EA-12-051

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102-07248-MLL/TNW/PJH
April 29, 2016

U.S. Nuclear Regulatory Commission
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References:
1. NRC Order Number EA-12-051, *Order Modifying Licenses with Regard to Reliable Spent Fuel Pool Level Instrumentation,* dated March 12, 2012
2. NRC Letter, *Palo Verde Nuclear Generating Station, Units 1, 2, and 3 – Interim Staff Evaluation and Request for Additional Information* (RAI) *Regarding Overall Integrated Plan for Implementation of Order EA-12-051, "Reliable Spent Fuel Pool Instrumentation* (SFPI)," dated October 29, 2013
3. NRC Email, *NRC Staff Request for FLEX SFPI Information*, dated May 13, 2014
4. NRC Email, *NRC Request to Docket Palo Verde FLEX SFPI RAIs*, dated March 19, 2016

Dear Sirs:

Subject: **Palo Verde Nuclear Generating Station (PVNGS)**
Units 1, 2, and 3
Docket Nos. STN 50-528, 50-529, and 50-530
APS Response to Request for Additional Information Regarding Overall Integrated Plan for Implementation of Order EA-12-051, *Reliable Spent Fuel Pool Instrumentation*

On March 12, 2012, the Nuclear Regulatory Commission (NRC) issued an order (Reference 1) to Arizona Public Service Company (APS). Reference 1 was immediately effective and directed that PVNGS must have a reliable means of remotely monitoring wide-range Spent Fuel Pool (SFP) levels to support effective prioritization of event mitigation and recovery actions in the event of a beyond-design-basis external event. Specific requirements are outlined in Attachment 2 of Reference 1.

The NRC issued PVNGS Interim Staff Evaluation (ISE) and RAI regarding the overall integrated plan for implementation of Order EA-12-051 in Reference 2. These RAI responses were provided in the electronic reading room. The enclosure to this letter contains the APS responses to the NRC RAIs contained in References 3 and 4. These RAI responses have been updated to reflect current practices and/or configuration information.

A001
NRR

Designate as original.
John Boska, NRC
6/3/16

No commitments are being made to the NRC by this letter.

Should you have any questions concerning the content of this letter, please contact Mike DiLorenzo, Section Leader, Nuclear Regulatory Affairs, at (623) 393-3495.

I declare under penalty of perjury that the foregoing is true and correct.

Executed on APRIL 29, 2016
(Date)

Sincerely,

Maria Lacal

MLL/TNW/PJH/af

Enclosure: Response to NRC RAIs Regarding Overall Integrated Plan for Implementation of Order EA-12-051, *Reliable Spent Fuel Pool Instrumentation*

cc:	M. L. Dapas	NRC Region IV Regional Administrator
	S. P. Lingam	NRC NRR Project Manager for PVNGS
	M. M. Watford	NRC NRR Project Manager
	C. A. Peabody	NRC Senior Resident Inspector for PVNGS
	J. P. Boska	NRC NRR/JLD/PPSD/JOMB Project Manager

ENCLOSURE

Response to NRC RAIs Regarding Overall Integrated Plan for Implementation of Order EA-12-051, *Reliable Spent Fuel Pool Instrumentation*

INTRODUCTION

On March 12, 2012, the U.S. Nuclear Regulatory Commission (NRC) issued Order EA-12-051, *Order Modifying Licenses with Regard to Reliable Spent Fuel Pool Instrumentation* [Agencywide Documents Access and Management System (ADAMS) Accession No. ML 12054A679], to all power reactor licensees and holders of construction permits in active status. This order required licensees to have a reliable indication of the water level in associated spent fuel storage pools capable of supporting identification of the following pool water level conditions by trained personnel: (1) level that is adequate to support operation of the normal fuel pool cooling system, (2) level that is adequate to provide substantial radiation shielding for a person standing on the Spent Fuel Pool operating deck, and (3) level where fuel remains covered and actions to implement make-up water addition should no longer be deferred.

By letter dated February 28, 2013 (ADAMS Accession No. ML 13070A077), Arizona Public Service Company (APS) provided the Overall Integrated Plan (OIP) for the Palo Verde Nuclear Generating Station (PVNGS) describing how compliance with Attachment 2 of Order EA-12-051 would be achieved; by fall 2014 for Unit 1, fall 2015 for Unit 2, and spring 2015 for Unit 3. By letter dated June 10, 2013 (ADAMS Accession No. ML 13157A065), the NRC staff provided a request for additional information (RAI) to APS. Supplemental information was provided to the NRC by APS letter numbers 102-06728 dated July 11, 2013 (ADAMS Accession No. ML 13199A033), and 102-06759 dated August 28, 2013 (ADAMS Accession No. ML 13246A008). By letter dated October 29, 2013 (ADAMS Accession No. ML 13296A006), the NRC staff provided a request for additional information (RAI) to APS. NRC Email, dated March 23, 2016, requested the RAI responses be docketed.

This enclosure contains the APS response to the RAIs regarding Reliable Spent Fuel Pool Instrumentation updated to reflect current practices and/or configuration information. The NRC staff introductory information in the October 29, 2013 letter, related to the background for the RAIs, is not included in this enclosure. The request for information is restated, followed by the APS response.

Order EA-12-051, Reliable Spent Fuel Pool Instrumentation RAI #1

Description of Other SFP Structures

Please provide the following:

a) A description of how the other structures in the vicinity of the SFPs (cask loading pit, transfer canals and gates) shown in Figure 2, "Spent Fuel Pool Geometry and Dimensions" are connected to the SFPs.

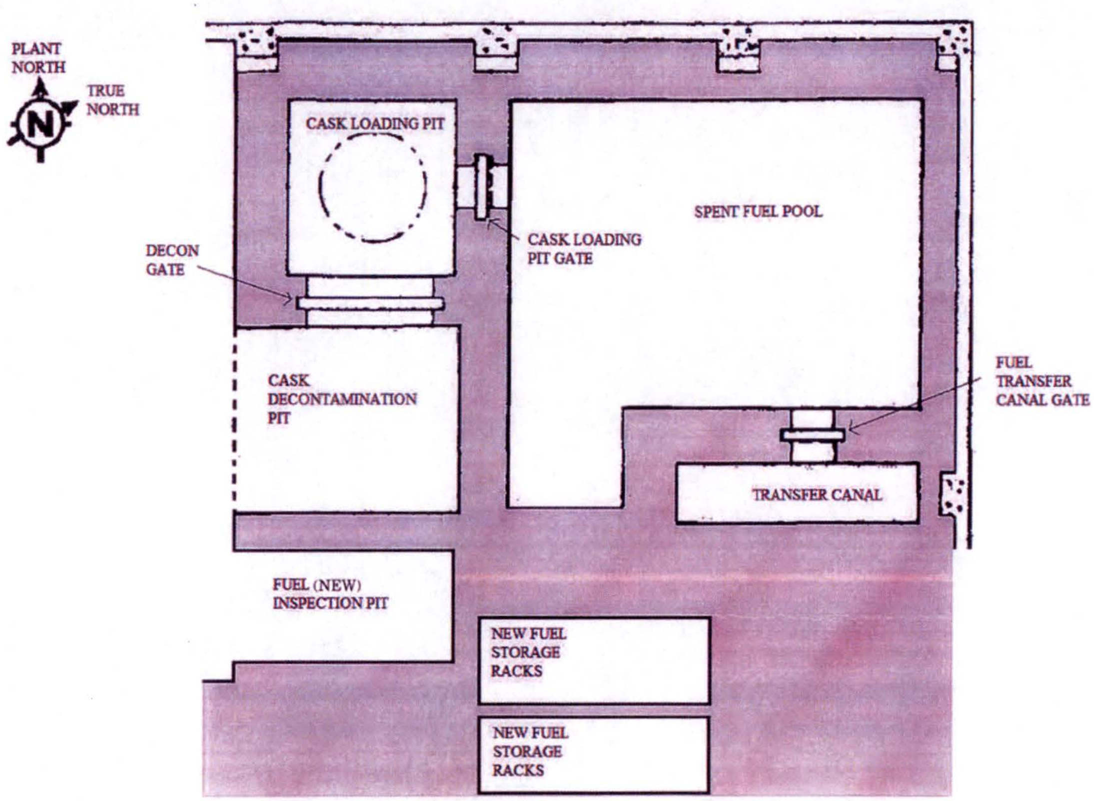
b) If additional structures, other than the SFPs in each unit, are used for fuel storage, describe in detail their usage, operation, and provide justifications for not installing separate level instrumentation in other structures used for fuel storage.

APS Response

a) The Spent Fuel Pool (SFP) is connected to two refueling structures; the Transfer Canal and the Cask Loading Pit, reference Figure 1. A Seismic Category I gate, with dual seals separates the inventory between the SFP and the Cask Loading Pit. A Seismic Category I gate and seal separates the inventory between the SFP and the Transfer Canal. This seal is currently being modified to a dual seal design independent of Order EA-12-051. In addition, a Seismic Category I gate, with dual seals, separates the inventory between the Cask Loading Pit and the Cask Decontamination Pit, which connects to the Fuel Building at grade elevation. This gate is only removed during dry cask campaigns when the gate between the SFP and Cask Loading Pit is installed. The lowest elevation of the gate between the Cask Loading Pit and the Cask Decontamination Pit is 124 feet, 0 inches which is above the top of the SFP storage rack (114 feet, 2 inches). The dual gate seals are pressurized by a redundant air and nitrogen gas supply and have an additional Seismic Category I back-up nitrogen source. The SFP is configured to comply with the requirements of Regulatory Guide 1.13, *Spent Fuel Storage Facility Design Basis*, Revision 0.

b) The independent spent fuel storage installation (ISFSI) is designed to store PVNGS irradiated spent nuclear fuel. The ISFSI consists of twelve large rectangular concrete pads. The concrete storage pads are approximately 285 feet long by 35 feet wide and are situated in a 3-pad by 4-pad array. Each storage pad is designed to accommodate 28 spent fuel storage casks arranged in two parallel rows of 14 casks. NAC International Inc. (NAC) was selected as the cask system supplier for Palo Verde. The NAC spent fuel cask system is a canister-based design for storage of spent nuclear fuel. After the casks are loaded, the water is removed from the casks, and they are subsequently vacuum dried and filled with helium. Therefore, no level indication is required (there is no water associated with the casks).

   PVNGS also has New Fuel Storage Racks inside the Fuel Building. The New Fuel Storage Racks are not connected to the Spent Fuel Pool. They maintain new, un-irradiated fuel assemblies in a dry and sub-critical configuration. Therefore, no level indication is required.



Plan View

Figure 1

Order EA-12-051, Reliable Spent Fuel Pool Instrumentation RAI #2

Summary of Proposed Wireless Technology

Please provide your plant-specific performance evaluation result and a brief summary of the proposed wireless technology that will be used in the primary and backup measurement systems to address the criteria summarized in Section 3.1 of NEI 12-02.

APS Response

PVNGS opted to use hardwired SFP level measurement systems instead of wireless, for both the primary and alternate systems installed in each SFP. The hardwired system for level instrumentation meets each of the requirements of Section 3.1 of NEI 12-02, *Industry Guidance for Compliance with NRC Order EA-12-051, "To Modify Licenses with Regard to Reliable Spent Fuel Pool Instrumentation."*

Order EA-12-051, Reliable Spent Fuel Pool Instrumentation RAI #3

Primary and Back-Up SFP Level Sensor

Please provide the following:

a) The final locations/placement of the primary and back-up SFP level sensor.

b) Additional information describing how the proposed arrangement of the sensor probe assembly and routing of the cabling between the sensor probe assembly and the electronics in the Auxiliary Building meets the Order requirement to arrange the SFP level instrument channels in a manner that provides reasonable protection of the level indication function against missiles that may result from damage to the structure over the SFP.

APS Response

a) The primary instrument channel sensor is mounted in accordance with JN350-A00038 (Reference 17 of this enclosure) in the northeast corner of the SFP on the east wall. The back-up (alternate) instrument channel sensor is located in the southeast corner of the Spent Fuel Pool (SFP) on the south wall, as shown in Figure 2.

b) Physical separation of the primary and alternate instrument channel signal cables and power cables is maintained using train separation requirements identified in PVNGS Specification 13-EN-0611, *Installation Specification for Reg. Guide 1.75 Cable and Raceway Separation*. The IEEE Standards for the Level Sensor Coaxial Signal Cable are IEEE 323-2003, *IEEE Standard for Qualifying Class 1E Equipment for Nuclear Power Generating Stations,* and IEEE 383-2003, *IEEE Standard for Qualifying Class 1E Electric Cables and Field Splices for Nuclear Power Generating Stations.*

   The Resistance Temperature Detector (RTD) Cables meet the requirements of IEEE-572-1985, *IEEE Standard for Qualification of Class 1E Connection Assemblies for Nuclear Power Generating Stations*, IEEE-383-1974, *IEEE Standard for Type Test of Class 1E Electric Cables, Field Splices, and Connections for Nuclear Power Generating Stations*, and IEEE-1202-1991, *IEEE Standard for Flame Testing of Cables for Use in Cable Tray in Industrial and Commercial Occupancies*, as shown on document JN350-A00010 (Reference 1 of this enclosure).

   The sensors are located close to the side walls of the SFP and below the floor elevation to utilize the pool walls as inherent protection. From the primary sensor, the primary signal cable, contained in rigid metal conduit, is run east along the floor to the east wall of the Fuel Building. The primary signal cable is then routed along the east wall until it penetrates the wall into the Auxiliary Building. From the alternate sensor, the alternate signal cable, contained in rigid metal conduit, is run east along the floor to the east wall of the Fuel Building. The alternate signal cable is then routed along the east wall until it penetrates the wall into the Auxiliary Building. The raceway containing the signal cables share only a small distance along the common east wall of the Fuel Building where they penetrate the wall and enter the Auxiliary Building.

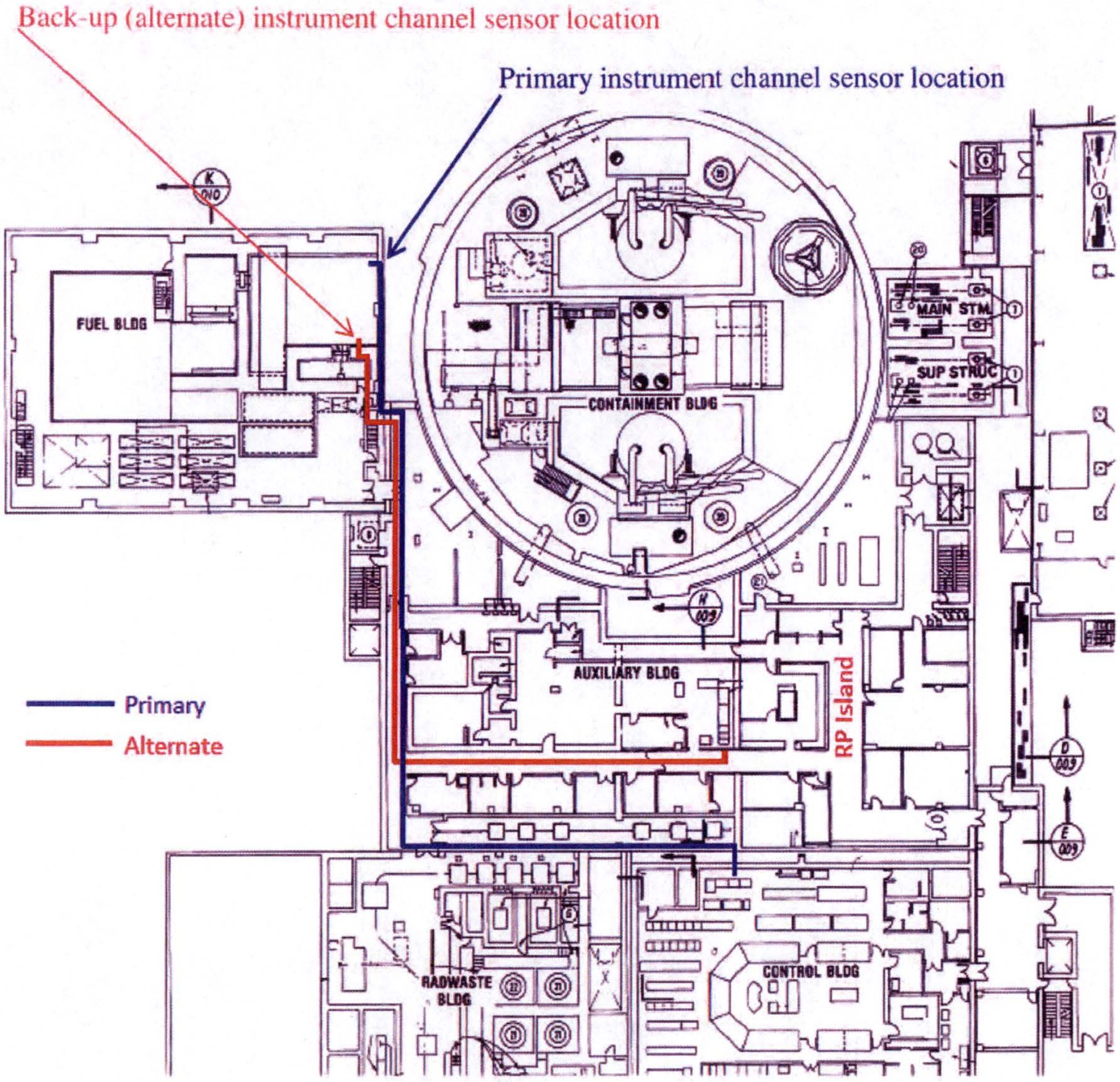
Once the cables enter the Auxiliary Building they are routed to separate locations prior to connecting to the electronics. The SFP walls and corners provide inherent missile protection for the level sensor cable. See Figure 2 for a depiction of the conduit routing.

The Fuel and Auxiliary Buildings are classified as Seismic Category I structures designed to remain intact and functional following a Safe Shutdown Earthquake (SSE) or Operating Basis Earthquake (OBE) event. The inherent design function of the structures precludes any part of the building structure from falling or becoming a missile during/after a seismic event. Seismic Category I components attached to the building structures are designed to the same requirements as the structures and will remain intact and functional following an SSE or OBE event. Non-Seismic Category I components are also attached to the building structures. These components are classified as Seismic Category IX and are designed to remain intact following an SSE event. Seismic Category IX components are not required to remain functional and can deform but are designed to preclude falling or becoming a missile during/after a seismic event.

Additionally, Seismic Category I structures are designed for, and protected against, the effects of internal and external missiles. The missiles considered were both tornado-generated (external) and internally-generated (i.e., turbine missiles). For each potential missile, its origin, size, impact velocity or energy, and direction were considered. Seismic Category I structures were analyzed for these values per the analysis and design guidelines of Bechtel Topical Report BC-TOP-9A, *Design of Structures for Missile Impact*, UFSAR Section 3.5, *Missile Protection,* and UFSAR Appendix 3C, *Design of Structures for Tornado Missile Impact*. Missile-resistant barriers and structures were designed to withstand and absorb missile impact loads in order to prevent damage to protected structures, systems, and components.

Tornado missile protection for Seismic Category I structures, other than the Containment Building, is provided by the following exterior wall and roof thicknesses:

- Walls: Minimum 21 inches ($f'_c = 4000$ lb./in^2)
- Roofs: Minimum 16 inches ($f'_c = 5000$ lb./in^2)



Routing of Sensor Cables from Sensor Location to Display Locations
Figure 2

Order EA-12-051, Reliable Spent Fuel Pool Instrumentation RAI #4

Seismic Testing of the Sensor Probe Assembly

Please provide the analyses verifying that the seismic testing of the sensor probe assembly and the electronics units, and the licensee's analysis of the combined maximum seismic and hydrodynamic forces on the sensor probe assembly exposed to the potential sloshing effects, show that the SFP instrument design configuration will be maintained during and following the maximum seismic ground motion considered in the design of the SFP structure.

APS Response

Level Sensor Bracket: The mounting bracket for the sensing probe was designed according to the plant design basis for Safe Shutdown Earthquake (SSE) seismic hazard curve at the pool deck elevation, as documented in JN350-A00083 (Reference 2 of this enclosure). Loads that were considered in the evaluation of the bracket and its mounting are:

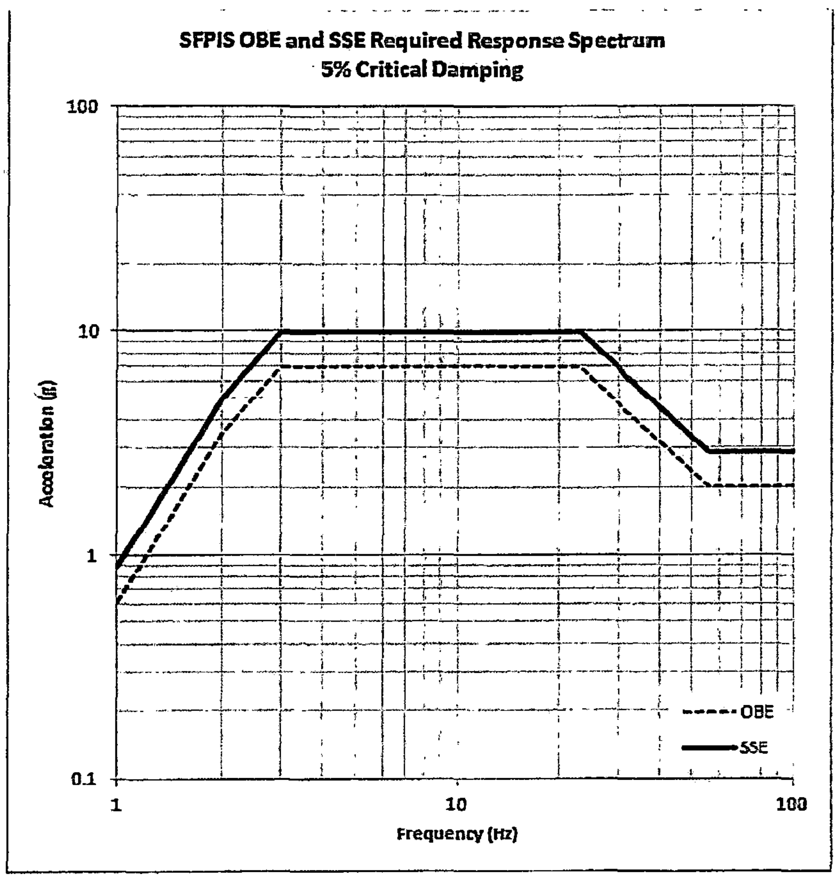
(1) Static loads including the dead weight of the mounting bracket in addition to the weight of the level sensing instruments, stilling well and cabling;
(2) Dynamic loads including the seismic load due to excitation of the instruments dead weight in addition to the hydrodynamic effects resulting from the excitation of the SFP water.

A response spectra analysis was performed for the seismic evaluation of the mounting bracket using GTSTRUDL (Reference 3 of this enclosure). Hydrodynamic effects on the mounting bracket were evaluated using Technical Report *Nuclear Reactors and Earthquakes*, TID-7024, dated August 1963 and added to the GTSTRUDL model. Plant acceptance criteria and applicable codes were used for the design of the bracket and its anchorage.

Results were shown to be adequate for the loads and load combinations used in the analysis. Welded and bolted connections were evaluated and were shown to be adequate. The base plate of the mounting bracket and the anchorage to the concrete were evaluated using Plate Wizard in GTSTRUDL and designed to meet the plant criteria for base plates and anchors.

Spent Fuel Pool Instrumentation System (SFPIS) Equipment (sensor and electronics): The seismic testing for the Sensor and Electronics is documented in JN350-A00076 (Reference 4 of this enclosure). The seismic testing was satisfied for SSE in accordance with IEEE 344-2004, *IEEE Recommended Practice for Seismic Qualification of Class 1E Equipment for Nuclear Power Generating Stations*, Required Response Spectra (RRS) to IEEE 323-2003 with 10% margin included. SSE is shown in Figure 3. The Operating Basis Earthquake (OBE) RRS at 5% critical damping was at least 70% of the respective SSE seismic level of Figure 3.

The sensor and electronics met each of the required performance and acceptance criteria, maintained structural integrity during the acceptable SSE test runs, and acceptable OBE test runs to the RRS. Acceptable functionality of the electronics and sensor was confirmed upon completion of seismic testing. In accordance with the requirements of JN350-A00076 (Reference 4 of this enclosure), testing included five successful OBE tests and two successful SSE tests. The post-test inspection, performed upon completion of the seismic tests, revealed no major structural issues or damage.



SFPIS OBE and SSE RRS for all Principal Directions at 5% Critical Damping (10% Margin Included)

Figure 3

Order EA-12-051, Reliable Spent Fuel Pool Instrumentation RAI #5

Mounting Attachments for SFP Level Equipment

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.

APS Response

The design input and qualification methodology is consistent with the current seismic design for existing plant structures/equipment.

With the exception of the level sensor probe mounting bracket which was qualified by analysis, all the system equipment is seismically qualified by testing. The outputs of the seismic test of equipment were used as the design input for the qualification of the mounting of that specific equipment.

The sensing probe mounting bracket was designed according to the plant design basis for Safe Shutdown Earthquake (SSE) or Operating Basis Earthquake (OBE) at the appropriate plant elevation. In order to ensure adequate design margin for the SSE and OBE events, the seismic inputs were increased by 10%. The following loads that were considered in the evaluation of the bracket and its mounting:

(1) Static loads including the dead weight of the mounting bracket in addition to the weight of the level sensing instruments, stilling well and cabling;
(2) Dynamic loads including the seismic load due to excitation of the dead weight of the system in addition to the hydrodynamic effects resulting from the excitation of the SFP water.

A response spectra analysis was performed for the seismic evaluation of the mounting bracket using GTSTRUDL software (Reference 3 of this enclosure) and using floor response spectrum at the operating deck elevation as identified in the PVNGS UFSAR Revision 17 and the Palo Verde Design Basis Manual C5, Revision 4, *Seismic Topical*. Hydrodynamic effects on the mounting bracket were evaluated using Technical Report *Nuclear Reactors and Earthquakes*, TID-7024, dated August 1963. Plant acceptance criteria and applicable codes were used for the design of the bracket and its anchorage. Evaluations of support members and connections showed a design margin of 10% or more (JN350-A00083, Reference 2 of this enclosure).

The seismic testing for the sensor electronics bracket is documented in JN350-A00076 (Reference 4 of this enclosure). The seismic testing was satisfied by performing seismic testing to the SSE in accordance with IEEE 344-2004. The Required Response Spectra (RRS) in accordance with IEEE 323-2003 *Standard for Qualifying Class 1E Equipment for Nuclear Power Generating Stations* including a 10% margin.

Order EA-12-051, Reliable Spent Fuel Pool Instrumentation RAI #6

Radiological Conditions at Equipment Location

Please provide analysis of the maximum expected radiological conditions (dose rate and total integrated dose) to which the equipment located within the control building or AB [Auxiliary Building] will be exposed. Also, please provide documentation indicating the radiological dosage amount that the electronics for this equipment is capable of withstanding. Please discuss the time period over which the analyzed total integrated dose was applied.

APS Response

During a beyond-design-basis external event (BDBEE) it is expected that conditions in the Auxiliary and Control Buildings are consistent with the normal operating conditions established in the PVNGS Equipment Qualification (EQ) Program Manual. For the Auxiliary Building Total Integrated Dose (TID) for a 40 year period is 1.00 E06 Rads gamma at the location of the subject instrumentation. TID for the 140 foot of the Control Building is not identified in the EQ Program Manual as it is considered a mild environment. Mild environment conditions are those occurring during normal plant operation (all modes), including any abnormal operating occurrence. For the Auxiliary Building and Control Building, all areas with instrumentation dose rates are typically <0.2 mRem per hour.

A summary of the radiological conditions to which the equipment is qualified is provided below.

Radiological conditions for the Spent Fuel Pool Instrumentation System (SFPIS) components in the SFP area:

The coaxial cable, the coupler, the pool-side bracket, and the probe in the SFP area will operate reliably in the service environmental conditions specified in the table below.

Parameter	Normal*	Beyond Design Basis*
Radiation TID (above pool)	1.00 E03 Rads gamma	1.00 E07 Rads gamma
Radiation TID (12" above top of fuel rack)	1.00 E09 Rads gamma (probe & weight only)	1.00 E07 Rads gamma

* Per Table 4.1.2-1 of JN350-A00079 (Reference 5 of this enclosure) and Table 4.8-1 of JN350-A00078 (Reference 9 of this enclosure)

The SFP area radiological conditions are detailed in JN350-A00079 (Reference 5 of this enclosure).

Radiological conditions outside of the SFP area:

The level sensor electronics (i.e., transmitter), sensor electronics bracket, indicators, and the electronics enclosures outside of the SFP area are required to operate reliably in the service environmental conditions specified in the table below.

Parameter	Normal**	Beyond Design Basis**
Radiation TID	≤ 1E03 Rads gamma	≤ 1E03 Rads gamma

** Per Table 4.1.3-1 of JN350-A00079 (Reference 5 of this enclosure) and Table 4.8-2 of JN350-A00078 (Reference 9 of this enclosure)

Order EA-12-051, Reliable Spent Fuel Pool Instrumentation RAI #7

Temperature Ratings for System Electronics

Please provide information indicating a) the temperature ratings for all system electronics (including sensor electronics, system electronics, transmitter, receiver and display) and whether the ratings are continuous duty ratings; and, b) what will be the maximum expected temperature and relative humidity conditions in the room(s) in which the sensor electronics will be located under BDB [Beyond Design Basis] conditions in which there will be no ac power available to run Heating Ventilation and Air Conditioning (HVAC) systems.

APS Response

a) For components in the Auxiliary and Control Buildings, the sensor electronics are rated for minimum high temperature of 140°F at atmospheric pressure and a humidity of 0-100% (non-condensing). Other Spent Fuel Pool Instrumentation System (SFPIS) components located in the Auxiliary and Control Buildings (e.g., those in the display cabinets) are rated for minimum high temperature of 140°F at atmospheric pressure and a humidity of 0-95% (non-condensing). Components (level sensor guided wave radar wire cable, Resistance Temperature Detector (RTD), and their respective interconnecting cables) in the Fuel Building are qualified for BDB conditions of 212°F at atmospheric pressure and 100% humidity (saturated steam). All equipment is qualified for continuous duty.

b) The Control Room environment under BDB conditions has been evaluated to be a maximum temperature of <113°F (PVNGS Study 13-NS-A108, Reference 6 of this enclosure) with a relative humidity (RH) <75% (UFSAR Table 2.3-15, Reference 7 of this enclosure) in equilibrium with outside air. For the Auxiliary Building Rooms A-302 and A-345, the PVNGS design conditions are considered to be bounding, with a maximum design temperature of 104°F (Table 3-2A of Auxiliary Building HVAC System (HA) System Design Basis Manual, Reference 8 of this enclosure). However, under BDB conditions, the temperatures in the Auxiliary Building rooms could be the same as the adjacent Control Room, <113°F and < 75% RH in equilibrium with outside air (established in Study 13-NS-A108, PVNGS Engineering responses to INPO IER-11-4, *Near-Term Actions to Address the Effects of an Extended Loss of All AC Power in Response to the Fukushima Daiichi Event*).

Order EA-12-051, Reliable Spent Fuel Pool Instrumentation RAI #8

Evaluation of Sensor Electronics Design and Testing

Please provide the following:

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

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

APS Response

a) The active electronic components of the Spent Fuel Pool Instrumentation System (SFPIS) are firmly mounted inside NEMA-4X enclosures which are seismically qualified as detailed in documents JN350-A00076 (Reference 4 of this enclosure) and JN350-A00079 (Reference 5 of this enclosure). These housings are mounted to a seismically qualified wall and will not be subject to additional shock forces outside of those for seismic. The location selected was also reviewed for II/I (2/1) seismic and rotary equipment and missile generation impact. Therefore, no additional shock testing is required beyond Seismic Qualification Requirements as defined in IEEE 344-2004, *IEEE Recommended Practice for Seismic Qualification of Class 1E Equipment for Nuclear Power Generating Stations.*

The SFPIS equipment seismic adequacy is demonstrated based on the guidance in Sections 7, 8, 9, and 10 of IEEE 344-2004.

b) The active electronic components of the SFPIS are firmly mounted inside NEMA-4X enclosures. These enclosures are mounted to seismically qualified walls and will not be subject to additional vibration forces outside of those for seismic. Therefore, no additional vibration testing is required beyond Seismic Qualification Requirements defined in IEEE 344-2004.

Order EA-12-051, Reliable Spent Fuel Pool Instrumentation RAI #9

Analysis of Seismic Testing Results

Please provide analysis of the seismic testing results and show that the instrument performance reliability, following exposure to simulated seismic conditions representative of the environment anticipated for the SFP structures at Palo Verde, has been adequately demonstrated. Include information describing the design inputs and methodology used in any analyses of the mountings of electronic equipment onto plant structures, as requested in RAI #5 above.

APS Response

The Spent Fuel Pool Instrumentation System (SFPIS), with the exception of the pool-side bracket, is qualified per IEEE 344-2004, *IEEE Recommended Practice for Seismic Qualification of Class 1E Equipment for Nuclear Power Generating Stations*. The objective of the testing and analysis was to demonstrate that the SFPIS meets the seismic performance requirements of JN350-A00078 (Reference 9 of this enclosure). The Required Response Spectrum (RRS) for this program includes the 10% margin recommended by IEEE 323-2003, *Standard for Qualifying Class 1E Equipment for Nuclear Power Generating Stations*. The seismic test and analysis results are documented in JN350-A00076 and JN350-A00079 (References 4 and 5, respectively of this enclosure). The pool-side bracket is qualified as Seismic Category I, per JN350-A00083 (Reference 2 of this enclosure).

Order EA-12-051, Reliable Spent Fuel Pool Instrumentation RAI #10

Final Configuration of Power Supply Source

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.

APS Response

The primary and alternate Spent Fuel Pool Instrumentation System (SFPIS) channels are powered by different Class AC buses. There are two Trains, each comprised of two Channels for a total of four Channels. Train A is comprised of Channels A and C, and Train B is comprised of Channels B and D. For the following equipment numbers x=the Unit, and is a 1, 2 or 3. The primary SFPIS channel receives its primary power from xEPNCD2726 (Train A, Channel C) which is powered from Class 1E Battery MCC xEPKCM43 (Train A, Channel C). This Primary SFPIS channel receives its back-up power from xEPNDD2826 (Train B, Channel D) which is powered from Class 1E Battery MCC xEPKDM44 (Train B, Channel D). The alternate SFPIS channel receives its primary power from xEPNDD2826 (Train B, Channel D) powered from Class 1E Battery MCC xEPKDM44 (Train B, Channel D) with back-up power from xEPNCD2726 (Train A, Channel C) which is powered from Class 1E Battery MCC xEPKCM43 (Train A, Channel C). Primary and Back-up power sources for both the Primary and Backup Display Systems are isolated from each other through the use of manual Transfer Switches xEPCNU05 and xEPCNU06, respectively.

Each SFPIS channel of equipment has an independent power supply and an independent Uninterruptible Power Supply (UPS) with 24V battery backup that ensures at least 72 hours of power without AC power, per the power consumption calculation JN350-A00081 (WNA-CN-00300-GEN, Reference 10 of this enclosure).

Order EA-12-051, Reliable Spent Fuel Pool Instrumentation RAI #11

Electrical AC Power Sources and Battery Backup Duty Cycle Requirements

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.

APS Response

a) For Local Electronics Enclosure xJPCNE015 (Primary Display) the primary power is fed via existing 120 VAC vital instrumentation and controls panel xEPNCD27 breaker D2726 (Train A, Channel C). The back-up power is 120 VAC vital instrumentation and controls panel xEPNDD28 breaker D2826 (Train B, Channel D). The power source can be transferred from primary to backup via manual transfer switch xEPCNU05.

   Local Electronics Enclosure xJPCNE016 (Back-up Display) primary power is xEPNDD28 breaker D2826 (Train B, Channel D) and back-up power is xEPNCD27 breaker D2726 (Train A, Channel C). The power source for the Backup Display can be transferred from primary to backup via manual transfer switch xEPCNU06.

   The 120 VAC vital instrumentation panels xEPNCD27 and xEPNDD28 are normally fed from station class-1E batteries xEPKCF13 and xEPKDF14, respectively, via inverters xEPNCN13 and xEPNDN14. The existing 120 VAC vital instrumentation and controls panels xEPNCD27 and xEPNDD28 also have a back-up AC source via voltage regulators xEPNCV27 and xEPNDV28.

   Each Display Panel contains a 24 VDC UPS inverter. Upon loss of normal AC power this UPS is used to feed the SFPIS electronics (i.e. indicator, displays, etc.). Power consumption calculation JN350-A00081 (Reference 10 of this enclosure) shows the UPS battery back-up configuration identified in Table 1 will provide power for 5.07 days, which in excess of the 72 hours required.

   In the case of an extended loss of all AC power, the primary and backup SFPIS are powered from their respective UPS until AC power is restored within 72 hours.

b) Table 1 is a summary of the calculation contained in the vendor document JN350-A00081 (Reference 10 of this enclosure) demonstrating the capacity of the fully charged UPS is sufficient to maintain the SFPIS indication function for the stated 72 hour requirement of NEI 12-02, *Industry Guidance for Compliance with NRC Order EA-12-051, To Modify Licenses with Regard to Reliable Spent Fuel Pool Instrumentation*. The calculation results demonstrate a capacity of more than 120 hours of operation for both the primary and backup SFPIS systems. The approximately 120 hours UPS capacity provides sufficient margin for the SFP level indication to function until PVNGS transitions to Phase 2, as outlined in APS letter 102-06670 (Reference 11 of this enclosure). During Phase 2 operation, the SFPIS will be powered from an AC power source via the same inverters (xEPNCN13 and xEPNDN14) mentioned above while also recharging the SFPIS UPS. This alignment allows the instrumentation to function until an offsite resource is available.

Part #	**Description**	**Amps**	**Notes**
MT5000	Radar Level Sensor into transmitter	0.020	Loop powered device with 20mA max current draw.
2864273	Temp. to 4-20 mA converter	0.021	per datasheet
2320212	Uninterrupted Power Supply	0.054	Calculated based on idle load dissipation in battery mode per datasheet. 1.3W/24V = 0.054A. Rational, the normal load of 3.3W is at 5A where the SFPIS is less than 0.5A.
2864176	4-20ma splitter - Level	0.030	Per datasheet, max.
2864176	4-20ma splitter - Temperature	0.030	Per datasheet, max.
2864215	Digital Display - Level	0.053	Per datasheet, 2 watts max. This calculates to 0.083 A. Not using the optional output (30mA). 0.083 A - 0.030 A = 0.053 A
2864215	Digital Display - Temperature	0.053	Per datasheet, 2 watts max. This calculates to 0.083 A. Not using the optional output (30mA). 0.083 A - 0.030 A = 0.053 A
Average Consumption (Amps)		0.261	
Including Design Margin (10%)		0.287	In accordance with Section 6.2.2 of IEEE 485-2010
Including Aging Margin (25%)		0.359	In accordance with Section 6.2.3 of IEEE 485-2010
Including Temperature Correction Factor @ 50 °F (19%)		0.427	In accordance with Section 6.2.1 and Table 1 of IEEE 485-2010
2320429	**Amp Hours of Battery Provided** 26.00 x 2	52.00	
Total Hours Battery will last at Full Charge		121.76	
Total Days Battery will Last at Full Charge		5.07	

Table 1

Order EA-12-051, Reliable Spent Fuel Pool Instrumentation RAI #12

Instrument Channel Accuracy Performance and Maximum Allowed Deviation

Please provide the following:

a) **An estimate of the expected instrument channel accuracy performance 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.**

APS Response

a) The channel accuracy for each Spent Fuel Pool Instrumentation System (SFPIS) instrument channel is ± 3 inches for the full level measurement range which envelopes level 1, 2, and 3 datum points. This covers the normal SFP surface level or higher to within six inches of the fuel assembly under both normal and BDB conditions. More details regarding the requirements on measurement accuracy are defined in the design specification document JN350-A00078 (Reference 9 of this enclosure) and the channel accuracy calculation document JN350-A00080 (Reference 12 of this enclosure).

b) The channel accuracy requirements are identified in document JN350-A00078 (Reference 9 of this enclosure) and demonstrated by the channel accuracy calculation, JN350-A00080 (Reference 12 of this enclosure). NEI 12-02, *Industry Guidance for Compliance with NRC Order EA-12-051, To Modify Licenses with Regard to Reliable Spent Fuel Pool Instrumentation,* and ISA-RP67.04.02, *Methodologies for the Determination of Set points for Nuclear Safety-Related Instrumentation,* were used for calculating the overall channel accuracy.

   Both SFP primary and backup redundant sensor electronics require periodic calibration verification to check that the channel's measurement performance is within the specified tolerance (± 3 inches). If the difference is larger than the allowable tolerance during the verification process, an electronic output verification/calibration will be required. If the electronic output verification/calibration does not restore the performance, a calibration adjustment will be required.

   The electronic output verification/calibration will verify electronics are working properly using simulated probe signals.

The calibration adjustment is performed to restore level measurement accuracy within the acceptance criteria at 0%, 25%, 50%, 75%, and 100% points of the full span. The calibration acceptance criteria and procedures are defined in JN350-A00077 (Reference 13 of this enclosure).

The calibration verification is an empirical two-point check using the sliding bracket calibration verification method in Section 2.2 of document JN350-A00077 (Reference 13 of this enclosure) or the fixed bracket calibration verification method in Section 2.3 of document JN350-A00077 (Reference 13 of this enclosure). These methods use different level positions to verify the sensor and sensor electronics are in proper working order to detect level differences. This check is to be completed within 60 days of a planned refueling outage, considering normal testing scheduling allowances (e.g., 25%). This check is not required to be performed more than once per 12 months per NEI 12-02, *Industry Guidance for Compliance with NRC Order EA-12-051, To Modify Licenses with Regard to Reliable Spent Fuel Pool Instrumentation.*

Order EA-12-051, Reliable Spent Fuel Pool Instrumentation RAI #13

Level Sensing Equipment Capability, Testing, Functional Checks, and Maintenance Tasks

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 functional checks will be performed, and the frequency at which they will be conducted. Describe how calibration tests will be performed, and the frequency at which they will be conducted. Provide a discussion as to how these surveillances will be incorporated into the plant surveillance program.**

d) **A description of what preventive maintenance tasks are 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.**

APS Response

a) The sensor electronics module (i.e., transmitter) has electronic verification/calibration capabilities to check for correct signal output and verify correct level instrument loop operation.

   If the verification/calibration indicates that the instrument loop is operating out of specifications or an anomaly is observed, then a full range calibration adjustment is performed using a calibration test kit. The test kit is used with the sensor electronics module to perform a full range calibration. The test kit consists of a replicate probe, coupler, launch plate, simulated pool liner, coax signal cable, and a movable target plate (to simulate water level). The probe, coupler, launch plate and coax signal cable are equivalent to the installed equipment in the SFP area. The full range calibration can be performed inside/outside of the SFP area.

   The calibration verification, electronic output verification/calibration, and the calibration adjustment are detailed in the JN350-A00077 (Reference 13 of this enclosure).

b) The Spent Fuel Pool (SFP) level measurement instrumentation system is not safety related and not subject to the channel check requirements defined in IEEE 338-1987, *IEEE Standard Criteria for the Periodic Surveillance Testing of Nuclear Power Generating Station Safety Systems*, for Class 1E system. However, inspection and verification of system operation is addressed in the nightly Control

Room surveillances. The seven surveillance procedures are mode specific and are listed as follows:

40ST-9ZZM1, *Operations Mode 1 Surveillance Logs*
40ST-9ZZM2, *Operations Mode 2 Surveillance Logs*
40ST-9ZZM3, *Operations Mode 3 Surveillance Logs*
40ST-9ZZM4, *Operations Mode 4 Surveillance Logs*
40ST-9ZZM5, *Operations Mode 5 Surveillance Logs*
40ST-9ZZM6, *Operations Mode 6 Surveillance Logs*
40ST-9ZZM7, *Operations Defueled Surveillance Logs*

The procedures include a nightly check of the system including comparison with existing level systems and guidance for required action(s) should a channel be found non-functional. Additionally, the area operator logs include a nightly check of the indicators located in the Auxiliary Building to verify proper operation and notification to the Control Room if the system is not functioning as expected. The area logs are included in procedures 40DP-9OPA3, *Area 3 Operator Logs, Modes 1-4* and 40DP-9OPB1, *Primary Operator Logs, Modes 5, 6 and Defueled.*

Calibration and testing are addressed in Procedure 36MT-9FH01, *Spent Fuel Pool Instrumentation System Level and Temperature Calibration Check - Primary* and 36MT-9FH02 *Spent Fuel Pool Instrumentation System Level and Temperature Calibration Check - Alternate*. These procedures are based on information from JN350-A00077 (Reference 13 of this enclosure); which contains the calibration and test procedures, the periodic calibration verification checks, and periodic maintenance checks for the probe. These procedures ensure that the Spent Fuel Pool Instrumentation System (SFPIS) will retain its accuracy as defined by the design specification document JN350-A00078 (Reference 9 of this enclosure), the channel accuracy calculation document JN350-A00080 (Reference 12 of this enclosure), the NRC order, and NEI guidance as clarified by the interim staff guidance (JLD-ISG-2012-03, Reference 14 of this enclosure).

c) The SFPIS calibration and functional verification process is described briefly by part a) and b) above and in more detail in document JN350-A00077 (Reference 13 of this enclosure). Plant personnel perform these periodic calibration verification checks on each SFPIS channel based on the plant maintenance procedure. The periodic calibration verification is performed within 60 days of a planned refueling outage considering normal testing scheduling allowances (e.g., 25%).

d) The periodic calibration verification check is performed within 60 days of a planned refueling outage considering normal testing scheduling allowances (e.g., 25%). Additionally, at the time of the calibration verification check, the probe is partially extracted from the pool for inspection to ensure no frays or nicks have occurred since the last verification check and to remove any significant accumulation of boron where the probe transitions from water to air.

Order EA-12-051, Reliable Spent Fuel Pool Instrumentation RAI #14

SFP Level Instrumentation Back Up Display

For the SFP level instrumentation back up display 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.

APS Response

An informal evaluation was performed to determine that the SFP level instrumentation back-up (alternate) display location can be accessed without unreasonable delay following a BDB event. The location of the alternate display is shown in Figure 2 (on RAI #3) of this enclosure. Based on a plant walkdown, the time to access the display was less than five minutes, if the normal access through a non-seismic structure is available.

During a beyond design basis (BDB) seismic event when the normal structures may be damaged and normal egress / ingress paths may be impeded, an alternative safe path was identified and timed. Total walkdown time by an operator from the Control Room to the alternate display location was less than 30 minutes. Palo Verde's credited evaluation indicates worst case time-to-boil in the SFP is 17 hours. Therefore, the actual time to access the alternate display location based on the walkdown conducted demonstrates there is an adequate amount of time to access the indicator under adverse beyond design bases seismic conditions.

The radiological and environmental conditions on the BDB seismic event pathway to this indicator would be acceptable for personnel transit. The path is through seismically qualified buildings and outside next to seismically qualified buildings. Adequate radiological shielding would be available along the expected travel path. The maximum estimated dose rate to an operator is predicted to be less than 15 mRem per hour during this evolution and well within the quarterly limits of 10 CFR 20.

The alternate display location environmental conditions (temperature and humidity), following a BDB event, would be very similar to the conditions at the primary SFP level instrumentation display, in the Main Control Room. The location on the 140 foot elevation of the Auxiliary Building is near the emergency plan Operation Support Center (OSC) and the normal Radiological Controlled Area (RCA) access point. Personnel will not be continuously stationed at the display location; it will be monitored periodically as determined necessary by the Control Room staff. Reference RAI #7 response for additional details regarding environmental conditions.

Order EA-12-051, Reliable Spent Fuel Pool Instrumentation RAI #15

List of Procedures

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

APS Response

Normal operation of the Spent Fuel Pool Instrumentation System (SFPIS) is addressed in Procedure 40OP-9PC06, *Spent Fuel Pool Operations.* Guidance is provided in the procedure for placing the SFPIS in service, transferring power between the normal and backup power supplies and removing the SFPIS from service.

There are no specific abnormal operations required for the SFPIS. However the SFPIS is one of the level instruments to be considered when determining the Entry Conditions for abnormal operating procedure 40AO-9ZZ23, *Loss of SFP Level or Cooling*.

Calibration and testing of the two SFPIS channels (primary and alternate) are performed using 36MT-9FH01, *Spent Fuel Pool Instrumentation System Level and Temperature Calibration Check - Primary* and 36MT-9FH02, *Spent Fuel Pool Instrumentation System Level and Temperature Calibration Check - Alternate*. These procedures are based on information from JN350-A00077 (Reference 13 of this enclosure), Spent Fuel Instrumentation System Calibration Procedure, which contains the calibration and test procedures, the periodic calibration verification checks, and periodic maintenance checks for the probes. These procedures ensure that the SFPIS will retain its accuracy as defined by the design specification document JN350-A00078 (Reference 9 of this enclosure), the NRC Order (EA-12-051) and NEI guidance (NEI 12-02, *Industry Guidance for Compliance with NRC Order EA-12-051, To Modify Licenses with Regard to Reliable Spent Fuel Pool Instrumentation*) as clarified by the interim staff guidance JLD-ISG-2012-03 (Reference 14 of this enclosure) *Compliance with Order EA-12-051, Reliable Spent Fuel Pool Instrumentation.*

Inspection and verification of SFPIS operation are addressed in the nightly Control Room surveillances. The seven surveillance procedures are mode specific and are listed as follows:

40ST-9ZZM1, *Operations Mode 1 Surveillance Logs*
40ST-9ZZM2, *Operations Mode 2 Surveillance Logs*
40ST-9ZZM3, *Operations Mode 3 Surveillance Logs*
40ST-9ZZM4, *Operations Mode 4 Surveillance Logs*
40ST-9ZZM5, *Operations Mode 5 Surveillance Logs*
40ST-9ZZM6, *Operations Mode 6 Surveillance Logs*
40ST-9ZZM7, *Operations Defueled Surveillance Logs*

The procedures include a nightly check of the system including comparison with existing level systems and guidance for required action(s) should a channel(s) be found non-functional. Additionally, the area operator logs include a nightly check of the indicators located in the Auxiliary Building to verify proper operation and notification to the Control Room if the system is not functioning as expected. The area logs are Procedures 40DP-9OPA3, *Area 3 Operator Logs, Modes 1-4* and 40DP-9OPB1, *Primary Operator Logs, Modes 5, 6 and Defueled.*

JN350-A00082 (Reference 16 of this enclosure) contains instructions for installation, normal operation, abnormal response/troubleshooting, cleaning, calibration, maintenance, spare parts, and special tools for the SFPIS, as well as the major components of the system. This document was used to develop the above listed procedures.

Order EA-12-051, Reliable Spent Fuel Pool Instrumentation RAI #16

Maintenance and Testing Program and In-Situ Calibration Process

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 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.**

b) **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.**

APS Response

a) The maintenance and testing program will ensures that regular testing and calibration are performed and verified. Calibration and testing for the instruments are based on SDOC JN350-A00077 (Reference 13 of this enclosure) as adapted to specific site procedures. Concurrent with calibration activities, maintenance activities include partially extracting the level probe from the pool for inspection to ensure no frays or nicks have occurred since the last verification check, and to remove any significant accumulation of boron where the probe transitions from water to air.

   Site specific procedures define the periodicity for Operator rounds to compare the primary and backup instrument channel indications to existing SFP level instrumentation to determine if more immediate action is required for calibration, maintenance or compensatory action implementation. The periodic calibration verification check is performed within 60 days of a planned refueling outage considering normal testing scheduling allowances (e.g., 25%).

b) The sensor electronics module (i.e., transmitter) has electronic verification/calibration capabilities to check for correct signal output and verify correct level instrument loop operation.

   If the verification/calibration indicates that the instrument loop is operating out of specifications or an anomaly is observed, then a full range calibration adjustment is performed using a calibration test kit. The test kit is used with the sensor electronics module to perform a full range calibration. The test kit consists of a replicate probe, coupler, launch plate, simulated pool liner, coax signal cable, and a movable target plate (to simulate water level). The probe, coupler, launch plate and coax signal cable is equivalent to the installed equipment in the SFP area. The full range calibration can be performed inside/outside of the SFP area.

The calibration verification, electronic output verification/calibration, and the calibration adjustment are defined in SDOC JN350-A00077 (Reference 13 of this enclosure).

References

1. JN350-A00010 (Document 10116D46), *Spent Fuel Pool Instrumentation System Instrumentation Resistance Temperature Detector (RTD) Procurement*
2. JN350-A00083 (CN-PEUS-13-26), *Seismic Analysis of the Spent Fuel Pool Mounting Bracket for the Palo Verde Nuclear Plant*
3. Westinghouse Letter-SST-13-2, Rev. 1, *Software Release Letter for GTSTRUDL 32 for the XP and XP64 System States.* Georgia Tech STRUctural Design Language (GTSTRUDL). A finite element analysis compute code, Georgia Tech Research Corporation.
4. JN350-A00076 (Document EQ-QR-269), *Design Verification Testing Summary Report for the Spent Fuel Pool Instrumentation System*
5. JN350-A00079 (Document WNA-TR-03149-GEN), *SFPIS Standard Product Final Summary Design Verification Report*
6. Study 13-NS-A108, *PVNGS Engineering Responses to INPO IER-11-4*
7. UFSAR Table 2.3-15
8. Design Basis Manual (HA), *Auxiliary Building HVAC System, Table 3-2A, Auxiliary Building Normal Air Handling Units (AHUs), 13-M-HAN-A01A & B*
9. JN350-A00078 (WNA-DS-02957-GEN), *Nuclear Automation Spent Fuel Pool Instrumentation Systems Standard Production Non-Safety Augmented Quality Design Specification*
10. JN350-A00081 (Document WNA-CN-00300-GEN), *Spent Fuel Pool Instrumentation System Power Consumption Calculation*
11. APS Letter 102-06670, *APS Overall Integrated Plan in Response to March 12, 2012 Commission Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events (Order Number EA-12-049)*, dated February 28, 2013
12. JN350-A00080 (WNA-CN-00301-GEN), *Spent Fuel Pool Instrumentation System Channel Accuracy Analysis*
13. JN350-A00077 (WNA-TP-04709-GEN), *Spent Fuel Pool Instrumentation System Calibration Procedure*
14. Interim Staff Guidance JLD-ISG-2012-03, *Compliance with Order EA-12-051, Order Modifying Licenses With Regard to Reliable Spent Fuel Pool Instrumentation*
15. APS letter to NRC 102-06728, *Palo Verde Nuclear Generating Station (PVNGS) Units 1, 2, and 3 Docket Nos. STN 50-528, 50-529, and 50-53 Response to Request for Additional Information for the PVNGS Overall Integrated Plan in Response to March 12, 2012 Commission Order Modifying Licenses with Regard to Reliable Spent Fuel Pool Level Instrumentation (Order Number EA-12-051)*, dated July 11, 2013
16. JN350-A00082 (Document WNA-GO-00127-GEN), *Spent Fuel Pool Instrumentation System Technical Manual*
17. JN350-A00038 (Drawing 10067E04), *Spent Fuel Pool Primary and Backup Instrumentation Mounting Brackets Plan, Sections and Details*

RAI Number: None
(Additional information requested by the NRC Staff on Phone call on 5/15/2014)

Staff question (transmitted by Email May 13, 2014)

From: Boska, John
To: Kelsey, David H

"EMI: This is a follow up question that we will have with all vendors using Westinghouse Electric Company (WEC). We know that the WEC instrument was tested and passed EMI testing to a level B. That means that some signals could preclude the instrument from working but once that signal is gone, the instrument is good. We just want the information from the licensee where they tell us what actions they are taking to make sure no signal will interfere with the instrument when it is needed. This could be something added to a procedure or a line painted around the area where no walkie-talkies are allowed, something along those lines. It might not even be an issue because of the location of the instrument, and if that's the case then we just need them to tell us."

APS Response

APS has completed the following actions to minimize the potential for Electromagnetic Interference (EMI) interference:

1. A caution sign has been posted at the Spent Fuel Pool Instrumentation System (SFPIS) electronic components (local electronics enclosures) which are located on the 140 foot elevation of the Auxiliary Building adjacent to the Radiation Protection (RP) Island. Also, caution signs have been posted at the 140 foot elevation of the primary and alternate readout module locations in the Control Room envelope and Auxiliary Building, respectively.

2. Operators are briefed in general training on the susceptibility of various plant equipment to EMI.

3. Design Verification Testing (DVT) was performed after installation in one PVNGS unit within the Fuel Building, to assess the potential for EMI impacts on essential equipment operation, such as the probe, bare guide wave cable and connectors. Since PVNGS is implementing the SFPIS with the 'stilling well' protection feature, no EMI interference was expected or encountered[1]. As a result of the DVT, APS has determined that no additional actions are warranted.

[1] The stilling well is a 3-inch diameter 299-inch long Schedule 40 stainless steel tube which is welded to the launch plate and extends into the pool. The Level Sensor probe drops into the pool and is inside the tube. The stilling well serves both to shield the probe from EMI and to reduce any wave effects on the probe that might occur due to sloshing in the pool.