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JUN 26 2015

SOUTHERN COMPANY

Docket No.: 50-348

NL-15-0699

U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, D. C. 20555-0001

Joseph M. Farley Nuclear Plant Unit 1
Completion of Required Action by NRC Order EA-12-051
Reliable Spent Fuel Pool Level Instrumentation

Ladies and Gentlemen:

On March 12, 2012, the Nuclear Regulatory Commission (NRC) issued Order EA-12-051, *Order Modifying Licenses with Regard to Reliable Spent Fuel Pool Instrumentation*, to Southern Nuclear Operating Company (SNC). This Order was effective immediately and directed the Farley Nuclear Plant (FNP) Units 1 and 2 to install reliable spent fuel pool instrumentation as outlined in Attachment 2 of the Order. This letter, along with its enclosures, provides the notification required by Item IV.C.3 of the Order that full compliance with the requirements described in Attachment 2 of the Order has been achieved for FNP Unit 1.

This letter contains no new NRC commitments. If you have any questions, please contact John Giddens at 205.992.7924.

Mr. C. R. Pierce states he is the Regulatory Affairs Director for Southern Nuclear Operating Company, is authorized to execute this oath on behalf of Southern Nuclear Operating Company and, to the best of his knowledge and belief, the facts set forth in this letter are true.

Respectfully submitted,

C. R Pierce

C. R. Pierce
Regulatory Affairs Director

CRP/JMG/GLS

*Sworn to and subscribed before me this* 26th *day of* June, *2015.*

Catherine B Galloway
*Notary Public*

*My commission expires:* 1/2/2018

A001
NRR

Enclosures: 1. Compliance with Order EA-12-051
2. NRC Requests for Information

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Joseph M. Farley Nuclear Plant Unit 1
Completion of Required Action by NRC Order EA-12-051
Reliable Spent Fuel Pool Level Instrumentation

Enclosure 1

Compliance with Order EA-12-051

Enclosure 1 to NL-15-0699
Joseph M. Farley Nuclear Plant – Unit 1
Compliance with Order EA-12-051

## BACKGROUND

On March 12, 2012, the Nuclear Regulatory Commission (NRC) issued Order EA-12-051, *Order Modifying Licenses with Regard to Reliable Spent Fuel Pool Instrumentation* (Reference 2), to Southern Nuclear Operating Company (SNC). This Order was effective immediately and directed the Farley Nuclear Plant (FNP) - Units 1 and 2 to install reliable spent fuel pool instrumentation as outlined in Attachment 2 of the Order. The compliance date for FNP Unit 1 was May 4, 2015. The information provided herein documents full compliance for FNP Unit 1 in response to the Order.

## COMPLIANCE

Farley Nuclear Plant has installed two independent full scale level monitors on the Unit 1 Spent Fuel Pool (SFP) in response to Reference 2. The FNP site has two fuel pools (one for each unit) operated independently with Reference 13 written previously documenting full compliance of Unit 2 in response to this Order.

In accordance with SNC letter dated February 27, 2013 (Reference 1), FNP fully expected compliance with Reference 2 would coincide with implementation of Order EA-12-049, *Order to Modify Licenses with Regard to Mitigation Strategies for Beyond-Design-Bases External Events* (Reference 3). By letter dated April 14, 2014, *Relaxation of Certain Schedule Requirements for Order EA-12-049* (Reference 11), the NRC granted schedule relief for FNP implementation of Reference 3. As a result, equipment required by Reference 3 is not currently available as originally planned for compliance with Reference 2. Specifically, the portable FLEX diesel generators for compliance with Item 1.6 of Attachment 2 to Reference 3 are not available to provide backup power to the spent fuel pool instrumentation as originally intended for compliance with Reference 2. Upon completion of the modifications required by Reference 3, the portable FLEX diesel generators will provide backup power supply for the spent fuel pool instrumentation as originally planned. In the interim, a backup power supply, including procedures for its use, is provided for compliance with the requirements of Reference 2.

Following SNC submittal of the FNP Overall Integrated Plan (Reference 1), the NRC provided its interim staff evaluation and requested additional information necessary for completion of the review (Reference 9). The requested information previously provided to the NRC is included in Enclosure 2.

Compliance with Order EA-12-051 was achieved using the guidance in Nuclear Energy Institute (NEI) document NEI 12-02 (Reference 15) which has been endorsed by the NRC (Reference 16).

## IDENTIFICATION OF LEVELS OF REQUIRED MONITORING - COMPLETE

FNP-Unit 1 has identified the three required levels for monitoring SFP level in compliance with Order EA-12-051. Until Order EA-12-049 is fully implemented, current plant procedures conservatively direct Operations personnel to maintain SFP above the level that is adequate to support operation of the normal fuel pool cooling system using current makeup capabilities. Once Order EA-12-049 is fully implemented, Operations procedures will be updated to integrate the full capability of the SFP level indication system.

**INSTRUMENT DESIGNED FEATURES - COMPLETE**

The design of the instruments installed at FNP Unit 1 complies with the requirements specified in Reference 2 and described in NEI 12-02 "Industry Guidance for Compliance with NRC Order EA-12-051." The instruments have been installed in accordance with the station design control process.

The instruments are arranged to provide reasonable protection against missiles. The instruments are mounted to retain design configuration during and following the maximum expected ground motion. The instruments are designed to be reliable at expected environmental and radiological conditions including extended periods when the SFP is at saturation. The instruments are independent of each other and have separate and diverse power supplies. The instruments are designed to maintain their designed accuracy following a power interruption and to allow routine testing and calibration.

The SFP instrument display is readily accessible during postulated events and allows level information to be promptly available to decision makers.

**PROGRAM FEATURES - COMPLETE**

Training for FNP Unit 1 is complete and was performed in accordance with an accepted training process (Systematic Approach to Training) as recommended in NEI 12-02, Section 4.1.

Operating and maintenance procedures for FNP Unit 1 have been developed and integrated with existing procedures. Procedures have been verified and are available for use in accordance with the site procedure control program.

Site processes have been established to ensure the instruments are maintained at their design accuracy.

**MILESTONE SCHEDULE – ITEMS COMPLETE**

| **FNP Unit 1 Milestone** | **Completion Date** |
|---|---|
| Submit 20 Day Letter Acknowledging Receipt of Order | March 27, 2012 |
| Submit Overall Integrated Plan | February 27, 2013 |
| **Unit 1 - Refueling Outage** | **November 2013** |
| 1st 6 Month Update | August 2013 |
| 2nd 6 Month Update | February 2014 |
| Instrument Design Complete | October 2014 |
| Receipt of Unit 1 SFP Instrument Channel | July 2014 |
| 3rd 6 Month Update | August 2014 |
| 4th 6 Month Update | February 2015 |
| Complete Functional Test of Unit 1 SFPI | January 28, 2015 |
| Procedures and Training Complete | February 2015 |
| **Unit 1 - Refueling Outage / Implementation Complete** | **May 4, 2015** |

Based on the above, the requirements of Order EA-12-051 have been achieved for FNP Unit 1. A summary of FNP Unit 1 compliance with the Order is provided as follows:

COMPLIANCE ELEMENTS SUMMARY

**In accordance with NRC Order EA-12-051, FNP 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,**

**(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.**

The FNP Unit 1 Spent Fuel Pool Level Indication System (SFPLIS) is capable of measuring SFP level from approximately ten inches above the top of the fuel racks to approximately one foot below the top of the SFP. A visual aid is included with the SFPLIS display units which indicates the three key SFP levels required by the Order.

1. **In accordance with NRC Order EA-12-051, the spent fuel pool level instrumentation shall include the following design features:**

   a. **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.**

      Two independent level detectors have been permanently installed in the Unit 1 SFP. The level detectors are redundant and either may be used as the primary device with the other acting as the backup device.

   b. **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.**

      The detectors are located in opposing sides of the SFP, separated by a distance greater than the shortest length of a side of the pool, which provides reasonable protection of the level indicating function against missiles that may result from damage to the structure over the SFP.

   c. **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.**

The sensing elements, detectors and display units are seismically qualified and mounted, consistent with the FNP Unit 1 licensing bases.

**d. 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).**

The instrument channels are qualified to be reliable at temperature, humidity, and radiation levels consistent with the SFP water at saturation conditions for an extended period. Westinghouse, supplier of the SFPLIS, has qualified the equipment through a quality assurance process.

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

The two instrumentation channels are independent. No equipment is shared between the two channels. Each channel has independent conduit runs and the conduit runs inside the Auxiliary Building have been routed to provide adequate channel separation.

**f. 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 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.**

The instrumentation channels are each powered from separate uninterruptable power supplies (UPS). The UPS for each channel is capable of powering the instrument for greater than 72 hours. Onsite portable generators will be used to supply power to the instruments should an extended loss of AC power occur. A 72 hour battery life is sufficient time to obtain a portable generator and connect to the SFPLIS. The site acceptance test confirmed the ability of the batteries to power the channels for a minimum of 24 hours.

Interim backup power to the FNP Unit 1SFPLIS is provided in accordance with the requirements of the Order as follows:

i. Two 1kW propane generators are available for supplying backup power to the SFPLIS. One generator has sufficient capacity to supply both instrument channels.

ii. One of the two portable generators is stored in a robust structure (location identified in plant procedures).

iii. Three 20-pound propane tanks are stored in diverse locations throughout the plant site consistent with the reasonable protection requirements of Reference 3 and described in NEI 12-06. The location of the propane

tanks is provided in Standing Order S-2014-009. Procedures have been developed for connecting and use of the portable generator to supply backup power to the SFPLIS in the event of an extended loss of AC power.

iv. The Operations Curriculum Review Committee (CRC) determined that formal training is not required. Skill of the craft and instructions provided in approved procedures are adequate to monitor displays and to supply backup power if needed. Training of Operations personnel has been conducted to familiarize them with the location of the displays and the procedures associated with this new system.

v. Administrative controls in the form of procedures have been established in the interim for use of any portable generator in lieu of the FLEX portable diesel generator.

vi. Preventive Maintenance Procedures are in place for maintaining and testing the portable generators. These procedures require that periodic load tests be performed.

vii. A timed validation of the generator hook-up and operation has been completed.

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

The channels are designed to maintain accuracy following a power interruption. This feature was confirmed during the site acceptance test.

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

The channels are designed for routine testing and calibration. These features were confirmed during the site acceptance test.

**i. 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.**

The displays provide continuous level indication, are outside the spent fuel pool room, and are located in an area that is easily accessible by operators.

**2. In accordance with NRC Order EA-12-051, the spent fuel pool instrumentation shall be maintained available and reliable through appropriate development and implementation of the following programs:**

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

The Systematic Approach to Training process has been used to evaluate and develop personnel training for the SFPLIS.

I&C Technicians: The CRC determined that current task training is adequate to support maintenance and calibration of the new level detection system. Accordingly, no additional training is required.

Operations: CRC determined that formal training is not required. Skill of the craft and instructions within approved procedures are adequate to monitor displays and to supply backup power, if needed. Training of Operations personnel was conducted to familiarize them with the location of the displays and the procedures associated with this new system.

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

The following procedures have been either updated or created for testing, calibration and use of the SFPLIS:

- FNP-1-SOP-54.0: Spent Fuel Pit Cooling and Purification System
  - Section added to describe operation of the display unit
  - Section added to describe supplying power with a portable generator
- FNP-1-SOP-36.4: 120V AC Instrumentation Distribution System
  - Added power supply (alternate) locations for the new SFPLI system
- FNP-2-SOP-36.4: 120V AC Instrumentation Distribution System
  - Added power supply (primary) locations for the new SFPLI system
- FNP-1-AOP-36.0: Loss of Shutdown Cooling
  - Added option to use new SFPLI for monitoring level.
- FNP-1-STP-30.0: Hot Shutdown Panel Instrumentation Channel Checks
  - Added monthly check/comparison of primary and alternate level displays with the SFP ruler level.
  - Added monthly check of UPS status
- NMP-OS-019-013: BDB Equipment Unavailability Tracking
  - New procedure which provides instructions for tracking unavailability time of the new SFPLI system

**c. 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.**

- FNP-1-IMP- 222.0: Unit 1 Spent Fuel Pool Level Instrumentation Calibration
  - New procedure which provides instructions for calibration of new instrument system

- Task generated to periodically perform SFPLI channel check and calibration

**REFERENCES**

The following references support the FNP Unit 1 compliance with the requirements of Order EA-12-051:

1. SNC letter NL-13-0171, *Farley Nuclear Plant Units 1 and 2 Overall Integrated Plan in Response to March 12, 2012 Commission Order Modifying Licenses with Regard to Requirements for Reliable Spent Fuel Pool Instrumentation (Order EA-12-051),* dated February 27, 2013.
2. NRC Order EA-12-051, *Order Modifying Licenses with Regard to Reliable Spent Fuel Pool Instrumentation*, dated March 12, 2012.
3. NRC Order EA-12-049, *Order to Modify Licenses with Regard to Mitigation Strategies for Beyond-Design-Bases External Events*, dated March 12, 2012.
4. SNC letter NL-12-0618, *Answer to the March 12, 2012 Commission Order Modifying License with Regard to Reliable Spent Fuel Pool Instrumentation (Order Number EA-12-051),* dated March 27, 2012.
5. SNC letter NL-12-2150, *Farley Nuclear Plant – Units 1 and 2 Initial Status Report in Response to March 12, 2012 Commission Order Modifying Licenses with Regard to Requirements for Reliable Spent Fuel Pool Instrumentation (Order Number EA-12-051),* dated October 23, 2012.
6. NRC letter, *Farley Nuclear Plant - Request for Additional Information Regarding Overall Integrated Plan for Reliable Spent Fuel Pool Instrumentation (Order EA-12-051),* dated August 1, 2013.
7. SNC letter NL-13-1734, *Farley Nuclear Plant – Units 1 and 2 Response to Request for Additional Information Regarding Overall Integrated Plan for Reliable Spent Fuel Pool Instrumentation (Order EA-12-051),* dated August 20, 2013.
8. SNC letter NL-13-1765, *Farley Nuclear Plant – Units 1 and 2, First Six-Month Status Report of Implementation of the Requirements of the Commission Order with Regard to Reliable Spent Fuel Pool Instrumentation (Order EA-12-051),* dated August 27, 2013.
9. NRC letter, *Interim Staff Evaluation and Request for Additional Information – Farley Nuclear Plant Units 1 and 2 Regarding Overall Integrated Plan (OIP) for Reliable Spent Fuel Pool Instrumentation (Order EA-12-051),* dated October 30, 2013.
10. SNC letter NL-14-0183, *Farley Nuclear Plant – Units 1 and 2, Second Six-Month Status Report of Implementation of the Requirements of the Commission Order with Regard to Reliable Spent Fuel Pool Instrumentation (Order EA-12-051),* dated February 26, 2014.
11. NRC Letter, *Relaxation of Certain Schedule Requirements for Order EA-12-049*, dated April 14, 2014.

12. SNC letter NL-14-1109, *Farley Nuclear Plant – Units 1 and 2, Third Six-Month Status Report of the Implementation of the Requirements for Commission Order with Regard to Reliable Spent Fuel Pool Instrumentation (Order EA-12-051),* dated August 26, 2014.

13. SNC letter NL-15-0074, *Joseph M. Farley Nuclear Plant Completion of Required Action Order EA-12-051 Reliable Spent Fuel Pool Level Instrumentation,* for FNP Unit 2 dated January 14, 2015.

14. SNC letter NL-15-0239, *Joseph M. Farley Nuclear Plant - Units 1 and 2 Fourth Six-Month Status Report of the Implementation of the Requirements of the Commission Order with Regard to Reliable Spent Fuel Pool Instrumentation (EA-12-051),* dated February 26, 2015.

15. NEI 12-02, *Industry Guidance for Compliance with NRC Order EA-12-051, Order Modifying Licenses with Regard to Reliable Spent Fuel Pool Instrumentation,* dated August 24, 2012.

16. 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. ML 12221A339),* dated August 29, 2012, 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.*

Joseph M. Farley Nuclear Plant – Unit 1
Completion of Required Action by NRC Order EA-12-051
Reliable Spent Fuel Pool Level Instrumentation

Enclosure 2

NRC Requests for Information

The information provided below is generally a culmination of the previously provided SNC responses to NRC letter, *Interim Staff Evaluation and Request for Additional Information – Farley Nuclear Plant Units 1 and 2 Regarding Overall Integrated Plan (OIP) for Reliable Spent Fuel Pool Instrumentation (Order EA-12-051),* dated October 30, 2013. Some information has been updated and/or revised including RA #11 Unit 1 power supplies and other status completions. Requests for Information (RAI) numbers 4, 10, and 14 were not included in the NRC letter dated October 30, 2013 and are identified as "Not Applicable" below.

**NRC RAI 1:**

Please provide clarification on the elevation identified as Level 2, the elevation of the highest point of any fuel rack seated in the SFP, and the elevation identified as Level 3.

**SNC Response to RAI 1:**

Level 3 is the nominal Top of Rack elevation at 129'-3.5". Level 2 is 10 feet above at elevation 139'-3.5".

**NRC RAI 2:**

Please identify the final SFP level instrumentation measurement range appropriate to the resolution of the Levels identified in the response to RAI #1 above.

**SNC Response to RAI 2:**

The SFP level instrumentation measurement range is 153'-10.0" to 130'-1.5" (+/- 1 ft. of the top of the fuel rack, per NEI 12-02).

**NRC RAI 3:**

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

**SNC Response to RAI 3:**

A plan view sketch of the SFP area is provided as Figure 1. The sketch depicts the SFP inside dimensions, locations/placement of the primary and alternate level sensors, and the routing of cables that extend toward the location of the electronics. Physical separation of the primary and alternate channels, to the extent practicable and comparable to the short side of the pool, is used to provide reasonable protection of the level indication function against missiles that may result from the damage to the structure over the SFP.

**NRC RAI 4:**

Not Applicable

**NRC RAI 5:**

Please provide the following:

a) The design criteria that will be used to estimate the total loading on the mounting device(s), including static weight loads and dynamic loads. Describe the methodology that will be used to estimate the total loading, inclusive of design basis maximum seismic loads and the hydrodynamic loads that could result from pool sloshing or other effects that could accompany such seismic forces.

b) A description of the manner in which the level sensor (and stilling well, if appropriate) will be attached to the refueling floor and/or other support structures for each planned point of attachment of the probe assembly. Indicate in a schematic the portions of the level sensor that will serve as points of attachment for mechanical/mounting or electrical connections.

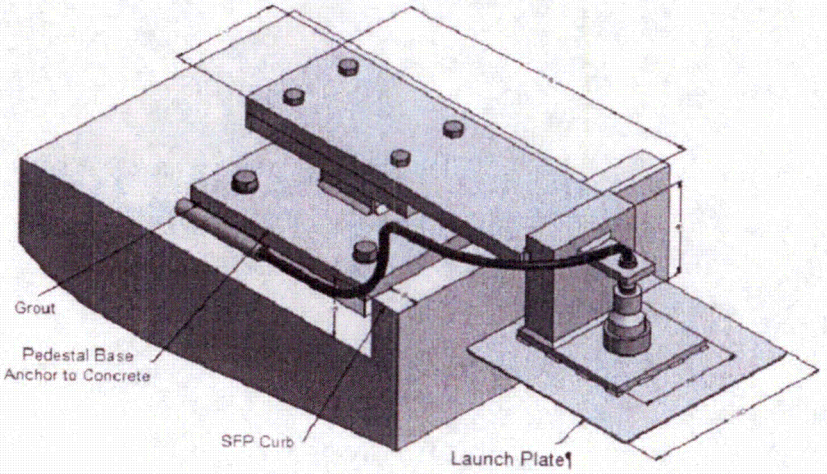
c) A description of the manner by which the mechanical connections will attach the level instrument to permanent SFP structures so as to support the level sensor assembly.

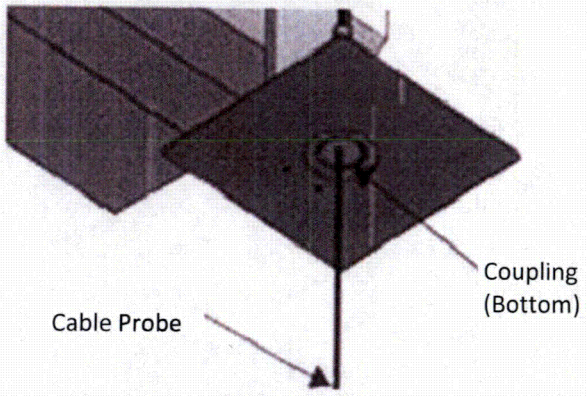
**SNC Response to RAI 5:**

a) 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 are provided in the "Westinghouse Status of Spent Fuel Pool Level Instrumentation for the Joseph M. Farley Nuclear Plant" provided in the Attachment.

b) The mounting bracket is attached to the SFP concrete floor utilizing expansion-type concrete anchor bolts. The level sensor consists of a stranded stainless steel cable level probe that is threaded on the top end. The probe attaches (threads) into a coupling that is secured to the mounting bracket launch plate and extends down into the pool. The attachment to the signal cable is via a coaxial connection on the top side of the launch plate coupling.

   The simplified drawing below shows a representation of the attachment of the probe and the sensor cable to the mounting bracket (launch plate), and mounting bracket attachment to the SFP structure. The Farley SFP does not have a raised concrete curb and as such, the mounting bracket does not utilize the curb for support.




c) The level sensor (probe) is attached near its upper end to the mounting bracket, as described in the response to RAI # 3b above. The mounting bracket is attached to the SFP concrete floor utilizing expansion-type concrete anchor bolts. The mounting bracket to the SFP concrete floor anchorage is designed to meet the requirements of the Farley design and licensing basis for Seismic Category I components including seismic loads, static weight loads and hydrodynamic loads.

**NRC RAI 6:**

For RAI 5(a) above, please provide the analyses used to verify the design criteria and methodology for seismic testing of the SFP instrumentation and the electronics units, including, design basis maximum seismic loads and the hydrodynamic loads that could result from pool sloshing or other effects that could accompany such seismic forces.

**SNC Response to RAI 6:**

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, are provided in the Attachment.

**NRC RAI 7:**

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.

**SNC Response to RAI 7:**

The design inputs and methodology used to qualify the structural integrity of the affected structures/equipment for each of the mounting attachments required to attach SFP Level equipment to plant structures are provided in the Attachment.

**NRC RAI 8:**

Please provide the following:

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

b) A description of the testing and/or analyses that will be conducted to provide assurance that the equipment will perform reliably under the worst-case credible design basis loading at the location where the equipment will be mounted. Include a discussion of this seismic reliability demonstration as it applies to a) the level sensor mounted in the SFP area, and b) any control boxes, electronics, or read-out and re-transmitting devices that will be employed to convey the level information from the level sensor to the plant operators or emergency responders.

c) A description of the specific method or combination of methods that will be used to confirm the reliability of the permanently installed equipment such that following a seismic event the instrument will maintain its required accuracy.

**SNC Response to RAI 8:**

a) A description of the specific method or combination of methods applied to demonstrate the reliability of the permanently installed equipment under BDB ambient temperature, humidity, shock, vibration, and radiation conditions is provided in the Attachment.

b) A description of the testing and/or analyses conducted to provide assurance that the level sensors will perform reliably under the worst-case credible design basis loading at the location where the equipment is mounted is provided in the Attachment. Any control boxes, electronics, or read-out and re-transmitting devices employed to convey the level information from the level sensor to the plant operators or emergency responders is installed per DCP, utilizing Site SSE, and ASME & IEEE codes as described in the Farley FSAR.

c) A description of the specific method or combination of methods used to confirm the reliability of the permanently installed equipment such that following a seismic event the instrument will maintain its required accuracy is provided in the Attachment.

**NRC RAI 9:**

For RAI #8 above, please provide the results for the selected methods, tests and analyses used to demonstrate the qualification and reliability of the installed equipment in accordance with the Order requirements.

**SNC Response to RAI 9:**

The results for the selected methods, tests and analyses used to demonstrate the qualification and reliability of the installed equipment in accordance with the Order requirements are provided in the Attachment.

**NRC RAI 10:**

Not Applicable

**NRC RAI 11:**

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.

**SNC Response to RAI 11:**

The Farley power supplies are assigned as follows:

| Channel | Panel |
|---|---|
| U2 Primary | N2R22L0002 |
| U2 Backup | N1R19L0001G |
| U1 Primary | N2R19L0596 |
| U1 Backup | N1R19L0582 |

**NRC RAI 12:**

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.

**SNC Response to RAI 12:**

The results of the calculation for determining the battery backup duty cycle requirements necessary to demonstrate its capacity is sufficient to maintain the level indication function until offsite resource availability is reasonably assured are provided in the Attachment.

**NRC RAI 13:**

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.

**SNC Response to RAI 13:**

Analysis verifying that the proposed instrument performance is consistent with these estimated accuracy normal and BDB values, along with demonstration that the channels will retain these accuracy performance values following a loss of power and subsequent restoration of power, is provided in the Attachment.

**NRC RAI 14:**

Not Applicable

**NRC RAI 15:**

Please provide the following:

a) The specific location for the primary and backup instrument channel displays.

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

**SNC Response to RAI 15:**

a) See Figure 2 for SFPLIS equipment proposed location sketches.

The proposed location of the U1 and U2 Primary display panels is in room 2452 on EL 155' of the Aux Building. The proposed location of the U1 and U2 Alternate display panels is in room 345 on EL 139' of the Aux Building.

b) The locations have been evaluated within the DCP considering the accident conditions described in NEI 12-02 and NEI 12-06, using design inputs from Westinghouse, existing Station Blackout evaluations and NUMARC-8700, "Guidelines and Technical Bases for NUMARC Initiatives Addressing Station Blackout at Light Water Reactors", November 20, 1987. The results of the evaluation performed, to determine accessibility of the SFPLI displays following an ELAP event, indicate the displays can be accessed without unreasonable delay and without placing station personnel at undue risk with regards to temperature, humidity, and radiation levels.

The selected location of the U1 and U2 Primary display panels in room 2452 on EL 155' of the Aux Building is approximately 180 feet from the West exit of the Control Room. The selected location of the U1 and U2 Alternate display panels in room 345 on EL 139' of the Aux Building is approximately 220 feet from the West exit of the Control Room. Using a conservative walking pace of 1 mph, Primary & Alternate display locations would each require less than 10 minutes to access the display location, perform local function and return to the Control Room. With the displays located outside the Radiation Controlled Area, the substantial structures between the SFP and the pathway to the display,

combined with the short transient duration, personnel traveling the pathways shown on Figure 2 will not require heroic means with the SFP at Level 3 or above. The display location remains habitable considering the: (1) minimal time required to periodically access the displays, (2) distance from the SFP and substantial structures, and (3) the lack of heat producing equipment within the room during accident conditions. Accordingly, both the Primary and Alternate SFPLI panel locations allow prompt, non-heroic access to the displays from the Control Room necessary to allow periodic monitoring of the SFP level.

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

**SNC Response to RAI 16:**

Procedures have been developed to ensure the following objectives:

| Procedure | Objectives to be achieved |
|---|---|
| 1) System Inspection | To verify that system components are in place, complete, and in the correct configuration, and that the sensor probe is free of significant deposits of crystallized boric acid. |
| 2) Calibration and Test | To verify that the system is within the specified accuracy, is functioning as designed, and is appropriately indicating SFP water level. |
| 3) Maintenance | To establish and define scheduled and preventive maintenance requirements and activities necessary to minimize the possibility of system interruption. |
| 4) Repair | To specify troubleshooting steps and component repair and replacement activities in the event of system malfunction. |
| 5) Operation | To provide sufficient instructions for operation and use of the system plant operation staff. |
| 6) Responses | To define the actions to be taken upon observation of system level indications, including actions to be taken at the levels defined in NEI 12-02. |

**NRC RAI 17:**
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.

**SNC Response to RAI 17:**

While the SFP is operating within design basis and at normal level, the indicators may be compared to fixed marks within the SFP by visual observation to confirm indicated level. The periodic calibration verification will be performed within 60 days of a refueling outage considering normal testing scheduling allowances (e.g., 25%). Calibration verification will not be required to be performed more than once per 12 months. These calibration requirements are consistent with the guidance provided in NEI 12-02 section 4.3. Periodic calibration verification procedures have been developed based on information provided by Westinghouse in WNA-TP-04709-GEN, "Spent Fuel Pool Instrumentation System Calibration Procedure." Preventive maintenance procedures include tests, inspection, and periodic replacement of the backup batteries based on recommendations from Westinghouse.

Figure 1

Sketch on section from drawings:

Unit 1: D176039 Unit 2: D206039

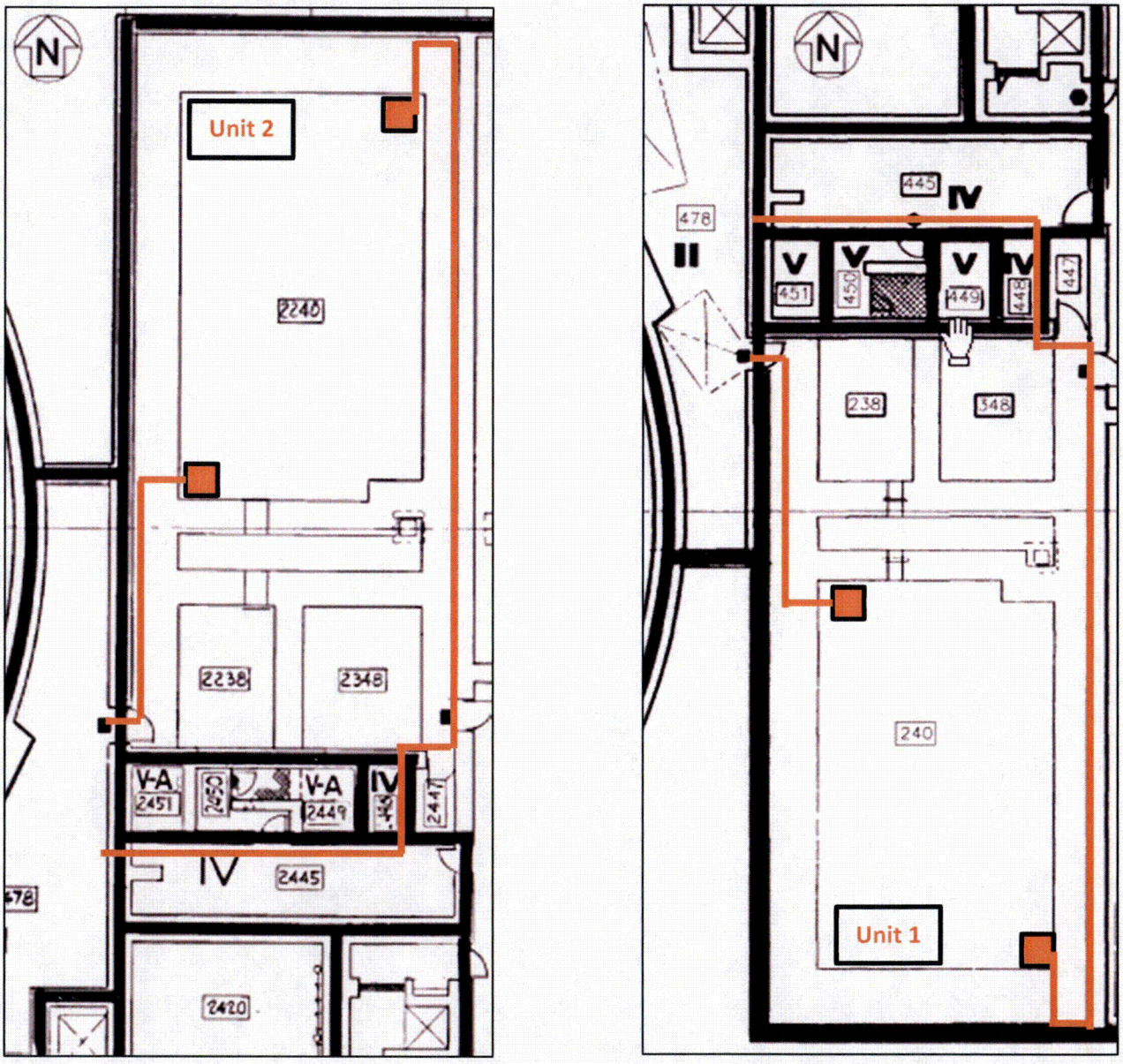
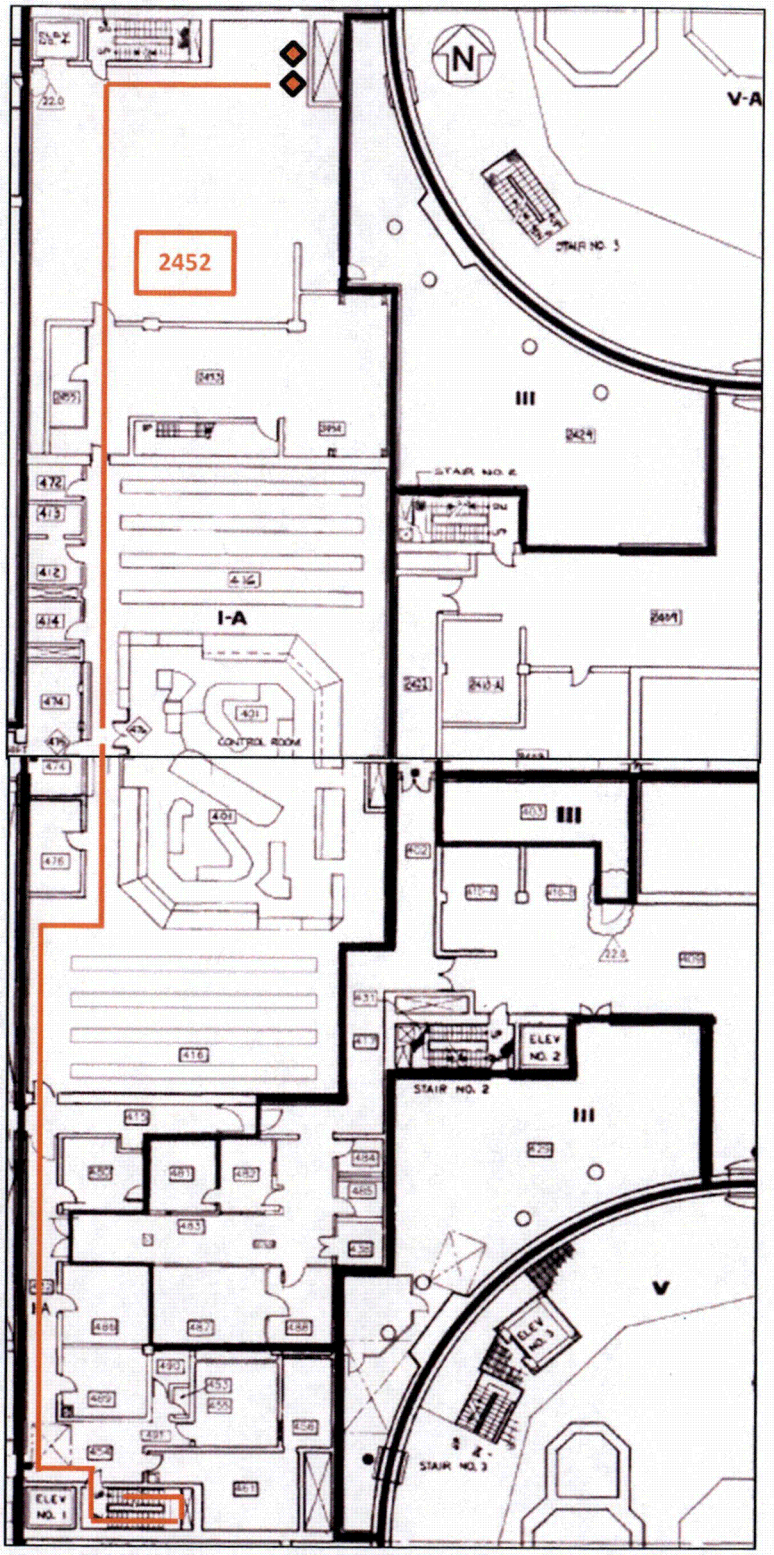


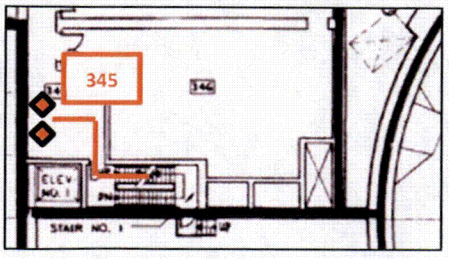
Figure 2

Sketch on section of drawing:

Aux Building EL 155' Unit 1: D176039 Unit 2: D206039




Aux Building EL 139' Unit 1: D176038



Attachment – Design Requirements for Structural Integrity and Reliability

| # | Topic | Parameter Summary | Westinghouse Reference Document # | Additional Comment | Test or Analysis Results |
|---|---|---|---|---|---|
| 1 | Design Specification | SFPIS Requirements derived from References 1, 2, & 3 | WNA-DS-02957-GEN | Contains technical SFPIS requirements based on NRC order, NEI guidance, and the ISG listed above. | N/A |
| 2 | Test Strategy | Per Requirements. | WNA-PT-00188-GEN | Strategy for performing the testing and verification of the SFPIS and pool-side bracket. | N/A |
| 3 | Environmental qualification for electronics enclosure with Display | $50^0$ F to $140^0$ F,<br>0 to 95% RH<br><br>TID ≤ 1E03 R γ normal (outside SFP area)<br><br>TID ≤ 1E03 R γ abnormal (outside SFP area) | EQ-QR-269, Rev. 2 and<br>WNA-TR-03149-GEN for all conditions. | Results are summarized in EQ-QR-269, Rev. 2 and WNA-TR-03149-GEN.<br><br>Radiation Aging verification summarized in Section 5 of WNA-TR-03149-GEN. | Test passed conditions described. |
| 4 | Environmental Testing for Level Sensor components in SFP area – Saturated Steam & Radiation | $50^0$ F to $212^0$ F and 100% humidity | EQ-QR-269, Rev. 2 | Testing summarized in Section 5.7. | Passed |
| | | 1E03 R γ normal (SFP area) | WNA-TR-03149-GEN | Thermal Aging & radiation aging verification summarized in Sections 4.1 and 5 (entire system) of WNA-TR-03149-GEN. | Passed |

| # | Topic | Parameter Summary | Westinghouse Reference Document # | Additional Comment | Test or Analysis Results |
|---|---|---|---|---|---|
| | | 1E07 R γ BDB (SFP area) | EQ-QR-269, Rev. 2 | Additional radiation aging testing documented in Section 5.3. | Passed |
| 5 | Environmental Testing for Level Sensor Electronics Housing – outside SFP | $50^0$ F to $140^0$ F, 0 to 95% RH | EQ-QR-269, Rev. 2 | Testing summarized in Section 5.5. | Passed |
| | | 100% RH | WNA-TR-03149-GEN | 100% humidity addressed in Section 7.5. | Passed |
| | | TID ≤ 1E03 R γ normal (outside SFP area)<br><br>TID ≤ 1E03 R γ abnormal (outside SFP area) | WNA-TR-03149-GEN | Radiation Aging verification summarized in Section 5. | Passed |
| 6 | Thermal & Radiation Aging – organic components in SFP area | 1E03 R γ normal (SFP area) | EQ-QR-269, Rev. 2 and WNA-TR-03149-GEN | Thermal Aging & radiation aging verification summarized in Sections 4.1 and 5 (entire system) of WNA-TR-03149-GEN. | Passed |
| | | 1E07 R γ BDB (SFP area) | EQ-QR-269, Rev. 2 | Additional radiation aging testing documented in Section 5.3. | Passed |

| # | Topic | Parameter Summary | Westinghouse Reference Document # | Additional Comment | Test or Analysis Results |
|---|---|---|---|---|---|
| 7 | Basis for Dose Requirement | SFP Normal Conditions:<br>1E03 R γ TID (above pool)<br><br>1E09 R γ TID (1' above fuel rack)<br><br>SFP BDBE Conditions:<br>1E07 R γ TID (above pool)<br><br>< 1E07 R γ TID (1' above fuel rack) | LTR-SFPIS-13-35 and WNA-DS-02957-GEN | Explanation of Basis for Radiation Dose Requirement<br>(includes the clarification of production equivalency of electronics enclosure used for Seismic and EMC Testing) | Passed for all conditions |
| 8 | Seismic Qualification | Per Spectra in WNA-DS-02957-GEN | EQ-QR-269, Rev. 2 | Documented in Section 5.4. | Passed |
| | | | WNA-TR-03149-GEN | WNA-TR-03149-GEN provides high level summary of the pool-side bracket analysis and optional RTD. | Passed |
| | | | EQ-QR-269, Rev. 2 | Seismic Pull test for new connectors documented in Section 4.4. | Passed |
| 9 | Sloshing | N/A | LTR-SEE-II-13-47 | Calculation to demonstrate that probe will not be sloshed out of the SFP. | Passed |

| # | Topic | Parameter Summary | Westinghouse Reference Document # | Additional Comment | Test or Analysis Results |
|---|---|---|---|---|---|
| | | | WNA-TR-03149-GEN | Sloshing is also addressed in Section 7.2. | Passed |
| 10 | Spent Fuel Pool Instrumentation System Functionality Test Procedure | Acceptance Criteria for Performance during EQ testing | WNA-TP-04613-GEN | Test procedure used to demonstrate that SFPIS meet its operational and accuracy requirements during Equipment Qualification Testing programs. | See applicable EQ test. |
| 11 | Boron Build-Up | Per requirement in WNA-DS-02957-GEN | WNA-TR-03149-GEN | Boron build up demonstrated through Integrated Functional Test (IFT). | Passed |
| 12 | Pool-side Bracket Seismic Analysis | N/A | CN-PEUS-14-7, Rev. 1 | Also includes hydrodynamic forces, as appropriate. | Passed |
| 13 | Additional Brackets (Sensor Electronics and Electronics Enclosure) | N/A | WNA-DS-02957-GEN | Weights provided to licensees for their own evaluation. | N/A |
| 14 | Shock & Vibration | WNA-DS-02957-GEN | WNA-TR-03149-GEN | Section 7 provides rationale and summary of RTD. | N/A |
| 15 | Requirements Traceability Matrix | Maps Requirements to documentation / evidence that Requirement is met | WNA-VR-00408-GEN, Rev. 1 | The RTM maps the requirements of the NRC order, NEI guidance, ISG to the applicable technical requirements in the SFPIS design specification and maps the design specification requirements to the documentation demonstrating the requirement is met. | Complete |

| # | Topic | Parameter Summary | Westinghouse Reference Document # | Additional Comment | Test or Analysis Results |
|---|---|---|---|---|---|
| 16 | Westinghouse Factory Acceptance Test, including testing of dead-zones | IFT Functional Requirements from WNA-DS-02957-GEN | WNA-TP-04752-GEN | The Integrated Functional Test (IFT) demonstrates functionality of the full system for each customer's FAT, which includes calibration of each channel. | Pilot IFT executed/passed<br><br>Vogtle functional checks executed/ passed |
| | | 12" dead-zone at top of probe<br>4" dead-zone at bottom of probe | WNA-TP-04752-GEN | Dead-zone tests are in Section 9.6.2. | N/A |
| 17 | Channel Accuracy | +/- 3 inches per WNA-DS-02957-GEN | WNA-CN-00301-GEN | Channel accuracy from measurement to display. | Passed |
| 18 | Power Consumption | 3 day battery life (minimum)<br><br>0.257 Amps power consumption | WNA-CN-00300-GEN | N/A | Passed |
| 19 | Technical Manual | N/A | WNA-GO-00127-GEN | Information and instructions for Operation, Installation, use, etc. are included here. | N/A |
| 20 | Calibration | Routine Testing/calibration verification and Calibration method | WNA-TP-04709-GEN | Also, includes preventative maintenance actions such as those for Boron buildup and cable probe inspection. | N/A |
| 21 | Failure Modes and Effects Analysis (FMEA) | N/A | WNA-AR-00377-GEN | Addresses mitigations for the potential failure modes of the system. | N/A |

| # | Topic | Parameter Summary | Westinghouse Reference Document # | Additional Comment | Test or Analysis Results |
|---|---|---|---|---|---|
| 22 | Emissions Testing | RG 1.180 R1 test conditions | EQ-QR-269, Rev. 2 | Documented in Section 5.6. | Passed |

References:

1) ML12056A044, NRC Order EA-12-051, "ORDER MODIFYING LICENSES WITH REGARD TO RELIABLE SPENT FUEL POOL INSTRUMENTATION," Nuclear Regulatory Commission, March 12, 2012.

2) ML12240A307, 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" August, 2012.

3) ML12221A339, Revision 0, JLD-ISG-2012-03, "Compliance with Order EA-12-051, Reliable Spent Fuel Pool Instrumentation", August 29, 2012, Nuclear Regulatory Commission Japan Lessons-Learned Project Directorate.

4) Westinghouse Proprietary Document, WNA-DS-02957-GEN, "Spent Fuel Pool Instrumentation System (SFPIS) Standard Product System Design Specification," Revision 4 reviewed by NRC in April 2014; current revision is Revision 4.

5) Westinghouse Proprietary Document, WNA-PT-00188-GEN, "Spent Fuel Pool Instrumentation System (SFPIS) Standard Product Test Strategy," Revision 1 reviewed by NRC in February 2014; NRC did not review in April; current revision is Revision 3.

6) Westinghouse Proprietary Document, EQ-QR-269, "Design Verification Testing Summary Report for the Spent Fuel Pool Instrumentation," Revision 1 reviewed by NRC in April 2014; current revision is Revision 2.

7) Westinghouse Proprietary Document, WNA-TR-03149-GEN, "SFPIS Standard Product Final Summary Design Verification Report," Revision 1 reviewed by NRC in April 2014; current revision is Revision 1.

8) Westinghouse Proprietary Document, LTR-SFPIS-13-35, "SFPIS: Basis for Dose Requirement and Clarification of Production Equivalency of Electronics Enclosure Used for Seismic Testing," Revision 0 reviewed by the NRC in February 2014; NRC did not review in April; current revision is Revision 1.

9) Westinghouse Proprietary Document, LTR-SEE-II-13-47, "Determination if the Proposed Spent Fuel Pool Level Instrumentation can be Sloshed out of the Spent Fuel Pool during a Seismic Event," Revision 0 reviewed by the NRC in February 2014; NRC did not review in April; current revision is Revision 0.

10) Westinghouse Proprietary Document, WNA-TP-04613-GEN, "Spent Fuel Pool Instrumentation System Functionality Test Procedure," Revision 5 reviewed by the NRC in February 2014; NRC did not review in April; current revision is Revision 5.

11) Westinghouse Proprietary Document, CN-PEUS-14-7, "Seismic Analysis of the SFP Mounting Bracket at Farley Nuclear Plant and Vogtle Electric Generating Station," Revision 1; not reviewed by the NRC.

12) Westinghouse Proprietary Document, WNA-VR-00408-GEN, "Spent Fuel Pool Instrumentation System Requirement Traceability Matrix," Revision 0 reviewed by the NRC in April 2014; current revision is Revision 1.

13) Westinghouse Proprietary Document, WNA-TP-04752-GEN, "Spent Fuel Pool Instrumentation System Standard Product Integrated Functional Test Procedure," Revision 1 reviewed by the NRC in February 2014; NRC did not review in April; current revision is Revision 2.

14) Westinghouse Proprietary Document, WNA-CN-00301-GEN, "Spent Fuel Pool Instrumentation System Channel Accuracy Analysis," Revision 0 reviewed by the NRC in February 2014; NRC did not review in April; current revision is Revision 2.

15) Westinghouse Proprietary Document, WNA-CN-00300-GEN, "Spent Fuel Pool Instrumentation System Power Consumption Calculation," Revision 0 reviewed by the NRC in February 2014; NRC did not review in April; current revision is Revision 0.

16) Westinghouse Proprietary Document, WNA-GO-00127-GEN, "Spent Fuel Pool Instrumentation System Standard Product Technical Manual," Revision 1 reviewed by the NRC in April 2014; current revision is Revision 3.

17) Westinghouse Proprietary Document, WNA-TP-04709-GEN, "Spent Fuel Pool Instrumentation System Calibration Procedure," Revision 3 was reviewed by the NRC in February 2014; NRC did not review in April; current revision is Revision 4.

18) Westinghouse Proprietary Document, WNA-AR-00377-GEN, "Spent Fuel Pool Instrumentation System Failure Modes and Effect Analysis," Revision 2 was reviewed by the NRC in February 2014; NRC did not review in April; current revision is Revision 4.