location for SFP instrumentation displays as it is occupied or promptly accessible, outside the area surrounding the SFP, inside a structure providing protection against adverse weather and outside of any very high radiation areas or LOCKED HIGH RAD AREA during normal operation. The licensee's proposed location for the primary and backup SFP instrumentation displays appears to be consistent with NEI 12-02, as endorsed by the ISG.

3.12 Programmatic Controls: Training

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

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

NEI 12-02 states, in part, that

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

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

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

3.13 Programmatic Controls: Procedures

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

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

NEI 12-02 states, in part, that

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

In its OIP, the licensee stated, 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.
>
> 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* (References 5 and 7).

In its letter dated July 3, 2013, the licensee stated, in part, that

> Procedures for inspection, maintenance, repair, operation, abnormal response, and administrative controls associated with the SFP level instrumentation will be developed utilizing vendor instructions in accordance with existing controlled station administrative procedures that govern procedure development. These procedures ensure standardization of format, content, terminology and human performance considerations.
>
> There are no portable level channel instruments associated with the new SFP level instrumentation system that will be installed. Consequently, procedures for storage and installation will not be required.

The NRC staff notes that the procedures for inspection, maintenance, repair, operation, abnormal response, and administrative controls associated with the SFP level instrumentation are not available for review. The staff has identified this request as:

RAI #17

Please provide a list of the procedures addressing operation (both normal and abnormal response), calibration, test, maintenance, and inspection procedures that will be developed for use of the spent SFP instrumentation. The licensee is requested to include a brief description of the specific technical objectives to be achieved within each procedure.

3.14 Programmatic Controls: Testing and Calibration

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

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

NEI 12-02 states, in part, that

> Processes shall be established and maintained for scheduling and implementing necessary testing and calibration of the primary and backup SFP level instrument

channels to maintain the instrument channels at the design accuracy. The testing and calibration of the instrumentation shall be consistent with vendor recommendations or other documented basis.

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

> Processes will be established and maintained for scheduling and implementing necessary testing and calibration of the primary and backup SFP water level instrument channels to maintain the instrument channels at the design accuracy. Testing and calibration of the instrumentation will be consistent with vendor recommendations and any other documented basis. Calibration will be specific to the mounted instrument and the monitor. Out of service time as identified in NEI I2-02 will be incorporated consistent with the programmatic process used for compliance with NRC Order EA-I2-049, Issuance of Order to Modify Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design Basis External Events (Reference 2). Functionality testing will be performed at the frequency specified in NEI 12-02. Additional testing and calibration information is provided in Section XI of this plan.
>
> Instrument channel out of service times as identified in NEI 12-02 will be implemented and controlled consistent with the programmatic process used for compliance with NRC Order EA-12-051.

In its letter dated July 3, 2013, the licensee stated, in part, that

> The maintenance and testing of the SFP level instrumentation system will be incorporated into the normal station work control processes based on vendor recommendations for maintenance and periodic testing. The calibration and maintenance program will include testing to validate the functionality of each instrument channel within 60 days of a planned refueling outage considering normal testing scheduling allowances
> (e.g., 25%).
>
> The preventive maintenance, test and calibration program will be developed consistent with the vendor's recommendations. This information will be available following completion of the final design and will be forwarded to the NRC on February 28, 2014 with the second CCNPP Overall Integrated Plan status update.

In its OIP, the licensee stated:

> Instrument channel out of service times as identified in NEI 12-02 will be implemented and controlled consistent with the programmatic process used for compliance with NRC Order EA-12-051.

While addressing compensatory actions for a channel being out of service, in its letter dated July 3, 2013, the licensee stated, in part, that

> In the event a channel of SFP level instrumentation is out-of-service for any reason, the time out-of- service will be administratively tracked with an action to restore the channel to service within 90 days. Functionality of the other channel will be confirmed via appropriate testing measures within the following 7 days and every 90 days thereafter until the non-functioning channel is restored to service.
>
> The appropriate compensatory actions have not yet been specified for both channels out-of-service. The determination of these actions, administrative requirements, and implementation procedures will be available following completion of the final design and will be forwarded to the NRC on February 28, 2014 with the second CCNPP Overall Integrated Plan status update.

The licensee further stated:

> In the event that a channel cannot be restored to service within the 90 day period, expedited actions to restore the channel would be initiated and tracked via CCNPP's Corrective Action Program. If both channels are determined to be non-functional, CCNPP will initiate appropriate compensatory actions within 24 hours. The expedited and compensatory actions will be defined in the applicable maintenance procedure.
>
> The appropriate compensatory actions have not yet been specified. The determination of these actions, administrative requirements, and implementation procedures will be available following completion of the final design and will be forwarded to the NRC on February 28, 2014 with the second CCNPP Overall Integrated Plan status update.

The licensee's proposed plan, with respect to defining processes for scheduling and implementing necessary testing and calibration and compensatory actions when a channel is out of service or when one of the instrument channels cannot be restored to functional status within 90 days appears to be consistent with NEI 12-02, as endorsed by the ISG. The NRC staff notes further information with regard to testing, calibration and compensatory actions will be provided on February 28, 2014 with the second CCNPP Overall Integrated Plan status update. The staff has identified these requests as:

RAI #18

Please provide the following:

a) Further information describing the maintenance and testing program the licensee will establish and implement to ensure that regular testing and calibration is performed and verified by inspection and audit to demonstrate conformance with design and system readiness requirements. Please include a description of the plans for ensuring that necessary channel checks, functional tests, periodic calibration, and maintenance will be conducted for the level measurement system and its supporting equipment.

b) Information describing compensatory actions when both channels are out-of-order, and the implementation procedures.

c) Additional information describing expedited and compensatory actions in the maintenance procedure to address when one of the instrument channels cannot be restored to functional status within 90 days.

The NRC staff has concerns 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 the following requests as:

RAI #19

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

3.15 Instrument Reliability

NEI 12-02 states, in part, that

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

In its OIP, the licensee stated that the reliability of the primary and backup instrument channels will be assured by conformance with the guidelines of NRC JLD-ISG-2012-03 and NEI 12-02 as discussed under Design Features and Program Features. The licensee stated instrument channel design will be consistent with the guidance of the ISG and NEI 12-02.

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

4.0 CONCLUSION

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

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 CONSTELLATION ENERGY NUCLEAR GROUP, LLC NINE MILE POINT NUCLEAR STATION UNITS 1 AND 2 DOCKET NOS. 50-220 AND 50-410

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 letters dated February 28, 2013 (ADAMS Accession No. ML13066A172) and March 8, 2013 (ADAMS Accession No. ML13073A155), Constellation Energy Nuclear Group, LLC, (the licensee) provided the OIP for Nine Mile Point Nuclear Station, Units 1 and 2 (NMP1, NMP2), describing how it will achieve compliance with Attachment 2 of Order EA-12-51 by Spring, 2015, for Unit 1 and Spring, 2016, for Unit 2. By letter dated June 5, 2013 (ADAMS Accession No. ML13154A399), the NRC staff sent a request for additional information (RAI) to the licensee. The licensee provided supplemental information by letter dated July 5, 2013 (ADAMS Accession No. ML13197A220), and August 27, 2013 (ADAMS Accession No. ML13254A279).

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 license to have a reliable indication of the water level in associated spent fuel storage pools capable of supporting identification of the following pool water level conditions by trained personnel: (1) level that is adequate to support operation of the normal fuel pool cooling system, (2) level that is adequate to provide substantial radiation shielding for a person standing on the SFP operating deck, and (3) level where fuel remains covered and actions to implement make-up water addition should no longer be deferred.

Attachment 2 of Order EA-12-051, states that the SFP level instrumentation shall include the following design features:

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

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

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

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

1.5 Independence: The primary instrument channel shall be independent of the backup instrument channel.

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

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

1.8 Testing: The instrument channel design shall provide for routine testing and calibration.

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

Attachment 2 of Order EA-12-051, states that the SFP instrumentation shall be maintained available and reliable through appropriate development and implementation of the following programs:

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

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

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

On August 29, 2012, the NRC issued an Interim Staff Guidance document (the ISG), JLD-ISG-2012-03, "Compliance with Order EA-12-051, Reliable Spent Fuel Pool Instrumentation" (ADAMS Accession No. ML12221A339), to describe methods acceptable to the NRC staff for complying with Order EA-12-051. The ISG endorses, with exceptions and clarifications, the methods described in the Nuclear Energy Institute (NEI) guidance document NEI 12-02, Revision 1, "Industry Guidance for Compliance with NRC Order EA-12-051, 'To Modify Licenses with Regard to Reliable Spent Fuel Pool Instrumentation,'" dated August 2012 (ADAMS Accession No. ML12240A307).

> 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

Nine Mile Point, Units 1 and 2 have two independent SFPs. The NMP1's pool is approximately 37 feet (ft.) 5.5 inches (in.) long by 33 ft. 2 in. wide and 39 ft. deep. The NMP2's pool is approximately 44 ft. long by 34 ft. 6 in. wide and 38 ft. deep. The pools for both units are not interconnected in any way.

The licensee's OIP was submitted on February 28, 2013. The OIP stated that installation of the SFP level instrumentation at Nine Mile Point Nuclear Station will be completed by Spring, 2015, for Unit 1, and Spring 2016, for Unit 2, which is before startup from the second refueling outage for each unit.

The NRC staff has reviewed the licensee's schedule for implementation of SFP level instrumentation provided in its OIP. If the licensee completes implementation in accordance with this schedule, it would appear to achieve compliance with Order EA-12-051 within two refueling cycles after submittal of the OIP and before December 31, 2016.

3.2 Spent Fuel Pool Water Levels

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

> All licensees identified in Attachment 1 to this Order shall have a reliable indication of the water level in associated spent fuel storage pools capable of supporting identification of the following pool water level conditions by trained personnel: (1) level that is adequate to support operation of the normal fuel pool cooling system [Level 1], (2) level that is adequate to provide substantial radiation shielding for a person standing on the SFP operating deck [Level 2], and (3) level where fuel remains covered and actions to implement make-up water addition should no longer be deferred [Level 3].

NEI 12-02 states, in part, that

> Level 1 represents the HIGHER of the following two points:

- The level at which reliable suction loss occurs due to uncovering of the coolant inlet pipe, weir or vacuum breaker (depending on the design), or
- The level at which the water height, assuming saturated conditions, above the centerline of the cooling pump suction provides the required net positive suction head specified by the pump manufacturer or engineering analysis.

In its OIP, the licensee stated that Level 1 is the indicated water level on either the primary or backup instrument channel of greater than elevation 338 ft. 10.5 in., for Unit 1 and 352 ft. 7.5 in., for Unit 2. The licensee stated that this elevation, for both units, is based on the loss of inlet flow to the SFP Surge tanks as water level lowers below the skimmers weirs which results in a loss of reliable suction to SFP Cooling Pumps.

In its July 5, 2013 letter, the licensee stated, in part, that

> The Level 1 value is established at NMP1 based on the Spent Fuel Pool (SFP) skimmer weir elevation. The bottom elevation of the weir is 338'-10.5". When water level in the SFP lowers to below this elevation, inflow to the SFP Surge tanks terminates, breaking the closed loop flow cycle.
>
> With SFP Pumps in service taking suction on the surge tank, the surge tank will pump down and the pumps will trip on low tank level. The pumps are located on elevation 281' in the Reactor Building with a centerline suction elevation of 282'-7". The Net Positive Suction Head (NPSH) required for each pump at runout flow of 1,150 gallons per minute (GPM) is 16 feet. Available NPSH based on saturation temperature of 212'F is 39 feet with surge tank level at the low level alarm point of the 324'-9" elevation. This is lower than the elevation at which the SFP skimmer weirs lose inflow (338'-10.5") making the bottom of the skimmer weirs the higher of the two points selected for the Level I value.

The licensee determined the NMP1 Level I elevation to be 338'-10.5".

> The Level 1 value is established at NMP2 based on the SFP weir elevation. The bottom elevation of the weir is 352'-7.5". When water level in the SFP lowers to below this elevation, inflow to the SFP Surge tanks terminates, breaking the closed loop flow cycle.
>
> With SFP Pumps in service taking suction on the surge tank, the surge tank will pump down and the pumps will trip on low flow. The pumps are located on elevation 289' in the Reactor Building with a centerline suction elevation of 291 '-3". The NPSH required for each pump at a flow of 2,400 GPM is 13 feet. Available NPSH based on saturation temperature of 212'F is 27 feet with surge tank level at the low level alarm point of the 339'-I 1.5" elevation. This is lower than the elevation at which the SFP skimmer weirs lose inflow (352'-7.5") making the bottom of the skimmer-weirs the higher of the two points selected for the Level 1 value.

The licensee determined the NMP2 Level I elevation to be 352'-7.5".

The NRC staff notes that Level 1 at 338 ft. 10.5 in., for Unit 1, and at 352 ft. 7.5 in., for Unit 2, is adequate for normal SFP cooling system operation; it is also sufficient for NPSH and 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 is the indicated level on either the primary or backup instrument channel of greater than elevation 320 ft. 11.5 in., for Unit 1, and 334 ft. 11.9 in., for Unit 2. The licensee stated that this elevation, for both units, is approximately 5 ft. above the top of the fuel racks and ensures a minimum level of water shielding above the top of the fuel racks. Calculations performed determined that with 5 ft. of water above the top of the racks, the largest calculated dose rate near the edge of the SFP would be well below 100 mrem/hr.

In its letter dated July 5, 2013, the licensee stated, in part, that

> Only the NMP2 SFP was modeled, and was assumed to contain all of the fuel discharged up to the 4,049 assembly capacity of the NMP2 SFP. The NMPI SFP capacity at 4,086 assemblies is only slightly greater, however the NMP2 SFP bounds the NMP1 SFP. This is because NMP2 fuel operates at a higher specific power than NMP1 fuel; the higher specific power fuel will have the higher source term.
>
> The SFP source term was taken as if all 4,049 spent fuel rack locations in the NMP2 SFP are filled. Although the spent fuel racks contain different fuel designs, all discharged fuel for the dose evaluation was assumed to be NMP2, GEI4 fuel.
>
> Calculations were performed at water levels of 5-foot above the rack and 1-foot above the rack. The modeling included the SFP and the general NMP2 reactor building area adjacent to the SFP. The roof and closest wall adjacent to the SFP are modeled but other walls were excluded. Concrete around the SFP was only modeled to a thickness of 1-foot since gamma photons which penetrate greater than that depth are unlikely to significantly contribute to dose in the SFP top edge area.

> Dose rates in the SFP area are determined using grid configured to provide vertical slices of the SFP and SFP area. Dose rates at the SFP edge utilize the maximum dose rate from either the north or east edge of the SFP. These dose rates were calculated using grid cells running the entire length of the SFP edge. Dose rates at the water surface are taken from a circular surface tally with a radius of 240 centimeters (cm) centered over the middle of the racks at I-foot intervals in the water for the 5-foot case.
>
> Based on the calculation performed, with 6 feet of water over the SFP racks, Figure 2 depicts the projected dose rate locations on a plan view sketch, from the edge of the SFP up to 2 foot back from the SFP edge, and up to 6 foot high. All areas surrounding the SFP under this condition are calculated to be less than 100 milli-Rem/hour (mRem/hr).

The NRC staff notes that the licensee followed the second method identified in the guidance to determine the acceptability of Level 2. This method requires that enough level is in the SFP to provide radiation shielding to maintain personnel radiological dose levels within acceptable limits while performing local operations in the vicinity of the pool. Further, NEI guidance states that the level could be established using the dose limits defined in EPA-400. The staff notes that although the licensee stated in its OIP that elevations provided for Level 2 were 5 ft. above the top of fuel racks, the licensee performed calculations to determine dose rates near the edge of the SFP with 6 ft. of water above the top of the fuel racks, and found that the dose rate would be lower than 100 mrem/hr.

In the sketch provided with the licensee's letter of July 5, 2013, the staff notes that the licensee appears to have changed the proposed elevations for Level 2 from those indicated in its OIP of February 28, 2013. The new elevations for Level 2 at 321 ft. 11.5 in., for Unit 1 and at 335 ft. 11.9 in., for Unit 2 are each 12 in. higher than the elevations proposed in the licensee's OIP to account for the use of 6 ft. of water above the top of the fuel racks in the licensee's calculation. The staff also notes that the currently proposed dose rate is reasonable for the licensee to perform actions in the vicinity of the SFP to maintain total dose within regulatory limits.

In its letter dated July 5, 2013, the licensee stated, in part, that

> The dose calculation assumed no other irradiated equipment or materials are stored in the SFP. If irradiated materials are planned to be stored in the SFP in the future, additional analysis will be performed to determine the projected dose rate impact and the appropriate Level 2 value. The addition of irradiated materials to the SFP and any additional analysis will be controlled by a station procedure. Specific requirements of the procedure, including details of the analysis to be performed, will be developed as part of the final instrument design and will be forwarded to the NRC on February 28, 2014 with the second NMPNS Overall Integrated Plan status update.
>
> The dose calculation assumed no other irradiated equipment or materials are stored in the SFP. A SFP cleanup activity is planned for the Fall of 2013 to remove source terms other than irradiated fuel from the NMP2 SFP. If irradiated materials are planned to be stored in the SFP in the future, additional analysis

> will be performed to determine the projected dose rate impact and the appropriate Level 2 value. The addition of irradiated materials to the SFP and any additional analysis will be controlled by a station procedure. Specific requirements of the procedure, including details of the analysis to be performed, will be developed as part of the final instrument design and will be forwarded to the NRC on February 28, 2014 with the second NMPNS Overall Integrated Plan status update.

The NRC staff notes that a SFP cleanup activity is planned for the Fall of 2013 to remove source terms other than irradiated fuel from the NMP2 SFP. The staff also notes that further information regarding specific requirements of the procedure controlling irradiated equipment or materials stored in the SFP, including details of the analysis performed is not available for review and that in its August 27, 2013 letter, the licensee identified the status of this activity as "Started". The licensee indicated that the information will be provided to staff on the February 28, 2014, with the second NMPNS OIP status update. The staff has identified this request as:

RAI #1

Please confirm that the correct elevations for Level 2 at NMP1 and NMP2 are 321 ft. 11.5 in. and 335 ft. 11.9 in., respectively, and provide the information regarding specific requirements of the procedure controlling irradiated equipment or materials stored in the SFP, including details of the analysis to be performed to determine the projected dose rate impact and the appropriate Level 2 value as a result of the potential for irradiated material to be stored in the SPF in the future.

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 is the indicated level on either the primary or backup instrument channel of greater than elevation 315 ft. 11.5 in., for Unit 1, and 329 ft. 11.9 in., for Unit 2. The licensee stated that this elevation, for both units, is the top of the spent fuel racks.

In its letter dated July 5, 2013, the licensee submitted a SFP elevation view sketch for each unit. The NRC staff reviewed these sketches and notes that the identified elevations for Level 3 are the highest point of any spent fuel storage rack seated in both SFPs.

The licensee's proposed plan, with respect to identification of Levels 1 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].

The licensee stated in its OIP that it intends to implement one permanent fixed primary and one permanent fixed backup level instrument for both the NMP1 and NMP2 SFPs. These instruments would be permanently located and mounted in the SFP. For Unit 1, each instrument channel will be capable of monitoring SFP water level from the top of the fuel racks (340 ft. 0 in. elevation) to the normal water level in the pool (315 ft. 11.5 in. elevation), for a minimum range of about 24 ft. For Unit 2, each instrument channel will be capable of monitoring SFP water level from the top of the fuel racks (354 ft. 0 in. elevation) to the normal water level in the pool (354 ft. 11.9 in. elevation), for a minimum range of about 24 ft.

The NRC staff notes that the range specified for the licensee's instrumentation will cover Levels 1, 2, and 3 for Units 1 and 2 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.

Unit 1

In its OIP, the licensee stated that the primary instrument channel level sensing components would be located in the northeast corner of the SFP; and the backup would be located near the northwest corner of the SFP at elevation 340 feet. The OIP includes a plan view of NMP1 showing the proposed location for both the primary and the backup instruments. The licensee also stated that the transmitter would be located in the Reactor Building at elevation 318 ft. directly below the SFP operating floor. According to the licensee, these locations would provide reasonable protection against missiles without interfering with SFP activities. Cabling for power supplies and indications for each channel would be routed in separate conduits from cabling from other channels; and separation between cables for the primary and backup channels would be maintained.

In its letter dated July 5, 2013, the licensee stated that it intends to implement the fixed primary level instrument in the northeast corner of the NMP1 SFP and the backup level instrument in the southeast corner of the SFP. The licensee also provided a plan view of NMP1 SFP depicting the proposed sensor placements. This figure also depicts the horns and waveguides cantilevered over the pool edge, above the water surface in the corners described above. The licensee also stated that the waveguides are routed through a core bore in the refueling floor to the sensor in the reactor building below. Finally, the licensee stated that the electronics and display units will be mounted in the NMP1 Main Control Room (MCR).

Additionally, in its letter dated July 5, 2013, the licensee stated that final locations for the level sensor, electronics and display units have not been determined. The final system component locations and wire routings will be available upon completion of the final design, and will be forwarded to the NRC staff on February 28, 2014 with the second NMPNS Overall Integrated Plan status update.

In its letter dated August 27, 2013, the licensee stated that the SFP level instrument sensors would be located in the northeast and southeast corners of the SFP, instead of the northeast and northwest corners. The licensee noted that this change would enhance separation of the level instruments. In addition, in this letter, the licensee indicated that information regarding

final arrangement of the SFP level instrument channels was not available, but that it would be provided to the NRC staff on February 28, 2014, with the second NMPNS OIP status update.

The NRC staff notes that the separation between the sensors appears to be the longer, east side of the pool with a dimension of approximately 37 ft. 5.5 in. In addition, the staff notes that the licensee modified the location of the backup sensors that was identified in its OIP. The current location for the backup sensor would be the south east corner.

Unit 2

In its OIP, the licensee stated that for Unit 2, the primary instrument channel level sensing components would be located in the northeast corner of the SFP; and the backup would be located near the northwest corner of the SFP at elevation 353 ft. 10 in. The OIP includes a plan view of NMP2 showing the proposed location for both the primary and the backup instruments. The licensee also stated that the transmitter would be located in the Reactor Building at elevation 328 ft. 10 in. directly below the SFP operating floor. According to the licensee, these locations would provide reasonable protection against missiles without interfering with SFP activities. Cabling for power supplies and indications for each channel would be routed in separate conduits from cabling from other channels; and separation between cables for the primary and backup channels would be maintained.

In its July 5, 2013, the licensee stated that it intends to implement the fixed primary level instrument in the northeast corner of the NMP2 SFP and the fixed backup level instrument in the northwest corner of the NMP2 SFP. The licensee provided a plan view of NMP2 SFP depicting the proposed sensor placements and giving the longer, north side of the pool dimension as 44 ft. 0 in. The figures provided by the licensee depict the horns and waveguides cantilevered over the pool edge, above the water surface in the corners described above. The licensee also stated that the waveguides are routed through a core bore in the refueling floor to the sensor in the reactor building below. Finally, the licensee stated that the electronics and display units will be mounted in the NMP2 MCR.

Additionally, in its letter dated July 5, 2013, the licensee mentioned that final locations for the level sensor, electronics and display units have not been determined. The final system component locations and wire routings will be available upon completion of the final design, and will be forwarded to the NRC on February 28, 2014 with the second NMPNS Overall Integrated Plan status update.

The NRC staff notes that the separation between the sensors appears to be the longer, east side of the pool with a dimension of approximately 44 ft. The staff also notes that, for both units, the information regarding final component locations and wire routings for the SFP level instrumentation is not currently available for review and that in its August 27, 2013 letter, the licensee identified the status of this activity as "Started". The licensee indicated that the information will be forwarded to the staff on February 28, 2014, with the second NMPNS OIP status update. The staff has identified this request as:

RAI #2

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

(This information was previously requested as RAI-2 in the NRC letter dated June 5, 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, for both NMP1 and NMP2, in part, that

> Mounting will be Seismic Class 1. Installed equipment will be seismically qualified to maintain the current seismic class of the SFP which is Seismic Class 1... An evaluation of other hardware stored in the SFP will be conducted to ensure it will not create an adverse interaction with the fixed SFP instrument locations.

In its letter dated July 5, 2013, the licensee provided a sketch and description stating that it intends to mount the SFP Level Instrument sensing element to the refueling floor just outside the SFP. The design for this mounting will apply the seismic design criteria applicable to the design basis maximum for the plant, capable of withstanding all active and passive loads, including the effects of pool sloshing during a seismic event. The licensee also stated that the design loading considerations for the mounting hardware include the static weight loads and dynamic weight loads of the horn antenna, waveguide assembly, and attached waveguide pipe up to the nearest pipe support. The dynamic loading on the mounting bracket consists of the design basis maximum seismic loading on the bracket and mounted components, along with the hydrodynamic loads produced by impinging surface waves caused by seismically-induced pool sloshing. The methodology for ensuring that the mounting bracket and attached equipment can withstand the seismic dynamic forces will be by analysis and/or test of the combined maximum seismic and hydrodynamic forces on the cantilevered portion of the waveguide assembly and

horn antenna exposed to potential seismically induced wave action. In addition to the analysis described above, seismic qualification testing will be performed to seismic response spectra that envelope the maximum seismic ground motion for the installed location. According to the licensee, this testing will demonstrate that the waveguide and horn assembly will retain its design configuration following a design basis maximum seismic event.

Additionally, in its letter dated July 5, 2013, the licensee noted that additional details of the hydrodynamic/seismic evaluation will be provided by the vendor in accordance with the final procurement specification. The licensee anticipates that the full qualification would be available upon completion of the final design and would be forwarded to the NRC on February 28, 2014 with the second NMPNS Overall Integrated Plan status update.

The NRC staff notes that the information regarding full hydrodynamic/seismic qualification and final mounting details for the SFP level instrumentation is not currently available for review and that in its August 27, 2013 letter, the licensee identified the status of this activity as "Started". The licensee indicated that the information will be forwarded to the staff on February 28, 2014, with the second NMPNS OIP status update. The staff has identified these requests as:

RAI #3

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 #4

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

3.6 Design Features: Qualification

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

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

NEI 12-02 states, in part, that

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

- conditions in the area of instrument channel component use for all instrument components,

- effects of shock and vibration on instrument channel components used during any applicable event for only installed components, and

- seismic effects on instrument channel components used during and following a potential seismic event for only installed components...

The NRC staff assessment of the instrument qualification is discussed in the following subsections below: (3.6.1) Augmented Quality Process, (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 the instrumentation systems will not be safety-related, but will meet the requirements for augmented quality in accordance with NEI 12-02 and the ISG. The licensee also stated that augmented quality requirements, similar to those applied to fire protection, will 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, and
>
> - a concentrated borated water environment.

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, or until off-site resources can be deployed by the mitigating strategies resulting from Order EA-12-049 (Reference 2), will be addressed in the engineering and design phase. 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 3 as described in this plan,
> - temperatures of 212°F and 100% relative humidity environment,
> - boiling water and/or steam environment

In its OIP, the licensee stated, for both NMP1 and NMP2, in part, that

> The primary and backup channel sensors will be reliable at temperature, humidity, and radiation levels consistent with the SFP water at saturation conditions for an extended period. Saturation temperature at the bottom of the SFP, assuming normal water level will be approximately 255°F. Post event temperature at sensors located above the SFP is assumed to be 212°F. Post event humidity near and above the SFP is assumed to be 100% with condensing steam. Equipment will be qualified for expected conditions at the installed location assuming that normal power is unavailable and that the SFP has been at saturation for an extended period. 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 the top of the spent fuel racks (Level 3) for an extended period of time.
>
> Transmitters will be located in the Reactor Building [at elevation 318 ft., for Unit 1 and 328 ft. 10 in., for Unit 2], immediately below the SFP operating floor. This elevation is expected to have a lower temperature. Exposure of the electronics to temperatures above 150°F may result in equipment failure. Expected area environmental conditions will be determined during the engineering and design phase to verify that the equipment will operate at the expected temperatures.
>
> Cables coupling the sensor to the transmitter will be installed in dedicated conduit. The cables from the transmitter to the control room will be routed through existing or new cable raceways such that they will be protected from event generated missiles.

While addressing post-event temperature conditions, in its letter dated July 5, 2013, the licensee stated, for both NMP1 and NMP2, in part, that

> The postulated ambient temperature in the SFP area that results from a boiling SFP is 100°C (212°F). The electronics in the sensor are rated for a maximum ambient temperature of 80°C (176°F) on the condition that the process temperature (that which the flange connection is in contact with) is not greater than 130°C (266°F). The level sensor electronics will be located outside of the SFP area in the lower building elevation. The temperature will not exceed the rated temperature.

The NRC staff has concerns with the licensee's lack of information regarding the ambient temperature in the vicinity where the electronics equipment will be located under normal and worst case postulated conditions. The staff has identified this request as:

RAI #5

Please provide information indicating (a) whether the 80°C rating for the sensor electronics is a continuous duty rating; and, (b) what will be 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.

In its letter dated July 5, 2013, the licensee stated, for both NMP1 and NMP2, in part, that

> The maximum humidity postulated for the SFP room is 100% Relative Humidity (RH), essentially a saturated steam environment.

The licensee also described the sensor electronics as being located outside of the SFP room in an area away from the steam atmosphere. According to this description, the waveguide tube in the Fuel Handling Building (FHB) can withstand condensation formed on the inside walls provided there is no pooling of the condensate in the waveguide tube, and that this is ensured by installing weep holes at the low spots in the wave guide pipe. The licensee also stated in this same letter that ability of the radar to "see through" the steam has been demonstrated by test. In addition to testing, the proposed instrument has been used in numerous applications that involve measuring the level of boiling liquids.

The NRC staff has concerns with the licensee's lack of information regarding whether the sensor electronics is capable of continuously performing its required functions under this expected humidity condition. The staff has identified this request as:

RAI #6

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 is capable of continuously performing its required functions under this expected humidity condition.

In its letter dated, July 5, 2013 the licensee stated, in part, that

> The area above and around the SFP will be subject to large amounts of radiation in the event that the fuel becomes uncovered. The only parts of the measurement channel in the SFP radiation environment are the metallic waveguide and horn, which are not susceptible to the expected levels of radiation. The electronics will be located on the elevation below the refuel floor in an area that does not exceed the $1X10^3$ Rad analyzed limit.

The NRC staff has concerns with the licensee's lack of information regarding its analysis of the maximum expected radiological conditions for the area where the sensor will be located that might be considered credible under BDB conditions. The staff is also concerned with the lack of documentation indicating how it was determined that the electronics can withstand a total integrated dose of $1X10^3$ Rads. The staff has identified this request as:

RAI #7

Please provide analysis of the maximum expected radiological conditions (dose rate and total integrated dose) to which the sensor and associated co-located electronic equipment will be exposed. Also, please provide documentation indicating how it was determined that the electronics for this equipment is capable of withstanding a total integrated dose of $1X10^3$ Rads. Please discuss the time period over which the analyzed total integrated dose was applied.

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 that components of the instrument channels would be qualified for shock and vibration using one or more of the methods identified in NEI 12-02.

Sensor Shock

In its letter dated July 5, 2013, the licensee stated that the sensor is similar in form, fit, and function to a version of the sensor that was previously shock tested in accordance with MIL-STD-901D, "Requirements for High-Impact Shock Tests, Shipboard Machinery, Equipment, and Systems," dated March 17, 1989. The licensee also indicated that the proposed waveguide piping is not shock sensitive.

The NRC staff notes that the use of MIL-STD-901D is an acceptable method for shock testing. However, the NRC staff has concerns with the licensee's lack of information regarding descriptions of the tests, applied forces, and the operability condition of the sensor after the tests were completed. The staff has identified this request as:

RAI #8

Please provide information describing the evaluation of the comparative sensor design, the shock test method, test results, and forces applied to the sensor applicable to its successful tests demonstrating that the referenced previous testing provides an appropriate means to demonstrate reliability of the sensor under the effects of severe shock.

Sensor Vibration

In its letter dated July 5, 2013, the licensee stated that the sensor is similar in form, fit, and function to a version of the sensor that was previously vibration tested in accordance with MIL-STD-167-1, "Department of Defense Test Method Standard--Mechanical Vibrations of Shipboard Equipment (Type I – Environmental and Type II – Internally Excited), May 1, 1974." This vibration testing only applies to the sensor. The licensee also indicated that the proposed waveguide piping is not vibration sensitive.

The NRC staff notes that the use of MIL-STD-167-1 is an acceptable method for vibration testing. However, the staff has concerns with the licensee's lack of information describing the tests, applied forces and their directions and frequency ranges, and the operability condition of the sensor after the tests were completed. The staff has identified this request as:

RAI #9

Please provide information describing the evaluation of the comparative sensor design, the vibration test method, test results, and the forces and their frequency ranges and directions applied to the sensor applicable to its successful tests, demonstrating that the referenced previous testing provides an appropriate means to demonstrate reliability of the sensor under the effects of high vibration.

Electronics Panel Shock and Vibration

In its letter dated July 5, 2013, the licensee described the power and control panel it plans to install, which is similar in form, fit, and function to a mobile version of this product. The readout portion of the display for the mobile version was previously shock and vibration tested with the

sensor as described above. The display unit for the mobile version of this product is designed for mobile applications subject to shock and vibration resulting from normal handling, transportation, and setup.

The NRC staff has concerns with the licensee's lack of information regarding description of the manufacturer's shock and vibration ratings for this equipment and the results of any testing performed by the manufacturer to achieve those ratings. The staff also 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 #10

Please provide information describing the evaluation of the comparative display panel ratings against postulated plant conditions. Also 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.

In its letter dated July 5, 2013, the licensee noted that there are three components within the power and control panel that were not included with the mobile remote display that are similar in construction to those that were tested for shock and vibration and/or mounted on vibration dampeners. Therefore, the power and control panel will be subjected to seismic testing. The NRC staff has concerns with the licensee's lack of information regarding the results of such testing to determine the acceptability of using IEEE 344-2004 as an appropriate means to demonstrate reliability of the display panel under the effects of severe shock and vibration. The staff has identified this request as:

RAI #11

Please provide the results of seismic testing per IEEE 344-2004, to demonstrate the reliability of the components within the power and control panel with regard to shock and vibration effects.

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, for both NMP1 and NMP2, in part, that

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

In its letter dated July 5, 2013, the licensee stated, for both NMP1 and NMP2, in part, that

> A seismic shake test will be performed to the requirements of IEEE 344-2004 Recommended Practice for Seismic Qualification of Class 1 E Equipment for elements of the VEGAPULS 62ER Through Air Radar to levels anticipated to envelop most if not all plants in the US. The equipment to be tested includes the readout and power control panel, and the level sensor electronics. The items will be tested to the Required Response Spectra (RRS) contained in EPRI TR-107330 Qualification of Microprocessor-Based Equipment to account for the potentially high seismic motion that could occur to cabinet-mounted readout and power control panel. This RRS will also envelop the seismic ground motion for items mounted to the building structure, SFP edge, etc. ...
>
> Further details of the qualification and test program used to confirm the reliability of the permanently installed equipment during and following seismic conditions will be available upon completion of the final design and will be forwarded to the NRC on February 28, 2014 with the second NMPNS Overall Integrated Plan status update.

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 test when it is completed. The staff has identified this request as:

RAI #12

Please provide analysis of the seismic testing results and show that the instrument performance reliability, following exposure to simulated seismic conditions representative of the environment anticipated for the SFP structures at Nine Mile Point, 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 for both NMP1 and NMP2, that:

> The primary instrument channel would be redundant to and independent of the backup instrument channel, including power supplies.

In its letter dated July 5, 2013, the licensee stated, for both NMP1 and NMP2, in part, that

> The two channels of the AREVA Through Air Radar SFP Level Measurement system meet the requirement for independence in accordance with the guidance in NRC JLD-ISG-2012-03 and NEI 12-02 through separation by distance and electrical independence of one another. The horn antenna for each level instrument will be installed on opposite comers of the SFP. This separation will be maintained for the routing of the stainless steel waveguide piping and each channel's sensor electronics. Wiring from the sensors and wiring to the power control panels and displays located in the respective Main Control Room for each channel will be routed in separate conduits and cable raceways to maintain separation.
>
> The instrumentation power sources are provided with independent and battery backed-up supplies. The 120 VAC power sources will be determined in the final design process. Independence will be maintained throughout the entire train for each channel. Therefore, failure of one power source will not result in a loss of both instrument channels.
>
> Further details on independence and channel separation of the permanently installed equipment will be available upon completion of the final design and will be forwarded to the NRC on February 28, 2014 with the second NMPNS Overall Integrated Plan status update.

The NRC staff notes that the licensee's proposed independence and physical and power separation appears to be consistent with NEI 12-02, as endorsed by the ISG. This proposed arrangement would not affect the operation of the independent channel under BDB event conditions, and the electrical functional performance of each level measurement channel would be considered independent of the other channel. This independence would result in a reliable SFP level measurement. However, the NRC staff plans to review the final electrical power supply design information to complete its review. The NRC staff has identified this request as:

RAI #13

Please provide the NRC staff with the final configuration of the power supply source for each channel so that the staff may conclude that the two channels are independent from a power supply assignment perspective.

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, for both NMP1 and NMP2, in part, that

> The primary and backup channels will be powered from dedicated batteries and local battery chargers. The battery chargers for both channels will normally be powered from non-safety related 120V AC power. 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 readily available.

> During a loss of normal power, the battery chargers will be connectable to another 120V AC power source. This will be from portable generators stored onsite, consistent with the reasonable protection requirements associated with NEI 12-06 (Reference 5), or from generators deployed from off-site by the mitigating strategies resulting from Order EA-12-049, at approximately 24 hours after the event.

In letter dated July 5, 2013, the licensee stated, for both NMP1 and NMP2, in part, that

> The primary power supply will be from station 120VAC panels and will be connected to the display panel which will be located in the Main Control Room. As required in NEI 12-02, in the event of loss of primary power the instruments can be manually switched to backup power. The VEGAPULS has a self-contained (eight (8) standard AA lithium cells) backup source which is included in the display panel. It will support 2.5 years with 30 minutes of operation per day, or > 300 hours of continuous operation. During this time, it supplies the power to the whole system, i.e., sensor electronics and the display with a power consumption of < 0.5 Watts.
>
> The sizing of the battery back-up for each channel of the VEGAPULS 62ER is based on the ability to supply the sensor at full load (20 milli-amps (mA)) and the level monitoring display, for the duration specified in the plant FLEX program of at least seven days after a Station Black Out (SBO), with built-in margin. The sizing of the battery will be verified by calculation and/or test prior to installation. The self-contained battery system will be independent from existing station batteries.
>
> Further details on the AC and DC power supplies of the permanently installed equipment will be available upon completion of the final design and will be forwarded to the NRC on February 28, 2014 with the second NMPNS Overall Integrated Plan status update.

The NRC staff notes that the proposed criteria for sizing of the battery backup appears to be consistent with NEI 12-02, as endorsed by the ISG. However, the staff plans to verify the results of the licensee's calculation for required duty cycle given the final design load of the instrument channel for its installed configuration. The staff has identified this request as:

RAI #14

Please provide the results of the calculation depicting the battery backup duty cycle requirements demonstrating that its capacity is sufficient to maintain the level indication function until offsite resource availability is reasonably assured.

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, for both NMP1 and NMP2, 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 and steam environment. Additionally, instrument accuracy will be sufficient to allow trained personnel to determine when the actual water level exceeds the specified lower level of each indicating range (levels 1, 2 and 3) without conflicting or ambiguous indication. The accuracy will consider the resolution requirements of Figure 1 of NEI 12-02.

In its letter dated July 5, 2013, the licensee stated, for both NMP1 and NMP2, in part, that

> The reference accuracy for the instrument defined by the manufacturer is ± 2 millimeters (mm) based on sensor horn without a waveguide using a metal target. However, with a waveguide and water as a target, accuracy under normal SFP level conditions has been demonstrated to be ± 1 inch based on tests performed by AREVA. This is the design accuracy value that will be used for the SFP level instrument channels. This accuracy value is subject to change dependent on the actual performance with the installed waveguide constructed to support the desired installation location for each channel. The final instrument accuracy will be determined following installation testing implemented as part of the design change acceptance process.
>
> The accuracy of the instrument channel is affected under BDB conditions (i.e., radiation, temperature, humidity, post-seismic, and post-shock conditions)...
>
> The overall accuracy due at BDB conditions described above is conservatively estimated to not exceed ± 3 inches or 0.926% of the 27 foot instrument span, which is within the required ± 1 foot described in NEI 12-02...

> The estimated design accuracy for each instrument is ±1 inch. The maximum deviation between the two instrument channels for determining that instrument calibration is needed will be ±2 inches based on a still water level in the pool.
>
> The final instrument accuracy will be determined following installation testing implemented as part of the design change acceptance process.

The NRC staff notes that the estimated instrument channel design accuracies and methodology are reasonable since it would be expected to result in maintaining the instrument channels to within their design basis accuracies before significant drift can occur. This appears to be consistent with NEI 12-02, as endorsed by the ISG. 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 this request as:

RAI #15

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

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 that can be performed in-situ consistent with Order EA-12-051 and the guidance in NEI 12-02. Details will be determined during the engineering and design phase. Additional testing and calibration information is provided in Section XV of this plan.

In its letter dated July 5, 2013, the licensee stated, for both NMP1 and NMP2, in part, that

> Multi-point testing is enabled by means of a radar horn antenna capable of being rotated away from the SFP water surface and aimed at a movable metal target that is positioned at known distances from the horn. This allows checking for correct readings of all indicators along a measurement range and validates the functionality of the installed system.
>
> The Primary and Backup instrument channels will have indicators that can be compared against each other and against any other permanently-installed SFP level instrumentation. Since the two level channels are independent, a channel check tolerance based on the final design accuracy of each channel will be applied for cross comparison between the two channels.

In its letter dated July 5, 2013, the licensee also explained that the instrument channels would have indicators to allow operators to compare the level indicated against other SFP level instrumentation currently installed. According to the licensee, with this information and the maximum level allowed deviation for the instrument channel design accuracy, the operators could determine if recalibration or troubleshooting is needed.

The NRC staff notes that the licensee's proposed design, with respect to routine in-situ instrument channel functional and calibration tests, appears to be consistent with NEI 12-02, as endorsed by the ISG.

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, for NMP1 and NMP2, the licensee stated, in part, that remote indicate of the:

> Primary and backup channel SFP water level would be provided in the respective NMP1 or NMP2 Control Rooms.

The licensee also explained how the control room met the characteristics identified in NEI 12-02 for an accessible location.

The NRC staff notes that the NEI guidance for "Display" specifically mentions the control room as an acceptable location for SFP instrumentation displays as it is occupied or promptly accessible, outside the area surrounding the SFP, inside a structure providing protection against adverse weather and outside of any very high radiation areas or LOCKED HIGH RAD AREA during normal operation. The licensee's proposed location for the primary and backup SFP instrumentation displays appears to be consistent with NEI 12-02, as endorsed by the ISG.

3.12 Programmatic Controls: Training

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

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

NEI 12-02 states, in part, that

> The personnel performing functions associated with these SFP level instrumentation channels shall be trained to perform the job specific functions

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

In its OIP, the licensee stated, for both NMP1 and NMP2, in part, that

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

3.13 Programmatic Controls: Procedures

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

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

NEI 12-02 states, in part, that

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

In its OIP, the licensee stated, for both NMP1 and NMP2, 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 letter dated July 5, 2013, the licensee stated, for both NMP1 and NMP2, in part, that

> Procedures for inspection, maintenance, repair, operation, abnormal response, and administrative controls associated with the SFP level instrumentation will be developed utilizing vendor instructions in accordance with existing controlled station administrative procedures that govern procedure development. These procedures ensure standardization of format, content, and terminology and human performance considerations.

> There are no portable level channel instruments associated with the new SFP level instrumentation system that will be installed. Consequently, procedures for storage and installation for portable instruments will not be required.

The NRC staff notes that the procedures for inspection, maintenance, repair, operation, abnormal response, and administrative controls associated with the SFP level instrumentation are not available for review. The staff has concerns with the licensee's lack of information about its plans to develop procedures. The staff previously requested this information as RAI-10 in NRC letter dated June 5, 2013. However, based on feedback from licensees, the staff revised this RAI as follows:

RAI #16

Please provide a list of the procedures addressing operation (both normal and abnormal response), calibration, test, maintenance, and inspection procedures that will be developed for use of the spent SFP instrumentation. The licensee is requested to include a brief description of the specific technical objectives to be achieved within each procedure.

3.14 Programmatic Controls: Testing and Calibration

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

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

NEI 12-02 states, in part, that

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

In its OIP, the licensee stated, for both NMP1 and NMP2, in part, that

> Processes will be established and maintained for scheduling and implementing necessary testing and calibration of the primary and backup SFP water level instrument channels to maintain the instrument channels at the design accuracy. Testing and calibration of the instrumentation will be consistent with vendor recommendations and any other documented basis. Calibration will be specific to the mounted instrument and the monitor. Out of service time as identified in NEI 12-02 will be incorporated consistent with the programmatic process used for compliance with NRC Order EA-12-049, Issuance of Order to Modify Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events (Reference 2). Functionality testing will be performed at the frequency delineated in NEI 12-02. Additional testing information is provided in Section XI of this plan.

> Instrument channel out of service times as identified in NEI 12-02 will be implemented and controlled consistent with the programmatic process used for compliance with NRC Order EA-12-051.

In its letter dated July 5, 2013, the licensee stated, for both NMP1 and NMP2, in part, that

> The maximum allowed deviation from the instrument channel design accuracy that will be employed under normal operating conditions as an acceptance criterion for a calibration procedure to flag to operators and to technicians that the channel requires adjustment to within the normal condition design accuracy will be based upon the difference between readings of the Primary and Backup level instruments.

Additionally, in its letter dated July 5, 2013, the licensee stated, for both NMP1 and NMP2, in part, that

> The Primary and Backup instrument channels will have indicators that can be compared against each other and against any other permanently-installed SFP level instrumentation. Since the two level channels are independent, a channel check tolerance based on the final design accuracy of each channel will be applied for cross comparison between the two channels. Refer to the accuracy performance described in the Response to Request for Additional Information 8.a. The final accuracy of the instrumentation will be determined following installation testing to develop acceptance criteria for whether recalibration or troubleshooting is needed.
>
> Functional checks will be performed on a regularly scheduled basis. The functional check includes visual inspection, verification of the instrument display reading, verification of proper power supply voltage, and testing of the battery backup on simulated loss of normal power. Multi-point calibration tests will also be made on a regularly scheduled basis. The frequency as prescribed in NEI 12-02 will be adopted to perform functional testing within 60 days of a planned refueling outage considering normal testing schedule allowances (e.g., 25%) and not to exceed more than once every 12 months.
>
> The maintenance and testing program for the SFP level instruments will meet the requirements in NEI 12-02. Periodic functional tests will be scheduled to occur within 60 days of each planned refueling outage. The functional tests will verify that the readings for the Primary and Backup channels are consistent with the actual SFP level. The Through Air Radar instrument requires no regular preventative maintenance, except for routine replacement of the backup lithium battery cells in the power control panel. This will be performed during regularly scheduled checks and testing.
>
> Specific details of the functional and calibration test program, including frequencies, will be developed as part of the final instrument design and will be forwarded to the NRC on February 28, 2014 with the second NMPNS Overall Integrated Plan status update.

While addressing compensatory actions for a channel being out of service, in its letter dated July 5, 2013, the licensee stated, in part, that

> In the event a channel of SPF level instrumentation is out of service for any reason, the out-of-service time will be administratively tracked with an action to restore the channel to service within 90 days. Functionality of the other channel will be confirmed via appropriate testing measures within the following 7 days and every 90 days thereafter until the non-functioning channel is restored to service.
>
> The appropriate compensatory actions have not yet been specified for both channels out of service. The determination of these actions, administrative requirements, and implementation procedures will be available following completion of the final design and will be forwarded to the NRC on February 28, 2014 with the second NMPNS Overall Integrated Plan status update.
>
> In the event that a channel cannot be restored to service within the 90 day period, expedited actions to restore the channel would be initiated and tracked via NMPNS' Corrective Action Program. If both channels are determined to be non-functional, NMPNS will initiate appropriate compensatory actions within 24 hours. The expedited and compensatory actions will be defined in the applicable maintenance procedure.

The licensee's proposed plan, with respect to defining processes for scheduling and implementing necessary testing and calibration and compensatory actions when a channel is out of service or when one of the instrument channels cannot be restored to functional status within 90 days appears to be consistent with NEI 12-02, as endorsed by the ISG. The NRC staff notes that further information with regard to testing, calibration and compensatory actions will be forwarded on February 28, 2014 with the second NMPNS OIP status update. The staff has identified these requests as:

RAI #17

Please provide the following:

d) Further information describing the maintenance and testing program the licensee will establish and implement to ensure that regular testing and calibration is performed and verified by inspection and audit to demonstrate conformance with design and system readiness requirements. Please include a description of the plans for ensuring that necessary channel checks, functional tests, periodic calibration, and maintenance will be conducted for the level measurement system and its supporting equipment.

e) Information describing compensatory actions when both channels are out-of-order, and the implementation procedures.

f) Additional information describing expedited and compensatory actions in the maintenance procedure to address when one of the instrument channels cannot be restored to functional status within 90 days.

The NRC staff has concerns 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 #18

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

3.15 Instrument Reliability

NEI 12-02 states, in part, that

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

In its OIP, the licensee stated, for both NMP1 and NMP2, 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 VII, Qualification. Reliable water level indication will be functional during all modes of operation consistent with Section XV, Testing and Calibration.

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.

In order for the NRC staff to review the final licensee's SFP instrumentation OIPs and complete the NRC staff's evaluation, all the requested information must be provided no later than September 30, 2014. Our interim staff evaluation input for Calvert Cliffs Nuclear Power Plant is provided as Enclosure 1, and our interim staff evaluation for Nine Mile Point Nuclear Station, Units 1 and 2 is provided as Enclosure 2.

Please contact me at (301) 415-1476 or email Mohan.Thadani@nrc.gov, if you have any questions on this issue.

Sincerely,
/ra/
Mohan C. Thadani, Senior Project Manager
Plant Licensing Branch I-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket Nos. 50-317, 50-318, 50-220, and 50-410

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