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

December 5, 2013

Site Vice President
Entergy Nuclear Operations, Inc.
Pilgrim Nuclear Power Station
600 Rocky Hill Road
Plymouth, MA 02360-5508

SUBJECT: PILGRIM NUCLEAR POWER STATION - INTERIM STAFF EVALUATION AND REQUEST FOR ADDITIONAL INFORMATION REGARDING THE OVERALL INTEGRATED PLAN FOR IMPLEMENTATION OF ORDER EA-12-051, "ISSUANCE OF ORDER TO MODIFY LICENSES WITH REGARD TO RELIABLE SPENT FUEL POOL INSTRUMENTATION" (TAC NO. MF0778)

Dear Sir or Madam:

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 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.

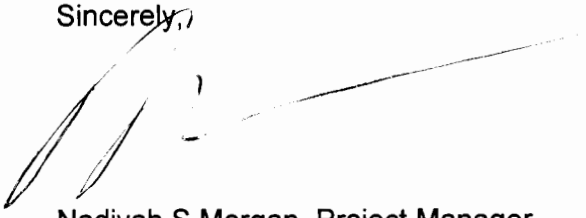
By letter dated February 28, 2013 (ADAMS Accession Nos. ML13063A097), Entergy Nuclear Operations, Inc., the licensee, provided the OIP for Pilgrim Nuclear Power Station, describing how it will achieve compliance with Attachment 2 of Order EA-12-51 by spring 2015. By letter dated June 20, 2013 (ADAMS Accession No. ML13165A276), the NRC staff sent a request for additional information to the licensee. The licensee provided supplemental information by letters dated July 19, 2013 (ADAMS Accession No. ML13207A142) and August 28, 2013 (ADAMS Accession No. ML13247A412).

The 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 evaluation 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. The interim staff evaluation is enclosed.

Please contact me, if you have any questions on this issue.

Sincerely,



Nadiyah S Morgan, Project Manager
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Office of Nuclear Reactor Regulation

Docket No. 50-293

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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 ENTERGY NUCLEAR OPERATIONS, INC. PILGRIM NUCLEAR POWER STATION DOCKET NO. 50-293

INTRODUCTION

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

By letter dated February 28, 2013 (ADAMS Accession Nos. ML13063A097), Entergy Nuclear Operations, Inc., Entergy, the licensee provided the OIP for Pilgrim Nuclear Power Station (Pilgrim), describing how it will achieve compliance with Attachment 2 of Order EA-12-51 by spring 2015. By letter dated June 20, 2013, (ADAMS Accession No. ML13165A276) the NRC staff sent a request for additional information (RAI) to the licensee. The licensee provided supplemental information by letters dated July 19, 2013 (ADAMS Accession No. ML13207A142) and August 28, 2013 (ADAMS Accession No. ML13247A412).

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

On August 29, 2012, the NRC issued an Interim Staff Guidance document (the ISG), JLD [Japan Lessons Learned Project Directorate]-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

Pilgrim has a single SFP.

The licensee submitted its OIP on February 28, 2013. The OIP states that installation of the SFP level instrumentation will be completed by spring 2015, which is before startup from the second refueling outage for the 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, in part, that

> (1) The level at which reliable suction loss occurs due to uncovering the coolant inlet pipe or any weirs or vacuum breakers associated with suction loss. For Pilgrim, this level, (1), is established based on the siphon break elevation which is at 115 feet [ft.] 8 inches [in.] (Reference 6).
>
> (2) The level at which the normal fuel pool cooling pumps lose required NPSH [net positive suction head] assuming saturated conditions in the pool. The fuel pool cooling pumps trip on low level in the skimmer surge tank. This level will be lower than the level as defined in (1) above.
>
> The higher of the above points is (1). Therefore, Level 1 is elevation 115 ft. 8 in.

The NRC staff notes that Level 1 at 115 ft. 8 in. for Pilgrim is adequate for normal SFP cooling system operation. It is also sufficient for NPSH and represents the higher of the two points described above.

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

In its OIP, the licensee stated that Level 2 would be set at an elevation of 102 ft. 8 in. which is approximately 10 ft. above Level 3.

In its letter dated July 19, 2013, the licensee provided a sketch depicting the elevations identified as Levels 1, 2 and 3 and the minimum sensor range. The NRC staff reviewed this sketch and notes that Level 2 has been adjusted from 102 ft. 8 in. to 111 ft. 3 in.

In its OIP, the licensee stated that:

> Other hardware stored in the SFP will be evaluated to ensure that it does not adversely interact with the SFP instrument probes during a seismic event.

In its letter dated June 20, 2013, the NRC staff requested information regarding the impact from other irradiated hardware stored in the SFP in the identification of the elevation for Level 2.

In its letter dated July 19, 2013, the licensee stated, in part, that

> NEI 12-02 gives two options to determine Level 2. The first option defines Level 2 as ten [ft.] above the highest point of any fuel rack, based on the guidance in Regulatory Guide 1.13, Revision 2. The second option states that Level 2 is based on the need to provide adequate radiation shielding to maintain personnel radiological dose levels within acceptable limits while performing local operations in the vicinity of the pool. The evaluation of the level needed to provide personnel protection should consider the scope of the local operations, including installation of portable FLEX components, along with the emergency conditions that may apply at the time of operator actions.
>
> Level 2 has been adjusted to account for materials stored in the SFP by specifying Level 2 at the Technical Specification [TS] minimum limit (refer to Figure 1).

The NRC staff notes that the licensee adjusted the elevation for Level 2 to 111 ft. 3 in. and that this elevation for Level 2 is more than 10 ft. above the top of the fuel rack and accounts for the potential dose rate impact of other irradiated material stored in the SFP. The NRC staff also notes that this elevation for level 2 corresponds to the elevation listed in the plant TS 3.10.C, which is 33 ft. above the bottom of the pool, 78ft. 3in.

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 SFP. Level 3 is defined in this manner to provide the maximum range of information to operators, decision makers and emergency response personnel.

In its OIP, the licensee stated that Level 3 would be set at an elevation of 92 ft. 8 in. which corresponds to the highest point of any fuel rack seated in the SFP.

In its letter dated July 19, 2013, the licensee provided a sketch depicting the elevations identified as Levels 1, 2 and 3 and the minimum sensor range. The NRC staff reviewed this sketch and notes that Level 3 has been revised to 93 ft. 9 in., which is above the highest point of any spent fuel storage rack seated in the SFP and above the bottom of the SFP gate.

The licensee's proposed plan, with respect to identification of Levels 1, 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 [SFP] level instrument channel is considered reliable when the instrument channel satisfies the design elements listed in Section 3 [Instrumentation Design Features] of this guidance and the plant operator has fully implemented the programmatic features listed in Section 4 [Program Features].

In its OIP, the licensee stated that both the primary and backup Instrument channels are permanently fixed channels and that each instrument channel will be capable of monitoring SFP water level over a single continuous span from above Level 1 to within 1 foot of the top of the spent fuel racks (Level 3).

In its letter dated July 19, 2013, the licensee provided a sketch depicting the elevations identified as Levels 1, 2 and 3 and the minimum sensor range.

In addition, the licensee stated that:

> The spent fuel pool (SFP) level lower instrument span or probe bottom extends down to at least three inches below the upper limit of the range of Level 3 to account for channel accuracy or instrument loop uncertainty.

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

3.4 Design Features: Arrangement

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

> The [SFP] 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 [SFP] area, and to utilize inherent shielding from missiles provided by existing recesses and corners in the [SFP] structure.

NEI 12-02 states, in part, that

> The intent of the arrangement requirement is to specify reasonable separation and missile protection requirements for permanently installed instrumentation used to meet this order. Although additional missile barriers are not required to be installed, separation and shielding can help minimize the probability that

> damage due to an explosion or extreme natural phenomena (e.g., falling or wind-driven missiles) will render fixed channels of SFP instrumentation unavailable. Installation of the SFP instrument channels shall be consistent with the plant-specific SFP design requirements and should not impair normal SFP function.
>
> Channel separation should be maintained by locating the installed sensors in different places in the SFP area.

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

> Level instruments will be installed in the approximate locations shown on Attachment 1. Separation of the channels/probes reduces the potential for falling debris or missiles affecting both channels of instrumentation. This placement coupled with separate routing paths for cables and use of rigid conduit provides reasonable protection against falling debris and structural damage.

In its letter dated July 19, 2013, the licensee stated that:

> Physical separation of the two channels will be accomplished by separately routing cable and conduit as much as practical. The use of conduit on the refueling floor will provide additional protection from damage due to debris during a BDB event.

In this letter, the licensee also stated, in part, that

> The primary instrument (Channel A) will be in the southwest corner of the SFP and the backup instrument (Channel B) will be in the northwest corner of the SFP. Locating the new instruments in the corners of the SFP takes advantage of missile and debris protection inherent in the corners. Channel A and B displays will be located in the Control Room Annex adjacent to the Main Control Room door.

In its OIP, the licensee provided a simplified sketch with the SFP instrument locations and approximate cable routing. The NRC staff reviewed this sketch and notes that the licensee's proposed plan, with respect to the location of the primary and back-up level instruments for both of its SFPs, appears to be consistent with NEI 12-02, as endorsed by the ISG. However, the NRC staff also noted that the routing appears to be run side by side before going into the location of the SFP level instrumentation displays in the main control room (MCR). The NRC staff has concerns with the proximity of the routing from the instrument probe to the instrument display location and whether this arrangement is in accordance with the guidance on channel separation, as described in NEI 12-02. The NRC staff has identified this request as:

RAI #1

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

3.5 Design Features: Mounting

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

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

NEI 12-02 states, in part, that

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

In its OIP, the licensee stated that both the primary and backup system installation will incorporate seismic category I mounting. The licensee also stated that

> Other hardware stored in the SFP will be evaluated to ensure that it does not adversely interact with the SFP instrument probes during a seismic event.

The licensee also stated in its OIP that:

> Probes, cables, connectors, and mounting hardware in the area of the SFP will be designed to function after the effects of seismically induced sloshing.
>
> In the SFP area, cables would be routed in seismically mounted rigid metal conduit. Outside the pool area, cables shall be routed in seismically mounted rigid metal conduit, trays, or raceways....

In its letter dated July 19, 2013, the licensee stated, in part, that

> The loading on the probe mount and probe body includes both seismic and hydrodynamic loading using seismic response spectra that bounds the Pilgrim design basis maximum seismic loads applicable to the installation location(s). The static weight load is also accounted for in the modeling described below but is insignificant in comparison to seismic and hydrodynamic loads. Analytic modeling is being performed by the instrument vendor using Institute of Electrical and Electronic Engineers(IEEE) 344- 2004 methodology.
>
> The simple unibody structure of the probe assembly make it a candidate for analytic modeling and the dimensions of the probe and complex hydrodynamic loading terms in any case preclude meaningful physical testing.

> A detailed computational SFP hydrodynamic model has been developed for the instrument vendor by Numerical Applications, Inc., author of the GOTHIC computational fluid dynamics code. The computational model accounts for multi-dimensional fluid motion, pool sloshing, and loss of water from the pool.
>
> Seismic loading response of the probe and mount is separately modeled using finite element modeling software. The GOTHIC-derived fluid motion profile in the pool at the installation site and resultant distributed hydrodynamic loading terms are added to the calculated seismic loading terms in the finite element model to provide a conservative estimate of the combined seismic and hydrodynamic loading terms for the probe and probe mount, specific to the chosen installation location for the probe.
>
> The proximal portion of the level probe is designed to be attached near its upper end (refer to Figure 2) to a Seismic Category I mounting bracket configured to suit the requirements of a particular SFP. The bracket may be bolted and/or welded to the SFP deck and/or SFP liner/wall according to the requirements of the particular installation per Seismic Category I requirements.

Related to other hardware stored in the SFP, in its letter dated July 19, 2013, the licensee stated, in part, that

> An evaluation of non-special nuclear material inventory located in the SFP will be performed during the Spent Fuel Pool Instrumentation (SFPI) modification process. Non-special nuclear material access to the SFP is governed by Procedure 1.16.1, Spent Fuel Pool Non-SNM Inventory Control. This procedure will be used to prevent any instrument interference from non-special nuclear materials. Special nuclear materials are stored in SFP racks, under administrative controls of Entergy Procedure EN-NF-200; Special Nuclear Materials Controls.

The NRC staff notes that the proposed application of such seismic design criteria appears to be reasonable and addresses the staff-endorsed NEI 12-02 guidance stating that the channel is to be designed to be consistent with the highest seismic or safety classification of the SFP. The licensee's proposed plan, with respect to the seismic design of the mounting, appears to be consistent with NEI 12-02, as endorsed by the ISG. The NRC staff plans to verify the results of the licensee's seismic testing and analysis report when it is completed based on the licensee's response to the following RAI questions.

RAI #2

Please provide the analysis verifying the seismic testing of the level probes, the mounting brackets, and the electronics units, and the analysis of the combined maximum seismic and hydrodynamic forces on the cantilevered portion of the assembly exposed to the potential sloshing effects. Show that the SFP instrument design configuration will be maintained during and following the maximum seismic ground motion considered in the design of the SFP structure.

RAI #3

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, in part, that

> Augmented quality requirements will be applied to all components in the instrumentation channels for:
>
> - design control
> - procurement document control

- instructions, procedures, and drawings
- control of purchased material, equipment, and services
- inspection, testing, and test control
- inspections, test, and operating status
- nonconforming items
- corrective actions
- records
- audits

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 (BDB) 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 Fahrenheit (° 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

> Components in the area of the SFP will be designed for the temperature, humidity, and radiation levels expected during normal, 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 12-049, "Order Modifying Licenses with Regard to Requirements for Mitigation or Beyond-Design-Basis External Events." Examples of post-event conditions that will be considered are:
>
> - Radiological conditions for a normal refueling quantity of freshly discharged (100 hours) fuel with SFP water level within 1 foot of the top of the SFP racks (Level 3) as described in this order,
>
> - Temperatures of 212° F and 100% relative humidity environment,

- Boiling water and steam environment
- Concentrated borated water environment, and...

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

> Equipment located in the SFP will be qualified to withstand a total accumulated dose of expected lifetime at normal conditions plus accident dose received at post event conditions with SFP water level within 1 foot of the top of the fuel rack seated in the [SFP] (Level 3).
>
> The metal probe and cable in the [SFP] area are robust components that are not adversely affected by expected radiation, temperature, or humidity. The areas selected for display/processor installation are considered mild environments, such that personnel access is not prohibited by radiation, temperature or humidity, and are readily accessible by operators during or after a BDB event.

In its letter dated July 19, 2013, the licensee stated, in part, that

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

RAI #4

Please provide analysis of the maximum expected radiological conditions, dose rate and total integrated dose, to which the sensor electronics will be exposed. Also, provide documentation indicating what is the maximum total integrated dose the sensor electronics can withstand and how it was determined. Please discuss the time period over which the analyzed total integrated dose was applied.

While addressing post-event temperature and humidity conditions, in its letter dated July 19, 2013, the licensee stated, in part, that

> Temperature:
>
> Signal processor: Designed for mild environment installation. Physical testing in an environmental chamber to demonstrate normal operation at the operating temperatures specified for the instrument.

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

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

RAI #5

Please provide information indicating 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, and whether the sensor electronics are capable of continuously performing required functions under this expected temperature condition.

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

3.6.3 *Shock and Vibration*

NEI 12-02 states, in part, that

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

- substantial history of operational reliability in environments with significant shock and vibration loading, such as transportation applications, or

- use of component inherently resistant to shock and vibration loadings or are seismically reliable such as cables.

In its OIP, the licensee stated that components of the instrument channels will be qualified for shock and vibration using the methods identified in NEI 12-02.

In its letter dated July 19, 2013, the licensee stated, in part, that

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

The NRC staff has concerns with the licensee's lack of information regarding qualification of the SFP level instruments for shock and vibration. The NRC staff has identified these requests as:

RAI #7

Please provide 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 shock and vibration conditions. Identify the specific commercial and/or military standards that will be used to establish the testing requirements and the specific acceleration levels and frequencies that will be simulated.

RAI #8

For RAI #7 above, please provide the results for the selected methods, tests, and analysis used to demonstrate the qualification and reliability of the installed equipment in accordance with the Order requirements.

3.6.4 *Seismic Reliability*

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

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

> Components 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 area of instrument channel component...

In its letter dated July 19, 2013, the licensee stated, in part, that

> Signal processor (electronics): Triaxial shake-table testing is planned to be performed by the vendor to envelope seismic category 1 safe shutdown earthquake (SSE) conditions or Pilgrim design basis maximum seismic loads (relative to the location where the equipment is mounted) using IEEE 344-2004 methodology.
>
> Probe assembly (level sensor): Seismic and hydrodynamic finite element analysis is performed by the vendor using relevant IEEE 344-2004 methodology (using enveloping seismic category 1 SSE conditions or Pilgrim design basis maximum seismic loads relative to the location where the equipment is mounted), as described in the RAI-3.a response above.
>
> With respect to the probe assembly, combined seismic and hydrodynamic analysis will be used to demonstrate that the probe waveguide's geometric dimensions do not change significantly as a result of the seismic conditions. In the absence of alteration to the geometric configuration of the probe waveguide there is no mechanism for seismic excitation of the probe assembly to alter system accuracy.
>
> The accuracy of system electronics will be demonstrated following seismic excitation as part of the seismic testing protocol.

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

RAI #9

Please provide analysis of the vendor analysis and 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 Pilgrim, 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, in part, that

> The primary instrument channel will be independent of the backup instrument channel. Independence is obtained by physical separation of components between channels and the use of normal power supplied from separate 480V buses. Independence of power sources is described in Section 11. The two (2) permanently mounted instruments in the pool are physically separated as described in Sections 6 and 7.

In addition, in its OIP, the licensee stated that:

> Channels will be physically separated by routing instrument cables in separate conduits, trays, or raceways, locating sensors on opposite sides of the pool near the corners, etc. Physical channel separation will be maintained down through and including each channel display/processor where convergence may be allowed so that display/processors can be located in close proximity or side by side.

In its letter dated July 19, 2013, the licensee stated, in part, that

> The conceptual design provides two independent level instruments in the SFP with cabling routed to two display/processors mounted in the Main Control Room Annex by the door to the Main Control Room. The Control Room Annex is classified as a mild environment. Power for each channel is provided from independent 120VAC, 60 Hz sources....

The NRC staff notes that with this arrangement, the loss of one backup power supply will not affect the operation of the independent channel under BDB event conditions. The implementation of such design provisions appears to be consistent with NEI 12-02, as endorsed

by the ISG, and the electrical functional performance of each level measurement channel would be considered independent of the other channel. However, the NRC staff plans to verify the final electrical power supply design information when it is provided. The NRC staff has identified this request as:

RAI #10

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.

The physical separation of the instruments was previously discussed in Section 3.4, "Arrangement." As stated in Section 3.4, it appears that part of the cable routing for each of the independent SFP level sensors is in close proximity to one another, thus jeopardizing the independence between primary and backup instrument channels that could have been gained from the application of physical separation (Reference RAI # 1).

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

> Each instrument channel is normally powered from 120VAC 60 Hz plant [power] distribution panel to support continuous monitoring of SFP level. The [primary] distribution panel for the primary channel receives power from a different 480V bus than the distribution panel for the backup channel. Therefore, loss of any one 480V bus does not result in loss of normal 120VAC power for both instrument channels.

- On loss of normal 120VAC power, each channel's UPS automatically transfers to a dedicated backup battery. If normal power is restored, the channel will automatically transfers back to the normal AC power.

- The backup batteries are maintained in a charged state by commercial-grade uninterruptible power supplies. The batteries are sized to be capable of supporting intermittent monitoring for a minimum of 3 days of operation. This provides adequate time to allow the batteries to be replaced, or until off-site resources can be deployed by the mitigating strategies resulting from Order EA-12-049 Revision 0.

- An external connection permits powering the system from any portable DC source.

- Instrument accuracy and performance are not affected by restoration of power or restarting the processor.

In NRC's staff letter dated June 20, 2013, the staff requested the design criteria that will be applied to size the backup battery.

In its letter dated July 19, 2013, the licensee stated, in part, that

> The sample rate estimates have been developed by the vendor using conservative instrument power requirements and measured battery capacity with draw-downs during and following exposure of the batteries to their maximum operating temperature for up to seven days. The instrument configuration is planned to be established for an automated sample rate when under battery power consistent with seven days continuous operation. Permanent installed battery capacity for seven days continuous operation is planned consistent with NEI 12-02 duration without reliance on or crediting of potentially more rapid FLEX

> Program power restoration. Batteries are readily replaceable via spare stock without the need for recalibration to maintain accuracy of the instrument. These measures ensure adequate power capacity and margin.

The NRC staff notes that the proposed criteria for sizing of the backup battery 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 #11

Please provide the results of the calculation depicting the battery backup duty cycle requirements and compatibility with the duration required for the plant mitigating strategy for assuring SFP level filling/cooling.

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

> Accuracy will be consistent with the guidelines of NRC JLD-ISG-2012-03 Revision 0 and NEI 12-02 Revision 1. Accuracy and indication features are as follows:
>
> - Accuracy: The absolute system accuracy is equal or better than ± 3 inches. This accuracy is applicable for normal conditions and the temperature, humidity, chemistry, and radiation levels expected for BDBE event conditions.
>
> - Trending: The display trends and retains data when powered from either normal or backup power.
>
> - Restoration after Loss of Power: The system automatically swaps to available power (backup battery power or external DC source) when normal power is lost. Neither the source of power nor system restoration impact accuracy. Previously collected data is retained.

- Diagnostics: The system performs and displays the results of real-time information related to the integrity of the cable, probe, and instrument channel.

In its letter dated July 19, 2013, the licensee stated, in part, that

> The instrument channel level accuracy will be specified as less than ± 3.0 inches for all expected conditions. The expected instrument channel accuracy performance would be approximately ±1% of span (based on the sensitive range of the detector).
>
> In general relative to normal operating conditions, any applicable calibration procedure tolerances (or acceptance criterion) are planned to be established based on manufacturer's stated/recommended reference accuracy (or design accuracy). The methodology used is planned to be captured in plant procedures and/or programs.

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

RAI #12

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.

RAI #13

Please provide a description of the methodology that will be used for determining the maximum allowed deviation from the instrument channel design accuracy that will be employed under normal operating conditions as an acceptance criterion for a calibration procedure to flag to operators and to technicians that the channel requires adjustment to within the normal condition design accuracy.

3.10 Design Features: Testing

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

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

NEI 12-02 states, in part, that

> Static or non-active installed (fixed) sensors can be used and should be designed such that testing and/or calibration can be performed in-situ. For microprocessor

> based channels the instrument channel design shall be capable of testing while mounted in the pool.

In its OIP, the licensee stated that:

> The display/processor performs automatic in-situ calibration and automatically monitors for cable, connector, and probe faults using time domain reflectometry (TDR) technology. Channel degradation due to age or corrosion is not expected but can be identified by monitoring trends.

In its letter dated July 19, 2013, the licensee stated, in part, that

> The instrument automatically monitors the integrity of its level measurement system using in-situ capability. Deviation of measured test parameters from manufactured or as-installed configuration beyond a configurable threshold prompts operator intervention.
>
> Periodic calibration checks of the signal processor electronics to extrinsic National Institute of Standards and Technology (NIST)-traceable standards can be achieved through the use of standard measurement and test equipment.
>
> The probe itself is a perforated tubular coaxial waveguide with defined geometry and is not calibrated. It is planned to be periodically inspected electromagnetically using time-domain reflectometry (TDR) at the probe hardline cable connector to demonstrate that the probe assembly meets manufactured specification and visually to demonstrate that there has been no mechanical deformation or fouling.

Additionally, in its letter dated July 19, 2013, the licensee stated, in part, that

> Each instrument electronically logs a record of measurement values over time in non-volatile memory that is compared to demonstrate constancy, including any changes in pool level, such as that associated with the normal evaporative loss/refilling cycle. The channel level measurements can be directly compared to each other (i.e., regular cross-channel comparisons)....

The licensee also stated that any existing permanently installed SFP level instrumentation or other direct measurements of SFP level may be used for diagnostic purposes if cross-channel comparisons are anomalous.

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

RAI #14

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

3.11 Design Features: Display

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

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

NEI 12-02 states, in part, that

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

In its OIP, the licensee stated that the primary and backup instrument displays will be located in the Control Building. The licensee also provided a simplified sketch of the SFP instrument locations and approximate cable routings. The NRC staff reviewed this sketch notes that the processor/displays are located in the MCR.

In its letter dated July 19, 2013, the licensee stated that:

> The conceptual design provides two independent level instruments in the SFP with cabling routing to two display/processors mounted in the MCR Annex by the door to the MCR.

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

3.12 Programmatic Controls: Training

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

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

NEI 12-02 states, in part, that

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

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

> The Systematic Approach to Training (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 that procedures for maintenance and testing will be developed using regulatory guidelines and vendor instructions.

In its letter dated July 19, 2013, the licensee stated, in part, that

> Vendor recommended inspection, maintenance, and repair procedures for the liquid level measurement system have been developed through the vendor's 30-year experience developing and manufacturing liquid level measurement and cable testing instrumentation. These are for the most part specific to the system's proprietary electronics, subject to relevant industry standards for electronics fabrication and inspection and vendor's quality management system.
>
> Where relevant, standards for naval shipboard liquid level indicating equipment have been used to develop procedures for operation, abnormal response, and administrative controls.
>
> Portable instrumentation is not utilized. Both primary and backup SFPI channels incorporate permanent hard-wired installation.
>
> The specific procedures to be used to capture the required activities described in this RAI response have not yet been developed but are planned to be developed in accordance with the vendor recommendations and Entergy processes and procedures.

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

RAI #15

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

3.14 Programmatic Controls: Testing and Calibration

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

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

NEI 12-02 states, in part, that

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

In its OIP, the licensee stated that station procedures and preventive maintenance tasks will be developed as necessary (e.g. to perform required surveillance testing, calibration, backup battery maintenance, functional checks, and visual inspections of the probes).

In its letter dated July 19, 2013, the licensee stated, in part, that

> Performance tests (functional checks) are automated and/or semi-automated (requiring limited operator interaction) and are performed through the instrument menu software and initiated by the operator. There are a number of other internal system tests that are performed by system software on an essentially continuous basis without user intervention but can also be performed on an on-demand basis with diagnostic output to the display for the operator to review. Other tests such as menu button tests, level alarm, and alarm relay tests are only initiated manually by the operator. [Operator] performance checks are described in detail in the Vendor Operator's Manual, and the applicable information is planned to be contained in plant operating procedures.
>
> [Operator] performance tests are planned to be performed periodically as recommended by the equipment vendor, for instance quarterly but no less often than the calibration interval of two years.
>
> Channel functional tests per operations procedures with limits established in consideration of vendor equipment specifications are planned to be performed at appropriate frequencies established equivalent to or more frequently than existing SFPI.
>
> Manual calibration and operator performance checks are planned to be performed in a periodic scheduled fashion with additional maintenance on an as-needed basis when flagged by the system's automated diagnostic testing features.

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

Additionally, in its letter dated July 19, 2013, the licensee stated, in part, that

> SFPI channel/equipment maintenance/preventative maintenance and testing program requirements to ensure design and system readiness are planned to be established in accordance with Entergy's processes and procedures and in consideration of vendor recommendations to ensure that appropriate regular testing, channel checks, functional tests, periodic calibration, and maintenance is performed [and available for inspection and audit]. Subject maintenance and testing program requirements are planned to be developed during the SFPI modification design process.
>
> Both primary and backup SFPI channels incorporate permanent installation (with no reliance on portable, post-event installation) of relatively simple and robust augmented quality equipment. Permanent installation coupled with stocking of adequate spare parts reasonably diminishes the likelihood that a single channel (and greatly diminishes the likelihood that both channels) is (are) out-of-service for an extended period of time....

In its letter dated July 19, 2013, the licensee also provided a table with compensatory actions for unlikely extended out-of-service events.

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

RAI #16

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

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 Revision 0 and NEI 12-02 Revision 1....

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

4.0 CONCLUSION

The NRC staff is unable to complete its evaluation regarding the acceptability of the licensee's plans for implementing the requirements of Order EA-12-051 due to the need for additional information as described above. The NRC 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. The interim staff evaluation is enclosed.

Please contact me, if you have any questions on this issue.

Sincerely,

/ra/

Nadiyah S Morgan, Project Manager
Plant Licensing Branch 1-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-293

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