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January 22, 2016
RC-16-0001

U. S. Nuclear Regulatory Commission
Document Control Desk
Washington, DC 20555-0001

Dear Sir / Madam:

Subject: VIRGIL C. SUMMER NUCLEAR STATION (VCSNS) UNIT 1
DOCKET NO. 50-395
OPERATING LICENSE NO. NPF-12
REPORT OF FULL COMPLIANCE WITH MARCH 12, 2012, COMMISSION ORDER MODIFYING LICENSES WITH REGARD TO RELIABLE SPENT FUEL POOL INSTRUMENTATION (ORDER EA-12-051) AND RESPONSES TO REQUESTS FOR ADDITIONAL INFORMATION

References:

1. Nuclear Regulatory Commission Order Number EA-12-051, *Issuance of Order to Modify Licenses with Regard to Reliable Spent Fuel Pool Instrumentation*, dated March 12, 2012, Agencywide Documents Access and Management System (ADAMS) Accession Number ML12054A679

2. SCE&G Letter, *Virgil C. Summer Nuclear Station (VCSNS) Unit 1- Integrated Plan with Regard to Requirements for Reliable Spent Fuel Pool Instrumentation (Order Number EA-12-051)*, dated February 28, 2013, ADAMS Accession No. ML13063A099

3. NRC Letter, *Virgil C. Summer Nuclear Station, Unit 1- Interim Staff Evaluation and Request for Additional Information Regarding the Overall Integrated Plan for Implementation of Order EA-12-051, Reliable Spent Fuel Pool Instrumentation (TAC NO. MF1173)*, dated December 5, 2013, ADAMS Accession No. ML13305A100

4. NRC Letter, *Virgil C. Summer Nuclear Station, Unit 1- Report for the Onsite Audit Regarding Implementation of Mitigating Strategies and Reliable Spent Fuel Instrumentation Related to Orders EA-12-049 and EA-12-051 (TAC NO.s MF2338 and MF1173)*, dated September 16, 2015, ADAMS Accession No. ML15253A721

On March 12, 2012, the Nuclear Regulatory Commission issued Order EA-12-051 (Reference 1) to South Carolina Electric & Gas Company (SCE&G). The order was immediately effective and directs SCE&G to have a reliable indication of the water level in associated spent fuel storage pools. Specific requirements are outlined in Attachment 2 of Order EA-12-051.

Order EA-12-051 requires holders of operating reactor licenses, issued under Title 10 of the *Code of Federal Regulations* Part 50, to submit an Overall Integrated Plan (OIP) including a

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description of how compliance with the requirements of the order will be achieved. By letter dated February 28, 2013, the OIP for Virgil C. Summer Nuclear Station (VCSNS) Unit 1 was submitted (Reference 2) in response to Order EA-12-051.

The purpose of this letter is to provide the report of full compliance with Order EA-12-051 pursuant to Section IV, Condition C.3, of the order for VCSNS Unit 1. VCSNS Unit 1 has installed two independent full scale level monitors for the spent fuel pool in response to Order EA-12-051.

Enclosure 1 provides a brief summary of the key elements associated with compliance to Order EA-12-051 for VCSNS Unit 1. It also includes an update to the milestone schedule that was initially submitted in the OIP and revised in subsequent status reports.

Enclosure 2 provides responses to NRC requests for additional information in Reference 3 for VCSNS Unit 1. The responses were previously provided to the NRC during the audit process. The NRC audit report (Reference 4) did not identify any open or pending items related to Order EA-12-051. Hence, VCSNS considers all spent fuel pool level instrumentation items closed.

This letter contains no new regulatory commitments. If you have any questions regarding this report, please contact Bruce L. Thompson at (803) 931-5042.

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

1-22-2016
Executed on

Thomas D. Gatlin

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Enclosure 1: VCSNS Unit 1, Summary of Compliance Elements for Order EA-12-051

Enclosure 2: VCSNS Unit 1, Response to 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*

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VIRGIL C. SUMMER NUCLEAR STATION (VCSNS) UNIT 1

ENCLOSURE 1

SUMMARY OF COMPLIANCE ELEMENTS FOR ORDER EA-12-051

The elements identified below for VCSNS Unit 1, as well as the Overall Integrated Plan (Reference 1), the six month status reports (References 2-6), and any additional docketed correspondence (References 7-8), demonstrate compliance with Order EA-12-051 (Reference 9). Of note, references identified in this enclosure are listed at the end of the enclosure.

Identification of Levels of Required Monitoring – Complete

VCSNS Unit 1 has identified the three required levels for monitoring the Spent Fuel Pool (SFP) level in compliance with Order EA-12-051. These levels have been integrated into site processes for monitoring level during events and responding to loss of SFP inventory.

Incorporation of Required Instrumentation Design Features – Complete

The design of the spent fuel pool level instrumentation (SFPLI) installed at VCSNS Unit 1 complies with the requirements specified in Order EA-12-051 and described in Section 3 of NEI 12-02, *Industry Guidance for Compliance with NRC Order EA-120-051*, with the exception of instrument arrangement.

The SFPLI, consisting of a primary and backup channel, has been permanently installed in accordance with the station design control process. The instrumentation has been mounted to retain design configuration during and following the maximum expected ground motion. The SFPLI is designed for reliable operation at environmental and radiological conditions consistent with beyond design basis external events (BDBEE). The primary and backup channels are independent of one another and have their own power supplies. The SFPLI will maintain its accuracy following a power interruption and is designed to be routinely tested and calibrated. The SFPLI displays are located in accessible areas and are designed to provide continuous or on-demand indication of SFP level following a BDBEE.

The backup channel of SFPLI is routed outside the fuel handling building. Therefore, the backup channel is not fully protected from all external hazards. As this configuration is an alternative to the requirements of NEI 12-02, VCSNS Unit 1 has implemented additional controls for the SFPLI. The controls include reducing the allowed out of service time for either channel to 30 days, maintaining a set of replacements parts, and providing procedural guidance to maintain the SFP level within the normal narrow range indication level during an ELAP event.

Development and Implementation of Required Programs - Complete

Training related to the SFPLI installed at VCSNS Unit 1 has been completed in accordance with the requirements specified in Order EA-12-051 and described in NEI 12-02, Section 4. Procedures have been developed for the use, testing, and calibration of the SFPLI. Processes have been established for scheduling and implementing testing and calibration of the SFPLI to maintain design accuracy of the channels.

Milestone Schedule

The following provides an update to the milestone schedule of the Overall Integrated Plan.

Milestone	Target Completion Date	Activity Status	Revised Target Completion Date
Submit 60 Day Status Report	Oct 2012	Complete	
Submit Overall Integrated Plan	Feb 2013	Complete	
Submit Response to RAIs on Overall Integrated Plan	Aug 2013	Complete	
Submit Response to RAIs on Overall Integrated Plan	Oct 2014	Complete	
Submit 6 Month Updates:			
Update 1	Aug 2013	Complete	
Update 2	Feb 2014	Complete	
Update 3	Aug 2014	Complete	
Update 4	Feb 2015	Complete	
Update 5	Aug 2015	Complete	
Modifications:			
Modification Development	Jan 2014	Complete	January 2015
Complete Procurement of Instrumentation Package	Jun 2013	Complete	
Complete Engineering and Design	Jul 2014	Complete	January 2015
Commence Implementation	Oct 2014	Complete	April 2015

Milestone	Target Completion Date	Activity Status	Revised Target Completion Date
Unit 1 Implementation Outage	Oct 2015	Complete	
Procedures:			
Complete Procedures Development	Feb 2015	Complete	October 2015
Training:			
Develop Training Plan	Feb 2015	Complete	June 2015
Training Complete	Aug 2015	Complete	

References

The following references support the information contained within Enclosure 1.

1. SCE&G Letter, *Virgil C. Summer Nuclear Station (VCSNS) Unit 1- Integrated Plan with Regard to Requirements for Reliable Spent Fuel Pool Instrumentation (Order Number EA-12-051)*, dated February 28, 2013, ADAMS Accession No. ML13063A099
2. SCE&G Letter, *Virgil C. Summer Nuclear Station (VCSNS) Unit 1- 6-Month Status Report of Order EA-12-051, Order Modifying Licenses with Regard to Requirements for Reliable Spent Fuel Pool Instrumentation*, dated August 28, 2013, ADAMS Accession No. ML13242A272
3. SCE&G Letter, *Virgil C. Summer Nuclear Station (VCSNS) Unit 1- Second 6-Month Status Report of Order EA-12-051, Order Modifying Licenses with Regard to Requirements for Reliable Spent Fuel Pool Instrumentation*, dated February 27, 2014, ADAMS Accession No. ML14063A201
4. SCE&G Letter, *Virgil C. Summer Nuclear Station (VCSNS) Unit 1- Third 6-Month Status Report of Order EA-12-051, Order Modifying Licenses with Regard to Requirements for Reliable Spent Fuel Pool Instrumentation*, dated August 28, 2014, ADAMS Accession No. ML14245A404
5. SCE&G Letter, *Virgil C. Summer Nuclear Station (VCSNS) Unit 1- Fourth 6-Month Status Report of Order EA-12-051, Order Modifying Licenses with Regard to Requirements for Reliable Spent Fuel Pool Instrumentation*, dated February 27, 2015, ADAMS Accession No. ML15062A008
6. SCE&G Letter, *Virgil C. Summer Nuclear Station (VCSNS) Unit 1- Fifth 6-Month Status Report of Order EA-12-051, Order Modifying Licenses with Regard to Requirements for Reliable Spent Fuel Pool Instrumentation*, dated August 20, 2015, ADAMS Accession No. ML15237A041

7. SCE&G Letter, *Virgil C. Summer Nuclear Station (VCSNS) Unit 1- Response to Request for Additional Information - Overall Integrated Plan in Response to Commission Order Modifying License Requirements for Reliable Spent Fuel Pool Instrumentation (Order Number EA-12-051),* dated August 28, 2013, ADAMS Accession No. ML13247A338

8. SCE&G Letter, *Virgil C. Summer Nuclear Station (VCSNS) Unit 1- Response to Request for Additional Information – Overall Integrated Plan in Response to Commission Order Modifying License Requirements for Reliable Spent Fuel Pool Instrumentation (Order No. EA-12-051)*, dated October 29, 2014, ADAMS Accession No. ML14304A538

9. NRC Order Number EA-12-051, *Issuance of Order to Modify Licenses with Regard to Reliable Spent Fuel Pool Instrumentation*, dated March 12, 2012, ADAMS Accession No. ML12054A679

VIRGIL C. SUMMER NUCLEAR STATION (VCSNS) UNIT 1

ENCLOSURE 2

RESPONSE TO 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*

RAI #1

Please provide additional information describing how the design of shielding for the SFP level instrumentation meets the requirement of the Order to arrange the instruments 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. Also, describe plans for protecting any equipment mounted outside the buildings from the effects of tornado-driven missiles, freezing, elevated temperature, humidity, flooding, and other BDB conditions.

Response to RAI #1

The primary and backup trains of level instrumentation are mounted in the southwest and northwest corners of the Spent Fuel Pool (SFP) respectively, providing separation by the distance of the width of the SFP. The primary channel, horn, and waveguide pipe are located and mounted in the southwest corner of the SFP (463 feet elevation). The primary waveguide pipe is routed due west into the north stairwell of the Auxiliary Building (AB), where the remote transmitter is located. The power control panel, auxiliary battery panel, and display for the primary channel are located due south of the remote transmitter and are mounted on a column due south of the AB lift.

Per Virgil C. Summer Nuclear Station (VCSNS) Technical Report, TR00080-003, *FLEX Equipment Ventilation and Habitability Assessment*, the maximum temperature in the north AB stairwell is 150 degrees Fahrenheit. This provides a 26 degree Fahrenheit margin over its rated temperature for the remote transmitter. Also in TR00080-003, the maximum temperature range south of the AB lift is determined to be between 105-115 degrees Fahrenheit. The minimum rating for the equipment being installed in this area is 158 degrees Fahrenheit (VEGADIS 61 Indication and Adjustment Unit), per AREVA Document 01-9225772-002, *Through Air Radar Spent Fuel Pool Level Instrument (SFPLI) Instruction Manual for V.C. Summer.*

The backup level channel horn and waveguide pipe are mounted in the northwest corner of the SFP (463 feet elevation). The backup waveguide pipe is routed northwest through the west wall of the Fuel Handling Building (FHB). The backup waveguide pipe is routed down along the outside wall of the FHB and the remote transmitter is mounted on the (458 feet - 9 inch elevation). The remote transmitter has been tested in accordance with AREVA Document 51-9202556-004, *Qualification Analysis of VEGAPULS 62 ER Through Air Radar,* for temperature and humidity. The backup power control unit, auxiliary battery panel, and display are mounted roughly 5 feet from the ground elevation of approximately 436 feet, which is above the site's maximum flood elevation of 437 feet - 8 inches (VCSNS design calculation, DC00080-002, *Site Hazards Design Parameters for FLEX*).

Per VCSNS design calculation, DC00080-002, the maximum design temperature for components located outdoors is 107 degrees Fahrenheit for high temperature and negative 2 degrees Fahrenheit for a low temperature. Per the vendor maintenance manual, the limiting minimum rated maximum temperature for the outside components is 158 degrees Fahrenheit (VEGADIS 61 Indication and Adjustment Unit), AREVA Document 01-9225772-00, *Through Air Radar Spent Fuel Pool Level Instrument (SFPLI) Instruction Manual for V.C. Summer.* The VEGADIS 61's temperature rating is negative 4 degrees Fahrenheit, which is below our site's minimum temperature requirement. However, the minimum temperature rating is limited by the PLICSCOM which is housed within the unit. The only time the PLICSCOM is needed is when the sensor needs to be configured. The storage temperature rating for the PLISCOM is negative 40 degrees Fahrenheit; therefore it is reasonable to assume that the sensor would function at negative 2 degrees Fahrenheit. It is reasonable to assume that all components mounted outside will be able to survive and function as designed during site-specific freezing conditions.

One of the SFPLI channel displays, ILI09780, is protected from applicable external hazards by being located inside the AB, a safety related structure. The other channel display, ILI09781, is located outside on the west wall of the FHB. The outdoor channel display location is considered an alternative approach from NEI 12-02, Revision 1. The display, battery panels, transmitter, conduit, and related instrument waveguide pipe for ILI09781 are all located outside and are not protected against the high winds hazard. To compensate for the lack of protection for ILI09781 against the high winds hazard, the allowable outage time for the protected channel, ILI09780, is reduced from 90 days to 30 days to minimize the likelihood that a high winds event could damage ILI09781 and cause a loss of spent fuel pool cooling while ILI09780 is out of service. The allowed outage time for ILI09781 is also reduced to 30 days.

The only parts of the primary and backup trains of level instrumentation that will be in the environment of 212 degrees Fahrenheit and 100 percent humidity (Section 3.4 of NEI 12-02, Revision 1) are the waveguide horn and portions of the waveguide pipe. These items are made of stainless steel and will be able to function normally in these environments. All other equipment will be mounted in areas where these conditions do not exist.

VCSNS Unit 1 will maintain recommended spare parts on site.

RAI #2

Please provide the following:

a) The design criteria to be used to estimate the total loading on the mounting device(s), including static weight loads and dynamic loads. Describe the methodology to be used

to estimate the total loading, inclusive of design basis maximum seismic loads and the hydrodynamic loads that could result from pool sloshing or other effects that could accompany such seismic forces.

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

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

<u>Response to RAI #2</u>

a) Applicable hydrodynamic (wave impact) forces are included with seismic inertial and static loads in the radar horn/pipe qualification and mounting qualification load combinations.

The primary and backup channels consisting of the remote transmitter, horn, and waveguide piping are mounted seismically. The mounting designs for the remote transmitter support and horn support were qualified considering the total weight of the waveguide piping and its components and the seismic accelerations for the building structure. To meet the seismic design criteria contained in NEI 12-02, the loading for the mounting supports was generated considering Safe Shutdown Earthquake (SSE) seismic accelerations.

The remote transmitter mounting support is qualified by a generic calculation using a simple C-channel steel section that is welded centrally on a steel base plate mounted on the outside west wall of the FHB (backup) and the east wall of the north AB stairwell (primary). The generic sensor mounting support was designed for generic enveloping seismic accelerations of 10g (horizontal) and 6.67g (vertical), which envelope the site seismic response spectra. The calculation further assumed an enveloping sensor cantilevered length. VCSNS calculation FX003, *FX003 Piping Analysis* and VCSNS calculation FXH5042, *Pipe Support FXH5042*, compare the site specific loadings to the vendor supplied generic calculations and determine the site specific loading is bounded by the generic calculation.

VCSNS has decided to treat the waveguide pipe as quality related piping. This means the piping will meet ASME, Sec III, Class 2, design requirements, but using non-ASME Stamped Code material, making it Seismic Category 1. The seismic spectra used were taken from both the Operating Basis Earthquake (OBE) and SSE specific for VCSNS Unit 1 at the SFP and adjacent building (i.e., composite spectra). Differential building movement was taken into account (SAM – seismic anchor movement), along with the pool hydrodynamic sloshing loads. The reactions at the support locations (from the analysis above) were reviewed to ensure they were bounded by the loads used in the vendor supplied calculations.

The horn mounting support is qualified similarly to the remote transmitter support. It is qualified by a generic calculation which has been verified to bound site specific geometry and seismic loadings. The generic design of the horn mounting support conservatively uses generic seismic accelerations of 10g (horizontal) and 6.67g (vertical). VCSNS calculation FX003 and VCSNS calculation FXH5043, *Pipe Support FXH5043*, compare the site specific loadings to the vendor supplied generic calculations and determine the site specific loading is bounded by the generic calculation.

The mounting supports for the waveguide piping are attached to either the outside west wall of the FHB, the 463 foot elevation of the FHB floor, or the east wall of the north AB stairwell.

The mounting design for the power control panels and auxiliary battery panels are qualified considering the total weight of the panel and its associated components and the seismic accelerations for the building structure. To meet the seismic design criteria contained in NEI 12-02, the loading for the panels were generated considering beyond design basis seismic accelerations.

b) & c) The waveguide piping assembly, horn, and remote transmitter are designed to attach to the FHB concrete floor, outside west wall of the FHB, and east wall of the north AB stairwell by means of mounting supports. These mounting supports consist of sensor support and horn support. Spacing of the mounting supports complies with site specific specifications and standards and qualification restrictions for the waveguide pipe assembly. Site Drawings 317-322, Sheet 1 and Sheet 2, show the designed attachment points for the waveguide piping and horn assemblies.

The remote transmitter mounting support is designed using a simple C-channel steel section that is welded centrally on a steel base plate on the east wall of the north AB stairwell (primary) and outside west wall of the FHB (backup). The base plate is anchored to the wall with four Hilti bolts.

The horn mounting support is designed using a simple C-channel steel section that is welded on a base plate and anchored to the FHB concrete floor. The base plate is anchored to the floor with four Hilti bolts.

The power control panel is designed to attach to a column in the AB (primary) and the outside west wall of the FHB (backup). The mounting of the power control panel consist of bolting the power control panel to two sections of Unistrut. The Unistrut is anchored to the column and wall using Hilti bolts.

RAI #3

Please provide an evaluation verifying the seismic testing of the horn and waveguide assembly and the electronics units, and the analysis of the combined maximum seismic and hydrodynamic forces on the cantilevered portion of the assembly exposed to the potential sloshing effects, demonstrate 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.

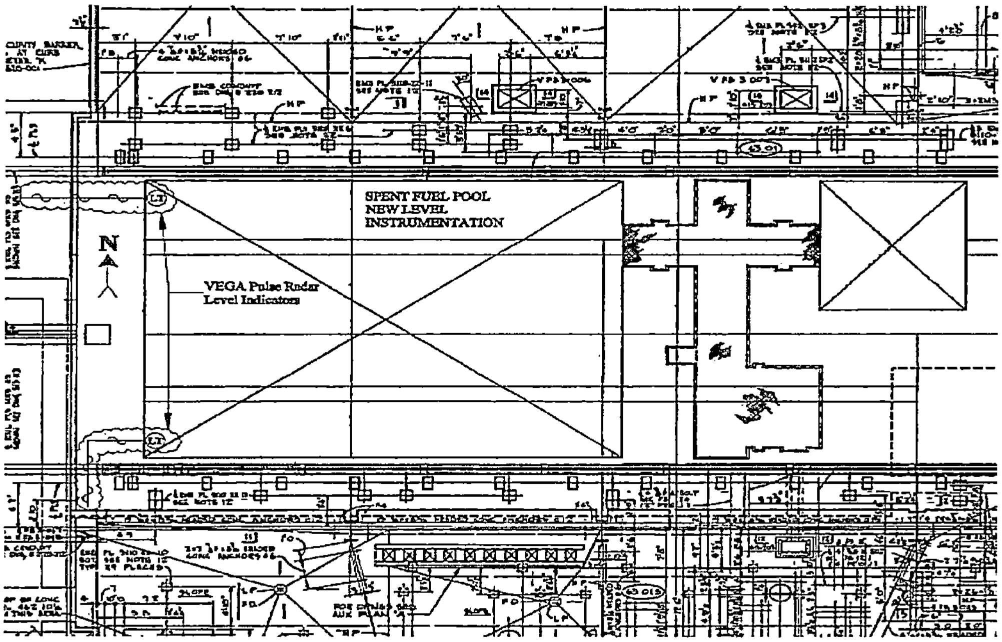
Response to RAI #3

The potential SFP sloshing effects due to a postulated seismic event have been evaluated for the primary and backup channels in VCSNS design calculation DC00080-004, *Spent Fuel Pool Sloshing Evaluation for SFPLI Equipment*. The maximum seismic induced wave height in the SFP as well as maximum hydrodynamic (convective mode) pressures which are potentially imparted upon FLEX SFPLI installed by Engineering Change Request (ECR) 51001 were calculated. The maximum calculated wave height of 2.56 feet and associated hydrodynamic pressure of 1.1 psi is presented as input to design and calculation of the applicable FLEX SFPLI components installed atop the SFP walls in the FHB.

The Required Response Spectra (RRS) used for seismic testing of the SFP primary and backup level instrumentation and the electronics units envelop the VCSNS design basis seismic spectra for the locations where the equipment will be installed.

The remote transmitter mounting support is qualified by a generic calculation using a simple C-channel steel section that is welded centrally on a steel base plate on the outside west wall of the FHB (backup) and the east wall of the north AB stairwell (primary). The generic sensor mounting support was designed for generic enveloping seismic accelerations of 10g (horizontal) and 6.67g (vertical), which envelope the site seismic response spectra at the applicable locations and frequencies. The calculation further assumed an enveloping sensor cantilevered length.

The horn mounting support is qualified similarly to the remote transmitter support. It is qualified by a site specific calculation using a simple C-channel steel section welded on a base plate on the concrete operating deck floor in the spent fuel pool area. The generic design of the horn mounting support conservatively uses generic seismic accelerations of 10g (horizontal) and 6.67g (vertical). A visual representation of the pool edge mounting configuration for the radar horn is shown in Figures 1 and 2 of the VCSNS response to NRC's request for additional information regarding the SFPLI OIP (i.e., ADAMS Accession No. ML15062A008). The submittal also provided the mounting configuration. The layout is depicted in the following SFPLI location drawing.



RAI #4

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

Response to RAI #4

The adequacy of the structural/seismic design and installation comply with the site specific requirements for seismic design and installation of seismically qualified equipment. The calculations which qualify the mounting of the SFPLI equipment also consider any potential impact to the affected structures and evaluate as applicable. The applied loads consist of self-weight, thermal growth, seismic inertial loads, SAM, and loads associated with potential hydrodynamic effects for the equipment located on the SFP operating deck and exposed to postulated pool sloshing. The design of the waveguide piping analyzes the piping as if it were ASME, Section III, Class 2 piping.

The instrumentation and electrical panels are mounted as Seismic Category 1 equipment. The loadings are composed of seismic accelerations and displacements developed from the plant floor response spectra curves for the respective locations. The load combinations used are in accordance with standard plant design criteria (VCSNS Unit 1 Final Safety Analysis Report Sections 3.8.4.3 and 3.9.2.2). Site calculations were completed for the mounting design of the SFPLI equipment.

RAI #5

Please provide analysis of the maximum expected radiological conditions (dose rate and total integrated dose) to which the equipment located within the FH building exterior wall and the auxiliary building stairwell will be exposed. Also, provide documentation indicating how it was determined the electronics for this equipment is capable of withstanding a total integrated dose of $1X10^3$ Rads. Discuss the time period over which the analyzed total integrated dose was applied.

Response to RAI #5

The area above and surrounding the pool will be subject to radiation dose in the event that the water levels are lowered and even potentially higher levels if the fuel becomes uncovered. The only parts of the instrument channels in the pool radiation environment are the metallic waveguide, horn, and fused silica glass horn cover which are not susceptible to the expected levels of radiation, and silicone elastomer moisture seal for the horn cover, which has associated radiation test data from the manufacture (AREVA Document 51-9202556-004, *Qualification Analysis of VEGAPULS 62 ER Through Air Radar*). The silicon elastomer seal has been tested for up to $7x10^8$ rad, although above $1.6x10^8$ rad the elastic modulus began to increase substantially. Nevertheless, even considering the conservative scenario above, the silicon elastomer test data demonstrates that the silicon is acceptable for the expected radiation dose for this application. VCSNS design calculation, DC00030-057, *Operator Dose as a Function of SFP Water Level*, contains dose rates for multiple receiver points located in the SFP Building, in the area immediately surrounding the SFP (i.e., Table 7 of Section 8). Receiver Point 3 is the bounding location in the area surrounding the pool, and the dose rate for 1 foot of water cover, is calculated to be $8.30x10^6$ mr/hr. The Total Integrated Dose, calculated over a 7 day period, is $1.39x10^6$ Rad, which is below the point at which the elastic modulus of the elastomer begins to increase and also below the tested limit of the elastomer.

The electronics are located in areas that are shielded from the direct shine from the fuel, and bounce and scatter effects above the pool. As noted in AREVA Document 51-9202556-004, Table C-1 of USNRC Bulletin 79-01B, *Environmental Qualification of Class 1E Equipment,* contains a listing of radiation thresholds for various materials. The most susceptible material, and therefore having the lowest threshold, was NMOS electronics with a threshold of $1x10^3$ rad. 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 (NUREG 1793, Section 3.11.3.2.1). This is further confirmed in Regulatory Guide 1.209, *Guidelines for Environmental Qualification of Safety-Related Computer-Based Instrumentation and Control Systems in Nuclear Power Plants,* 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 circuits to about 105 Gy (104 krad) for radiation hardened circuits." Based on the information provided in the references listed above, the electronics in the VEGAPULS 62 ER sensor, displays, and power control panel are considered to be qualified for $1x10^3$ rad.

VCSNS Unit 1 has developed dose calculations (i.e., VCSNS design calculation, DC00030-057) for the areas in which the electronics of the systems will be located (AB 463 feet north stairwell, AB 463 feet General Area south of the equipment hatch, and at the AB Column). The calculation results contain dose rate and total integrated dose (TID) for each area. The calculation results conclude that the dose in these areas is below the radiation threshold for the electronics outlined in AREVA Document 51-9202556-004. The maximum TID for the bounding location was calculated to be 8.75×10^{1} rad and the maximum dose rate was calculated to be 2.93×10^{3} mr/hr. The TID was calculated over a time period of 7 days. The calculation modeled SFP boil-off and calculated doses considering level decreases from normal operating level to 1 foot of water cover above the fuel. The calculation considered the 1foot of water remained constant until the end of the evaluated time period.

RAI #6

Please provide information indicating a) the temperature ratings and whether the temperature ratings for the system electronics are continuous duty ratings; and, b) the maximum expected ambient temperature in the rooms in which the system electronics will be located under BDB conditions, with no AC power available to run Heating Ventilation and Air Conditioning (HVAC) systems.

Response to RAI #6

a) Per AREVA Document 01-9225772-002, *Through Air Radar Spent Fuel Pool Level Instrument (SFPLI) Instruction Manual for V.C. Summer*, the continuous duty temperature ranges for the system electronics are as follows:

VEGAPULS 62 ER Sensor is -40 to 176°F

VEGADIS 61 Indications and Adjustment Unit -4 to 158°F

Power Control Panel -13 to 160°F

Auxiliary Battery Panel -13 to 160°F

Per AREVA Document 51-9202556-004, *Qualification Analysis of VEGAPULS 62 ER Through Air Radar*, the remote transmitter has been tested in accordance with IEC 60068-2-30 which varies the temperature from room temperature to elevated temperature at high humidity conditions, to verify that the test item withstands condensation that can occur due to the changing conditions. The sensor has been tested to EN 60529:2000 to achieve the rating IP66/IP68, which signifies totally dust tight housing, protection against water jets and waves, and protection against prolonged effects of immersion under 0.2 bar pressure. The VEGADIS 61 indicating and adjustment module has a housing which is similar to the VEGAPULS 62 ER remote transmitter and are therefore considered equally covered by the two tests.

The power control panel and auxiliary battery panel is rated for a maximum temperature of at least 158 degrees Fahrenheit. Allowing for 9 degrees Fahrenheit heat rise in the panel, the overall panel maximum ambient temperature for operation is 149 degrees Fahrenheit. The power control panel and auxiliary battery panels enclosures are rated NEMA 4X and provides protection to the internal components from the effects of high humidity environments.

b) Per VCSNS Technical Report TR00080-003, *FLEX Equipment Ventilation and Habitability Assessment*, the maximum temperature expected in the north stairwell of the AB is 150 degrees Fahrenheit. The only electronic equipment mounted in this area is the primary remote transmitter (VEGAPULS 62 ER Sensor). On the 463 foot elevation of the AB, south of the AB equipment lift, the maximum temperature range is 105-115 degrees Fahrenheit. The electronic equipment mounted in this location is the VEGADIS 61 indications and adjustment unit, the power control panel for the primary channel, and the auxiliary battery panel for the primary channel. Per VCSNS design calculation DC00080-002, *Site Hazard Design Parameters for FLEX*, the maximum outdoor temperature for components located outside is 107 degrees Fahrenheit.

Per the temperature ranges listed in section a) of this RAI it is reasonable to conclude that the electronics will be located in an area in which they will be able to withstand the maximum expected ambient temperature in the rooms in which the system electronics will be located under BDB conditions.

RAI #7

Please provide information indicating the maximum expected relative humidity in the rooms in which the system electronics will be located under BDB conditions, with no AC power available to run HVAC systems, and whether the sensor electronics are capable of continuously performing required functions under this expected humidity condition.

Response to RAI #7

The maximum humidity postulated for the SFP area is 100 percent relative humidity, saturated steam. The radar sensor electronics will be located outside of the spent fuel pool room in an area away from the steam atmosphere. The waveguide pipe can tolerate condensation formation on the inner wall surface, provided condensate pooling does not occur within the waveguide pipe. Condensate pooling is prevented by installing a weep hole(s) at the low point(s) in the waveguide pipe. The system electronics for the system are contained in the power control panel, which is sealed and gasketed. The power control panel is a NEMA 4X enclosure; it is designed for indoor or outdoor use to provide a degree of protection with respect to harmful effects on the equipment due to the ingress of moisture and condensation (e.g. rain, sleet, snow, splashing water, and hose directed water). The NEMA 4X power control panel enclosure provides protection to the internal components from the effects of high humidity environments (See Section 2.3 of AREVA Document 51-9202556-004, *Qualification Analysis of VEGAPULS 62 ER Through Air Radar*, for further information).

RAI #8

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 the referenced previous testing provides an appropriate means to demonstrate reliability of the sensor under the effects of severe shock.

Response to RAI #8

The following response is taken from Section 2.2 of AREVA Document 51-9202556-004, *Qualification Analysis of VEGAPULS 62 ER Through Air Radar:*

The VEGAPULS 62 ER through air radar sensor is similar in form, fit, and function to the VEGAPULS 66 including PLICSOM indicator that was shock tested in accordance with MIL-S-901D, and vibration tested in accordance with MIL STD 167-1. The test report is contained in AREVA Document 38-9193058-000, *Report of Shock and Vibration Test on Two (2) 3" Navy Flange Mount Level Indicators and One (1) 3" Triclamp, 1½" Navy Flange Mount Level Indicator for Ohmart/VEGA Corporation Cincinnati, Ohio.* Differences in construction are mainly in the smaller size of the VEGAPULS 62 ER. The shape of the housing, its material construction (precision cast stainless steel), the mass and form factor for the electronics modules, the materials and method for mounting the electronics into the sensor housing are the same between the VEGAPULS 66 and the VEGAPULS 62 ER. The incoupling and antennas for VEGAPULS 62 ER are smaller and lighter than for VEGAPULS 66 and therefore less susceptible to shock and vibration. Therefore, the shock and vibration testing is considered to be applicable to the VEGAPULS 62 ER sensor and the PLICSCOM indicator.

The MIL-S-901D test consisted of a total of nine (9) shock blows, three (3) through each of the three (3) principal axes of the sensor, delivered to the anvil plate of the shock machine. The heights of hammer drop for the shock blows in each axis were one (1) foot, three (3) feet and five (5) feet.

The MIL STD 167-1 vibration test procedure applies to equipment found on Navy ships with conventional shafted propeller propulsion. The test frequencies ranged from 4 Hz to 50 Hz with amplitudes ranging from 0.048 inch at the low frequencies to 0.006 inch at the higher frequencies. This procedure is not applicable to high-speed or surface effect ships that are subject to vibrations for high-speed wave slap, which produce vibration amplitudes and frequencies in excess of the levels on conventional Navy ships. The potential vibration environment around the spent fuel pool and surrounding building structure might contain higher frequencies than were achieved in the testing discussed above. However, in addition to the MIL Standard testing above, the VEGAPULS 62 ER sensor has been shock tested in accordance with EN 60068-2-27 (100g, 6 ms), and vibration tested in accordance with EN 60068-2-6, Method 204 (except 4g, 200Hz).

The VEGADIS 61 and VEGADIS 62 displays feature housings that are similar in size, materials, and form factor to the VEGAPULS 62 ER sensor, contain a terminal base attached with two screws similar to the electronics module in the VEGAPULS 62 ER, and contain a LCD display module that installs into the housing similar to the PLICSCOM in the VEGAPULS 62 ER. Therefore, these devices are considered to have the same resistance to shock and vibration as the VEGAPULS 62 ER and PLICSCOM.

RAI #9

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 the referenced previous testing provides an appropriate means to demonstrate reliability of the sensor under the effects of high vibration.

Response to RAI #9

See response to RAI #8. The response discusses both shock and vibration considerations.

RAI #10

Please 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.

Response to RAI #10

By design, the VEGADIS 62 display is mounted along with the power control panel to a stainless steel mounting plat. Both the display and the Power Control Panel (PCP) were seismically (vibration) tested as documented in AREVA Document No. 174-9213558-006, *Seismic Test Report for VEGAPULS.* For the seismic testing, the stainless steel mounting plate including the display and power control panel, were mounted to a rigid frame. Therefore, the assembly was tested in the as-installed configuration and frequencies and applicable forces were inherent to the testing. The seismic testing and associated qualification documentation was performed in accordance with IEEE-344-2004. The seismic Test Response Spectrum enveloped the site specific RRS for the installed locations of the display/power control panel. Per Section 5.0 of AREVA Document No. 174-9213558-006, the results of the seismic testing were satisfactory, both structurally and functionally, for the seismic event. Resonance frequencies and associated forces were not calculated as part of the seismic testing. VCSNS site specific calculation, DC0396H-039 Rev 0, *Mounting Detail for SFPLI Panels*, performed mounting qualification for the mounting configuration used at VCSNS. The mounting configuration included rigid mounting of the stainless steel mounting plate to existing concrete walls of Category 1 structures. The seismic accelerations selected were the peak of the floor response spectra for the applicable locations, and also a multi-mode factor was applied to determine seismic forces on the mounting.

RAI #11

Please provide an evaluation of the seismic testing results to show that the instrument performance reliability, following exposure to simulated seismic conditions representative of the environment anticipated for the SFP structures at Virgil C. Summer Nuclear Station has been adequately demonstrated. Include information describing the design inputs and methodology used in any analyses of the mounting of electronic equipment onto plant structures, as requested in RAI 4-D above.

Response to RAI #11

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 IEEE standard 344-2004. The system was monitored for operability before and after the resonance search and seismic tests. The required response spectra used for the five OBEs and the single SSE in the test were taken from EPRI TR-107330, Figures 4-5. The test response spectra from EPRI TR-107330, Figures 4-5, bound the building required response spectrum at all the locations where equipment will be located. Section 2.1 of AREVA Document 51-9202556-004, *Qualification Analysis of VEGAPULS 62 ER Through Air Radar*, contains a summary of seismic qualification.

Intermediate mounting brackets for the waveguide piping as well as mounting for the power control panel and associated equipment has been designed and installed in accordance with site specific standards for seismically mounted equipment and pipe supports. See response to RAI #4 for information regarding design inputs and methodology used in analyses of equipment mounting.

RAI #12

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

Response to RAI #12

Independence

The primary instrument channel is redundant to and independent of the backup instrument channel. The power sources for the primary and backup channels will be independent through the utilization of stand-alone battery power. The channels will be separated by a distance exceeding the shortest length of a side of the SFP as defined by NEI 12-02, Section 3.2.

Power Supplies

Both the primary and backup channels are powered from dual selectable power supplies utilizing dedicated lithium ion batteries with backup batteries available for easy replacement.

The minimum expected battery life for each battery supply provides for 7 days of continuous service. The battery systems will include provision for battery replacement should the installed battery be non-functional following the event. Spare batteries will be readily available to maintain power to the system for the entire period of the FLEX response.

RAI #13

Please provide a) A description of how the spare battery will be maintained to ensure that it will be readily available and b) The results of the calculation depicting the battery

backup duty cycle requirements demonstrating that battery capacity is sufficient to maintain the level indication function.

Response to RAI #13

a) New preventative maintenance (PM) activities for the SFPLI system and spare batteries have been created in accordance with VCSNS Procedure, SAP-0143, *Preventative Maintenance Program*. The PM tasks draw on input from AREVA, VCSNS maintenance best practices, EPRI templates, and industry operating experience (OE).

The following PM activities will verify the SFP level indication function, verify battery capability, and replace Lithium C-cell batteries every six months. These PMs ensure continued proper functioning of the VEGAPULS 62 ER Through Air Radar spent fuel pool level instrument:

Equipment #	Equipment name	PM summary	PM Frequency
ILT09780	FLEX SFPLI Primary Remote Transmitter	Verify SFP Level Indication Function, Verify Battery Capability, and Replace Lithium C-Cell Batteries	6 Months
ILT09781	FLEX SFPLI Backup Remote Transmitter	Verify SFP Level Indication Function, Verify Battery Capability, and Replace Lithium C-Cell Batteries	6 Months
XPN6075	FLEX SFPLI Primary PCP	Verify SFP Level Indication Function, Verify Battery Capability, and Replace Lithium C-Cell Batteries	6 Months
XPN6077	FLEX SFPLI BACKUP PCP	Verify SFP Level Indication Function, Verify Battery Capability, and Replace Lithium C-Cell Batteries	6 Months

b) The power control panel and auxiliary battery panel contain eight Tadiran Model TL-5920 C-cell lithium batteries each that provide power. The battery storage life is reported by the manufacturer to be up to 20 years; however, the replacement interval recommended by AREVA is coincident with mandated surveillance of the level instrument. The battery life for worst case condition of 20 mA discharge rate is derived from the manufacturer technical data sheet in AREVA Document 51-9202556-004, *Qualification Analysis of VEGAPULS 62 ER Through Air Radar.*

Vendor analyses support the battery capacity (at 20mA continuous discharge) can sustain approximately 130 hours at negative 22 degrees Fahrenheit and approximately 230 hours at 32 degrees Fahrenheit. The lifetime increases significantly at lower discharge rates or at higher temperatures. Lifetimes at the temperatures from AREVA Document 51-9202556-004 for a 20 mA discharge rate are summarized in the table below.

Table 2-1: Backup Battery Lifetimes vs. Temperature

Temperature	Ampere-Hours to 2.0 volts	Lifetime to 2.0 volts @ 20 mA (hours)	Lifetime at full voltage @ 20mA (hours)
-30°C (-22°F)	2.7	135	131
0°C (32°F)	4.8	240	233
25°C (77°F)	6.8	340	330
55°C (131°F)	7.2	360	349
75°C (167°F)	4.3	215	209

The system is planned to be energized weekly for a channel check, the check is expected to take less than 1 minute, so 2 minutes will be used as a conservative estimate. The worst case current draw from AREVA Document 51-9202556-004 is 20mA. Since the extreme temperature of negative 22 degrees Fahrenheit is not a reasonable assumption for normal operations when the channel check will be performed, a more realistic temperature of 77 degrees Fahrenheit is used for estimation purposes. Therefore, using the above inputs, as well as vendor supplied battery information, the battery usage is estimated below.

Weekly: 20mA × (2/60) hrs = 0.667mA-hrs

Yearly: 52 × 0.667 mA-hrs = 34.67 mA-hrs

<u>Or</u>

Reduction of rated life: 34.67/6600 = 0.53%

(Approximately 1.7 hours at nominal case environmental conditions)

As noted in response to Item a) above, the batteries are expected to be changed out every 6 months during calibration, but even if calibration is extended to 1 year, it is seen the weekly channel checks will have minimal impact on battery life of the primary batteries. Both the primary and the backup batteries are maintained in standby mode, and switched off/open. The circuit is open and there is no battery discharge while the instrument is switched off. The backup batteries will retain full qualified life as they will be maintained in the standby mode for the entire replacement cycle.

RAI #14

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

Response to RAI #14

The sensor, PLICSCOM display, 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 IEEE Standard 344-2004. The system was monitored for operability before and after the resonance search and seismic tests. The system is normally de-energized and is only energized during an ELAP or loss of normal SFP indication event. The loss of site power and subsequent restoration of power will have no impact on the SFPLI system, as the system is electrically isolated from normal plant power sources.

The factory acceptance testing of the channels demonstrated acceptable accuracy and performance capability. The factory acceptance testing was performed utilizing a reflective target for the following conditions:

normal operating conditions

simulated loss of normal AC power and automatic transfer to battery backup power

simulated BDB conditions with steam injection into the radar horn

simulated BDB conditions water introduction into the radar horn and waveguide pipe

The system is expected to retain the demonstrated accuracy following a loss of power and subsequent restoration. The system is normally de-energized and is only energized during an ELAP event, or other loss of normal spent fuel pool indication event. The loss of site power and sub-sequent restoration of power will have no impact on the SFPLI system, as the system is electrically isolated from normal plant power sources.

Post modification and the vendor site acceptance test where conducted at the same time. With the horn in the normal operating position, the actual water level was calculated by measuring the distance from the centerline of the waveguide pipe with a tape measure and then subtracting that distance from the known elevation of the centerline of the waveguide pipe. The minimum and maximum parameters were adjusted. A baseline for the sensor was then created. After this was done a small metal target was placed in the radar beam path to verify the system responded in the correct direction. The horn was then rotated 180 degrees to the calibration position and a metal target was placed above the horn in the radar beam path at a different distance than the distance to the water level when the horn was in the normal operating position. The indicated level was then compared to the expected level as measured from the centerline of the waveguide pipe including the offset in the calibration position as defined in the factory acceptance test report from the vendor, AREVA. The horn was then returned to the normal operation position, and the indicated level was verified to be within tolerance. The results for the primary SFPLI (Southwest) was an error of negative 0.04 feet with a measurement reliability of 36 dB. The results for the backup SFPLI (Northwest) was an error of 0.00 feet with a measured reliability of 60 dB systems. See AREVA Document 51-9241803-000, *Through Air Radar Spent Fuel Pool Level Instrument (SFPLI) Site Acceptance Test (SAT) Report for VCS Unit 1.* Both errors above fall within the vendors supplied accuracy of plus/minus 0.083 feet and are acceptable.

Also as part of this test, a power verification test was performed. This test verified the system functionally ran from each independent power source. While each battery source was tested, the other was removed from the circuit.

RAI #15

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

Response to RAI #15

The primary SFP level channel has multi-point testing capability, in that the radar horn antenna can be rotated away from the SFP water surface and aimed at a movable metal target that is positioned at known distances from the horn. This allows checking for correct readings at various points across the instrument measurement range and validates the functionality of the installed system.

The backup SFP level channel design readily supports periodic calibration across its monitoring range. The instrument is equipped with a calibration test tee and can be isolated from the process for routine calibrations.

Site maintenance procedure ICP-390.012, *Spent Fuel Pool Level ILT09780 and ILT09781 Calibration,* details in-situ calibration process that will result in channel calibration being maintained at its design accuracy.

RAI #16

Please describe the evaluation used to validate the display locations 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, 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.

Response to RAI #16

Per ECR-51001, *FLEX Spent Fuel Pool Level Indication*, local indication of SFP level from the primary channel of the FLEX SFPLI system is located on the 463 foot elevation of the AB, on a column near the AB equipment lift. This area is outside of the FHB and not subject to adverse radiological, heat, or humidity conditions which would be expected inside the FHB. Per TR00080-006, *FLEX Timeline Constraints Basis*, temperature ranges in this area are expected to be no more than 105-115 degrees Fahrenheit, provided that actions are taken within 14 hours to promote natural circulation ventilation. These actions are incorporated into FSP-20.1, *Vital Area Emergency Ventilation*, and have been validated per Attachment 10 of TR00080-007, *FLEX Validation Document*. Per the EQ Zone Database (for Zone AB-71), the maximum expected relative humidity is 90 percent. These conditions allow continued equipment operation and intermittent personnel access without further action.

Per ECR-51001, local indication of SFP level from the backup channel of the FLEX SFPLI system is located in the yard, at the 436 foot elevation, on the outside West wall of the FHB. This area is outside of the FHB and not subject to adverse radiological, heat, or humidity conditions which would be expected inside the FHB. Per Section 4.6 of TR00080-006, maximum ambient temperature during an ELAP event is 107 degrees Fahrenheit, which will allow continued equipment operation and intermittent personnel access without further action.

Design calculation DC00030-057, Revision 1, *Operator Dose as a Function of SFP Water Level*, calculates the dose rates at the location of the SFPLI sensors and displays. Table A4 of DC00030-357 contains a summary of dose rates at the desired locations. Location 2 is the display location for the primary channel (in the AB 463 General Area) and Location 3 is the location for the secondary channel (on the exterior wall of the FHB). The maximum dose rate is calculated considering 1 foot of SFP water above the top of the spent fuel, or elevation 436.5 feet. The maximum dose rate for Location 2 is $1.55x10^3$ mr/hr and the maximum dose rate for Location 3 is $1.20x10^3$ mr/hr.

Use of the FLEX SFPLI system is directed from FSP-11, *Alternate SFP makeup and Cooling*, which is entered from EOP-6.0, *Loss of all ESF AC Power*, when SFP Level decreases less than 460.5 feet. Normal level in the SF Pool is 461.5 feet, with a low level alarm from design basis instrumentation at 461 feet (Refer to ARP-001-XCP-608, *Annunciator Response Procedure*, Window 1-2 SFP LVL HI/LO). While use of the FLEX SFPLI system is not specifically considered a time sensitive action (TSA), it is placed in service in the course of accomplishing SFP makeup, which is considered a TSA and must be performed within 87 hours per Section 4.5 of TR00080-006. Performance times are documented in TR00080-007, Attachment 22 (i.e., *Perform SF Pool Makeup).*

Access to either channel of SFPLI would be through the AB, which is a safety related structure and is considered to survive all FLEX hazards. Normal access may be impeded somewhat, but it is expected that no significant obstacles would exist to access either channel of indication. Travel times to the location are expected to be less than 15 minutes for the control room or AB operators. An operator will not be continuously stationed at either location. Those operators performing SFP makeup strategies will periodically monitor level on these indications to gauge the success of their makeup/pumping actions. As SFP makeup operations are performed well into Phase 2, it is expected that additional personnel are available, if necessary. EPP-020, Revision 12, *Emergency Personnel Exposure Control*, is used to control radiation exposure to plant personnel during emergencies. EPP-20, Attachment III, allows for up to 25 REM of dose to workers performing emergency activities to prevent large offsite dose releases that would be expected for the dose rates considered at the locations. The travel path to the backup display is shown in a supporting document on the e-portal.

RAI #17

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

Response to RAI #17

ICP-390.012, *Spent Fuel Pool Level ILT09780 and ILT09781 Calibration*

This is a maintenance procedure for periodic calibration and testing of SFPLI.

FSP-11, *Alternate SF Pool Makeup and Cooling*

This procedure directs use of the system prior to makeup operations to monitor SF Pool level. It enables operators to determine if makeup operations are successfully being implemented if/when normal indication is unreliable.

The following AOPs have been revised to include use of this system:

AOP-123.1, *Decreasing Level in the Spent Fuel Pool or Refueling Cavity During Refueling.*

AOP-123.4, *Loss of Spent Fuel Cooling*

AOP-123.5, *Decreasing Level in the Spent Fuel Pool with the Transfer Tube Valve Closed*

RAI #18

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.

Response to RAI #18

a) New PM activities for the SFPLI system and spare batteries have been created in accordance with VCSNS Procedure SAP-0143, *Preventative Maintenance Program*. The Preventative maintenance tasks draw on input from AREVA, VCSNS maintenance best practices, EPRI templates, and industry OE. The PM activities will verify spent fuel pool level indication function, verify battery capability, and replace Lithium C-cell batteries every six months. The PMs ensure continued proper functioning of the VEGAPULS 62 ER through Air Radar spent fuel pool level instrument. See the table in the response to RAI #13 for more information.

CR-15-03206 has been initiated to document the need for a channel check. Operations has agreed to perform a weekly channel check on trend rounds. Operations has revised OAP-106.1, *Operator Rounds*, to include this channel check.

b) Chapter 9 of the Beyond Design Basis Program Document describes the elements managing availability of BDB equipment, including the reliable wide-range SFPLI. The program document will state that a failure to meet the N capability (i.e., the minimum required equipment to implement a strategy) due to unavailable equipment requires initiation of actions within 24 hours of discovery to restore the N capability and the establishment of a compensatory measure(s) within 72 hours.

VCS-ERP-0012 contains guidance for necessary actions if one or more of the SFP level indicators are not available.

c) Unavailability of the SFP level indicators is managed with VCS-ERP-0012. This procedure captures the requirement to initiate actions if one or both of the instrument channels cannot be restored to functional status within the allotted timeframe. The allowed outage time for LI09781and LI09780 is 30 days. The allowable outage times are reduced because LI09781 is located outside and the channel is not protected from the high winds hazard. VCS-ERP-0012 provides guidance for the development of compensatory measures if the allowable outage times are exceeded.

Necessary compensatory measures include, but are not limited to the following:

- Increase Emergency Response Unit available staffing if a tornado watch is issued
- Initiate action to verify location of spare battery for the operable level indicator
- Initiate action to provide refresher training to Emergency Response Unit staff to review actions necessary for the dewatering strategy
- Initiate action to defer maintenance on the operable level indicator