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June 2, 2015
L-15-128

10 CFR 2.202

ATTN: Document Control Desk
U.S. Nuclear Regulatory Commission
Washington, DC 20555-001

SUBJECT:
Perry Nuclear Power Plant
Docket No. 50-440, License No. NPF-58
Completion of Required Action by NRC Order EA-12-051, Reliable Spent Fuel Pool Instrumentation (TAC No. MF0802)

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 FirstEnergy Nuclear Operating Company (FENOC). This Order was effective immediately and directed FENOC to have a reliable indication of the water level in associated spent fuel storage pools for the Perry Nuclear Power Plant (PNPP) as outlined in Attachment 2 of the Order. This letter, along with its attachments, provides the notification required by Section IV.C.3 of the Order that full compliance with the requirements described in Attachment 2 of the Order has been achieved for PNPP.

This letter contains no new regulatory commitments. If you have any questions regarding this report, please contact Mr. Thomas A. Lentz, Manager – Fleet Licensing, at 330-315-6810.

I declare under penalty of perjury that the foregoing is true and correct. Executed on June 2, 2015.

Respectfully submitted,

Ernest J. Harkness

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

cc: Director, Office of Nuclear Reactor Regulation (NRR)
NRC Region III Administrator
NRC Resident Inspector
NRC Project Manager
Ms. Lisa M. Regner, NRR/JLD/PMB, NRC
Mr. Blake A. Purnell, NRR/JLD/PMB, NRC

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 1), to FirstEnergy Nuclear Operating Company (FENOC). This Order was effective immediately and directed FENOC to have a reliable indication of the water level in associated spent fuel storage pools for the Perry Nuclear Power Plant (PNPP) as outlined in Attachment 2 of the Order. The Order required compliance prior to plant startup from the second refueling outage following submittal of the overall integrated plan (OIP), or by December 31, 2016, whichever comes first. The compliance date for PNPP was April 18, 2015. The NRC staff requested that the compliance report be submitted within 60 days of the compliance date. The information provided herein documents full compliance for PNPP in response to the Order.

COMPLIANCE

FENOC has installed two independent full scale level monitors on the spent fuel pool (SFP) at PNPP in response to Reference 1. This SFP instrumentation was supplied and qualified by Westinghouse, LLC (Westinghouse). PNPP discharges irradiated fuel to a single spent fuel storage pool. With the exception of limited time periods for maintenance or non-refueling operations, administrative controls maintain gates in the open position between the following pools: fuel storage and preparation pool, fuel transfer pool, spent fuel storage pool, and cask pit. Thus, these pools are normally inter-connected and at the same water level when the water level in the spent fuel pool is greater than 3.5 feet above the top of stored fuel seated in the storage racks. These pools are treated as one SFP with regard to Reference 1.

FENOC submitted the PNPP OIP by letter dated February 27, 2013 (Reference 2). By letter dated December 11, 2013 (Reference 3), the NRC provided its interim staff evaluation and requested additional information necessary for completion of the review. The information requested by the NRC is included in Attachment 2 of this submittal.

Reference 1 required submission of an initial status report 60 days following issuance of the final interim staff guidance and status reports at six-month intervals following submittal of the OIP. FENOC provided the initial status report for PNPP by letter dated October 26, 2012 (Reference 4). The first, second, third, and fourth six-month status reports for PNPP were provided by letters dated August 26, 2013, February 27, 2014, August 28, 2014, and February 26, 2015, respectively (References 5, 6, 7, and 8.)

Compliance with Order EA-12-051 was achieved using the guidance in Nuclear Energy Institute (NEI) document NEI 12-02, Revision 1 (Reference 9), which has been endorsed by the NRC (Reference 10) with exceptions and clarifications. A summary of the compliance elements is provided below.

Identification of Levels of Required Monitoring

FENOC has identified the three required levels for monitoring SFP level in compliance with Reference 1. These levels have been integrated into the site processes for monitoring SFP level during beyond-design-basis external events (BDBEEs) and responding to loss of SFP inventory.

The design of the fuel transfer pool and its gates is such that there is an approximate 3.5 foot gap between the top of the fuel racks in the two pools containing spent fuel (the fuel storage and preparation pool and the spent fuel storage pool) and the top of the fuel transfer pool gate seat. As a result, the top of the fuel transfer pool gate seat is used as Level 3. This setting is in compliance with Reference 1; however, it represents a minor deviation to Reference 9. This is a conservative decision and ensures that actions are taken to prevent the spent fuel from being uncovered.

Instrumentation Design Features

FENOC has installed SFP instrumentation consisting of permanently mounted, fixed primary and backup instrument channels at PNPP. This SFP instrumentation was supplied and qualified by Westinghouse. The design of the SFP instrumentation system installed complies with the requirements specified in Reference 1 and Reference 9. The SFP instrumentation has been installed in accordance with the site design control process.

The instruments have been arranged to provide reasonable protection against missiles (airborne objects). Each channel consists of a level sensor, an electronics unit, and an indicator. The sensors are mounted at the western end of the SFP (the fuel preparation and storage pool), as close to the adjacent corners as possible to minimize the possibility of a single event or missile damaging both channels. The sensor arrangement also limits interference with existing equipment in or around the SFP. This design is in compliance with Reference 1; however, it does represent a minor deviation from Reference 9. This design also does not pose a potential hazard to personnel working around the pool or on the SFP level instrumentation itself.

The instruments have been mounted to retain design configuration during and following the maximum expected ground motion considered in the design of the SFP structure. The instruments will be reliable during expected environmental and radiological conditions when the SFP is at saturation for extended periods. The instruments are independent of each other and have separate and diverse power supplies. The instruments will maintain their designed accuracy following a power interruption and are designed to allow for routine testing and calibration.

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

Program Features

The Systematic Approach to Training was utilized to develop and implement training. Training has been provided for applicable personnel in the use of, and provision of alternate power to, primary and backup instrument channels.

Procedures for the testing, calibration, and use of the primary and backup SFP instrument channels have been established and integrated with existing procedures.

Preventive maintenance tasks have also been established and scheduled to ensure the instruments are maintained at their design accuracy.

REFERENCES

1. Nuclear Regulatory Commission (NRC) Order Number EA-12-051, Order Modifying Licenses with Regard to Reliable Spent Fuel Pool Instrumentation, dated March 12, 2012.

2. FirstEnergy Nuclear Operating Company's (FENOC's) Overall Integrated Plan in Response to March 12, 2012 Commission Order Issuance of Order to Modify Licenses with Regard to Reliable Spent Fuel Pool Instrumentation (Order Number EA-12-051), dated February 27, 2013.

3. NRC Letter, Perry Nuclear Power Plant, Unit 1, - Interim Staff Evaluation and Request for Additional Information Regarding the Overall Integrated Plan for Implementation of Order EA-12-051, Reliable Spent Fuel Pool Instrumentation, dated December 11, 2013.

4. FirstEnergy Nuclear Operating Company's (FENOC's) 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 26, 2012.

5. FirstEnergy Nuclear Operating Company's (FENOC's) First Six-Month Status Report in Response to March 12, 2012 Commission Order Modifying Licenses with Regard to Reliable Spent Fuel Pool Instrumentation (Order Number EA-12-051) (TAC Nos. MF0799, MF0800, MF0960, and MF0802), dated August 26, 2013.

6. FirstEnergy Nuclear Operating Company's (FENOC's) Second Six-Month Status Report in Response to March 12, 2012 Commission Order Modifying Licenses with Regard to Reliable Spent Fuel Pool Instrumentation (Order Number EA-12-051) (TAC Nos. MF0799, MF0800, MF0960, and MF0802), dated February 27, 2014.

7. FirstEnergy Nuclear Operating Company's (FENOC's) Third Six-Month Status Report in Response to March 12, 2012 Commission Order Modifying Licenses with

Regard to Reliable Spent Fuel Pool Instrumentation (Order Number EA-12-051) (TAC Nos. MF0799, MF0800, MF0960, and MF0802), dated August 28, 2014.

8. FirstEnergy Nuclear Operating Company's (FENOC's) Fourth Six-Month Status Report in Response to March 12, 2012 Commission Order Modifying Licenses with Regard to Reliable Spent Fuel Pool Instrumentation (Order Number EA-12-051) (TAC Nos. MF0799, MF0800, MF0960, and MF0802), dated February 26, 2015.

9. NEI Document, NEI 12-02, Industry Guidance for Compliance with NRC Order EA-12-051, "To Modify Licenses with Regard to Reliable Spent Fuel Pool Instrumentation," Revision 1, dated August 2012.

10. NRC Japan Lessons-Learned Project Directorate Interim Staff Guidance, JLD-ISG-2012-03, Compliance with Order EA-12-051, Reliable Spent Fuel Pool Instrumentation, dated August 29, 2012.

By letter dated December 11, 2013, the Nuclear Regulatory Commission (NRC) issued an interim staff evaluation (ISE) and request for additional information (RAI) regarding the Perry Nuclear Power Plant (PNPP) overall integrated plan for implementation of NRC Order EA-12-051, Reliable Spent Fuel Pool Instrumentation. Subsequently, by letter dated March 26, 2014, the NRC staff transitioned to an audit-based review process that allowed the use of the licensee's ePortal to provide responses to the RAIs to support the staff's review process. FirstEnergy Nuclear Operating Company (FENOC) utilized the ePortal to provide the majority of RAI responses for PNPP. The ISE RAIs are provided below. The responses to the following RAIs were previously provided to the NRC via the FENOC ePortal: RAI-3(b) schematic, RAI-4, RAI-6, RAI-7, RAI-9(b), RAI-10, RAI-11, RAI-12, RAI-13, and RAI-14. Of these RAIs, responses to RAI-4, RAI-7, RAI-11, and RAI-12 have been amended since the site audit. The responses are provided in the tense that was applicable when presented on the ePortal, and therefore may not reflect the final completed status. The NRC staff question is presented in bold type, followed by the FENOC response. Following the RAI responses is a copy of the bridging document that was previously provided to the NRC via the FENOC ePortal.

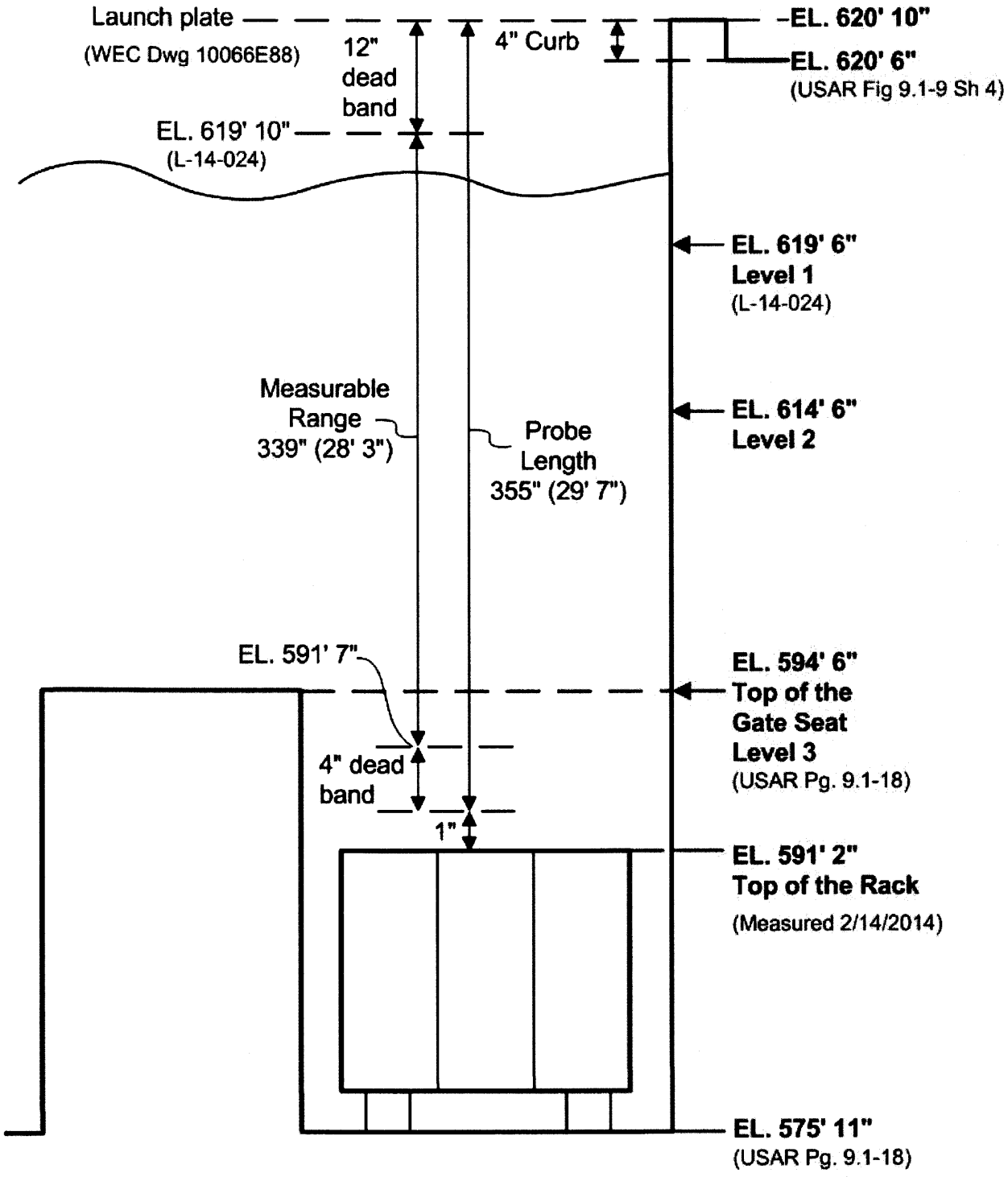
RAI-1:

Please provide a clearly labeled sketch depicting the elevation view of the proposed typical mounting arrangement for the portions of the instrument channel consisting of permanent measurement channel equipment (e.g., fixed level sensors and/or stilling wells, and mounting brackets). Indicate on this sketch the datum values representing Level 1, Level 2, and Level 3, as well as the top of the fuel racks. Indicate on this sketch the portion of the level sensor measurement range that is sensitive to measurement of the fuel pool level, with respect to the Level 1, Level 2, and Level 3, datum points.

(This information was previously requested as RAI-1[c] in the NRC letter dated June 10, 2013.)

Response:

By letter dated February 27, 2014, FENOC provided a sketch depicting the requested datum values. Subsequently, by FENOC letter dated August 28, 2014, Level 2 was changed. An updated sketch is provided below.


Launch plate
(WEC Dwg 10066E88)
12" dead band
4" Curb
EL. 620' 10"
EL. 620' 6"
(USAR Fig 9.1-9 Sh 4)
EL. 619' 10"
(L-14-024)
EL. 619' 6"
Level 1
(L-14-024)
Measurable Range
339" (28' 3")
Probe Length
355" (29' 7")
EL. 614' 6"
Level 2
EL. 591' 7"
EL. 594' 6"
Top of the Gate Seat
Level 3
(USAR Pg. 9.1-18)
4" dead band
1"
EL. 591' 2"
Top of the Rack
(Measured 2/14/2014)
EL. 575' 11"
(USAR Pg. 9.1-18)

RAI-2:

Please provide a clearly labeled sketch or marked-up plant drawing of the plan view of the SFP [spent fuel pool] 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.

(This information was previously requested as RAI-2 in the NRC letter dated June 10, 2013.)

Response:

The response to this RAI was provided by FENOC letter dated February 27, 2014.

RAI-3:

Please provide the following:

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

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

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

(This information was previously requested as RAI-3 in the NRC letter dated June 10, 2013.)

Response:

The response to parts (a) and (c) of this RAI was provided by FENOC letter dated February 27, 2014.

With the exception of providing a schematic, a response to part (b) of this RAI was provided by FENOC letter dated February 27, 2014. The requested schematic contains vendor proprietary information. Westinghouse, LLC (Westinghouse) drawing

10066E88, Revision 2, provides details of the mechanical and electrical connections for the mounting of the level sensor in the Fuel Handling Building. The drawing was made available to the NRC staff for review.

RAI-4:

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

Response:

The results of the analysis and the parameters used are contained in Westinghouse calculation CN-PEUS-13-27, Revision 2, Seismic Analysis of the SFP Mounting Bracket at Perry Nuclear Power Plant. The results are obtained from the GTSTRUDL model and are in accordance with site design requirements and American Institute of Steel Construction (AISC) 7th Edition. Considering all of the applicable loads and load combinations, all members of the bracket are acceptable. All welds and bolts are acceptable when compared to their applicable allowable values. The results of the analysis represent all the applied loads and load combinations that were applied. The GTSTRUDL model and output considers self-weight, dead load of the instrumentation, hydrodynamic effects of the SFP water, and seismic load on the bracket. All members passed code check with interaction ratios below the allowable limit using the applicable requirements per AISC 7th Edition. Considering all of the loads and load combinations, all members of the bracket are acceptable. All welds and bolts are acceptable when compared to their applicable values. This calculation, which contains vendor proprietary information, was made available for NRC review.

The seismic-related documents for the evaluation for the mounting of the electronic components and conduits were made available for NRC review. These documents included: Engineering Change Package (ECP) 12-0835-000, Reference Documents – Fukushima Spent Fuel Pool Level Instrumentation Design, ECP 12-0835-002, Primary Channel wiring, cables, conduits, trays, supports and equipment from the SFP area and to the Main Control Room (MCR), ECP 12-0835-005, Backup Channel wiring, cables, conduits, trays, supports and equipment from the SFP area and to the MCR; Calculations 7:24.000, Spent Fuel Pool Level Instrumentation Equipment Mounting, 0P42-0111, Self Weight Excitation Review of Hangers for Emergency Closed Cooling System, and 5:18.000, Spent Fuel Pool Level Instrumentation Mounting Anchor Qualification; Vendor Technical Information; Vendor Manual 1440; Qualification Reports; and Drawings. These documents demonstrate that the design for the mounting of electronic components and conduits was completed in accordance with the endorsed guidance in Institute of Electrical and Electronics Engineers, Inc. (IEEE) Standard 344-2004, "IEEE Recommended Practice for Seismic Qualification of Class 1E Equipment for Nuclear Power Generating Stations."

The PNPP specific wave height due to sloshing is 4.45 feet maximum. This value is documented in CN-PEUS-13-27, Section 4.5.2.3, and is based on TID-7024. This 4.45 feet value is bound by the 5-foot value considered in the generic qualitative analysis performed for the level sensing probe documented in LTR-SEE-II-13-47. The PNPP specific value for the distance from the bracket to the nominal water level is 16 inches, which is greater than the 12 inches used in the generic analysis performed by Westinghouse (LTR-SEE-II-13-47). Westinghouse and PNPP engineering have assessed the PNPP specific parameters by estimating the change in the postulated hydrodynamic load on the level sensor combined with the design loads resulting in an estimated maximum anchor tension of approximately 1530 pounds (lbs). Review of the postulated load has confirmed that it remains within the allowable limit of 2000 lbs for the 1/2 inch anchors, affirming the general conclusions of LTR-SEE-II-13-047 that the resulting loads on the level sensor probe will not result in probe ejection or potential impact of the instrument on the side walls.

RAI-5:

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

Response:

The response to this RAI was provided by FENOC letter dated February 27, 2014.

RAI-6:

Please provide the following:

(a) A description of the specific method or combination of methods that will be applied to demonstrate the reliability of the permanently installed equipment under BDB [beyond-design-basis] 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.

(This information was previously requested as RAI-4 in the NRC letter dated June 10, 2013.)

Response:

The NRC staff audited the Westinghouse SFP instrumentation design verification analyses and performance test results in support of its review of Tennessee Valley Authority's (TVA's) overall integrated plan for the Watts Bar Nuclear Plant (WBN) facility (ADAMS Accession No. ML14211A346) for compliance to EA-12-051. The NRC staff found the SFP instrumentation design and qualification process reasonable.

Westinghouse methodologies for demonstrating the reliability of the installed SFP level instrumentation system are described in Westinghouse report EQ-QR-269, Revision 1, Design Verification Testing Summary Report for the Spent Fuel Pool Instrumentation System and Westinghouse report EQ-QR-264, Revision 0, Equipment Qualification Abbreviated Summary Report for the Spent Fuel Pool Instrumentation System. These reports, which contain vendor proprietary information, were made available for NRC review.

(a) Environmental qualification testing was performed in accordance with IEEE Std. 323-2003 and electromagnetic compatibility (EMC) qualification testing was performed in accordance with the technical requirements of Regulatory Guide 1.180.

Temperature and Humidity – Thermal aging and steam testing were performed on the coaxial cables and couplers using a thermal aging oven at a temperature of 212°F for the calculated age duration of 311 hours plus 10 percent margin, or 343 hours and at 219°F for 206.5 hours plus a 10 percent margin, or 228 hours. The coaxial cables and couplers were coiled and set on separate racks in the thermal oven. The coupler was required to be threaded into the non-preconditioned end of the cable and aged as one assembly. Steam testing was performed in accordance with IEEE Std. 323-2003. The test specimen was exposed to 212°F (+/- 1.8°F), 100 percent saturated (+0, -2 percent) for a duration including 10 percent margin of 185 hours. In addition, the connectors were splash tested to determine the appropriate torque level and sealing.

Radiation – The coaxial cable and coupler underwent radiation aging in accordance with IEEE Std. 323-2003 for service in post-accident radiation conditions. Test specimens were required to be exposed to a minimum of 11 Mrad of Co^{60} gamma rays at a dose rate minimum of 0.2 – 0.5 Mrad/hour.

EMC – Susceptibility, emissions and harmonics testing was performed and the guidance and limits provided in Regulatory Guide 1.180 were used. Continuous monitoring was performed to monitor the performance during the application of EMC susceptibility testing. Performance Criterion for this system is determined to be Criterion B.

(b) Seismic qualification testing was performed in accordance with IEEE Std. 344-2004, which is endorsed by NRC Regulatory Guide 1.100, Revision 3, and IEEE Std. 323-2003. The electronics enclosure was mounted to the test fixture with four 3/8-inch Grade 5 bolts, lock washers, flat washers, and nuts torqued snug tight. The sensor head unit mounting bracket was mounted to the fixture with four 3/8-inch Grade 5 bolts, lock washers, and flat washers torqued snug tight. The sensor head unit was mounted to the sensor head unit mounting bracket with two 1/4 inch-20 bolts and lock washers torqued to 75 in-lbs. The coaxial coupler was torqued hand tight. The launch plate was mounted to the fixture with four 5/16-inch Grade 5 bolts and lock washers torqued snug tight. The sensor head unit mounting bracket was mounted to the coupler using the integral threads in the probe and a lock washer to snug tight. Terminal block attachments within the rear of the sensor head unit were torqued to 8 in-lbs.

Seismic testing was performed on a 4x4-foot independent triaxial test table using random, multi-frequency acceleration time history inputs. Accelerometers were mounted on the test table and equipment under test. The table drive signal was applied separately and simultaneously in both the horizontal and vertical directions for a duration of 30 seconds with a minimum of 20 seconds of strong motion. The response from the table and the response accelerometers were analyzed at 5 percent critical dampening for each operating basis earthquake (OBE) and safe shutdown earthquake (SSE) test and were plotted at one twelfth octave intervals over the frequency range of 1 to 100 Hz.

Seismic testing of the instrumentation was performed in accordance with IEEE 344-2004. The required response spectra (RRS) included a 10 percent margin recommended by IEEE 323-2003. Seismic testing was performed to the defined SSE and hard rock high frequency (HRHF) spectra. The OBE RRS at 5 percent critical damping was at least 70 percent of the respective SSE seismic level. At a minimum, five successful OBE level tests were required, followed by two successful SSE level tests and one successful HRHF level test. In addition, static pull tests were performed on the Radiall connectors (straight and 90 degree) to address seismic qualification of the connectors.

(c) The equipment under test (EUT) was powered on during OBE seismic test runs, but was not electrically monitored during the test runs. Functional testing was performed before and after the five successful OBE test runs. The system maintained accuracy after five successful OBE level tests and no loss of power was noted during the test runs. The EUT was powered on during all SSE and HRHF seismic test runs, but was not electrically monitored during the test runs. Functional testing was also performed before and after each successful SSE and HRHF test run. The system maintained accuracy after all SSE and HRHF level tests and no loss of power was noted during the test runs.

During the SSE 2, the alternating current (AC) power was removed from the system approximately 15 seconds into the run. This operation was performed to ensure that the uninterruptible power supply (UPS) was able to switch from line power to battery

power during a seismic event. The system performed without issue. The EUT met all of the required performance and acceptance criteria and maintained structural integrity during all acceptable OBE test runs, acceptable SSE test runs, and the acceptable HRHF test run to the RRS. Acceptable functionality of the EUT was confirmed upon completion of seismic testing. The post-test inspection performed upon completion of all seismic tests revealed no major structural issues or damage to the EUT.

RAI-7:

For RAI 6 above, please provide the results from the selected methods, tests and analyses used to demonstrate the qualification and reliability of the installed equipment in accordance with the Order requirements.

Response:

The NRC staff audited the Westinghouse SFP instrumentation design verification analyses and performance test results in support of its review of TVA's overall integrated plan for the WBN facility (ADAMS Accession No. ML14211A346) for compliance to EA-12-051. The NRC staff found the SFP instrumentation design and qualification process reasonable.

Westinghouse test results for the SFP level instrumentation system are described in Westinghouse report EQ-QR-269, Revision 1, Design Verification Testing Summary Report for the Spent Fuel Pool Instrumentation System and Westinghouse report EQ-QR-264, Revision 0, Equipment Qualification Abbreviated Summary Report for the Spent Fuel Pool Instrumentation System. These reports, which contain vendor proprietary information, were made available for NRC review.

Temperature and Humidity – Thermal aging was performed within the required temperature parameters and for the required duration and a post-thermal aging functional test was successfully performed. During steam testing, functional tests were performed, which verified that the test equipment was functioning within the required accuracy, as well as confirmed that the enclosure display correctly identified the simulated pool level. Acceptable functional test results were obtained during functional testing. Post-test baseline testing was conducted upon completion of environmental testing with successful functional results.

Westinghouse concluded that the probe, coaxial cable, 90 degree and straight connector, and stainless steel coupler are able to perform in abnormal conditions in the SFP area for up to seven days. In addition, Westinghouse tests demonstrated that the level sensor electronics with the coupler and the coaxial cable attached performs accurately when the probe, coupler, and coaxial cable are exposed to a temperature range of 10 to 100°C (50-212°F) and up to 100 percent relative humidity (RH).

Regarding components outside the SFP area, Westinghouse concluded the aggregate of the environmental verification activities for the SFP instrumentation demonstrate that

the instrumentation operates reliably in accordance with the service environmental requirements specified for both the harsh and outside SFP area conditions. The level sensor electronics housing was also verified to meet IP67 rating per EPSILON 08 TEST 2373, which will prevent water ingress and withstand 100 percent humidity.

In addition, Westinghouse completed their 10-year aging test. The purpose of the testing was to extend the existing qualified life from 15 months to 10 years. The system with the 90 degree connector passed the test and is now qualified to a 10-year life. The system with the straight connector performed during the 7 days of steam testing, but functionality was lost during the final ramp down at the end of the 7 days. The PNPP design uses the straight connector. Westinghouse recommended that those plants using the straight connector continue with installation since the connector is qualified for 15 months. Westinghouse issued CAPAL 100045159 and FENOC issued Condition Report 2014-14616 in their respective corrective action programs to track resolution of this issue. In December 2014, Westinghouse notified FENOC that a follow-up test was performed, and the straight connector passed the test with Raychem added. Raychem will be added to the PNPP straight connector. The straight connector is now qualified for 10 years.

Shock and Vibration – Seismic testing consisted of five successful OBE tests, two successful SSE tests, and one successful HRHF test. During the second successful SSE level test (281 SSE 2), AC power was cut off to the SFP instrumentation system to ensure that the UPS would reliably switch during a seismic event. No equipment failures were noted as a result of the seismic test runs. Westinghouse performed functional testing of the equipment before and after each SSE and HRHF runs, and the equipment maintained its functionality. In addition, Westinghouse inspected the equipment after the seismic testing and no damage was found. Westinghouse concluded that the system met all requirements, maintained structural integrity during and after all OBEs, SSEs and HRHF tests.

Radiation – The coaxial signal cable and coupler were subjected to thermal and radiation aging prior to seismic testing. Two sets of identical specimens were aged, and the components performed to the limits of 2.5 years for thermal aging and 10 MRad + 10 percent margin for radiation aging. The coaxial cable and coupler were visually inspected after radiation resting. It was identified that a lock washer was missing from the probe attachment point of the coupler. Westinghouse noted that the absence of this lock washer had no effect on the thermal or radiation aging performed, and that the inspection did not reveal any noticeable degradation. A baseline functional test was performed and did not show any change in performance as a result of the radiation aging performed.

EMC – The system met all of the identified performance requirements before, during and after each EMC susceptibility test and demonstrated compliant emission levels. No modifications or deviations were required to achieve compliance during EMC testing.

RAI-8:

Please provide the following:

(a) A description of how the two channels of the proposed level measurement system meet this requirement so that the potential for a common cause event to adversely affect both channels is minimized to the extent pacticable.

(b) Further information describing the design and installation of each level measurement system, consisting of level sensor electronics, cabling, and read-out devices. Please address how independence of these components of the primary and back-up channels is achieved through the application of independent power sources, physical and spatial separation, independence of signals sent to the location(s) of the readout devices, and the independence of the displays.

(This information was previously requested as RAI-5 in the NRC letter dated June 10, 2013.)

Response:

The response to this RAI was provided by FENOC letter dated February 27, 2014.

RAI-9:

Please provide the following:

(a) A description of the electrical ac power sources and capabilities for the primary and backup channels.

(b) 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.

(This information was previously requested as RAI-6 in the NRC letter dated June 10, 2013. However, based on feedback from the licensees, it was revised as above.)

Response:

The response to part (a) of this RAI was provided by FENOC letter dated February 27, 2014.

(b) The back-up battery is designed to last a minimum of 72 hours. The vendor's calculation has determined that the battery will last from a full charge for greater than 100 hours per Section 5.2.1 of Westinghouse calculation WNA-CN-00300-GEN, Revision 0, Spent Fuel Pool Instrumentation System Power Consumption.

RAI-10:

Please provide the following:

(a) An estimate of the expected instrument channel accuracy performance (e.g., in percent of span) under both (a) normal SFP level conditions (approximately Level 1 or higher) and (b) at the BDB conditions (i.e., radiation, temperature, humidity, post-seismic and post-shock conditions) that would be present if the SFP level were at the Level 2 and Level 3 datum points.

(b) A description of the methodology 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.

(This information was previously requested as RAI-7 in the NRC letter dated June 10, 2013.)

Response:

(a) The design accuracy is 3 inches or less for both normal and BDB conditions and the calculated accuracy for PNPP of 1.83 inches is within the design range. The calculated accuracy of the instrumentation is 0.54 percent and the calculated accuracy of the control room remote indicator is 0.7082 percent.

(b) A periodic calibration verification will be performed within 60 days of a refueling outage considering normal testing scheduling allowances (for example, 25 percent). 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 Nuclear Energy Institute (NEI) 12-02, Section 4.3. Per Westinghouse procedures, should the calibration verification indicate that the instrument is out of tolerance by more than the designed 3-inch tolerance, a recalibration will be performed.

RAI-11:

Please provide the following:

(a) A description of the capability and provisions the proposed level sensing equipment will have to enable periodic testing and calibration, including how this capability enables the equipment to be tested in-situ.

(b) A description of how such testing and calibration will enable the conduct of regular channel checks of each independent channel against the other, and against any other permanently-installed SFP level instrumentation.

(c) A description of how calibration tests and functional checks will be performed, and the frequency at which they will be conducted. Discuss how these surveillances will be incorporated into the plant surveillance program.

(d) A description of the preventive maintenance tasks required to be performed during normal operation, and the planned maximum surveillance interval that is necessary to ensure that the channels are fully conditioned to accurately and reliably perform their functions when needed.

(This information was previously requested as RAI-8 in the NRC letter dated June 10, 2013.)

Response:

(a) A periodic calibration verification will be performed in-situ to verify that the transmitter is in calibration using a calibration verification tool provided by the manufacturer and in accordance with the plant procedures and manufacturer's recommendations (Reference RAI 14 response for more detail). Should the calibration verification indicate that the transmitter is out of calibration, a full-range calibration adjustment will be completed using a calibration test kit. The portable test kit is composed of a replicate probe, coupler and launch plate equivalent to those installed, a replicate coaxial cable of the same electrical length as installed in the pool, a bracket to hold the weight end of the probe cable, simulated pool liner, and a moveable metal target. To perform the calibration, the installed SFP instrumentation system coaxial cable is disconnected from the sensor and the replicate test kit coaxial cable is connected. A metal target is used to measure several points along the length of the probe to perform the full-range calibration. The readings displayed on the output display at each point along the probe will be compared to the physical distance measured along the length of the probe cable to determine calibration acceptance. Each component in the instrument channel can be replaced (transmitter included) to restore the instrument loop to service in the event a component failure occurs.

(b) A channel check is conducted as part of ICI-B01-012, ABB/K-TEK MT5000 Guided Wave Radar Level Transmitter Calibration Check, Section 5.4, to ensure that upon completion of the calibration check or calibration that the two channels compare within acceptable limits. The SFP level indication is located in the main control room. To aid in early detection of any "off normal" readings which could indicate that channel adjustment may be required, a periodic channel check using this indication of SFP level has been added to "Control Room Plant Equipment Rounds" and is conducted per OAI-1702, "Operations Section Rounds Sheets, Logs, and Records." The channel check is performed daily and confirms that the two SFP level instruments are reading within one foot of each other. As installed, the level instruments typically read within approximately 1/2 foot of each other (±3 inches calibration tolerance for each instrument) and the instrument scale reading is in 1/2 foot increments, establishing the basis of one scale unit divergence (1/2 foot) for the one foot channel check acceptance criteria. The channel check periodicity and

acceptance criteria are controlled within PNPP operating procedures and periodic maintenance programs and may change based on equipment operating experience. Testing to validate instrument functionality per NEI 12-02, Section 4.3, is based on the instrument calibration periodicity as noted in response to RAI-11(c).

(c) FENOC will perform periodic calibration verifications using periodic maintenance procedures and manufacturer's guidelines. The periodic calibration verification will be performed within 60 days of a refueling outage considering normal testing scheduling allowances (for example, 25 percent). 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.

(d) Preventive Maintenance (PM) procedures will be in place for periodic replacement of the backup batteries based on manufacturer recommendations and for calibration verification.

RAI-12:

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

Response:

The modification review process will be used to ensure all necessary procedures are developed for maintaining and operating the spent fuel level instruments upon installation. These procedures will be developed in accordance with the FENOC procedural control process.

The objectives of each procedural area are described below:

Inspection, Calibration, and Testing – Guidance on the performance of periodic visual inspections, as well as calibration and testing, to ensure that each SFP channel is operating and indicating level within its design accuracy.

Preventative Maintenance – Guidance on scheduling of, and performing, appropriate preventative maintenance activities necessary to maintain the instruments in a reliable condition.

Maintenance – To specify troubleshooting and repair activities necessary to address system malfunctions.

Programmatic controls – Guidance on actions to be taken if one or more channels is out of service.

System Operations – To provide instructions for operation and use of the system by plant staff.

Response to inadequate levels – Action to be taken on observations of levels below normal level will be addressed in site Off Normal procedures and/or FLEX [Diverse and Flexible Coping Strategies] Support Guidelines (FSGs).

The following procedures have been identified to date:

- EOP-3 Chart, Secondary Containment Control (points to FSG 50.1 and FSG 50.2)
- FSG 50.1, Fuel Pool Fill Using Fire Main or Portable Pump
- FSG 50.2, Fuel Pool Spray Using Fire Main or Portable Pump
- FSG 50.3, Fuel Pool Fill Using Emergency Makeup System
- FSG 90.1, Reading Instrumentation Locally During Station Blackout
- ONI-SPI H-3, Instrumentation Available During Station Blackout
- ONI-SPI J-1, Maximizing Fuel Pool Cooling Water Flow
- ONI-SPI J-2, Supplying One FPCC [Fuel Pool Cooling and Cleanup] HX [Heat Exchanger] with ESW [Emergency Service Water] Cooling
- ONI-SPI J-3, Supplying Two FPCC HXs With a Single ESW Cooling Loop
- ONI-SPI J-4, Fuel Pool Fill Using Alternate Sources
- VLI-G41 (FPCC), Fuel Pool Cooling and Cleanup System
- TXI-0429, Primary Spent Fuel Pool Level Instrumentation System Power-Up and Acceptance Testing
- TXI-0430, Back-Up Spent Fuel Pool Level Instrumentation System Power-Up and Acceptance Testing
- ICI-B01-012, ABB/K-TEK MT5000 Guided Wave Radar Level Transmitter Calibration Check
- NOP-LP-7300, FLEX Program for the Perry Nuclear Power Plant (PNPP)

The following PMs support installation of the SFP instrumentation system:

- 600925790, Primary Level Sensor (transmitter) replacement (6 years)
- 600925914, Primary Level Sensor (transmitter) calibration (calibrate system as a loop and the control room analog meter)
- 600925793, Secondary Level Sensor (transmitter) replacement (6 years)
- 600925915, Secondary Level Sensor (transmitter) calibration (calibrate system as a loop and the control room analog meter)
- 600925916, Primary Electronics Enclosure replacement (10 years)
- 600925917, Secondary Electronics Enclosure replacement (10 years)
- 600927774, Primary Battery replacement (3 years)
- 600927776, Secondary Battery replacement (3 years)

- 600927780, Primary Coaxial Cable, Coupler, and Coaxial Connector replacement (10 years)
- 600927781, Secondary Coaxial Cable, Coupler, and Coaxial Connector replacement (10 years)

RAI-13:

Please provide the following:

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

(b) A description of FENOC's procedure/process to implement the guidance in NEI 12-02 Section 4.3 on compensatory actions for one or both non-functioning channels.

(c) A description of the compensatory actions to be taken in the event that one of the instrument channels cannot be restored to functional status within 90 days.

(This information was previously requested as RAI-11 in the NRC letter dated June 10, 2013.)

Response:

(a) SFP instrumentation channel/equipment maintenance/preventative maintenance and testing program requirements to ensure design and system readiness will be established in accordance with FENOC's processes and procedures. The design modification process will take into consideration the vendor recommendations to ensure that appropriate regular testing, channel checks, functional tests, periodic calibration, and maintenance is performed (and available for inspection and audit).

Once the maintenance and testing program requirements for the SFP are determined, the requirements will be documented in Maintenance program documents.

Performance checks, described in the vendor operator's manual, and the applicable information will be contained in plant procedures. Operator performance tests will be performed periodically as recommended by the vendor.

Channel functional tests with limits established in consideration of vendor equipment specifications will be performed at appropriate frequencies.

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.

(b) Both primary and backup SFP instrumentation 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. Planned compensatory actions for unlikely extended out-of-service events are summarized as follows:

# Channel(s) Out-of-Service	Required Restoration Action	Compensatory Action if Required Restoration Action not completed within Specified Time
1	Restore channel to functional status within 90 days (or if channel restoration not expected within 90 days, then proceed to Compensatory Action)	Immediately initiate action in accordance with Notes below
2	Initiate action within 24 hours to restore one channel to functional status and restore one channel to functional status within 72 hours	Immediately initiate action in accordance with Notes below

Notes:
1. Present a report to the on-site safety review committee within the following 14 days. The report shall outline the planned alternate method of monitoring, the cause of the non-functionality, and the plans and schedule for restoring the instrumentation channel(s) to functional status.
2. FENOC plans to place compensatory actions in NOP-LP-7300, FLEX Program for the Perry Nuclear Power Plant (PNPP).

(c) A Condition Report will be initiated and addressed through FENOC's Corrective Action Program. Provisions associated with out of service (OOS) or non-functional equipment, including allowed outage times and compensatory actions, will be consistent with the guidance provided in Section 4.3 of NEI 12-02. If one OOS

channel cannot be restored to service within 90 days, appropriate compensatory actions, including the use of alternate suitable equipment, will be taken. If both channels become OOS, actions would be initiated within 24 hours to restore one of the channels to operable status and to implement appropriate compensatory actions, including the use of alternate suitable equipment and/or supplemental personnel, within 72 hours.

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.

Response:

The calibration verification involves attaching a sliding plate to the flat surface above the launch plate of the fixed bracket and placing a metal target against the probe cable above the water level. To complete this method, the water level must be a sufficient distance below the 100 percent level mark, which is nominally 12 inches below the launch plate. The differences in distances imparted by this standard can be physically determined and compared to the distance difference observed on the level display of the sensor electronics. The second portion of this calibration verification is a visual waveform check to verify proper signal operation. If the calibration verification check falls within the required calibration tolerance (±3 inches) and the waveform check meets the criteria outlined, the calibration verification is successful and the equipment may be returned to the normal operating setup. If an anomaly with the calibration is observed during this calibration verification, the electronic verification or calibration adjustment is to be followed for further investigation. This verification shall be performed on both channels (primary and backup) of the SFP instrumentation system independently.

#	Topic	Parameter Summary	Westinghouse Reference Document #	Additional Comment	Test or Analysis Results	Licensee Evaluation
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	Acceptable. FENOC provided a supplemental Technical Requirements Document in the Equipment Purchase Order
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	Acceptable
3	Environmental qualification for electronics enclosure with Display	50° F to 140° F, 0 to 95% RH TID ≤ 1E03 R γ normal (outside SFP area) TID ≤ 1E03 R γ abnormal (outside SFP area)	EQ-QR-269 and WNA-TR-03149-GEN for all conditions.	Results are summarized in EQ-QR-269 and WNA-TR-03149-GEN. Radiation Aging verification summarized in Section 5 of WNA-TR-03149-GEN.	Test passed conditions described.	Acceptable
4	Environmental Testing for Level Sensor components in SFP area – Saturated Steam & Radiation	50 ° F to 212° F and 100% humidity	EQ-QR-269, Rev. 1	Testing summarized in Section 5.7.	Passed	Acceptable
		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	Acceptable
		1E07 R γ BDB (SFP area)	EQ-TP-354 (procedure) Actual test report is in progress.	Additional thermal & radiation aging programs being conducted under test procedure EQ-TP-354.	Additional aging program is in progress to achieve longer life.	Acceptable
5	Environmental Testing for Level Sensor Electronics Housing –	50° F to 140° F, 0 to 95% RH	EQ-QR-269, Rev. 1	Testing summarized in Section 5.5.	Passed	Acceptable

#	Topic	Parameter Summary	Westinghouse Reference Document #	Additional Comment	Test or Analysis Results	Licensee Evaluation
	outside SFP	100% RH	WNA-TR-03149-GEN	100% humidity addressed in Section 7.5.	Passed	
		TID ≤ 1E03 R γ normal (outside SFP area) 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. 1 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	Acceptable with the exception of the 10-year aging test failure documented per Westinghouse Letter LTR-EQ-14-149, steam test failure using the straight connector (affects Perry)
		1E07 R γ BDB (SFP area)	EQ-TP-354 (procedure) Actual test report is in progress.	Additional thermal & radiation aging programs being conducted under test procedure EQ-TP-354.	Additional aging program is in progress to achieve longer life.	
7	Basis for Dose Requirement	<u>SFP Normal Conditions:</u> 1E03 R γ TID (above pool) 1E09 R γ TID (1' above fuel rack) <u>SFP BDBE Conditions:</u> 1E07 R γ TID (above pool) < 1E07 R γ TID (1' above fuel rack)	LTR-SFPIS-13-35 and WNA-DS-02957-GEN	Explanation of Basis for Radiation Dose Requirement (includes the clarification of production equivalency of electronics enclosure used for Seismic and EMC Testing)	Passed for all conditions	Acceptable

#	Topic	Parameter Summary	Westinghouse Reference Document #	Additional Comment	Test or Analysis Results	Licensee Evaluation
8	Seismic Qualification	Per Spectra in WNA-DS-02957-GEN	EQ-QR-269, Rev. 1	EQ-QR-269, Rev. 1 summarizes the testing performed by Westinghouse.	Passed	Acceptable
			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. 1	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	Acceptable
			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.	Acceptable
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	Acceptable
12	Pool-side Bracket Seismic Analysis	N/A	CN-PEUS-13-25, Rev. 1 (Davis Besse and Beaver Valley) CN-PEUS-13-27, Rev. 2 (Perry)	Also includes hydrodynamic forces, as appropriate.	Passed	Acceptable
13	Additional Brackets (Sensor Electronics and Electronics Enclosure)	N/A	WNA-DS-02957-GEN	Weights provided to licensees for their own evaluation.	N/A	Acceptable

#	Topic	Parameter Summary	Westinghouse Reference Document #	Additional Comment	Test or Analysis Results	Licensee Evaluation
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	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	Acceptable
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 Beaver Valley IFT executed/passed Davis Besse IFT executed/passed Perry IFT executed/passed	Acceptable
		12" dead-zone at top of probe 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	Acceptable
18	Power Consumption	3 day battery life (minimum) 0.257 Amps power consumption	WNA-CN-00300-GEN	N/A	Passed	Acceptable

#	Topic	Parameter Summary	Westinghouse Reference Document #	Additional Comment	Test or Analysis Results	Licensee Evaluation
19	Technical Manual	N/A	WNA-GO-00127-GEN	Information and instructions for Operation, Installation, use, etc. are included here.	N/A	Acceptable
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	Acceptable
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	Acceptable
22	Emissions Testing	RG 1.180 R1 test conditions	EQ-QR-269, Rev. 1	Documented in Section 5.6.	Passed	Acceptable

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 2.

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 1.

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-13-25, "Seismic Analysis of the SFP Mounting Bracket at Davis Besse and Beaver Valley Nuclear Stations," Revision 1; never reviewed by the NRC.

12) Westinghouse Proprietary Document, CN-PEUS-13-27, "Seismic Analysis of the SFP Mounting Bracket at Perry Nuclear Power Plant," Revision 2; never reviewed by the NRC.

13) 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.

14) 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 1.

15) 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 1.

16) 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 1.

17) 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 1.

18) 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.

19) 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 3.