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NRC Order No. EA-12-051

FLL-14-030

August 26, 2014

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
11555 Rockville Pike
Rockville, MD 20852

Calvert Cliffs Nuclear Power Plant, Units 1 and 2
Renewed Facility Operating License Nos. DPR-53 and DPR-69
Docket Nos. 50-317 and 50-318

Subject: August 2014 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)

Reference: (1) NRC Order Number EA-12-051, Order Modifying Licenses with Regard to Reliable Spent Fuel Pool Instrumentation, dated March 12, 2012 (ML12054A679)

On March 12, 2012, the Nuclear Regulatory Commission (NRC) issued Order EA-12-051 (Reference 1) to Constellation Energy Nuclear Group, LLC (CENG) for Calvert Cliffs Nuclear Power Plant, LLC (CCNPP). Reference (1) requires submission of a status report at six-month intervals following submittal of the overall integrated plan. Attachment (1) provides the third Six-Month Status Report for CCNPP pursuant to Section IV, Condition C.2, of Reference (1). This report updates the milestone accomplishments since the submittal of the last status report, including any changes to the compliance method, schedule, or need for relief and the basis, if any.

There are no regulatory commitments contained in this letter.

If there are any questions regarding this letter, please contact Bruce Montgomery, Acting Manager - Licensing, at 443-532-6533.

A001
NRR

I declare under penalty of perjury that the foregoing is true and correct. Executed on the 26th day of August, 2014.

Respectfully,

Mary G. Korsnick

MGK/STD

Attachment (1) Six-Month Status Report (August 2014) for Reliable Spent Fuel Pool Instrumentation

cc: Regional Administrator, Region I, USNRC
NRC Project Manager, NRR – Calvert Cliffs Nuclear Power Plant
NRC Senior Resident Inspector – Calvert Cliffs Nuclear Power Plant
Director, Office of Nuclear Reactor Regulation

ATTACHMENT (1)

SIX-MONTH STATUS REPORT (AUGUST 2014)

FOR RELIABLE SPENT FUEL POOL INSTRUMENTATION

CALVERT CLIFFS NUCLEAR POWER PLANT, LLC
August 26, 2014

1. Introduction

The Calvert Cliffs Nuclear Power Plant, LLC (CCNPP) Overall Integrated Plan (OIP) was submitted to the Nuclear Regulatory Commission (NRC) in February 2013 (Reference 1), documenting the requirements to install reliable spent fuel pool level instrumentation (SFP LI), in response to NRC Order Number EA-12-051(Reference 2). Subsequently, a supplement to the CCNPP SFP LI OIP was submitted to the NRC in March 2013 (Reference 3). By letter dated June 19, 2013 (Reference 4), the NRC requested that CENG respond to a request for additional information (RAI) regarding the CCNPP OIP for Reliable Spent Fuel Pool Instrumentation. By letter dated July 3, 2013 (Reference 5), CENG responded to the June 19, 2013 RAI. By letter dated August 27, 2013, CENG provided the first Six-Month Status Report (Reference 8). By letter dated November 15, 2013 (Reference 9), the NRC issued the CCNPP, Unit Nos. 1 and 2 Interim Staff Evaluation (ISE) and RAI regarding the Overall Integrated Plan for Implementation of Order EA-12-051. By letter dated February 24, 2014, CENG provided the second Six-Month Status Report (Reference 11).

AREVA completed the engineering design of the VEGAPULS 62ER Through Air Radar system. The design included two (2) site visits to determine waveguide routing, fabrication of the waveguide, fabrication of the Power Control Panels and procurement of the VEGA instruments that are integrated into the Spent Fuel Pool Level Instrumentation System. The AREVA design was then integrated into the CCNPP Engineering Change Package (ECP). The engineering contractor, Sargent & Lundy prepared the design package and Exelon's Design Engineering Department at CCNPP performed the owner reviews and approval for the ECP.

Once AREVA fabricated all the components, they were all assembled and a factory acceptance test (FAT) was performed to demonstrate the system would perform as designed. The FAT performed the initial calibration, checked performance over the entire range of the instrument, and verified continued operation under extended loss of AC power (ELAP) conditions. The FAT was completed successfully, AREVA issued the test report, and the system was disassembled and shipped to CCNPP.

During implementation of the ECP, plant procedures were changed, and operations and maintenance personnel were trained on the new instrumentation system as well as the new procedures.

Following completion of implementation activities, each of the SFP Level Instrument systems will be subjected to a Site Acceptance Test (SAT) to perform a final calibration check and to demonstrate that the instrument systems will perform as designed. SAT will demonstrate that, with the installation of an antenna horn cover, there will be no loss of system performance. SAT results will be reviewed to determine acceptability of the installed system in preparation for turnover to Operations.

This attachment provides an update of milestone accomplishments since submittal of the last Six-Month Status Report, including any changes to the compliance method, schedule, or need for relief/relaxation and associated basis (if applicable).

2. Milestone Accomplishments

The following milestones have been completed since the development of the OIP (References 1 and 3), and are current as of July 15, 2014.

- Submitted Overall Integrated Plan 1Q2013
- Issued Purchase Order for Instrumentation 2Q2013
- Commenced Engineering and Design 2Q2013
- Selected Instrumentation and Technology 2Q2013
- Submitted first six-month update 3Q2013
- Submitted second six-month update 1Q2014
- Completed Engineering and Design 1Q2014
- Commenced Installation of SFP Instruments 2Q2014
- Provided responses to ISE RAIs 2Q2014

3. Milestone Schedule Status

Table 1 provides an update to the milestone schedule to support the OIP. It provides the activity status of each item and the expected completion date, noting any change. The dates are planning dates subject to change as design and implementation details are developed.

The revised milestone target completion dates do not impact the Order implementation date.

Table 1
Status of CCNPP Reliable Spent Fuel Pool Instrumentation OIP Milestones

Milestone	Target Completion Date	Status	Revised Target Completion Date
Commence Engineering and Design	2Q2013	Complete	
Complete Engineering and Design	3Q2013	Complete	1Q2014
Receipt of SFP Instruments	1Q2014	Complete	
Commence Installation of SFP Instruments	2Q2014	Complete	
Complete Installation of SFP Instruments	4Q2014	Started	
Close out Project/Plant Turnover	3Q2014	Not Started	4Q2014
Respond to NRC ISE RAI	3Q2014	Complete	

4. Changes to Compliance Method

Changes were made to the information provided in the OIP that do not change the compliance method with Nuclear Energy Institute (NEI) 12-02 (Reference 7).

Since the July 2013 RAI (Response 5) and August 2013 Six-Month Status Report (Reference 8), the NRC provided CENG with its ISE and RAI regarding the CCNPP OIP for Reliable Spent Fuel Pool Instrumentation (Reference 9). Open item and regulatory commitments that were identified in References 5 and 8 have been superseded by a commitment made in the February 2014 Six-month Status rreport in response to the ISE RAIs issued in Reference 9. Table 2 provides a list of the open items and regulatory commitments that have been superseded by the commitment made in the February 2014 submittal. Appendix 1 provides the ISE RAI and the CCNPP responses.

Following a series of meetings between the industry, the NEI and the NRC, it was agreed that responses to the ISE RAI could be placed in a plant-specific, electronic file location, the ePortal, that the NRC could access. In accordance with this agreement, responses to the CCNPP ISE RAI were uploaded to the ePortal and the NRC was advised via e-mail of this action.

These changes continue to meet the guidance in JLD-ISG-2012-03 (Reference 6) and NEI 12-02 (Reference 7).

5. Need for Relief/Relaxation and Basis for the Relief/Relaxation

CCNPP expects to comply with the order implementation date and no relief/relaxation is required at this time.

6. Open Items from Overall Integrated Plan and Draft Safety Evaluation

Table 2 provides a summary of the open items documented in the OIP or the Draft Safety Evaluation and the status of each item.

Table 2
Status of CCNPP Reliable Spent Fuel Pool Instrumentation OIP Open Items

CCNPP OIP Open Items	Status
1. Provide for Level 1 how the identified location representing the higher of the two points was specified to the NRC on February 28, 2014, with the second CCNPP OIP status update.	**Deleted (2/2014)** Superseded by ISE RAI Regulatory Commitment
2. Provide the final locations/placement of the primary and back-up SFP level sensor, and the proposed routing of the cables locations and cable routing to the NRC on February 28, 2014, with the second CCNPP OIP status update.	**Deleted (2/2014)** Superseded by ISE RAI Regulatory Commitment
3. Provide the final mounting details for the horn antenna and waveguide assembly upon completion of the final design to the NRC on February 28, 2014, with the second CCNPP OIP status update.	**Deleted (2/2014)** Superseded by ISE RAI Regulatory Commitment
4. Provide the final mounting details for the waveguide piping and radar sensor upon completion of the final design to the NRC on February 28, 2014, with the second CCNPP OIP status update.	**Deleted (2/2014)** Superseded by ISE RAI Regulatory Commitment
5. Provide further details of the qualification and test program used to confirm the reliability of the permanently installed equipment during and following Beyond Design Bases Events upon completion of the final design to the NRC on February 28, 2014, with the second CCNPP OIP status update.	**Deleted (2/2014)** Superseded by ISE RAI Regulatory Commitment
6. Provide further details of the qualification and test program used to confirm the reliability of the permanently installed equipment during and following seismic conditions upon completion of the final design to the NRC on February 28, 2014, with the second CCNPP OIP status update.	**Deleted (2/2014)** Superseded by ISE RAI Regulatory Commitment
7. Provide further details on independence and channel separation of the permanently installed equipment upon completion of the final design to the NRC on February 28, 2014, with the second CCNPP OIP status update.	**Deleted (2/2014)** Superseded by ISE RAI Regulatory Commitment
8. Provide a description of the different electrical AC power sources and capacities for the primary and backup channels to the NRC on February 28, 2014, with the second CCNPP OIP status update.	**Deleted (2/2014)** Superseded by ISE RAI Regulatory Commitment
9. Provide the final calibration methodology upon completion of the final design to the NRC on February 28, 2014, with the second CCNPP OIP status update.	**Deleted (2/2014)** Superseded by ISE RAI

CCNPP OIP Open Items	Status
	Regulatory Commitment
10. Provide specific details of the functional and calibration test program, including frequencies to the NRC on February 28, 2014, with the second CCNPP OIP status update.	**Deleted (2/2014)** Superseded by ISE RAI Regulatory Commitment
11. Provide a description of the preventive maintenance, test and calibration program to the NRC on February 28, 2014, with the second CCNPP OIP status update.	**Deleted (2/2014)** Superseded by ISE RAI Regulatory Commitment
12. Provide the description of appropriate compensatory actions for both channels out-of-service, administrative requirements, and implementation procedures upon completion of the final design to the NRC on February 28, 2014, with the second CCNPP OIP status update.	**Deleted (2/2014)** Superseded by ISE RAI Regulatory Commitment

7. Potential Draft Safety Evaluation Impacts

Not applicable.

8. References

The following references support the updates to the OIP described in this attachment.

1. Letter from M. G. Korsnick (CENG) to Document Control Desk (NRC), Overall Integrated Plan for Reliable Spent Fuel Pool Instrumentation (Order Number EA-12-051), dated February 28, 2013 (ML13066A172).

2. NRC Order Number EA-12-051, Order Modifying Licenses with Regard to Reliable Spent Fuel Pool Instrumentation, dated March 12, 2012 (ML12054A679).

3. Letter from M. G. Korsnick (CENG) to Document Control Desk (NRC), Supplement to Overall Integrated Plan for Reliable Spent Fuel Pool Instrumentation, dated March 8, 2013 (ML13073A155).

4. Letter from N. S. Morgan (NRC) to G. H. Gellrich (CENG), Calvert Cliffs Nuclear Power Plant, Units Nos. 1 and 2 – Request for Additional Information Regarding Overall Integrated Plan for Reliable Spent Fuel Pool Instrumentation, Order EA-12-051(TAC Nos. MF1140 and MF1141), dated June 19, 2013 (ML13164A393)

5. Letter from M .D. Flaherty (CENG) to Document Control Desk (NRC), Response to Request for Additional Information Regarding Overall Integrated Plan for Reliable Spent Fuel Pool Instrumentation (Order EA-12-051) (TAC Nos. MF1140 and MF1141), dated July 3, 2013 (ML13190A017).

6. NRC JLD-ISG-2012-03, Compliance with Order EA-12-051, Reliable Spent Fuel Pool Instrumentation, Revision 0, August 29, 2012 (ML12221A339).

7. 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, August 2012 (ML12240A307).

8. Letter from E. D. Dean (CENG) to Document Control Desk (NRC), 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), dated August 27, 2013 (ML13254A279).

9. Letter from M. C. Thadani (NRC) to J. A. Spina (CENG), Calvert Cliffs Nuclear Power Plant, Unit Nos. 1 and 2, and Nine Mile Point Nuclear Station, Unit Nos. 1 and 2, Interim Staff Evaluation and Request for Additional Information Regarding the Overall Integrated Plan for Implementation of Order EA-12-051, Reliable Spent Fuel Pool Instrumentation (TAC Nos. MF1131, MF1132, MF1140, and MF1141), dated November 15, 2013 (ML13281A205).

10. Memorandum from C .A. Hunt (NRC) to M. A. Mitchell (NRC), Summary of the November 26,

2013 Public Meeting to Discuss Industry Responses to Staff Interim Evaluations for Spent Fuel Pool Instrumentation, dated December 26, 2013 (ML13347B030).

11. Letter from M. G. Korsnick (CENG) to Document Control Desk (NRC), 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), dated February 24, 2014.

Appendix 1

Response to
Request for Additional Information
From
Interim Staff Evaluation on Reliable Spent Fuel Pool Instrumentation
Dated November 15, 2013
Calvert Cliffs Nuclear Power Plant, Units 1 & 2
Docket Numbers 50-317 and 50-318

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

CCNPP Response to RAI 1:
Level 1, the level that is adequate to support operation of the normal fuel pool cooling system, is defined in NEI 12-02 as the higher of the following two points:

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

As indicated in Figure 1.1, CCNPP designated Level 1 to be at the 65 foot 8.5 inch level of the spent fuel pool. This level corresponds to the bottom of the spent fuel pool skimmer weir, 3 inches below the low water alarm setpoint. Level 1 is selected to ensure that a void will not occur in the suction lines. Analysis has demonstrated that there is adequate NPSH for pump operation at saturated conditions for water at Level 1.

Thus Level 1 is the higher of the two pump-limiting conditions specified in NEI 12-02.

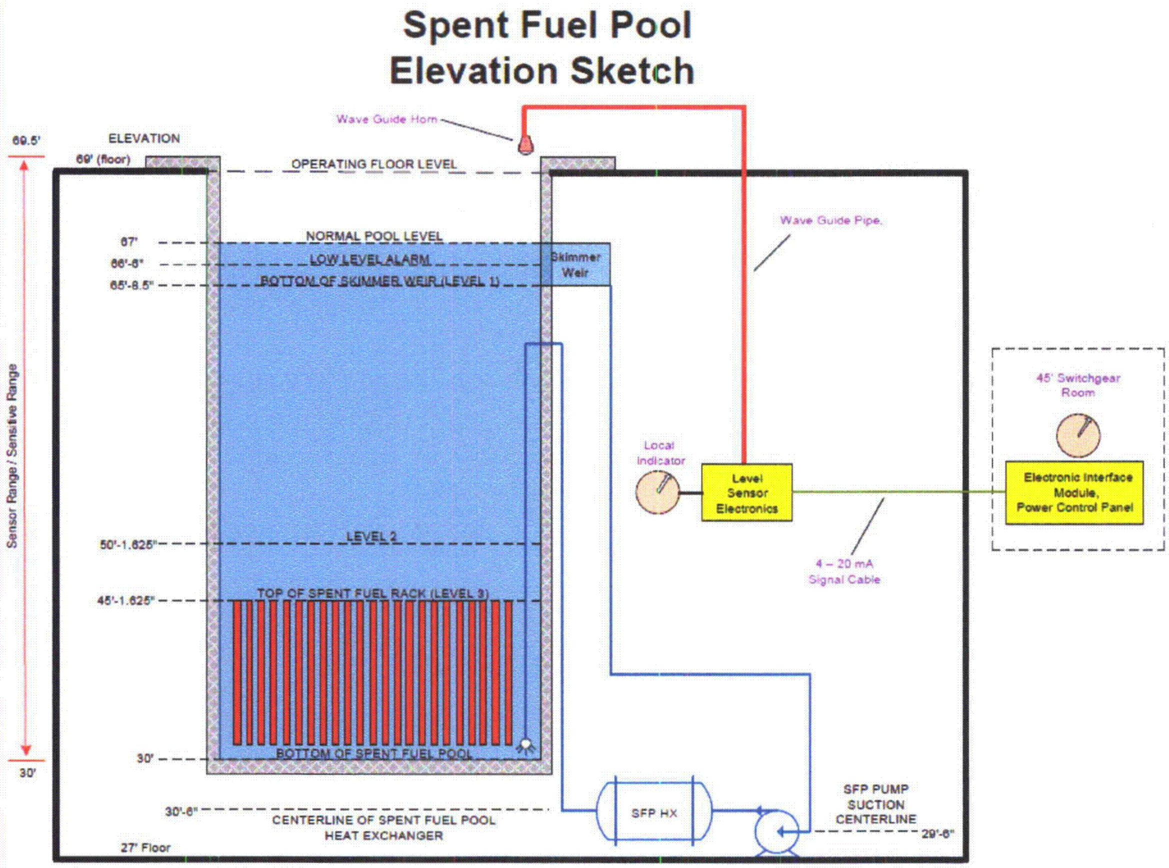

Figure 1.1, CCNPP Spent Fuel Pool Elevation View Sketch

NRC RAI 2:
Please describe the impact of the installation of the bulkhead gate on the reliability of the SFP level instrumentation for each SFP, and what compensatory measures would be taken to ensure reliable level indication in each SFP when the bulkhead gate is installed.

CCNPP Response to RAI 2:
The installation of the bulkhead gate has no impact on the reliability of the permanently installed channels of SFP level instrumentation. Should a breach occur under severe accident conditions, the bulkhead gate would be installed to isolate the unaffected side of the SFP in order to maintain the water inventory on that side. Initiation of this action is governed by a severe accident management guideline at CCNPP.

Under normal operating conditions and during refueling outages, the SFP is configured as one pool. As such, CCNPP has one SFP that can be separated by the bulkhead gate only under severe accident conditions that would involve a breach on one side of the pool with an attendant loss of water inventory. Consequently, since severe accident conditions are not postulated to occur concurrently with an ELAP, then the bulkhead gate will not be installed under ELAP conditions and therefore potentially impacting the reliability of SFP level instrumentation.

NRC RAI 3:

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

CCNPP Response to RAI 3:

There are no cables or conduit routed in the SFP area for this installation, but rather a waveguide antenna horn and approximately 8 feet of waveguide antenna tubing for each channel. The waveguide horns are mounted at opposite ends of the SFP and therefore physically separated to preclude missile damage to both channels. The SFP is a seismic Category I structure; therefore, in the SFP area above the pool, all equipment is required to meet Seismic II/I mounting requirements to ensure it does not fall and create a missile during a seismic event equal to the design basis of the SFP.

See Figures 3.1 and 3.2 for primary and back-up channel cable and conduit routing between the sensor and the display panel for each channel. As can be seen in the figures, each route is physically separated from each other to prevent a missile from damaging both channels.

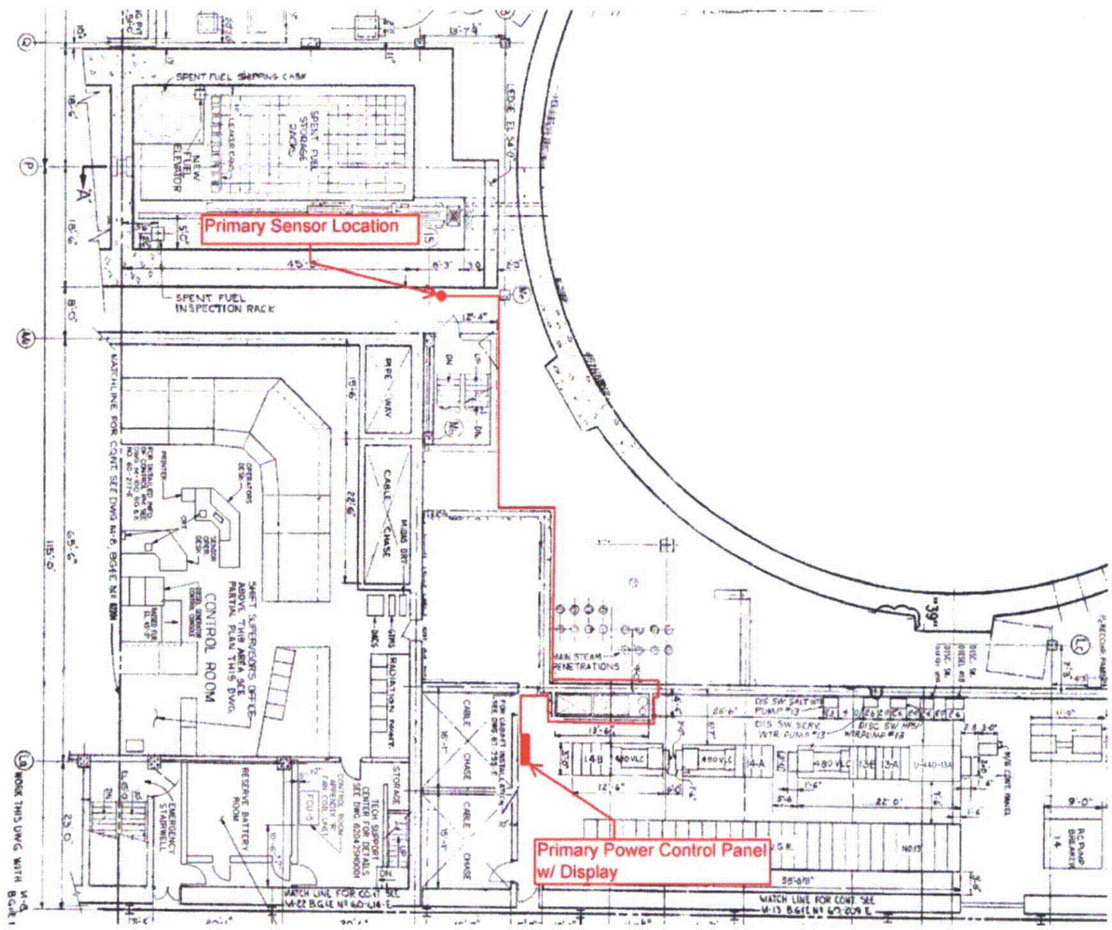

Figure 3.1, 45' Unit 1 Primary Level Cable Route

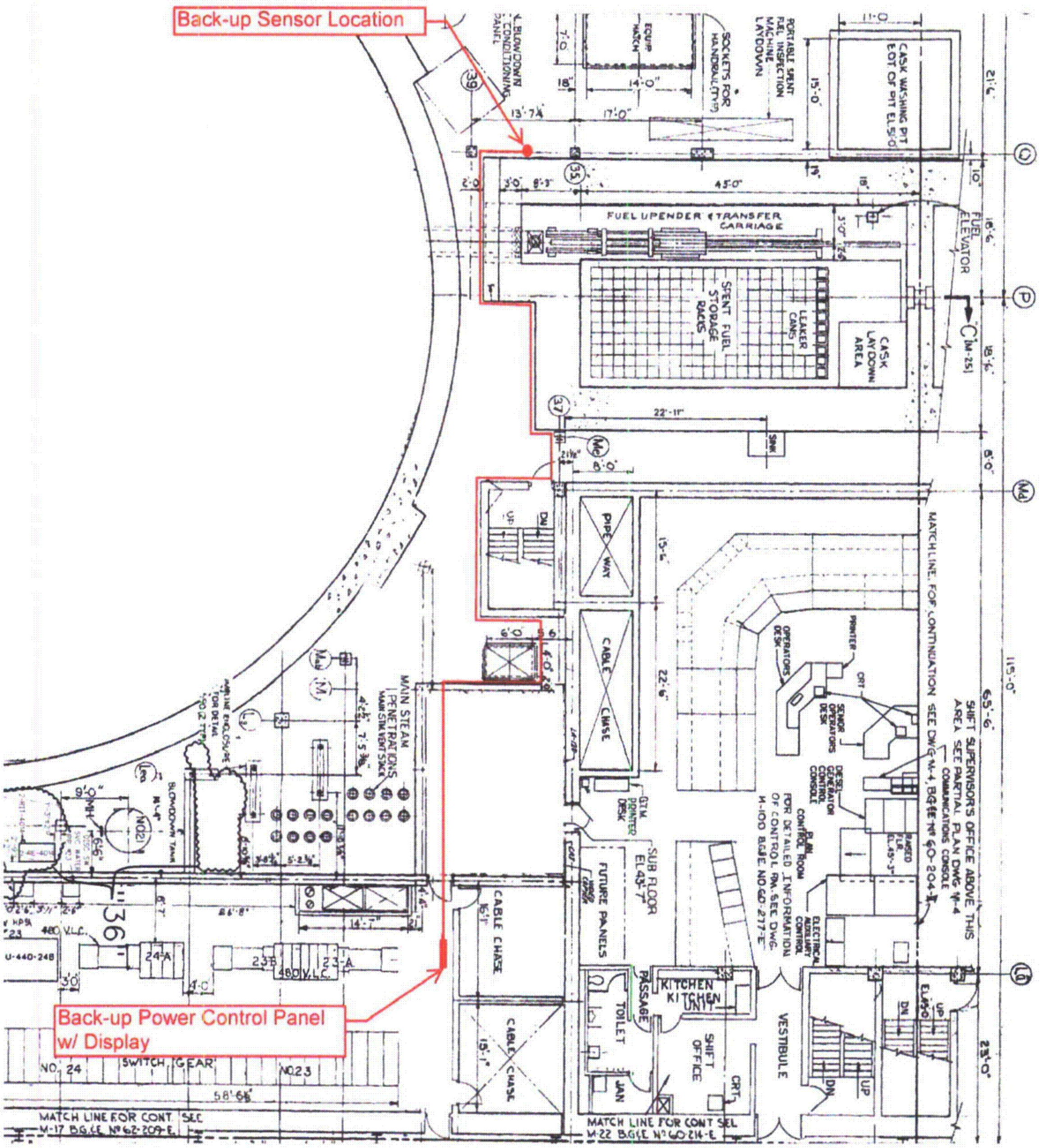

Figure 3.2, Unit 2 Back-up Level Cable Route

NRC RAI 4:

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

CCNPP Response to RAI 4:

Obtaining hydrodynamic pressures on a submerged object was determined by utilizing the methodologies in TID-7024, "Nuclear Reactors and Earthquakes" and "Dynamic Pressures on Accelerated Fluid Containers" by G.W. Housner, Reference 1 and Reference 2, respectively. Per Spent Fuel Pool Hydrodynamic Loads calculation (Reference 3), the calculated hydrodynamic loading due to the effects of sloshing is 0.17 psi of pressure to be experienced by the horn assembly.

The horn and waveguide assembly and the electronics units were successfully seismically tested in accordance with the requirements of the Institute of Electrical and Electronics Engineers (IEEE) Standard 344-2004, (Reference 4) (See the response to RAI #13 for results and further explanation of this test) using a bounding Safe Shutdown Earthquake (SSE) spectra having a peak spectral acceleration of 14g, (Reference 5, Attachment A-1). Per the seismic qualification report (Reference 5), while the SFPLI system did not meet the post-event test acceptance criteria (+/- 0.5 inches), it does functionally meet the NEI 12-02 requirements with respect to accuracy (+/- 1 ft.) before and after a seismic event. (See Seismic Test Report for details, Reference 5)

In addition to the seismic test, "Areva Spent Fuel Pool Level Monitoring Instrumentation –Horn End Assembly and Support Qualifications for CCNPP" calculation (Reference 6), Areva conducted an analysis that combined the effects of deadweight, seismic and a bounding hydrodynamic load due to the potential of sloshing effects on the cantilevered portion of the assembly.

Per Table 5A-8 of the Calvert Cliffs UFSAR (Reference 7), 2% critical damping is specified for both operating basis earthquake (OBE) and safe shutdown earthquake (SSE) cases for welded steel framed structures. The enveloped Zero Period Acceleration (ZPA) at 69' elevation for SSE is = 0.26 (vertical) and = 0.38 (horizontal). The SSE ZPA as well as a bounding hydrodynamic load of 3.95psi were conservatively used in the calculation (Reference 6), and then compared against normal ACI code allowables.

Below is a summary of the resulting critical component interaction ratios for the horn end assembly and support qualification (Reference 6):

Member/ Limit State	**Calculated IR**	**Comments**
Stiffened Pipe – SSE Bending Check	0.6	OK
Unstiffened Pipe – SSE Bending Check	0.52	OK
Unstiffened Pipe – SSE Shear Check	0.93	OK
5/8" Waveguide Bolts	0.45	OK
C8x18.75	0.07	OK
3/16" Fillet weld check between HSS and baseplate	0.34	OK
HSS 3"x3"x1/4"	0.38	OK
½" Kwik Hilti Bolt III	0.6	OK
12"x12"x1/2" Baseplate	1	OK (Based on maximum sloshing Load Limit of 3.95 psi, Actual is 0.17)

The CCNPP Unit 1 and Unit 2 waveguide horn end assembly and support are shown to be structurally adequate. The allowable sloshing force should be equal to or less than 3.95 psi does not include Dynamic Load Factor (DLF). The vendor instrumentation seismic testing adequately demonstrates the equipment is capable of reliably operating during a seismic event.

NRC RAI 5:

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

CCNPP Response to RAI 5:

The waveguide piping and electrical conduit are supported by standard seismically qualified supports per CCNPP's electrical installation standard E-406 (Reference 8). Conduit supports are used to support waveguide piping as its function and physical characteristics are more consistent with an empty electrical conduit rather than a liquid-carrying pipe. Standard supports were provided as part of original plant construction, consistent for Seismic Category I supports for the design bases of the plant. This is also true for mounting of the sensor, power control panel and remote indicator for each instrumentation loop. E-406 contains details for Seismic Category I supports of electrical panels weighing less than 350 lbs.

The sensor mount and the horn assembly mounts are qualified by calculation using AISC 9th Edition design manual for steel construction. All anchorages are qualified using concrete anchor bolts and the manufacturer's design guide. The qualification of the anchorages is meant to be a demonstration of the feasibility of the chosen anchorage bolts and anchorage pattern. The final site anchorage is qualified using the site-specific design guides.

The generic sensor calculation qualifies a simple C-channel steel section welded centrally on a ½ inch steel base plate. The base plate is anchored using four concrete anchor bolts. The generic sensor end support uses a generic seismic acceleration of 10g for SSE, which is meant to encompass the seismic response spectra of all the locations where these mounts are installed. The calculation assumes a maximum height of support to be 15 inches off of the wall. All mounts using a smaller length of C-channel are qualified by comparison.

There will be 5 mounting attachments of SFP Level equipment required to be attached to plant structures. The SFP Level equipment being mounted to plant structures is the Horn Assembly, the sensor, intermediate supports, Power Control Panels (PCP), Configuration/ Interface Indicator.

With the exception of the Horn Assembly mount, all attachments for SFP Level equipment to plant structures are per Calvert Cliffs Civil Standards, CS-5 (Reference 9) and Calvert Cliffs Electrical Installation Standard E-406, Section 104 (Reference 10). These standard supports were provided as part of original plant construction, to be used for Seismic Class I supports qualified to the design bases of the plant. This method is consistent with NEI 12-02 Section 3.3 guidance to mount equipment consistent with the design basis of the SFP structure.

Mounting attachments:

- Sensor & Configuration/Interface Indicator – These components are mounted using an E-406 Type 30 support. Each component is mounted individually on the outside of the SFP wall (lower elevation. The SFP wall is a seismic structure qualified to the design basis of the plant.

- Horn Assembly mounts – The horn assembly mount is qualified by AREVA calculation 32-9218253-001, (Reference 3), to the CCNPP Safe Shutdown Earthquake (SSE). This assembly is mounted to the refuel floor just outside the SFP, which is a Seismic Class I structure.

- PCP (Power Control Panel) – Each power control panel is mounted using an E-406 Type 30 support. Each PCP is mounted to a Seismic Class I wall inside the 45' Switchgear Rooms. The Switchgear Rooms are qualified to the design basis of the plant. The PCP integrity was qualified by test per 174-9213558-001 (Reference 11). This test report requires the use of six (6) bolts to support the PCP; however the equipment provided only included four (4) bolt holes locations. Subsequently, calculation 32-9221971-000 (Reference 12), was issued to justify that the reduced 4 bolt hole configuration is acceptable.

- Intermediate supports – The intermediate supports consist of a support for the waveguide piping and all required conduit supports. For the waveguide piping, E-406 conduit supports are used as its function and physical characteristics are more consistent with an empty electrical conduit rather than a liquid-carrying pipe. Standard Seismic Class I supports were used where necessary to provide a support at least every 10ft. The waveguide support is attached to the concrete outer wall of the SFP, which is a seismic structure qualified to the design basis of the plant.

  Similarly, all conduit supports are standard Seismic Class I supports per E-406. Conduit supports are required along the entire length from the SFP sensor to the 45' switchgear rooms (where PCP's are located). This entire route, for both units, is located within the Auxiliary Building, which is a Seismic Class I structure. Therefore, each support will be attached to a seismic wall qualified to the design basis of the plant.

NRC RAI 6:

Please provide analysis of the maximum expected radiological conditions (dose rate and total integrated dose) to which the electronics will be exposed. Also, please provide documentation indicating how it was determined that the electronics for this equipment is capable of withstanding a total integrated dose of $1x10^3$ Rads. Please discuss the time period over which the analyzed total integrated dose was applied.

CCNPP Response to RAI 6:

A location-specific dose calculation was performed, which demonstrated the sensor total integrated dose (TID) over its required mission time is enveloped by the vendor instrumentation design limit of $1x10^3$ rads. The area above and around the pool will be subject to high levels of radiation in the event that the fuel becomes uncovered. The only parts of the measurement channel in the pool radiation environment are the metallic waveguide and horn, which are not susceptible to the expected levels of radiation. The electronics is located in an area that is shielded from the direct shine from the fuel, and bounce and scatter effects above the pool. For the purpose of this analysis, the radiation levels in the area do not exceed $1x10^3$ rad., i.e. mild radiation environment.

For current generation operating reactors, the staff's definition of a mild radiation environment for electronic components, such as semiconductors, or any electronic component containing organic materials as a total integrated dose of less than $1x10^3$ rad (Reference 13), Section 3.11.3.2.1.)

This is further confirmed in Regulatory Guide 1.209 (Reference 14) which states "ionizing dose radiation hardness levels for MOS IC families range from about 10 gray (Gy) or 1 kilorad (krad) for commercial off-the-shelf (COTS) circuits to about 10^5 Gy (10^4 krad) for radiation hardened circuits". The $1x10^3$ rad radiation withstand rating of the SFPLI electronics is at the low end of this range, and therefore considered to be a conservative rating.

The location of the electronics of the spent fuel pool water level measuring instrumentation at the 45' Elevation is Column M-15 on drawing 60204 and Column Q-39 on drawing 62204. These locations are on the opposite side of the upender trench from the spent fuel pool racks. There is a 6-foot thickness of concrete in the outer wall of the spent fuel pool, which will provide additional shielding for the instrumentation location. Table 7-4 of CCNPP calculation CA07918 shows that, with the water at the NEI-12-02 Level 3 at elevation 1-foot above the top of the racks, the maximum gamma dose rate at the inside wall of the SFP next to the upender trench is 46 R/hr. A half value layer (thickness where half of the incident energy has been attenuated) of concrete for gammas with a Co-60 energy spectrum is 2.6 inches (ASTM E 94). The outer wall of the SFP represents over 27 half value layers of concrete, and will therefore ensure that the direct dose rates at the instrumentation location with the conservatively considered water at the Level 3 elevation will be less than 1 mrad/hr or less than 0.2 rad in 7-days. The Unit 2 instrumentation location will also be in an area that is open to the 45' truck bay, and thus may also be exposed to some indirect shine through the cask loading hatch. Table 7-4 also shows that the dose rates at the cask loading hatch on the 69' elevation will be less than 0.5 R/hr. The 7-day dose to a piece of equipment in that location would be 84 Rad (0.5 Rad/hr x 168 hours). The 7-day dose at the actual instrument location on the 45' elevation will be substantially less since the distance is greater and only a small fraction of the radiation passing through the cask loading hatch would scatter back towards the location of the instrumentation. Thus, a conservatively estimated dose to the instrumentation for a 7-day qualification at the NEI-12-02 Level 3 elevation would be 85 Rad.

Dose rates used for testing electronics using MIL-STD-883J, Method 1019.9 (Reference 15) are 50 rad/second or greater. The fact that this standard test does not test for dose rates lower than 50 rad/second, except as explained below, indicates that high dose rates that are lower than 50 rad/second are not a concern for electronic devices. At very low dose rates, some electronics that contain bipolar of BiCMOS or mixed-signal devices can be susceptible to Enhanced Low Dose Rate Sensitivity (ELDRS). For these devices MIL-STD-883J, Method 1019.9 also requires testing at low dose rate ≤0.01Rad/second. However, it has been shown in Reference 16 that at dose levels up to 10^4 rad there are no true dose rate effects. Therefore, at the total integrated dose estimated for the area where the electronics will be located, low dose rate sensitivity is not a concern.

Based on the information in the above references, the electronics in the VEGAPULS 62 ER sensor, displays and power control panel are considered to be qualified for 1×10^3 rad.

NRC RAI 7:

Please provide information indicating (a) whether the 80°C rating for the sensor electronics is a continuous duty rating; and, (b) what the maximum expected ambient temperature will be in the room in which the sensor electronics will be located under BDB conditions in which there is no ac power available to run Heating Ventilation and Air Conditioning (HVAC) systems.

CCNPP Response to RAI 7:

(a) The 80°C (176°F) rating of the sensor is a continuous duty rating according to the sensor manufacturer VEGA. The electronics are continuous duty rated 70°C (158°F) for the indicator and 65°C (149°F) for power control panel.

(b) The primary and back-up sensors are located in the 45' elevation of the Auxiliary building while the display panels are located in the 45' Unit 1 and Unit 2 switchgear rooms respectively. The table below provides the maximum expected ambient temperature in these rooms under BDB conditions.

Area	Maximum Temperature
45' Auxiliary Bldg.	110°F/116°F (43°C/47°C) (WBGT*/DBT**)
45' Unit 1 Switchgear Room	112°F/120°F (44°C/49°C) (WBGT/DBT)
45' Unit 2 Switchgear Room	

*WBGT: Wet Bulb Globe Temperature
** DBT: Dry Bulb Temperature

NRC RAI 8:

Please provide information indicating the maximum expected relative humidity in the room in which the sensor electronics will be located under BDB conditions, in which there is no ac power available to run HVAC systems, and whether the sensor electronics is capable of continuously performing its required functions under this expected humidity condition.

CCNPP Response to RAI 8:

The primary and backup sensors are located in the 45' elevation of the Auxiliary Building while the display panels are located in the 45' Unit 1 and Unit 2 switchgear rooms, respectively. The following table provides the maximum expected relative humidity in these rooms under BDB conditions.

Area	Maximum Relative Humidity
45' Auxiliary Bldg.	60%
45' Unit 1 Switchgear Room	83%
45' Unit 2 Switchgear Room	

The sensor has been tested in accordance with IEC 60068-2-30 (Reference 17) which varies the temperature from room temperature to elevated temperature at high humidity conditions (in this case, from +22°C (72 °F) to +57°C (135 °F) at a constant 96% relative humidity, to verify that the test item withstands condensation that can occur due to the changing conditions. The sensor has also been tested to DIN EN 60529:2000 (Reference 18) and is rated IP66/IP68, which signifies totally dust tight housing, protection against string water jets and waves, and protection against prolonged effects of immersion under 0.2 bar pressure. This rating further substantiates the ability of the sensor to perform at high humidity conditions including condensing. The VEGADIS 61 indicating and adjustment module and VEGADIS 62 display have housings which are similar to the VEGAPULS 62 ER sensor and are therefore considered to be equally covered by the tests given in References **Error! Reference source not found.** and **Error! Reference source not found.**. There is no published humidity rating for the power control panel. The power control panel enclosure is rated NEMA 4X and provides protection to the internal components from the effects of high humidity environments"

The humidity rating of the sensors, located in the 45' Auxiliary Building, is 85% and the Power Control Panel and components, located in the switchgear rooms, are rated at 95%. Therefore, the components are capable of continuously performing their required functions under the expected conditions.

NRC RAI 9:

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

CCNPP Response to RAI 9:

The VEGAPULS 62 ER Through Air Radar sensor has been shock tested in accordance with IEC EN 60068-2-27 (Reference 19) (100g, 6ms), ten shock blows applied along a radial line through the support flange. Sensor, displays, and power control panel have been tested and/or analyzed for shock and vibration. The vendor instrumentation shock and vibration testing adequately demonstrates the sensor is reliable under severe shock conditions.

NRC RAI 10:

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

CCNPP Response to RAI 10:

The potential vibration environment around the spent fuel pool and surrounding building structure might contain higher frequencies than were achieved in the testing of the sensor. Additional testing of the VEGAPULS 62 ER sensor was performed in accordance with IEC EN 60068-2-6 (Reference 20) Method 204 (except 4g, 200 Hz). This additional testing is considered to provide a stand-alone demonstration of the resistance to vibration of the VEGAPULS 62 ER sensor and further substantiates the results of the MIL STD 167-1 testing.

NRC RAI 11:
Please provide information describing the evaluation of the comparative display panel ratings against postulated plant conditions. Also provide results of the manufacturer's shock and vibration test methods, test results, and the forces and their frequency ranges and directions applied to the display panel associated with its successful tests.

CCNPP Response to RAI 11:
Per vendor input, the environmental qualifications of the sensor and display panel are as follows:

Component	Location	Temperature	Relative Humidity
Sensor	45' Auxiliary Bldg.	5°F – 158°F[1] (-15°C – 70°C)	85%
Display	45' Switchgear Room	-4°F – 158°F (-20°C – 70°C)	85%
Display Panel[2]	45' Switchgear Room	-13°F – 158°F (-25°C – 70°C)	5% - 95% (non-condensing)

[1] Temperature limitation is from removable indicator located on sensor. Without this indication temperature range is -40°F – 176°F (-40°C – 80°C).

[2] Characteristics from all components inside display panel were used to identify overall bounding temperature and humidity rating of panel.

The components used in the power control panel are listed in the following table. It provides the shock and vibration test and/or analysis for each component.

Component Name	Test standard used	Test levels per manufacturer description
Selector switch	Vibration resistance per IEC 60068-2-6 (Reference 20)	5 gn (f = 2…500Hz)
	Shock per IEC EN 60068-2-27 (Reference 19)	30 gn for 18 ms half sine wave acceleration 50 gn for 11 ms half sine wave acceleration
Terminal blocks	Not tested, These are considered suitable for use in the in shock and vibration environments based on their previous use in the manufacturer's mobile remote display.	N/A
Power supply	Vibration tested per IEC EN 60068-2-6 (Reference 20)	(Mounting by rail:Random wave, 10-500 Hz, 2G, ea. Along X, Y, Z axes 10 min/cycle, 60 mi)
	Shock tested per IEC 60068-2-27	Half sine wave, 4G, 22 ms, 3 axes, 6

Component Name	Test standard used	Test levels per manufacturer description
	(Reference 19)	faces, 3 times for each face
Fuse	Vibration tested per MIL-STD-202G (Reference 21)	Method 204, Test Condition C (Except 5g, 500 Hz)
	Shock tested per MIL-STD-202G (Reference 21)	Method 207 (HI Shock)
Indicating light	Not tested for shock or vibration resistance. Failure of light will not impact instrument functionality.	N/A
Control relay	Not tested, mounted on dampener (see analysis below)	N/A
Battery	Not tested, mounted on dampener (see analysis below)	N/A
Current isolator	Not tested, mounted on dampener (see analysis below)	N/A
Readouts –See note below	Test standards as described in RAI #9 and RAI #10 responses	Test levels as described in RAI #9 and RAI #10 responses

Note: The VEGA displays will be mounted separately from the power control panel. These displays have the same housing, the same material construction (precision cast stainless steel, and the same materials and method for mounting the electronics into the sensor housing as the VEGAPULS 62 ER that has been shock and vibration tested as discussed in the responses to RAI #6 and RAI #7 above.

The power control panel mounting is qualified as Seismic Class 1 per electrical installation standard E-406 and envelopes the test spectra used for seismic qualification testing. Three components that were not shock or vibration tested by the manufacturers were included in a power control panel that was successfully seismically tested in accordance with the requirements of the IEEE Standard 344-2004 (Reference 4). The seismic test levels reached peaks of 19g in the x direction, 20g in the y direction, and 21g in the z direction. The test response spectra exceeded 10g at all upper frequencies up to 100 Hz beyond which they were not recorded. The levels of acceleration to which the power control panel was exposed are considered to exceed the postulated shock environments at the locations where the power control panel will be mounted, i.e. concrete walls or rigid metal building structures. Likewise, the levels of acceleration to which the power control panel was exposed greatly exceed the postulated vibration amplitudes at the locations where the control panel will be mounted, which are postulated to be minimal since there is no vibration producing machinery in the vicinity.) Also, these components are mounted to vibration dampeners to further minimize the transfer of external vibration to these components.

NRC RAI 12:
Please provide the following:

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

b) Results for the selected methods, tests and analyses utilized to demonstrate the qualification and reliability of the installed equipment in accordance with the Order requirements.

CCNPP Response to RAI 12:
a) and b)

The following methods were used and the results demonstrate the reliability of the permanently installed equipment under BDB ambient conditions:

Temperature: The postulated BDB temperature in the SFP area can reach 212°F (100°C). The instrument equipment in the SFP area consists of passive metallic components that are not affected by this postulated temperature. In the area where the electronics consisting of the sensor, indicator and power control panel will be located, the temperatures will not exceed the maximum rated temperatures of the electronics, as discussed in the responses to RAI 7.

Humidity: The postulated BDB humidity in the SFP area can reach 100% RH, saturated steam. The instrument equipment in the SFP area consists of passive metallic horn antenna, waveguide assembly and waveguide pipe. Any pooling of condensation inside the waveguide pipe is prevented by cutting 4 slots 90^0 apart in the flange at the sensor. The ability of the through air radar to measure water level through a saturated steam atmosphere has been demonstrated by test. The reliability of measurements in BDB humidity conditions has been demonstrated for each waveguide during the Factory Acceptance Test by injecting steam and water into the waveguide pipe and checking the indicated values. The instrument accuracy at normal and BDB conditions was verified by testing of the actual waveguide configuration during the factory acceptance testing. Normal conditions testing included multi-point checks of accuracy at room temperature and humidity using a metal target. BDB conditions were simulated by injecting steam and water into the waveguide pipe and checking the indicated values. All results were within the estimated accuracy normal and BDB values. The accuracy performance values were also verified after a loss of power and subsequent restoration of power.

The reliability of the sensor, indicator and power control panel electronics is described in the response to RAI 8.

Shock: The postulated BDB shock environment and associated tests and analyses of the sensor electronics, readouts, and power control panel for resistance to severe shock are described in responses to RAI 9 and RAI 11.

Vibration: The postulated BDB vibration environment and associated tests and analyses of the sensor electronics, readouts, and power control panel for resistance vibration are described in responses to RAI 10 and RAI 11.

Radiation: The postulated BDB radiation environment and associated tests and analyses of the sensor electronics, readouts, and power control panel for resistance to radiation are described in the response to RAI 6.

NRC RAI 13:
Please provide analysis of the seismic testing results and show that the instrument performance reliability, following exposure to simulated seismic conditions representative of the environment anticipated for the SFP structures at CCNPP, has been adequately demonstrated.

CCNPP Response to RAI 13:
Sensor brackets and electronic enclosure mounting are seismically qualified to EPRI TR-107330. The sensor, indicator, power control panel, horn end of the waveguide, standard pool end and sensor end mounting brackets, and waveguide piping were successfully seismically tested in accordance with the requirements of the Institute of Electrical and Electronics Engineers (IEEE) Standard 344-2004, "Recommended Practice for Seismic Qualification of Class 1E Equipment for Nuclear Power Generating Stations". The system was monitored for functionality before and after the resonance search and seismic tests. The required response spectra used for the five Operating Basis Earthquakes (OBE) and one Safe Shutdown Earthquake (SSE) in the test were taken from EPRI TR-107330 (Reference 22), Figure 4-5. This test level exceeds the building response spectra where equipment will be located. Intermediate mounting brackets for the waveguide piping have been designed in accordance with the CCNPP's standard for seismic level 1 conduit supports per E-406.

NRC RAI 14:

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

CCNPP Response to RAI 14:

The primary channel receives normal AC power from Unit 1 lighting panel 1L12 while the back-up channel receives power from Unit 2 lighting panel 2L07. Figures 14.1 and 14.2 are marked-up single line diagrams identifying the upstream source for each channel. As can be seen, each channel is powered from an independent AC source during normal operation. Normal power supply to the primary SFP Wide Range Level Indicator (WRLI) is from a Unit 1 motor control center (MCC) and the backup SFP WRLI is from a Unit 2 MCC; however, during an ELAP power is automatically transferred to a battery backup within each of the power control panels. This feature was tested during the Factory Acceptance Test and was satisfactory. The loss of AC power test will be performed on site during the Site Acceptance Test following completion of field implementation activities.

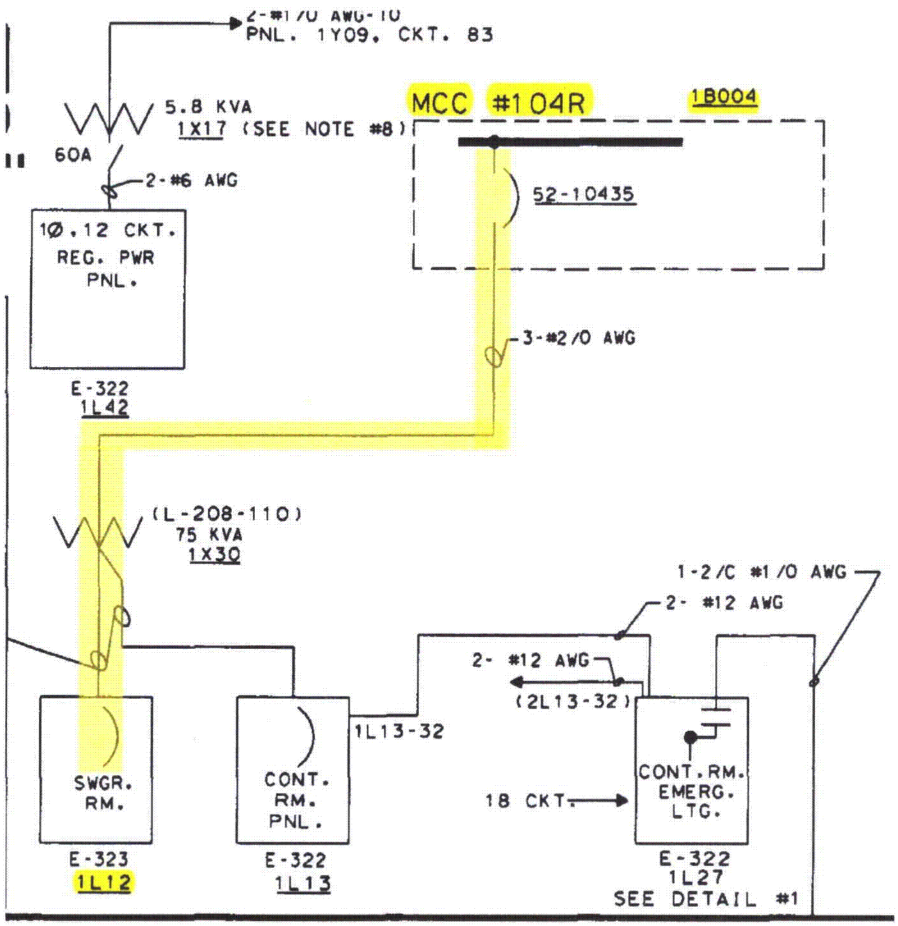

Figure 14.1, Primary Channel Power Supply Source 1L12

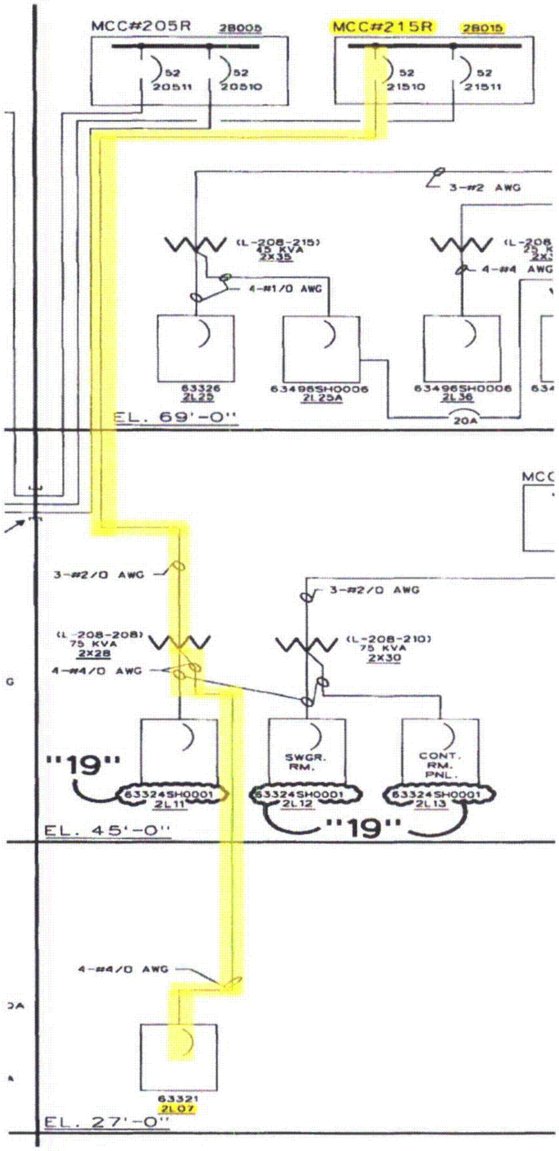

Figure 14.2, Backup Channel Power Supply Source 2L07

NRC RAI 15:
Please provide the results of the calculation depicting the battery backup duty cycle requirements demonstrating that its capacity is sufficient to maintain the level indication function until offsite resource availability is reasonably assured.

CCNPP Response to RAI 15:
The power control panel contains eight lithium C-cell batteries that provide automatic backup power to the 4 – 20 mA instrument loop when normal 120V AC power is not available. The battery life for a continuous 20 mA discharge rate has been calculated for a range of ambient temperatures. The results of the calculated lifetime at various temperatures are shown in the following table.

Temperature	Lifetime at full voltage @ 20 mA (hours)
-30°C (-22°F)	131
0°C (32°F)	233
25°C (77°F)	330
55°C (131°F)	349
75°C (167°F)	209

Battery capacity at full load is expected to readily exceed 131 hours under temperature conditions not expected to occur at the Calvert Cliffs site (i.e., -22°F). Based on vendor analyses the battery capacity is deemed sufficient to support reliable instrument channel operation until off-site resources can be deployed by the mitigating strategies in response to Order EA-12-049.

NRC RAI 16:

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

CCNPP Response to RAI 16:

The instrument accuracy at normal and BDB conditions was verified by testing of the actual waveguide configuration during the vendor factory acceptance testing. The vendor factory acceptance test demonstrated reliable operation of the SFP level instrumentation under normal conditions and under various simulated BDB test conditions (e.g. steam exposure). Normal conditions testing included multi-point checks of accuracy at room temperature and humidity using a metal target. BDB conditions were simulated by injecting steam and water into the waveguide pipe and checking the indicated values. All results were within the estimated accuracy normal and BDB values. The testing demonstrated the instrumentation met design accuracy and repeatability specifications.

The accuracy performance values were also verified after a loss of power and subsequent restoration of power. Normal power supply to the primary SFP Wide Range Level Indicator (WRLI) is from a Unit 1 motor control center (MCC) and the backup SFP WRLI is from a Unit 2 MCC; however, during an ELAP power is automatically transferred to a battery backup within each of the power control panels. This feature was tested during the factory acceptance test and was satisfactory. The loss of AC power test will be performed on site during the site acceptance test following completion of field implementation activities. Please refer to the response to RAI 15 for a description of the performance of the system batteries that provide automatic backup power.

NRC RAI 17:

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

CCNPP Response to RAI 17:

The 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 has not been finalized yet. The following procedures are either in development or will be developed in support of the RSFPI system:

- OI-24D, Spent Fuel Pool Cooling – Infrequent Operations
  - Normal startup and shutdown procedure for the system.
- OI -27D, Station Power 480 Volt System
  - Notes added for Loss of Power Effects (LOPE) for lighting panels 1L12 and 2L07.
- AOP-6F, Spent Fuel Pool Cooling System Malfunctions – Sustained Loss of SFP Cooling
  - Use of the new level indicators for wide range level monitoring will be added as a new attachment.
- AOP-7I, Loss of 4KV, 480 Volt or 208/120 Volt Instrument Bus Power
  - Loss of instrument power for the existing narrow range level indicators will point to the use of the new wide range level.
- ERPIP-612, Candidate High Level Actions SFP Fuel Uncovered (our existing SFP SAMG)
  - Use of the new level indicators for wide range level monitoring will be added.
- FSG-11, Alternate SFP Makeup and Cooling
  - Use of the new level indicators for wide range level monitoring will be included in this FSG.
- SFP Wide Range Level Monitoring Instrumentation Maintenance Procedure

It should be noted that based on negligible drift rate of VEGA electronics experienced over large user base, periodic calibration is not needed. Functional verification can be achieved using cross channel checks and functional checks per vendor manual.

<u>NRC RAI 18:</u>
Please provide the following:

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

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

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

<u>CCNPP Response to RAI 18:</u>
a) At Calvert Cliffs Nuclear Power Plant the Wide Range Spent Fuel Pool Level Indication system is being installed as an Engineering Design Change (EDC). As such all testing of the EDC will be performed in accordance with CNG-FES-015 Form 9 Part B "Testing Requirements and Acceptance Criteria". Table 18.1 shows the relationship between parameters to be tested and acceptance criteria. All parameters listed in the table are to be validated using Engineering Test Procedure ETP 14-002 "Acceptance Test for The Spent Fuel Pool Wide Range Level Indication". After the system is in service periodic testing will be performed including an annual loop calibration test and a monthly channel check.

Table 18.1--Relationship between Parameters to Be Tested and Acceptance Criteria

Parameters to Be Tested	Acceptance Criteria
Cable Integrity	Perform Megger, continuity, and/or TDR test on the following cables as required: B0LT2003A B0LT2004A B1L1224P B2L0722P
Wiring Verification	Perform "ME-001/Wiring Verification" of wiring changes per ECP-13-000665-MU-01 82749SH0003-N/A
Verify that both horn antennas 0LE2003 and 0LE2004 are capable of being rotated and aimed at the ceiling for testing. After verification, ensure that flange bolts are retightened.	The horn antennas can be rotated and aimed at the ceiling.
Verify indicators 0LI2003 and 0LI2004 indicate the same level.	The indicators display the same level +/-0.25'
Verify configuration interface/indicators 0LI2003A and 0LI2004A indicate the same level.	The configuration interface/indicators display the same level +/-0.25'
Set panel 0PNL0C220 selector switch to "On".	Verify that 0PNL0C220 AC power light illuminates. Verify that indicator 0LI2003 provides a level reading.
With AC power removed, set panel 0PNL0C220 selector switch to "On".	Verify that 0PNL0C220 AC power light is off. Verify that indicator 0LI2003 provides a level reading. Verify as-left configuration settings are maintained in accordance with table 1.
Set panel 0PNL0C220 selector switch to "Off".	Verify that 0PNL0C220 AC power light is off. Verify that indicator 0LI2003 does not provide any indication.
Set panel 0PNL0C220 selector switch to "Batt. Test"	Verify that 0PNL0C220 AC power light is off. Verify that indicator 0LI2003 provides a level reading.
Set panel 0PNL0C221 selector switch to "On".	Verify that 0PNL0C221 AC power light illuminates. Verify that indicator 0LI2004 provides a level reading.
With AC power removed, set panel 0PNL0C221 selector switch to "On".	Verify that 0PNL0C221 AC power light is off. Verify that indicator 0LI2004 provides a level reading. Verify as-left configuration settings are maintained in accordance with the master calibration data sheet (MCDS) of the EDC.
Set panel 0PNL0C221 selector switch to "Off".	Verify that 0PNL0C221 AC power light is off.

	Verify that indicator 0LI2004 does not provide any indication.
Set panel 0PNL0C221 selector switch to "Batt. Test"	Verify that 0PNL0C221 AC power light is off. Verify that indicator 0LI2004 provides a level reading.
Loop Calibration	Perform Calibration Checks of both instrument loops in accordance with the MCDS.

It should be noted that based on negligible drift rate of VEGA electronics experienced over large user base, periodic calibration is not needed. Functional verification can be achieved using cross channel checks and functional checks per vendor manual.

b) Non-functioning SFP level instrumentation that is credited in satisfying NRC Order EA-12-051 will be tracked by Emergency Planning Unit administrative procedure EP-1-109, Equipment Important to Emergency Preparedness.

Upon discovery and within a 90 day period, no compensatory actions will be taken in the event that one channel is non-functioning as long as the remaining instrument channel is available. The non-functioning instrument shall be returned to service within the 90 day period. If both instrument channels are determined to be non-functioning, actions will be initiated within 24 hours to restore one of the instrument channels to full functionality within 72 hours prior to implementing compensatory actions. Please see Table 18.2 for compensatory actions.

c) If one of the instrument channels cannot be restored within the 90-day period, compensatory actions will include enhanced monitoring of the existing SFP level instrumentation to ensure availability of normal alarms and increased direct visual monitoring of spent fuel pool level. The determination for time frames for enhanced monitoring will be defined as the procedure development is finalized. Please see Table 18.2 for compensatory actions.

Table 18.2--Operational Status of Spent Fuel Pool Level Instrumentation and Corresponding Compensatory Actions

Equipment	Condition	Required Action	Completion Time	Compensatory Actions
0-LT/LI-2003 **OR** 0-LT/LI-2004	One channel non-functional	Restore channel to service	≤ 90 days	Increase monitoring on functional channel
			> 90 days	Notify the Plant Operations Review Committee (PORC) of plan and schedule to return non-functional channel to service
0-LT/LI-2003 **AND** 0-LT/LI-2004	Both channels non-functional	Initiate action to restore one channel to service	24 hours	1. Monitor SFP water level using narrow range level instrument 2. Operations brief, use of AOP 6F, Att. 3, SFP Elevation Diagram 3. Notify PORC of plan and schedule to return non-functional channel to service
		Restore one channel to service	72 hours	

NRC RAI 19:

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

CCNPP Response to RAI 19:

The in-situ calibration process at the SFP location utilizes the capability to rotate the waveguide horn assembly from its normal downward-pointing position so that it can be pointed at a target that is moved along the radar beam path. By placing the moveable target at known distances from the horn, the instrument output can be checked at each target location. In the event that the as-found values are not within acceptance criteria, the measurement range can be shifted up or down to calibrate the instrument to within the required tolerance.

It should be noted that based on negligible drift rate of VEGA electronics experienced over large user base, periodic calibration is not needed. Functional verification can be achieved using cross channel checks and functional checks per vendor manual.

REFERENCES for RAI RESPONSES

1. TID-7024, Nuclear reactors and Earthquakes
2. G.W. Housner, Dynamic Pressures on Accelerated Fluid Containers
3. CA08171, Spent Fuel Pool Sloshing Calculation in Support of EA-12-051
4. IEEE Standard 344-2004, "Recommended Practice for Seismic Qualification of Class 1E Equipment for Nuclear Power Generating Stations"
5. 174-9213558-001 - AREVA Seismic Test Report for Vegapuls
6. 32-9218253-001 - Areva Spent Fuel Pool Level Monitoring Instrumentation –Horn End Assembly and Support Qualifications for CCNPP
7. CCNPP UFSAR, Table 5A-8
8. E-406, Electrical Installation Standard from Calvert Cliffs Nuclear Power Plant Design and Construction Standard 61406
9. CCNPP Civil Standards (CS-5)
10. CCNPP Electrical Installation Standard (E-406), Section 104
11. 174-9213558-001 Areva Spent Fuel Pool Level Monitoring Instrumentation –Horn End Assembly and Support Qualifications for CCNP
12. 32-9221971-000 – Power Control Panel Mounting
13. NUREG-173 Vol. 1; "Final Safety Evaluation Related to Certification of the AP1000 Standard Design, Docket No. 52-006" Section 3.11.3.2.1.
14. Regulatory Guide 1.209, "Guidelines for Environmental Qualification of Safety-Related Computer –Based Instrumentation and Control Systems in Nuclear Power Plants"
15. MIL- STD-883J, "Department of Defense Test Method Standard, Microcircuits"
16. Sandia National Laboratories Document SAND-2008-6851P, "Radiation Hardness Assurance Testing of Microelectronic Devices and Integrated Circuits: Radiation Environments, Physical Mechanisms, and Foundations for Hardness Assurance", Page 20 and Figure 20
17. IEC 60068-2-30, "Environmental testing – Part 2-30: Tests – Test Db: Damp heat , cyclic (12h + 12h cycle)"
18. DIN EN 60529:2000, "Degrees of Protection Provided by Enclosure (IP Code)"
19. IEC EN 60068-2-27, "Basic environmental testing procedures – Part 2:Tests – Test Ea and guidance: Shock"
20. IEC EN 60068-2-6, "Environmental testing - Part 2-6: Tests - Test Fc: Vibration (sinusoidal)"
21. MIL-STD-202G, "Department of Defense, Test Method Standard, Electronic and Electrical Component Parts"

22. EPRI TR-107330, "Generic Requirements Specification for Qualifying a Commercially Available PLC for Safety-Related Applications in Nuclear Power Plants"