FPL

May 12, 2015

L- 2015-115
10 CFR 2.202

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

St. Lucie Unit 1
Docket 50-335

RE: Florida Power & Light/St. Lucie Unit 1 Final Compliance with EA-12-051 Order Modifying Licenses with Regard to Reliable Spent Fuel Pool Instrumentation

References:

1. U.S. Nuclear Regulatory Commission, Order Number EA-12-051, Order Modifying Licenses with Regard to Reliable Spent Fuel Pool Instrumentation (Effective Immediately), dated March 12, 2012, Accession No. ML12056A044.
2. U.S. Nuclear Regulatory Commission, Interim Staff Guidance JLD-ISG-2012-03, "Compliance with Order EA-12-051, Reliable Spent Fuel Pool Instrumentation," Revision 0, dated August 29, 2012, Accession No. ML12221A339.
3. NEI 12-02, Revision 1, "Industry Guidance for Compliance with NRC Order EA-12-051, 'To Modify Licenses with Regard to Reliable Spent Fuel Pool Instrumentation,'" dated August, 2012, Accession No. ML12240A307.
4. FPL Letter L-2012-384, dated October 25, 2012, Florida Power & Light (FPL)'s Initial Status Report in Response to March 12, 2012 Commission Order Modifying Licenses with Regard to Requirements for Reliable Spent Fuel Pool Instrumentation (Order Number EA 12-051), Accession No. ML12300A420.
5. FPL Letter L-2013-079, dated February 28, 2013, Florida Power & Light/St. Lucie's Overall Integrated Plan in Response to March 12, 2012 Commission Order to Modify Licenses with Regard to Reliable Spent Fuel Pool Instrumentation (Order Number EA-12-051), Accession No. ML13063A026.
6. NRC Letter to Florida Power & Light St. Lucie Nuclear Plant, Units 1 and 2 - Request for Additional Information Regarding Overall Integrated Plan for Reliable SFP Instrumentation (Order No. EA-12-051) (TAC Nos. MF00090 and MF0091), dated July 16, 2013, Accession Number ML13196A079.
7. FPL Letter L-2013-223, dated July 26, 2013, Florida Power & Light/St. Lucie's Response to Request for Additional Information Regarding Overall Integrated Plan in Response to Order EA-12-051, "Reliable Spent Fuel Pool Instrumentation," Accession No. ML13219A838.
8. FPL Letter L-2013-253, dated August 27, 2013, Florida Power & Light/St. Lucie's First Six-Month Status Report to the Overall Integrated plan in Response to March 12, 2012 Commission Order to Modify Licenses with Regard to reliable Spent fuel Pool Instrumentation (Order Number EA-12-051), Accession No. ML13242A006.
9. NRC Letter to Florida Power & Light St. Lucie Nuclear Plant, Units 1 and 2 - Interim Staff Evaluation and Request for Additional Information Regarding the Overall

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Integrated Plan for Implementation of Order EA-12-051, Reliable Spent Fuel Pool Instrumentation (TAC Nos. MF0990 and MF0991) dated November 19, 2013, Accession No. ML13274A473.

10. FPL Letter L-2013-061, dated February 28, 2014, Florida Power & Light/St. Lucie's Second Six-Month Status Report to the Overall Integrated plan in Response to March 12, 2012 Commission Order to Modify Licenses with Regard to reliable Spent fuel Pool Instrumentation (Order Number EA-12-051), Accession No. ML14064A193.
11. FPL Letter L-2014-275 dated August 27, 2014, Florida Power & Light/St. Lucie Third Six Month Status Report in Response to March 12, 2012 Commission Order to Modify Licenses with Regard to Reliable Spent Fuel Pool Instrumentation (Order Number EA-12-051), Accession No. ML14253A185.
12. FPL Letter L-2015-054 dated February 23, 2015, Florida Power & Light/St. Lucie Fourth Six Month Status Report in Response to March 12, 2012 Commission Order to Modify Licenses with Regard to Reliable Spent Fuel Pool Instrumentation (Order Number EA-12-051), Accession No. ML15071A265.
13. NRC Letter dated February 27, 2015, St. Lucie Plant, Units 1 and 2, 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 Nos. MF0984, MF0985, MF0990, and MF0991), Accession No. ML15035A670.

On March 12, 2012, the Nuclear Regulatory Commission (NRC) issued an order (Reference 1) to FPL. Reference 1 was immediately effective and directs FPL to install reliable spent fuel pool level instrumentation. Specific requirements are outlined in Attachment 2 of Reference 1.

Reference 1 required submission of an initial status report 60 days following issuance of the final interim staff guidance (Reference 2) and an overall integrated plan pursuant to Section IV, Condition C. Reference 2 endorses industry guidance document NEI 12-02, Revision 1 (Reference 3) with clarifications and exceptions identified in Reference 2. Reference 4 provided the FPL initial status report regarding mitigation strategies. Reference 5 provided the FPL Overall Integrated Plan.

Reference 1 requires submission of a status report at six month intervals following submittal of the Overall Integrated Plan. Reference 3 provides direction regarding the content of the status reports. The first, second, third, and fourth six month status reports were submitted in References 8, 10, 11, and 12. The Audit Report in Reference 13 did not identify any audit open items associated with the SFP Order.

Condition C.3 of the Order required all Licensees to report to the Commission when full compliance with the requirements of the order is achieved. This letter provides notification that FPL has completed the requirements of EA-12-051 and is in full compliance with the Order for St. Lucie Unit 1. The enclosures to this letter provide: 1) a summary of how the compliance requirements were met and 2) the response to the SFPI RAIs requested by the NRC in References 6 and 9.

This letter contains no new regulatory commitments. If you have any questions regarding this report, please contact Mr. Eric Katzman, Licensing Manager, at (772) 467-7734.

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

Executed on May 12, 2015.

Respectfully submitted,

Christopher R Costanzo

Christopher R. Costanzo
Site Vice President
St. Lucie Plant

CRC/KWF

cc: USNRC Regional Administrator, Region II
USNRC Senior Resident Inspector, St. Lucie Units 1 and 2

Enclosures:

1. St. Lucie Plant, Unit 1 Order EA-12-051 Compliance Requirements Summary
2. St. Lucie Plant SFPI RAI Replies

St. Lucie Plant, Unit 1
Order EA-12-051 Compliance Requirements Summary

BACKGROUND

The St. Lucie Plant developed an Overall Integrated Plan (OIP) (Reference 2), documenting how the requirements for reliable spent fuel pool level instrumentation (SFPLI) would be achieved, in response to Order EA-12-051, "Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events," (Reference 1); The St. Lucie Plant Units 1 and 2 OIP was submitted to the NRC on February 28, 2013 and was supplemented by Six-Month Status Reports (References 3, 4, 5 and 6), in accordance with Order EA-12-051 (the Order). By letter dated November 19, 2013, the NRC provided its Interim Staff Evaluation and Request for Additional Information Regarding Order EA-12-051 (Reference 7).

Each St. Lucie unit is provided with a dedicated Spent Fuel Pool (SFP). St. Lucie Unit 1 had two independent SFP level measurement channels, supplied and qualified by Westinghouse, installed in response to Reference 1.

On April 20, 2015, St. Lucie Unit 1 achieved full compliance with Order EA-12-051 and commenced reactor startup on April 22, 2015. Completion of the elements identified below for St. Lucie Unit 1, as well as References 2, 3, 4, 5 and 6, constitutes full compliance with Order EA-12-051 for St. Lucie Unit 1.

The design features for the spent fuel pool level instrumentation are identified in Engineering Change EC 280519. This document has previously been provided to the NRC and is available for their review.

COMPLIANCE SUMMARY

NRC RAI, ISE, AND AUDIT ITEMS - STATUS: COMPLETE

During the ongoing audit process (Reference 8), Florida Power & Light's (FPL) provided responses for the following items for St. Lucie Unit 1:

- Request for Additional Information (RAI)
- Interim Staff Evaluation (ISE) Open Items
- ISE Confirmatory Items
- Licensee Identified Open Items
- Audit Questions
- Safety Evaluation Review Items

The "St. Lucie Plant, Units 1 and 2 - Report for the Onsite Audit Regarding Implementation of Mitigating Strategies and Reliable Spent Fuel Pool Instrumentation Related to Orders EA-12-049

and EA-12-051," (Reference 9) delineated the items reviewed during the St. Lucie onsite audit. Reference 9 identified no open audit item(s) related to SFPI within the Safety Evaluation.

As requested by the NRC, FPL responses, or references to the source document for the responses, to the SFPLI RAIs are provided in Enclosure 2 of this correspondence. It is FPL's position that no further actions related to the SFPLI RAIs are required.

MILESTONE SCHEDULE ITEMS - STATUS: COMPLETE

St. Lucie Unit 1 Milestone	Completion Status
Submit OIP	Complete
Commence Engineering and Design	Complete
Complete Engineering and Design	Complete
Complete Procurement of SFP Instruments	Complete
Commence Installation of SFP Instruments	Complete
Level Measurement System Functional	Complete

IDENTIFICATION OF LEVELS OF REQUIRED MONITORING - COMPLETE

St. Lucie Plant has identified the three required levels for monitoring spent fuel pool (SFP) level in compliance with Order EA-12-051. These levels have been integrated into the site processes for monitoring level during events and responding to loss of SFP inventory.

INSTRUMENT DESIGNED FEATURES - STATUS: COMPLETE

The design of the SFP level measurement instrumentation system installed at St. Lucie Unit 1 complies with the requirements specified in Order EA-12-051 and described in NEI 12-02 "Industry Guidance for Compliance with NRC Order EA-12-051." The instrumentation system has been installed in accordance with the station design control process.

The instruments have been arranged to provide reasonable protection against missiles. The instruments have been mounted to retain design configuration during and following the maximum expected ground motion. The instruments will be reliable during expected environmental and radiological conditions when the SFP is at saturation for extended periods.

The instruments are independent of each other and have separate and diverse power supplies. The instruments will maintain their designed accuracy following a power interruption and are designed to allow for routine testing and calibration. The instrument display is readily accessible during postulated events and allows for SFP level information to be promptly available to decision makers.

PROGRAM FEATURES - STATUS: COMPLETE

Training of personnel performing maintenance functions including calibration and surveillance associated with the SFP level instrument channels at St. Lucie Unit 1 has been completed in accordance with an accepted training process as recommended in NEI 12-02, Section 4.1. Operating and maintenance procedures for the St. Lucie Unit 1 SFP level instrument channels have been developed, and integrated with existing procedures. These procedures have been verified and are available for use in accordance with the site procedure control program. Site processes have been established to ensure the instruments are maintained at their design accuracy.

REFERENCES

The following references support the St. Lucie Unit 1 SFPLI Compliance Summary:

1. U.S. Nuclear Regulatory Commission, Order Number EA-12-051, Order Modifying Licenses with Regard to Reliable Spent Fuel Pool Instrumentation (Effective Immediately), dated March 12, 2012, Accession No. ML12056A044.
2. FPL Letter L-2013-079, dated February 28, 2013, Florida Power & Light/St. Lucie's Overall Integrated Plan in Response to March 12, 2012 Commission Order to Modify Licenses with Regard to Reliable Spent Fuel Pool Instrumentation (Order Number EA-12-051), Accession No. ML13063A026.
3. FPL Letter L-2013-253, dated August 27, 2013, Florida Power & Light/St. Lucie's First Six-Month Status Report to the Overall Integrated plan in Response to March 12, 2012 Commission Order to Modify Licenses with Regard to reliable Spent fuel Pool Instrumentation (Order Number EA-12-051), Accession No.ML13242A006.
4. FPL Letter L-2013-061, dated February 28, 2014, Florida Power & Light/St. Lucie's Second Six-Month Status Report to the Overall Integrated plan in Response to March 12, 2012 Commission Order to Modify Licenses with Regard to reliable Spent fuel Pool Instrumentation (Order Number EA-12-051), Accession No. 14064A193.
5. FPL Letter L-2014-275 dated August 27, 2014, Florida Power & Light/St. Lucie Third Six Month Status Report in Response to March 12, 2012 Commission Order to Modify Licenses with Regard to Reliable Spent Fuel Pool Instrumentation (Order Number EA-12-051), Accession No. ML14253A185.
6. FPL Letter L-2015-054 dated February 23, 2015, Florida Power & Light/St. Lucie Fourth Six Month Status Report in Response to March 12, 2012 Commission Order to Modify Licenses with Regard to Reliable Spent Fuel Pool Instrumentation (Order Number EA-12-051), Accession No. ML15071A265.
7. NRC Letter to Florida Power & Light St. Lucie Nuclear Plant, Units 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. MF0990 and MF0991) dated November 19, 2013, Accession No. ML13274A473.
8. NRC letter to All Operating Reactor Licensees and Holders of Construction Permits, "Nuclear Regulatory Commission Audits of Licensee Responses to Mitigation Strategies Order EA-12-049," dated August 28, 2013, Accession No. ML13234A503.
9. NRC Letter dated February 27, 2015, St. Lucie Plant, Units 1 and 2, 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 Nos. MF0984, MF0985, MF0990, and MF0991), Accession No. ML15035A670.

St. Lucie SFPI RAI Replies with Attachments

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ST. LUCIE PLANT, UNTS 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

RAI #	RAI	Response
1	Please provide additional information describing how the proposed arrangement of the SFP Guided Wave Radar sensing cables and routing of the instrumentation cabling between the SFP and final mounting location(s) of the monitoring read-out panels meets the Order requirements with respect to arrangement of 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.	The St. Lucie OIP was submitted to the NRC on February 28, 2013. In its OIP, the licensee stated that the primary instrument channel level sensing components will be located at the southeast wall of the SFP, and the backup instrument channel level sensing components will be located at the southwest wall of the SFP, approximately 33ft. from the primary instrument channel. Additionally, in its OIP, the licensee stated, in part, that the two SFP level instrument channels will be installed in diverse locations, arranged in a manner that provides reasonable protection of the level indication function against missiles that may result from damage to the structure over the SFP. Channel separation (independence) will be provided as part of the design of the SFP level instrumentation. SFP level sensor probes will be installed near the southeast and southwest walls of the SFP. Sensor conditioning electronics and battery backup will be located at the 48' elevation of the Fuel Handling Building. Level indication will be located at the 19'6" elevation of the Fuel Handling Building approximately 105 feet away from the SFP. The SFP and sensor conditioning electronics will be separated by a reinforced concrete wall(s) that will provide protection against missiles and will not interfere with SFP activities. Cabling for power supplies and indications for each channel will be routed in separate conduits for each channel. In addition, St. Lucie submitted a follow up letter dated August 28, 2013 that provided two sketches depicting the planned locations for the SFP level probes and the location of the level instrument components. A brief description of the method of maintaining physical separation between the primary and backup instrumentation channels was also included. Subsequent to those submittals, the NRC issued an Interim Staff Evaluation and request for additional information (RAIs) on November 19, 2013. After review of the St. Lucie OIP and the August follow up letter, the NRC staff concluded that the methodologies and guidance contained in the St. Lucie design appears to be consistent with the guidelines provided in NEI 12-02, Revision 1; However, the staff requested final cable routing drawings to confirm the independence of the two SFP level instruments. Therefore, as part of this submittal St. Lucie is providing final design drawings (Attachment 2) that illustrates the instrumentation mounting locations as well as the conduit routing.
2	Please provide the following: a) The design criteria that will be used to estimate the total loading on the mounting device(s), including static weight loads and dynamic loads. Describe the methodology that will be used to estimate the total loading, inclusive of design basis maximum seismic loads and the hydrodynamic loads that could result from pool sloshing or other effects that could accompany such seismic forces. b) A description of the manner in which the level	a) All SFPIS equipment will be designed in accordance with the St. Lucie Nuclear Plant Safe Shutdown Earthquake (SSE) design requirements. The vendor, Westinghouse, has evaluated the structural integrity of the Spent Fuel Pool (SFP) mounting bracket in calculation CN-PEUS-13-28. The GTSTRUDL model, used by Westinghouse to calculate the stresses in the bracket assembly, considers load combinations for the dead load, live load (including water sloshing) and seismic load. Calculation CN-PEUS-13-28 conservatively applied a factor of safety of 2 to the PSL Safe Shutdown Earthquake (SSE) floor response acceleration. The reactionary forces from Calculation CN-PEUS-13-28 became the design inputs for qualification of the anchors bolts that mount to the spent fuel room floor. <u>Dead Loads (Static weight loads)</u>

RAI #	RAI	Response
	sensor (and stilling well, if appropriate) will be attached to the refueling floor and/or other support structures for each planned point of attachment of the probe assembly. Indicate in a schematic the portions of the level sensor that will serve as points of attachment for mechanical/mounting or electrical connections. c) A description of the manner by which the mechanical connections will attach the level instrument to permanent SFP structures so as to support the level sensor assembly.	The self-weight of equipment, structural steel members and cable/conduit weight are obtained from vendor cut sheets and American Institute of Steel Construction (AISC) Manual of Steel. <u>Seismic (dynamic loads)</u> The following methodology was used in determining the stresses on the mounting devices: • Frequency analysis is performed to obtain the natural frequencies of the structure for various modes. • SSE Seismic acceleration values are obtained from St. Lucie Nuclear Plant's response spectra curves as well as critical damping values. Again, the Westinghouse calculation CN-PEUS-13-28 conservatively applied a factor of safety of 2 to these values. • Modal responses are combined using the Ten Percent Method per U.S. NRC Regulatory Guide 1.92, Revision 1, "Combining Modal Responses and Spatial Components in Seismic Response Analysis". This method is endorsed per Unit 2 UFSAR, Chapter 3 and Unit 1, Plant Standard, STD-C-004 for St. Lucie Nuclear Plant. • The seismic loads for each of the three directions are combined by the Square Root of the Sum of Squares (SRSS) Method for Unit 2 and worst case horizontal plus vertical absolute sum for Unit 1. • As stated below, sloshing analysis is performed to obtain liquid pressure and its impact on bracket design. • The seismic results are combined with the dead load results and the hydrodynamic pressure results in absolute sum. These combined results are compared with the allowable stress values. <u>Sloshing (hydrodynamic loads)</u> Sloshing forces were obtained by analysis. The TID-7024, Nuclear Reactors and Earthquakes, 1963, by the US Atomic Energy Commission, approach has been used to estimate the wave height and natural frequency. Horizontal and vertical impact force on the bracket components was calculated using the wave height and natural frequency obtained using TID-7024 approach. Using this methodology, sloshing forces have been calculated and added to the total reactionary forces that would be applicable for bracket anchorage design. The analysis also determined that the level probe can withstand a credible design basis seismic event. During the design basis event, the SFP water level is expected to rise and parts of the level sensor probe are assumed to become submerged in borated water. The load impact due to the rising water and submergence of the bracket components has also been considered for the overall sloshing impact. Reliable operation of the level measurement sensor with a submerged interconnecting cable has been demonstrated by analysis of previous Westinghouse testing of the cable, and the vendor's cable qualification. Boron build up on the probe has been analyzed to determine the potential effects on the sensor. The following Westinghouse documents provide information with respect to the design criteria used, and a description of the methodology used to estimate the total loading on the device. a. CN-PEUS-13-28 – Pool-side Bracket Seismic Analysis b. WNA-TR-03149-GEN – Sloshing Analysis c. EQ-QR-269, WNA-TR-03149-GEN, EQ-TP-353 – Seismic Qualification of other components of SFPI b) The level sensor, which is one long probe, will be suspended from the launch plate via coupler/connector assembly. The launch plate is a subcomponent of the mounting bracket assembly, which is mounted to the refuel floor via anchors. Attachment 3 shows a sketch of the level sensor mounting bracket base plate with details of the mechanical attachment points. St. Lucie Nuclear Plant calculation PSL-1FSC-14-009 provides the anchorage using the reaction forces from

RAI #	RAI	Response
		Calculation CN-PEUS-13-28 that conservatively applied a factor of safety of 2 to the PSL Safe Shutdown Earthquake (SSE) floor response acceleration. c) The bracket assembly that supports the sensor probe and launch plate will be mechanically connected to the SFP structure. The mechanical connection consists of four concrete expansion anchors that will bolt the bracket assembly to the SFP structure via the base plate. The concrete expansion anchors will be designed to withstand 2xSSE (conservatively assumed) and will therefore meet the St. Lucie seismic installation requirements. The qualification details of the bracket are provided in Westinghouse's Pool-side bracket Seismic Analysis CN-PEUS-13-28 and the qualification of the anchorage to the floor is provided in St. Lucie specific calculation PSL-1FSC-14-009 – Anchorage Qualification for Spent Fuel Pool Instrumentation System Upgrades.
3	For RAI 2(a) above, please provide the results of the analyses used to verify the design criteria and methodology for seismic testing of the SFP instrumentation and the electronics units, including, design basis maximum seismic loads and the hydrodynamic loads that could result from pool sloshing or other effects that could accompany such seismic forces.	The following Westinghouse documents provide the analyses used to verify the design criteria and describe the methodology for seismic testing of the SFP instrumentation and electronics units, inclusive of design basis maximum seismic loads and hydrodynamic loads that could result from pool sloshing and other effects that could accompany such seismic forces: a. CN-PEUS-13-28 – Pool-side Bracket Seismic Analysis b. WNA-TR-03149-GEN – Sloshing Analysis c. EQ-QR-269, WNA-TR-03149-GEN, EQ-TP-353 – Seismic Qualification of other components of SFPI No equipment failures were noted as a result of seismic test runs. Seismic test data has been documented in the seismic test reports, referenced above. St. Lucie specific calculations PSL-1FSC-14-009 – Anchorage Qualification for Spent Fuel Pool Instrumentation System Upgrades, addresses the seismic qualification of the SFPIS equipment to the primary building structure. The design criteria used in this calculation consist of SSE Seismic acceleration values obtained from St. Lucie Nuclear Plant's response spectra curves as well as critical damping values and St. Lucie anchorage design criteria that requires a safety factor of 4 for anchorage shear and tension allowable.
4	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.	RAI-3 provides the design criteria and methodology used by Westinghouse for the mounting attachments of the probe bracket. The Westinghouse documents provide the analyses used to verify the design criteria and describe the methodology for seismic testing of the SFP instrumentation and electronics units, inclusive of design basis maximum seismic loads and hydrodynamic loads that could result from pool sloshing and other effects that could accompany such seismic forces: St. Lucie specific calculations PSL-1FSC-14-009 – Anchorage Qualification for Spent Fuel Pool Instrumentation System Upgrades, addresses the seismic qualification of the SFPIS equipment to the primary building structure. The design criteria used in this calculation to qualify mounting of the readout displays, conduit supports and electrical panels in the Reactor Auxiliary Building consisted of SSE Seismic acceleration values obtained from St. Lucie Nuclear Plant's response spectra curves as well as critical damping values and St. Lucie anchorage design criteria that requires a safety factor of 4 for anchorage shear and tension allowable.
5	Please provide the following:	a) Beyond Design Basis Environment – Westinghouse qualified the components (probe, connector, cable) of

RAI #	RAI	Response
	a) A description of the specific method or combination of methods that will be applied to demonstrate the reliability of the permanently installed equipment under BDB ambient temperature, humidity, shock, vibration, and radiation conditions. b) A description of the testing and/or analyses that will be conducted to provide assurance that the equipment will perform reliably under the worst-case credible design basis loading at the location where the equipment will be mounted. Include a discussion of this seismic reliability demonstration as it applies to a) the level sensor mounted in the SFP area, and b) any control boxes, electronics, or read-out and re-transmitting devices that will be employed to convey the level information from the level sensor to the plant operators or emergency responders. c) A description of the specific method or combination of methods that will be used to confirm the reliability of the permanently installed equipment such that following a seismic event the instrument will maintain its required accuracy.	the SFPIS located in the SFP area to the beyond design basis environment. Components of the system were subjected to beyond design basis conditions of heat and humidity, thermal and radiation aging mechanisms. This testing confirmed functionality of these system components under these beyond design basis environmental conditions. Westinghouse performed testing to ensure aging of the components in the SFP area will not have a significant effect on the ability of the equipment to perform following a plant design basis earthquake. Reports with the test results document compliance to the Order. Reference Westinghouse documents EQ-TP-351 (Reference 11), WNA-TR-03149-GEN (Attachment 1, Item 8) and EQ TP-354 (Reference 12) for description of specific qualification methods. Mild Environment – Westinghouse qualified the system components (display panel, sensor) that reside in the mild environment conditions to determine that the components can satisfactorily perform under those conditions. Westinghouse has determined that aging does not have a significant effect on the ability of the equipment to perform following a plant design basis earthquake. Reports with the test results document compliance to the Order. Reference Westinghouse documents EQ-QR-269 (Reference 13), WNA-TR-03149-GEN (Attachment 1, Item 7) for description of specific methods. Shock and Vibration – SFPIS pool side brackets were analyzed for SSE design requirements per NRC order EA-12-051 and NEI 12-02 guidance. As provided by the NRC Order EA-12-051, the NEI 12-02 guidance and as clarified by the NRC interim staff guidance, the probe, coaxial cable, and the mounting brackets are "inherently resistant to shock and vibration loadings." As a result, no additional shock and vibration testing is required for these components. SFPIS pool side brackets for both the primary and backup Westinghouse SFP measurement channels will be permanently installed and fixed to rigid refuel floors, which are Seismic Category 1 structures. The SFPI system components, such as level sensor and its bracket, display enclosure and its bracket, were subjected to seismic testing, including shock and vibration test requirements. The results for shock and vibration tests were consistent with the anticipated shock and vibration expected to be seen by mounted equipment. The level sensor electronics are enclosed in a NEMA-4X housing. The display electronics panel utilizes a NEMA-4X rated stainless steel housing as well. These housings will be mounted to a seismically qualified wall and will contain the active electronics, and aid in protecting the internal components from vibration induced damage. Reference Westinghouse reports WNA-DS-02957 (Reference 4), WNA-TR-03149-GEN (Reference 16) for shock and vibration. b) The seismic adequacy of the SFPIS (all components) is demonstrated by vendor testing and analysis in accordance with below listed standards: • IEEE 344-2004, IEEE Recommended Practice for Seismic Qualification of Class 1E Electrical Equipment for Nuclear Power Generating Stations • IEEE-323-1974, Standard for Qualifying Class 1E Equipment for Nuclear Power Generating Stations • USNRC Regulatory Guide 1.100, Rev. 3 • USNRC Regulatory Guide 1.92, Rev. 1 • PSL-1FSC-14-009 – Anchorage Qualification for Spent Fuel Pool Instrumentation System Upgrades Seismic adequacy of the level sensor probe supporting bracket within the SFP area was demonstrated by analysis as discussed in response to RAI-3. c) Westinghouse has seismically qualified the SFPI instrument and its components. CN PEUS-13-28 (Reference 14) describes Pool-side Bracket Seismic Analysis, EQ-QR-269 (Reference 13), WNA TR 03149-

<table>
<tr><th>RAI #</th><th>RAI</th><th>Response</th></tr>
<tr><td></td><td></td><td>GEN (Reference 16) and EQ-TP-353 (Reference 23) describe remaining seismic qualifications of the instrument components. With the instrument being seismically qualified and installed as described in RAI 3b response, the instrument is assured to maintain reliable and accurate indication when required. Westinghouse report WNA-CN-00301-GEN (Reference 7) and St. Lucie Engineering Change 280519 provide the channel accuracy from measurement to display.

Reference Attachment 1 – Items 1, 8, 13</td></tr>
<tr><td>6</td><td>For RAI No. 5 above, please provide the results from the selected methods, tests and analyses used to demonstrate the qualification and reliability of the installed equipment in accordance with the Order requirements.</td><td>Below is a summary of the test conditions used by Westinghouse to qualify the SFPIS. These test conditions are also documented in Attachment 1, Items 7 thru 12. Environmental conditions for SFPIS components installed in the spent fuel pool area at St. Lucie are bounded by the test conditions and Engineering Evaluation (Reference Attachment 1 - Item 9). The radiation TID for beyond design basis conditions (BDB) to the sensor/connector at the SFP when the SFP water level is at Level 3 is 8.10E+05 Rad, based on the results of calculation NAI-1784-001, St Lucie Units 1 & 2 SFP Area Doses to Level Instrumentation. The results of calculation NAI-1784-001 were determined from the licensing basis fuel configuration evaluated for the SFP Fuel Handling Accident EPU dose analysis. The entire inventory of the pool was conservatively evaluated as if it were burned at uprate conditions. Recently discharged fuel was placed nearest the dose receptor point to generate conservative, bounding results. The BDB radiation value to which the Westinghouse equipment is qualified to is 1E+07 R γ for the probe stainless steel cable in the spent fuel pool and 1E+07 R γ for the equipment above the pool, per Section 5.1.2 of WNA-TR-03149-GEN. When the SFP water level is at Level 3, the only components of the SFPI that are exposed to high radiation are the stainless steel probe and anchor. These components are manufactured from materials that are resistant to radiation effects and which can withstand a 40 year radiation dose. Westinghouse updated the design specification (Reference 4) and LTR-SFPIS-13-35, Revision 1 (Reference 24) documentation to include the above technical justification.

<u>Environmental Conditions for SFPIS Components in the Spent Fuel Pool Area</u>

Level sensor probe, coax coupler and connector assembly, launch plate and pool side bracket assembly, coax cable are designed and qualified to operate reliably in the below specified environmental conditions.
<table>
<tr><th>Parameter</th><th>Normal</th><th>BDB</th></tr>
<tr><td>Temperature</td><td>50-140°F</td><td>212°F</td></tr>
<tr><td>Pressure</td><td>Atmospheric</td><td>Atmospheric</td></tr>
<tr><td>Humidity</td><td>0-95% RH</td><td>100% (saturated steam)</td></tr>
<tr><td>Radiation TID γ
(above pool)</td><td>1E+03 Rads</td><td>1E+07 Rads</td></tr>
<tr><td>Radiation TID γ
(12" above top of fuel rack)</td><td>1E+09 Rads
(probe and weight only)</td><td>1E+07 Rads</td></tr>
</table>
</td></tr>
</table>

RAI #	RAI	Response

Environmental Conditions Outside of the Spent Fuel Pool Area

The level sensor transmitter and bracket, electronics display enclosure and bracket are designed and qualified to operate reliably in the below specified environmental conditions.

Parameter	Normal	BDB	BDB (Level Sensor Electronics Only)
Temperature	50-120°F	140°F	140°F
Pressure	Atmospheric	Atmospheric	Atmospheric
Humidity	0-95% RH	0-95% (non-condensing)	0-100% (non-condensing)
Duration	3 days	3 days	3 days
Radiation TID γ	≤ 1E+03 R	≤ 1E+03 R	≤ 1E+03 R

Thermal and Radiation Aging – organic components in SFP area

Westinghouse documents EQ-QR-269, EQ-TP-354, WNA-TR-03149-GEN (Attachment 1, Item 10) provide thermal and radiation aging program details for the SFPI components. Westinghouse completed their thermal and radiation aging testing programs to qualify the SFPI components to 1.25 years.

Additional testing was performed to extend the qualified life to 10 years. A supplement to WNA-TR-03149-GEN, Rev. 2, SFPIS Final Design Verification Summary Report" (Umbrella Report) was issued to FPL on October 9,2014 which confirmed all SFPI components are qualified to a 10 year life for use in their proposed locations.

Seismic Category I Testing

Seismic qualification testing performed by Westinghouse along with the technical evaluations performed by Westinghouse confirms that the SFPIS meets the seismic requirements of the vendor's design specification (Attachment 1, Item 2). Westinghouse's design specification satisfies the St. Lucie installation requirements to withstand a SSE.

Vibration Justification

As specified in RAI-5, components of the system (i.e., bracket, transmitter enclosure, display enclosure, and readout display) will be permanently installed to meet the requirements to withstand a SSE and will meet the St. Lucie seismic installation requirements. Westinghouse has analyzed the pool side bracket to withstand design basis SSE. Other components of the SFPIS were subjected to shock and vibration during the seismic testing and met the requirements necessary for mounted equipment.

Sloshing Justification

The sloshing calculation performed by Westinghouse (Attachment 1, Item 13) was reviewed for a design basis seismic event and found acceptable. Sloshing forces were taken into consideration for the anchorage design of the

RAI #	RAI	Response
		pool side bracket to ensure the bracket is rigidly mounted to include sloshing affects. Reference Attachment 1 Items 7 through 13.
7	Please provide the NRC staff with the final configuration of the power supply source for each channel, as well as cable and conduit separation, so that the staff may conclude that the two channels are independent from a power supply assignment perspective.	Power Supply Source The NRC Order states "Permanently installed instrumentation channels shall each be powered by a separate power supply." At PSL, the primary and backup level instrument channels will be powered from previously spare breakers in non-essential lighting panels as discussed below. The primary level channel is powered from 120VAC Lighting Panel 103, circuit 7. LP-103 is powered from the essential section of MCC 1A-8 via a 30 KVA transformer. MCC 1A-8 is powered from 480 V Switchgear 1A-2 (SA). LP-103 is located in the FHB on the 48' Elevation on the North wall of the H&V room. The backup level channel is powered from 120VAC Lighting Panel 102, circuit 2. Panel LP-102 is powered from MCC 1B8 via a 30 KVA transformer. MCC 1B-8 is powered from 480 V Switchgear 1B-2 (SB). LP-102 is located in the FHB on the 19'-6" Elevation in the new fuel container storage area. The two SFP level instrument channels will be installed in diverse locations in opposing corners of the south wall of the SFP as allowed by the NEI guidance, approximately 30 feet apart. The level sensor/transmitters are located on the other side of the seismically qualified SFP Room wall and the level display enclosures are located two floors down and two rooms away from the probes at the SFP. Cable and Conduit Separation Each water level measurement device consists of a flexible stainless-steel sensor cable probe (LE-04-1A/B), suspended in the spent fuel pool from a seismic Category 1 bracket attached to the operating deck at the side of the pool. The sensor cable probe extends to within an inch of the top of the spent fuel racks. The measured range is sent to a sensor/transmitter which will be located in an enclosure on the outside of the SFP wall. Primary channel probe LE-04-1A will be mounted in the Southeast corner of the main pool adjacent to the transfer canal and backup channel probe LE-04-01B will be mounted in the southwest corner of the pool. The cables are protected by either stainless steel hose or rigid conduit around the SFP. All system cables are routed in dedicated conduit installed to Seismic II/I requirements. See Attachment 2 for Unit 1 and Attachment 6 for Unit 2. **NOTE**: The Unit 2 design has not yet been finalized. It is scheduled to be completed late in the first quarter of 2015. Therefore, the drawings provided in Attachment 6 are preliminary. Should any changes be made in the documents provided that would impact a response to the RAIs, the changes and impacts will be addressed in future six month updates.
8	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.	Each Local Processor Cabinet (LPC) contains sufficient battery backup capacity via its UPS to maintain the channel for 72 hours (3 days) upon the loss of its normal power supply. Westinghouse calculation WNA-CN-00300-GEN (Reference 6) demonstrates that for the Wired Level Configuration the Power Consumption (0.257A), the total duration the battery will last at full charge is 4.22 days. This exceeds the 3 day requirement. Options will then exist for replacement of depleted batteries with spares maintained on site. Additionally, the normal LPC supply sources may then be repowered by way of Phase 2 and/or Phase 3 FLEX coping strategies via an emergency power

RAI #	RAI	Response
		receptacle at the bottom of the panel and power selector switch.
9	Please provide the following: a) An estimate of the expected instrument channel accuracy performance (e.g., in percentage of span) under both a) normal SFP level conditions (approximately Level 1 or higher) and b) at the BDB conditions (i.e., radiation, temperature, humidity, post-seismic and post-shock conditions) that would be present if the SFP level were at the Level 2 and Level 3 datum points. b) A description of the methodology that will be used for determining the maximum allowed deviation from the instrument channel design accuracy that will be employed under normal operating conditions as an acceptance criterion for a calibration procedure to flag to operators and to technicians that the channel requires adjustment to within the normal condition design accuracy.	a) The Westinghouse documents WNA-CN-00301, System Accuracy Calculation, (Attachment 1, Item 1) and WNA-DS-02957-GEN, System Design Specification, (Attachment 1, Item 2) describe the channel accuracy under both (a) normal SFP level conditions and (b) at the Beyond Design Basis (BDB) conditions that would be present if SFP level were at Level 2 and Level 3 datum points. Each instrument channel will be accurate to within ±3" (approximately 2% of span) during normal spent fuel pool level conditions. The instrument channels will retain this accuracy after BDB conditions, in accordance with the above Westinghouse documents. This value is within the channel accuracy requirements of the Order (±1 foot). b) The Westinghouse document WNA-TP-04709-GEN (Attachment 1, Item 3) describes the methodology for routine testing/calibration verification and calibration methodology. This document also specifies the required accuracy criteria under normal operating conditions. St. Lucie calibration and channel verification procedures will follow the guidance and criteria provided in this document. Instrument channel calibration will be performed if the level indication reflects a value that is outside the acceptance band established in the St. Lucie calibration and channel verification procedures. Instrument channel loop accuracy and set point deviation/error are determined using the St. Lucie Setpoint Methodology Design Standard IC-3.17 for safety related instruments. The methodology used to determine the set point deviation in this standard is consistent with ANSI/ISA 67.04.01-2000. Per this methodology, since drift value was not specified by the vendor, a default random drift value of ±1% of span (or ±1% of full scale, for conservatism) for mechanical components were assigned. A setting tolerance of twice the reference accuracy, which is a typical value, was applied to the indicator to yield an overall setting tolerance of ± 2% of full scale. This value will be used for the calibration procedure being developed for this instrument loop. The resultant non-negligible terms (Reference Accuracy, Drift, Readability, Measurement and Test Equipment Effect, and Setting Tolerance) are all random terms, and will be combined using the Square Root Sum of Squares (SRSS) methodology given in Setpoint Methodology Design Standard IC-3.17. Thus, the maximum deviation introduced by the indicator, in percent of full span, is computed. Calibration will be performed once per refueling cycle for St. Lucie. Per Westinghouse document WNA-TP-04709-GEN (Attachment 1, Item 3) calibration on a SFP level channel is to be completed within 60 days of a planned refueling outage considering normal testing scheduling allowances (e.g. 25%). This is in compliance with the NEI 12-02 guidance for Spent Fuel Pool Instrumentation.
10	Please provide analysis verifying the instrumentation accuracy and that the proposed instrument performance is consistent with the 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.	Westinghouse documents WNA-CN-00301, Spent Fuel Pool Instrumentation System Channel Accuracy Analysis (Reference 7), and WNA-DS-02957-GEN, Spent Fuel Pool Instrumentation System Design Specification (Reference 4), describe the channel accuracy under both (a) normal SFP level conditions and (b) at the Beyond Design Basis (BDB) conditions that would be present if SFP level were at Level 2 and Level 3 datum points. Each instrument channel will be accurate to within ±3"during normal spent fuel pool level conditions. The instrument channels will retain this accuracy after BDB conditions, in accordance with the above Westinghouse documents. This value is within the channel accuracy requirements of the Order (±1 foot). Westinghouse document WNA-TP-04752-GEN, Spent Fuel Pool Instrumentation System Standard Product Integrated Functional Test Procedure (Reference 21), describes the Integrated Functional Test Plan which verifies that the SFPIS will perform to the specifications contained in WNA-DS-02957-GEN (Reference 4) during normal and BDB conditions. Included as part of these specification are requirements that:

RAI #	RAI	Response
		• After calibration, each SFPIS display, indication, and output shall be accurate to within ±3 inches of the actual water level. • After calibration, the SFPIS level sensor shall be able to sense SFP level from the normal surface level to within six inches of the fuel assembly at a resolution of at least 3 inches. • The SFPIS time response from system power-up (or power restoration) to display shall be less than or equal to three minutes. • All SFPIS components subject to calibration shall maintain calibration information during a power loss. • The SFPIS level sensor calibration/configuration parameters shall be stored such that they are retrievable upon loss of power without re-calibration or setup required. Westinghouse document EQ-QR-269, Design Verification Testing Summary Report for the Spent Fuel Pool Instrumentation System (Reference 13), documents the testing results and confirms adherence to the required design specifications.
11	Please provide the following: a) A description of the capability and provisions the proposed level sensing equipment will have to enable periodic testing and calibration, including how this capability enables the equipment to be tested in-situ. b) A description of how such testing and calibration will enable the conduct of regular channel checks of each independent channel against the other, and against any other permanently installed SFP level instrumentation. c) A description of how calibration tests and functional checks will be performed and the frequency at which they will be conducted. Discuss how these surveillances will be incorporated into the plant surveillance program. d) A description of what preventive maintenance tasks are required to be performed during normal operation, and the planned maximum surveillance interval that is necessary to ensure that the channels are fully conditioned to accurately and reliably perform their functions when needed.	a) Westinghouse calibration procedure WNA-TP-04709-GEN (Attachment 1, Item 3) and functional test procedure WNA-TP-04613-GEN (Attachment 1, Item 4) describe the capabilities and provisions of SFPI periodic testing and calibration, including in-situ testing. St. Lucie will utilize the Westinghouse calibration procedure for the functional check at the pool side bracket. b) The level displayed by the channels will be verified per the St. Lucie maintenance and operating procedures, as recommended by Westinghouse vendor technical manual WNA-GO-00127-GEN (Attachment 1, Item 5). If the level is not within the required accuracy per Westinghouse recommended tolerance in WNA-TP-04709-GEN (Attachment 1, Item 3), channel calibration will be performed. c) Functional checks will be performed per Westinghouse functionality test procedure WNA-TP-04613-GEN (Attachment 1, Item 4) at the Westinghouse recommended frequency. Calibration tests will be performed per Westinghouse calibration procedure WNA-TP-04709-GEN (Attachment 1, Item 3) at the Westinghouse recommended frequency. d) St. Lucie will develop preventive maintenance tasks for the SFPI per Westinghouse recommendation identified in the technical manual WNA-GO-00127-GEN (Attachment 1, Item 5) to assure that the channels are fully conditioned to accurately and reliably perform their functions when needed. These required actions are being tracked by AR PMCR# 01998547, AR PMCR# 01998536 and AR PMCR# 01998523.
12	Please 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)	The location for the SFP wide range level instrument displays will be on the 19'-6" elevation of the Fuel Handling Building (FHB) in the Pump and Filter Room hallway. A specific time for access to the SFPI has not been credited for the St. Lucie design; however, Section XII, Display of the OIP (Ref. 25) states:

RAI #	RAI	Response
	that it will take for personnel to access the display. Additionally, please include a description of the radiological and environmental conditions on the paths personnel might take. Describe whether the display location remains habitable for radiological, heat and humidity, and other environmental conditions following a BDB event.	The design will include remote indication that will be accessible during post event conditions. The location will ensure that it meets the following criteria [of being] promptly accessible to the appropriate plant staff giving appropriate consideration to various drain down scenarios. Various walkdowns during staffing studies and simulated responses have shown that plant personnel will be able to access the SFP Level Display within 15 minutes. The displays will be approximately 40 feet below the operating floor of the SFP. This location will ensure personnel can access the level indication promptly and in a safe environment (e.g. away from adverse weather and outside of any very high radiation area or locked high radiation areas during normal operation). They will be physically protected from the environmental and radiological conditions resulting from a beyond design basis (BDB) event. Based on the results of calculation NAI-1784-003, St Lucie Nuclear Plant Units 1 & 2 Fuel Handling Building Beyond Design Basis Event – Summary Document, the BDB dose rates were calculated to be less than 1.05E-06 mRad/hr for this location. Site specific calculation NAI-1784-003, St Lucie Nuclear Plant Units 1 & 2 Fuel Handling Building Beyond Design Basis Event Analysis, determined the long term temperature and relative humidity of the corridor and filter area, the location of the spent fuel pool level indicator, remains below the initial value of 104°F, and the relative humidity is between 90% and 95% over most of the seven-day event.
13	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.	Response provided via FPL Letter L-2014-061, dated February 28, 2014, Florida Power & Light/St. Lucie's second Six-Month Status Report to the Overall Integrated plan in Response to March 12, 2012 Commission Order to Modify Licenses with Regard to reliable Spent fuel Pool Instrumentation (Order Number EA-12- 051), Accession No.ML14064A193.
14	Please provide the following: a) Further information describing the maintenance and testing program the licensee will establish and implement to ensure that regular testing and calibration is performed and verified by inspection and audit to demonstrate conformance with design and system readiness requirements. Include a description of your plans for ensuring that necessary channel checks, functional tests, periodic calibration, and maintenance will be conducted for the level measurement system and its supporting equipment. b) A description of how the guidance in NEI12-02 Section 4.3 regarding compensatory actions for one or both non-functioning channels will be addressed.	Response provided via FPL Letter L-2014-061, dated February 28, 2014, Florida Power & Light/St. Lucie's second Six-Month Status Report to the Overall Integrated plan in Response to March 12, 2012 Commission Order to Modify Licenses with Regard to reliable Spent fuel Pool Instrumentation (Order Number EA-12- 051), Accession No.ML14064A193.

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

References:

1. NRC Order EA-12-051, "Order Modifying Licenses with regard to Reliable Spent Fuel Pool Instrumentation"
2. JLD-ISG-2012-03, Compliance with Order EA-12-051, Reliable Spent Fuel Pool Instrumentation, August 29, 2012, Nuclear Regulatory Commission, Japan Lessons Learned Project Directorate
3. 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
4. WNA-DS-02957-GEN, System Design Specification
5. WNA-GO-00127-GEN, System Technical Manual
6. WNA-CN-00300-GEN, Power Consumption Calculation
7. WNA-CN-00301-GEN, System Accuracy Calculation
8. NAI-1784-001, St. Lucie Units 1 & 2 SFP Area Doses to Level Instrumentation
9. NAI-1784-002, St. Lucie Nuclear Plant Units 1 & 2 Fuel Handling Building Beyond Design Basis Event Analysis (Environmental)
10. NAI-1784-003, St Lucie Nuclear Plan Units 1 and 2 Fuel Handling Building Beyond Design Basis Event – Summary Document
11. Westinghouse Proprietary Document, EQ-TP-351, "Environmental Qualification Test Procedure for the Spent Fuel Pool Instrumentation System Coaxial Cable and Connectors Inside the Spent Fuel Pool Area," Revision 0
12. Westinghouse Proprietary Document, EQ-TP-354, "Mechanical Preconditioning, Thermal Aging, and Radiation Aging Procedure for the Spent Fuel Pool Instrumentation System Coaxial Cables and Couplers," Revision 0
13. EQ-QR-269, Design Verification Testing Summary Report
14. Westinghouse Calculation CN-PEUS-13-28 - Seismic Analysis of the SFP Mounting Bracket at Point Beach Units 1&2 and St. Lucie Units 1&2 Revision 2
15. St. Lucie Unit 1 UFSAR, Rev. 26, Chapter 12, Figures 12.1-4 and 12.1-5
16. WNA-TR-03149-GEN, Rev. 1, Final Summary Design Verification Report
17. St. Lucie Unit 2 UFSAR, Rev. 21, Chapter 12, Figures 12.3-11 and 12.3-12
18. Email form Yves Masset (Westinghouse), dated May 1, 2014 at 1:49 PM.
19. Spent Fuel Pool Level Transmitter Environmental Test Profile.
20. SFPIS ENV Ramp Down Graph (2/11/2014 to 2/12).
21. WNA-TP-04752-GEN, Rev.2, Integrated Functional Test Procedure
22. IP66-IP67_Certificate_AT100_AT200_MT2000_MT5X00_2, Testing of Enclosures for Level Transmitters
23. Westinghouse Document EQ-TP-353, Revision 0, "Static Pull Test Procedure for Spent Fuel Pool Instrumentation System Connector,"
24. LTR-SFPIS-13-35, SFPIS: Basis for Radiation Dose Requirement and Clarification of Production Equivalency of Electronics Enclosure Used for Seismic and EMC Testing
25. FPL Letter L-2013-079, Florida Power & Light's Overall Integrated Plan in Response to March 12, 2012 Commission Order to Modify Licenses with Regard to Reliable Spent Fuel Pool Instrumentation (Order Number EA-12-051).
26. Enercon calculation FPLSL137-CALC-SFPI-001, Rev. 1, St. Lucie Units 1 & 2 Dose to SFP Level Instrumentation Transmitter.

ATTACHMENTS

NOTE: Evaluations apply to both St. Lucie Unit1 and Unit 2 unless otherwise noted.

#	Topic	Parameter Summary	Westinghouse Reference Document	Additional Comment	Test or Analysis Result	Licensee Evaluation
1	Channel Accuracy	+/- 3 inches per WNA-DS-02957-GEN	WNA-CN-00301-GEN	Channel accuracy from measurement to display.	Passed	NextEra has reviewed WNA-DS-02957-GEN and WNA-CN-00301-GEN and found that channel accuracy requirements are met.
2	Design Specification	SFPIS Requirements derived from References 1, 2, & 3	WNA-DS-02957-GEN	Contains technical SFPIS requirements based on NRC order, NEI guidance, and the ISG listed above.	N/A	NextEra has determined that WNA-DS-02957-GEN bounds the St. Lucie requirements from References 1, 2 and 3.
3	Calibration	Routine Testing/Calibration verification and calibration method	WNA-TP-04709-GEN	Also, includes preventative maintenance actions such as those for Boron buildup and cable probe inspection.	N/A	St. Lucie will utilize WNA-TP-04709-GEN as input for procedure preparation.
4	Spent Fuel Pool Instrumentation System Functionality Test Procedure	Acceptance Criteria for Performance during EQ testing	WNA-TP-04613-GEN	Test procedure used to demonstrate that SFPIS meet its operational and accuracy requirements during Equipment Qualification Testing	See applicable EQ test	NextEra has determined WNA-TP-00189-GEN "Integrated Functional Test Plan" to be acceptable.

				programs.		
5	Technical Manual	N/A	WNA-GO-00127-GEN	Information and instructions for Operation, Installation, use, etc. are included here.	N/A	St. Lucie will utilize WNA-GO-00127-GEN as input for procedure preparation.
6	Emissions Testing	RG 1.180, Rev. 1 test conditions Design Verification Report	WNA-TR-03149-GEN	N/A	Passed	NextEra has reviewed the test report and found it meets requirements for radiated emissions limits and Criterion A for susceptibility testing based on the modifications to be implemented.
7	Environmental qualification for electronics enclosure with Display	50^{0} F to 140^{0} F, 0 to 95% RH TID ≤ 1E+03 R γ normal (outside SFP area) TID ≤ 1E+03 R γ abnormal (outside SFP area)	EQ-QR-269 and WNA-TR-03149-GEN for all conditions.	Results are summarized in EQ-QR-269 and WNA-TR-03149-GEN. Radiation Aging verification summarized in Section 5 of WNA-TR-03149-GEN. .	Test passed conditions described.	Temperature is ≤ 140°F and humidity is ≤ 95% RH for abnormal conditions in the 19'6" elevation of the Fuel Handling Building (Reference 10). The above values are bounded by the values in Section 3.3 of WNA-TR-03149-GEN. The normal and abnormal TID of 1.76E-07 Rad from Reference 10 (for the Fuel Handling Building) is bounded by the justification for TID less

						than 1E+03 rads from Section 5.1.2 of WNA-TR-03149-GEN. Aging Tests – Additional testing has been performed to extend the qualified life to 10 years. A supplement to WNA-TR-03149-GEN, Rev. 2, SFPIS Final Design Verification Summary Report" (Umbrella Report) was issued to FPL on October 9,2014 which confirmed all SFPI components are qualified to a 10 year life for use in their proposed locations.
8	Environmental Testing for Level Sensor components in SFP area – Saturated Steam & Radiation	50 ^{o} F to 212^{o} F and 100% humidity	EQ-TP-351	Testing summarized in section 3.2.	Passed	The temperature and humidity values of 212°F and 100% RH from Reference 10 (for FHB) are bounded by Section 3.2 of WNA-TR-03149-GEN.
		1E+03 R γ normal (SFP area)	WNA-TR-03149-GEN	Thermal Aging & radiation aging verification summarized in Sections 4.1 and 5 (entire system) of WNA-TR-03149-GEN.	Passed	The normal operating dose in the SFP area per Reference 14 is 8.8E+2 R γ, for 40 years which is bounded by Section 5.1.1 of WNA-TR-03149-GEN.

		1E+07 R γ BDB (SFP area)	EQ-TP-354 (procedure)	Additional thermal & radiation aging programs being conducted under test procedure EQ-TP-354.	Passed	The BDB radiation value to which the Westinghouse equipment is qualified is 1.E+07 R γ for the probe, stainless steel cable and weight and 1E+07R γ for the equipment above the pool, per Section 5.1.2 of WNA-TR-03149-GEN. Per Reference 10, the TID value of 8.10E+05 R γ is lower than 1.E+07 R γ to which Westinghouse qualified the instruments. With SFP water level at Level 3 the only components of SFPI that are exposed to high radiation are the stainless steel probe and the stainless steel anchor. The materials with which the probe and the anchor are manufactured are resistant to radiation effects. The stainless steel anchor and stainless steel probe can withstand 40 year dose.

						Aging Tests – Westinghouse completed its aging qualification of SFPIS to 1.25 years. Westinghouse is continuing their aging tests to age the system components to 10 years. Additional testing has been performed to extend the qualified life to 10 years. A supplement to WNA-TR-03149-GEN, Rev. 2, SFPIS Final Design Verification Summary Report" (Umbrella Report) was issued to FPL on October 9,2014 which confirmed all SFPI components are qualified to a 10 year life for use in their proposed locations.
9	Environmental Testing for Level Sensor Electronics Housing – outside SFP	50° F to 140° F, 0 to 95% RH	WNA-TR-03149-GEN	Testing summarized in section 3.3	Accepted	The NAI Environmental Calc, Reference 9, shows a short term (4 minutes) temperature excursion above 140°F with a maximum of 175°F for U1 FHB under Scenario 1*. Also for U1, the humidity is at 100% for
		TID ≤ 1E+03 R γ normal (outside SFP area)	WNA-TR-03149-GEN	Radiation Aging verification summarized in	Accepted	

		TID ≤ 1E+03 R γ abnormal (outside SFP area)		Section 5.		the first 40 minutes of Scenario 1 with 3 very short excursions to 101%. Under Scenario 2* for U1, the temperature limit is also exceeded but by a much lesser amount (143°F) for about 5 minutes. The temperature profile for U2, Scenario 1*, shows 3 excursions above 140°F during the first 35 minutes of the event. The first and second spikes (158°F and 143°F respectively) have durations of less than 1 minute. The third excursion above 140°F (maximum 169°F) occurs at 32 minutes into the event and last for approximately 3 minutes. The temperature profile for U2, Scenario 2*, shows a maximum temperature of 132°F over the course of the entire event.

						The relative humidity profile for U2 under Scenario 1* shows an oscillation between 48% and 60% except during the first 30 minutes of the event when the relative humidity is as high as 101%, indicating a brief supersaturated condition. The overall duration of the excursions above 95% is approximately 25 minutes. The relative humidity profile for U2 under Scenario 2* shows that for the first two days of the event, the relative humidity remains at 100%. Afterwards, it oscillates between 0% and 30%. The normal TID of ≤ 1E+03 R γ from Reference 16 (outside of the Spent Fuel Pool area) in Section 5.1.3 of WNA-TR-03149-GEN bounds the St Lucie normal operational time period of 10 years

						for both Units 1 and 2. References 15 and 17 show a dose rate ≤ 2.5 mR/Hr for the areas in which the transmitters will be mounted. The TID for the operational time period of 10 years at the 48' elevation of the Fuel Handling Building equals 2.19E+02 Rad. The abnormal TID of ≤ 1E+03 R γ from Reference 16 (outside of the Spent Fuel Pool area) in Section 5.1.3 of WNA-TR-03149-GEN was exceeded by the St Lucie TID for the event duration for both Units 1 and 2 based on Reference 8 and 10. These references show a direct shine maximum dose of 1.13E-08 Rad which is well below the allowable dose. However, per Reference 8, with such high radiation sources, there is also an indirect "SkyShine" scatter of radiation off of the air

						in the FHB. The "SkyShine" scatter dose has been calculated to be 1.12E+04 Rad. Table 1 of Reference 8 notes that for the transmitter located at the fuel midpoint (the actual proposed location), the SkyShine model neglected the shielding between the FHB and the New Fuel Area. This inherent shielding includes steel plating on the floor, concrete walls, floors and a stainless steel enclosure for the transmitter electronics. FPL contracted Enercon Services to perform an additional calculation which included the inherent shielding noted above. Final results of the calculations (Reference 26) show a TID for the Unit 1 transmitter of 6.78E+02 rad and 7.86E+02 for the Unit 2 transmitter which are enveloped by the

						Westinghouse qualification. See Attachment 5 for Engineering Evaluation of these items.
10	Thermal & Radiation Aging – organic components in SFP area	1E+03 R γ normal (SFP area)	EQ-QR-269 and WNA-TR-03149-GEN	Thermal Aging & radiation aging verification summarized in Sections 4.1 and 5 (entire system) of WNA-TR-03149-GEN.	Passed	FPL has determined EQ-QR-269 and WNA-TR-03149-GEN documents provided to be acceptable for St. Lucie installation. The 40 year TID under normal conditions is calculated to be <8.8E+02 Rad per References 15 and 17.
		1E+07 R γ BDB (SFP area)	EQ-TP-354 (procedure) Actual test report is in progress.	Additional thermal & radiation aging programs being conducted under test procedure EQ-TP-354.	Passed	Aging Tests – Westinghouse completed its aging qualification of SFPIS to 1.25 years. Westinghouse is continuing their aging tests to age the system components to 10 years. Additional testing has been performed to extend the qualified life to 10 years. A supplement to WNA-TR-03149-GEN, Rev. 2, SFPIS Final Design Verification Summary Report" (Umbrella Report) was

						issued to FPL on October 9,2014 which confirmed all SFPI components are qualified to a 10 year life for use in their proposed locations.
11	Seismic Qualification	Per Spectra in WNA-DS-02957-GEN	EQ-QR-269	EQ-QR-269 summarizes the testing performed by Westinghouse	Passed	The Spectra in Reference 14 for the poolside mounting brackets bounds St. Lucie for meeting the requirements to withstand a SSE. Instrument panel mounting is qualified by Reference 14.
			WNA-TR-03149-GEN	WNA-TR-03149-GEN provides high level summary of the pool-side bracket analysis and optional RTD.	Passed	
			EQ-TP-353 (procedure)	Seismic Pull test for new connectors is in progress under procedure, EQ-TP-353.	Passed	
12	Sloshing	N/A	LTR-SEE-II-13-47	Calculation to demonstrate that probe will not be sloshed out of the SFP.	Passed	NextEra has determined WNA-TR-03149-GEN to be acceptable. Adequate sloshing forces (inclusive of vertical and horizontal impact forces, hydrodynamic forces) were accounted to calculate the overall sloshing forces. These forces were added to design the bracket
			WNA-TR-03149-GEN	Sloshing is also addressed in Section 7.2.	Passed	

						anchorage, to ensure the probe will not be sloshed due to a beyond design basis seismic event.
13	Pool-side Bracket Seismic Analysis	N/A	CN-PEUS-13-28	Also includes hydrodynamic forces, as appropriate.	Passed	See response to RAI No. 5. St. Lucie seismic requirements to withstand a SSE are bounded by Reference 14 for the poolside mounting brackets.

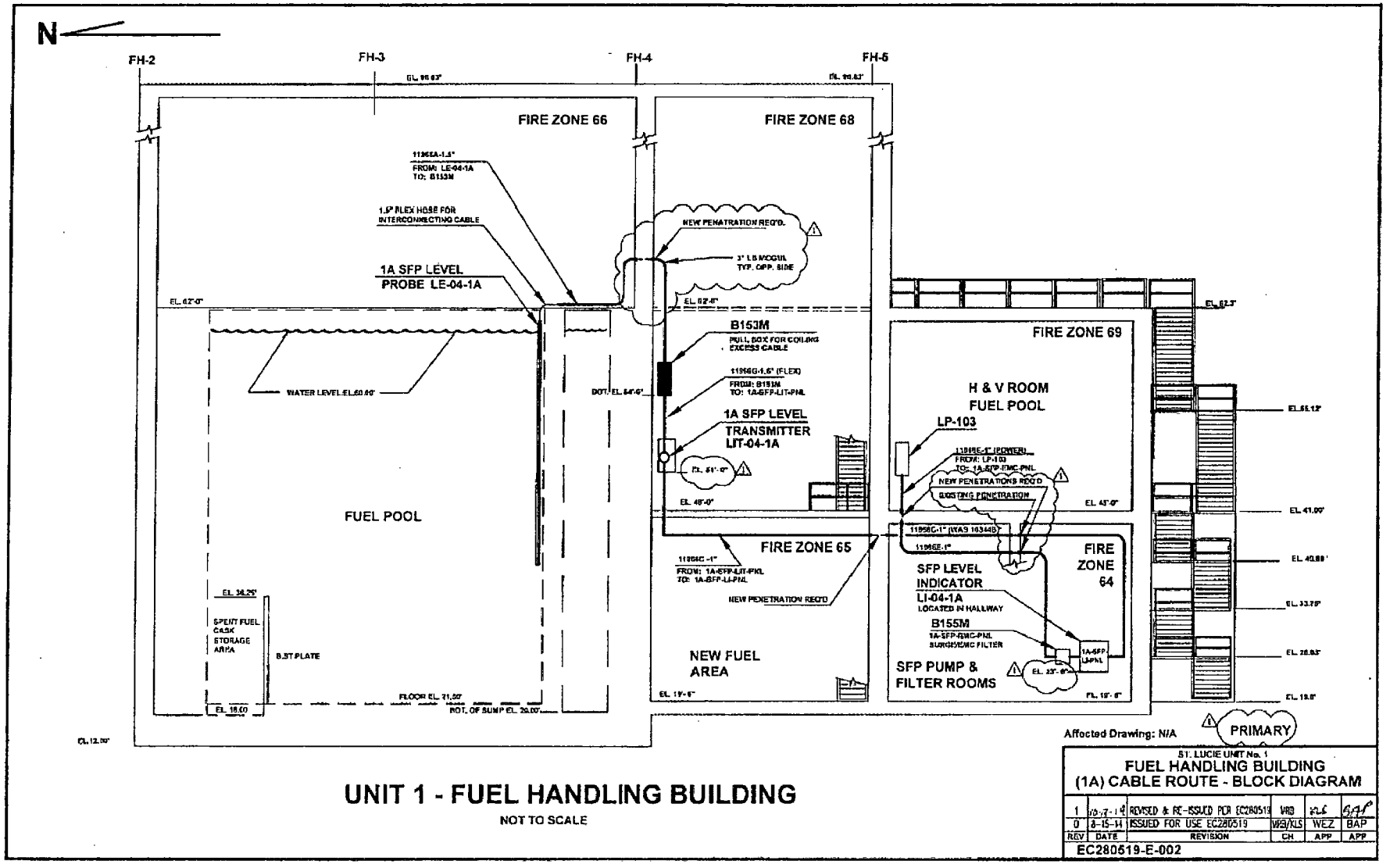
***Scenario 1 entails opening of the following doors:**

- **Full-height door on the south wall of the spent fuel pool room**
- **Personnel door at the north end of the spent fuel pool**
- **Personnel door at the south end of the new fuel area (62' level) opening onto the H&V room roof**
- **Roll-up door on the east side of the new fuel area (19'-6" level)**

***Scenario 2 entails opening of the following door:**

- **Spent fuel pool room cask handling door**
- **Full-height door on the south wall of the Spent Fuel Pool room open (but not required per calculation).**

ELAP FSGs invoke the configuration of Scenario 1.



UNIT 1 - FUEL HANDLING BUILDING

NOT TO SCALE

Affected Drawing: N/A

PRIMARY

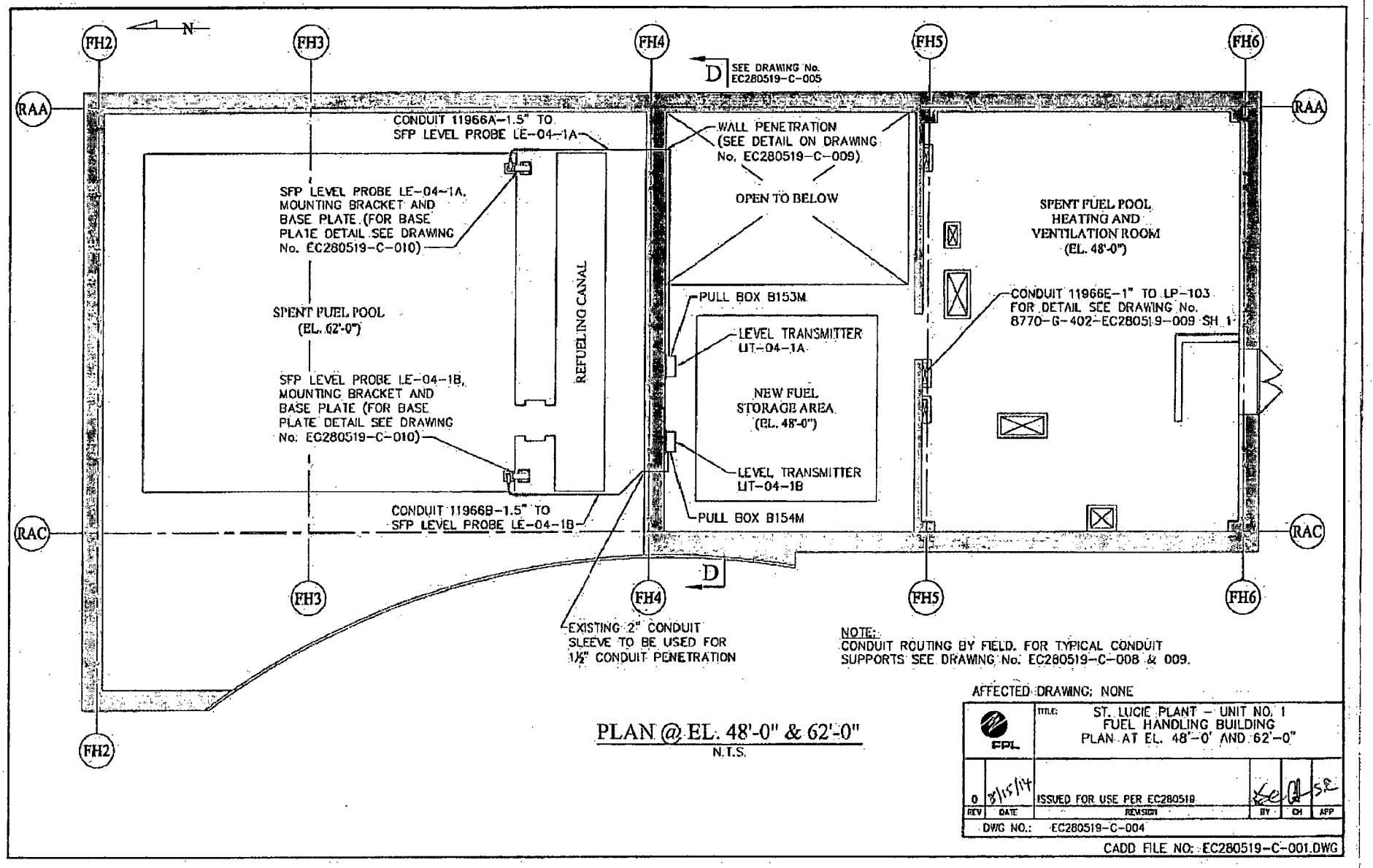
ST. LUCIE UNIT No. 1

FUEL HANDLING BUILDING
(1A) CABLE ROUTE - BLOCK DIAGRAM

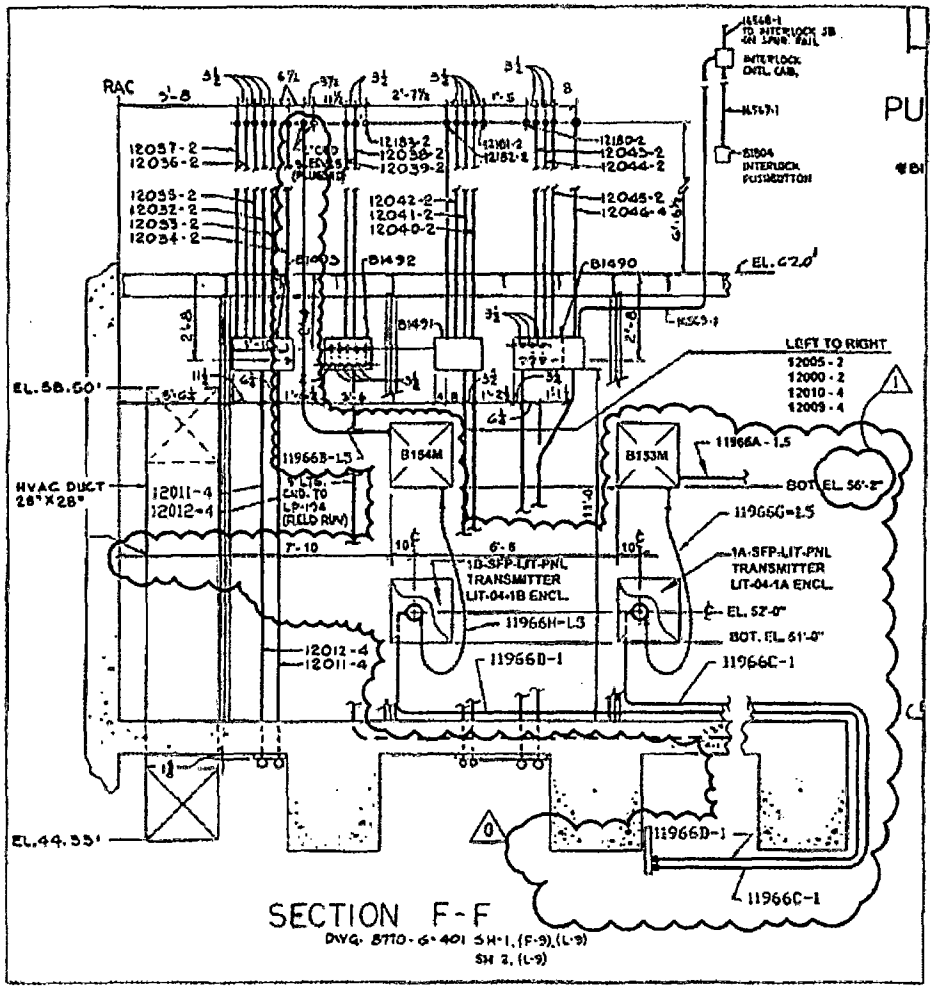
REV	DATE	REVISION	CH	APP	APP
1	10-7-14	REVISED & RE-ISSUED PER EC280519	VRB	WEZ	BAP
0	8-15-14	ISSUED FOR USE EC280519	WEB/KLS	WEZ	BAP

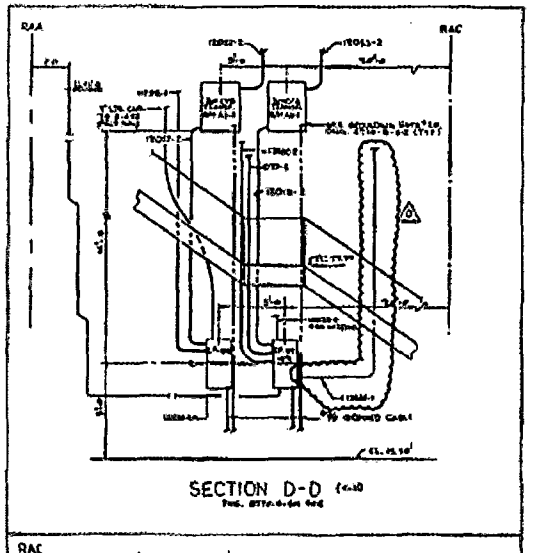
EC280519-E-002

CADD FILE: EC280519-E-002_1A SFP Level Instr.Block Dia.DWG



PLAN @ EL. 48'-0" & 62'-0"
N.T.S.





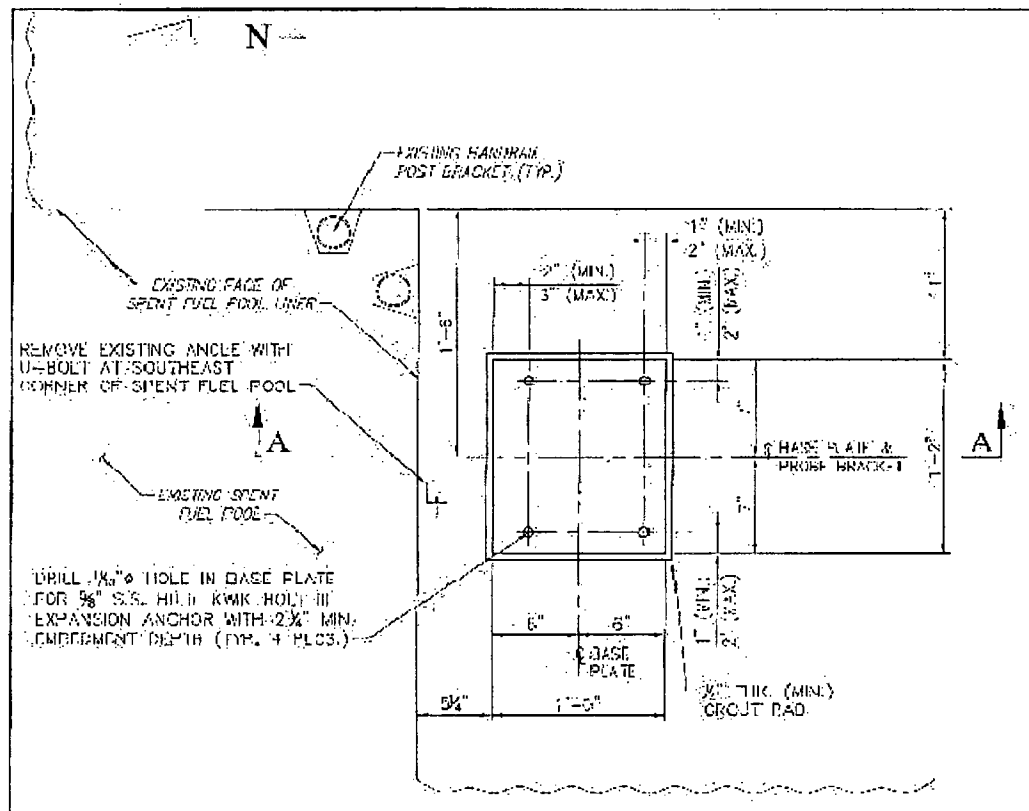
Affected Drawing: 8770-G-402 R13

ST. LUCIE UNIT No. 1
FUEL HANDLING BUILDING SECTIONS & DETAILS

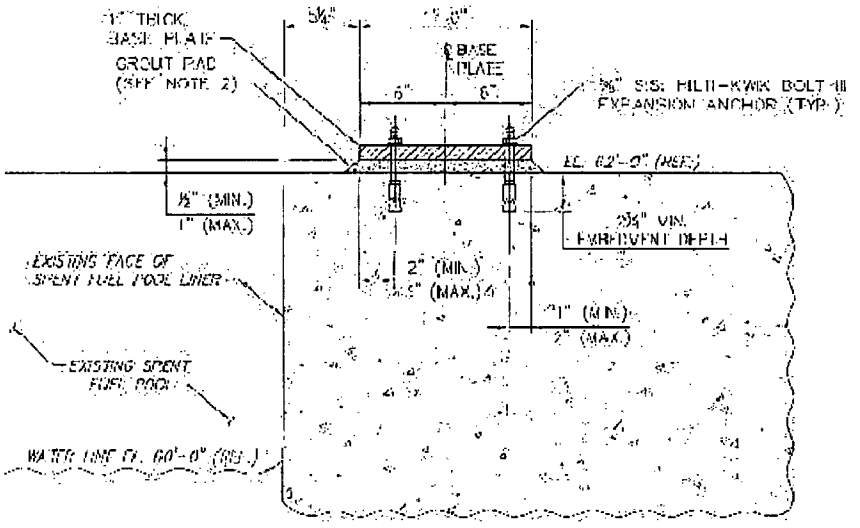
REV	DATE	REVISION	CH	APP	APP
1	6/5/15	REVISED & ISSUED FOR EC280519	MRB	KAS	BAP
0	8/15/14	ISSUED FOR USE EC280519	MRB/TLS	WEZ	BAP

8770-G-402 - EC280519-009 Sh1

CADD FILE: 8770-G-402_R13-EC280519-009_R0.DWG



SEP LEVEL PROBE MOUNTING BRACKET BASE PLATE DETAIL
SOUTHEAST CORNER OF POOL SHOWN
SOUTHWEST CORNER OF POOL OPPOSITE HAND
N.T.S.



SECTION A-A
N.T.S.

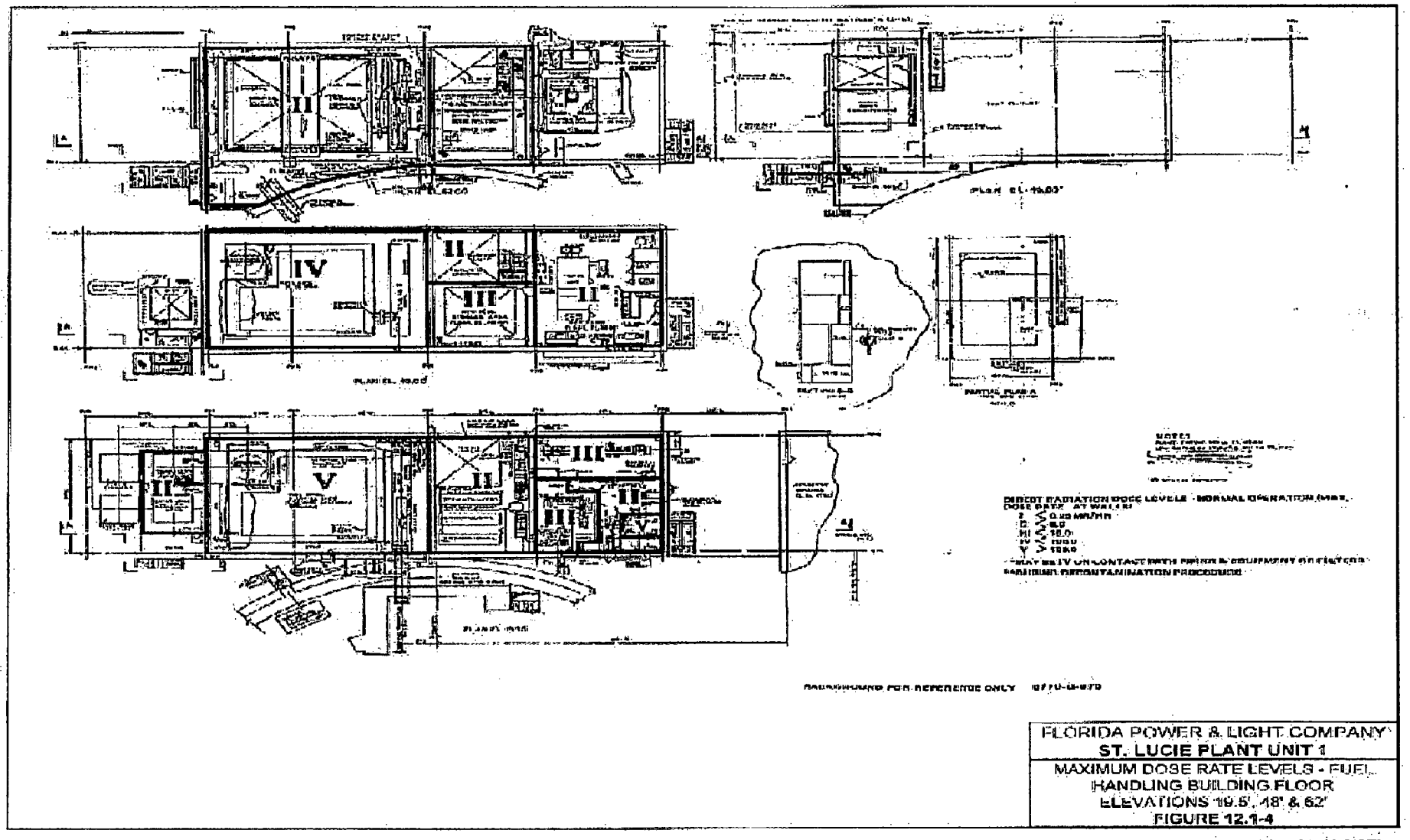
NOTES:
1. FOR SPENT FUEL POOL LEVEL PROBE MOUNTING BRACKET INSTALLATION DETAIL SEE DRAWING No. 8770-18401-EC280519-032.
2. GROUT SHALL BE MASTERFLOW 928 NON-SHRINK GROUT OR EQUAL IN ACCORDANCE WITH SPECIFICATION SPEC-C-042.

AFFECTED DRAWING: 8770-G-559, Rev. 03

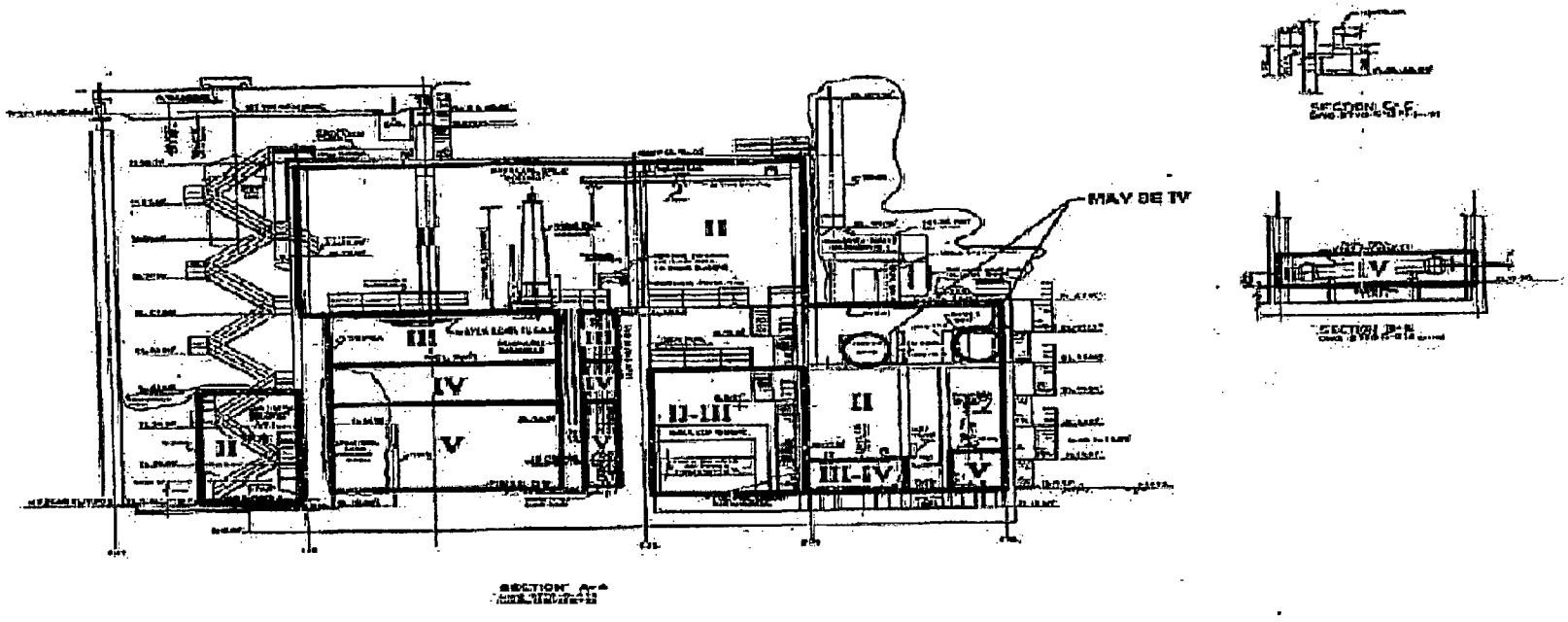
FPL		site: ST. LUCIE PLANT – UNIT NO. 1 FUEL HANDLING BUILDING SPENT FUEL POOL LEVEL PROBE LE-04-1A & LE-04-1B MOUNTING BRACKET BASE PLATE DETAIL		
C	2/15/15	ISSUED FOR USE PER EC280519		
REV	DATE	REMARK	BY	APP

DWG NO.: EC280519-C-001

CADD FILE NO.: EC280519-C-001.DWG



Amendment No. 22 (05/07)



DIRECT RADIATION DOSE LEVELS — NORMAL OPERATION
(MAX. DOSE RATE AT WALL)

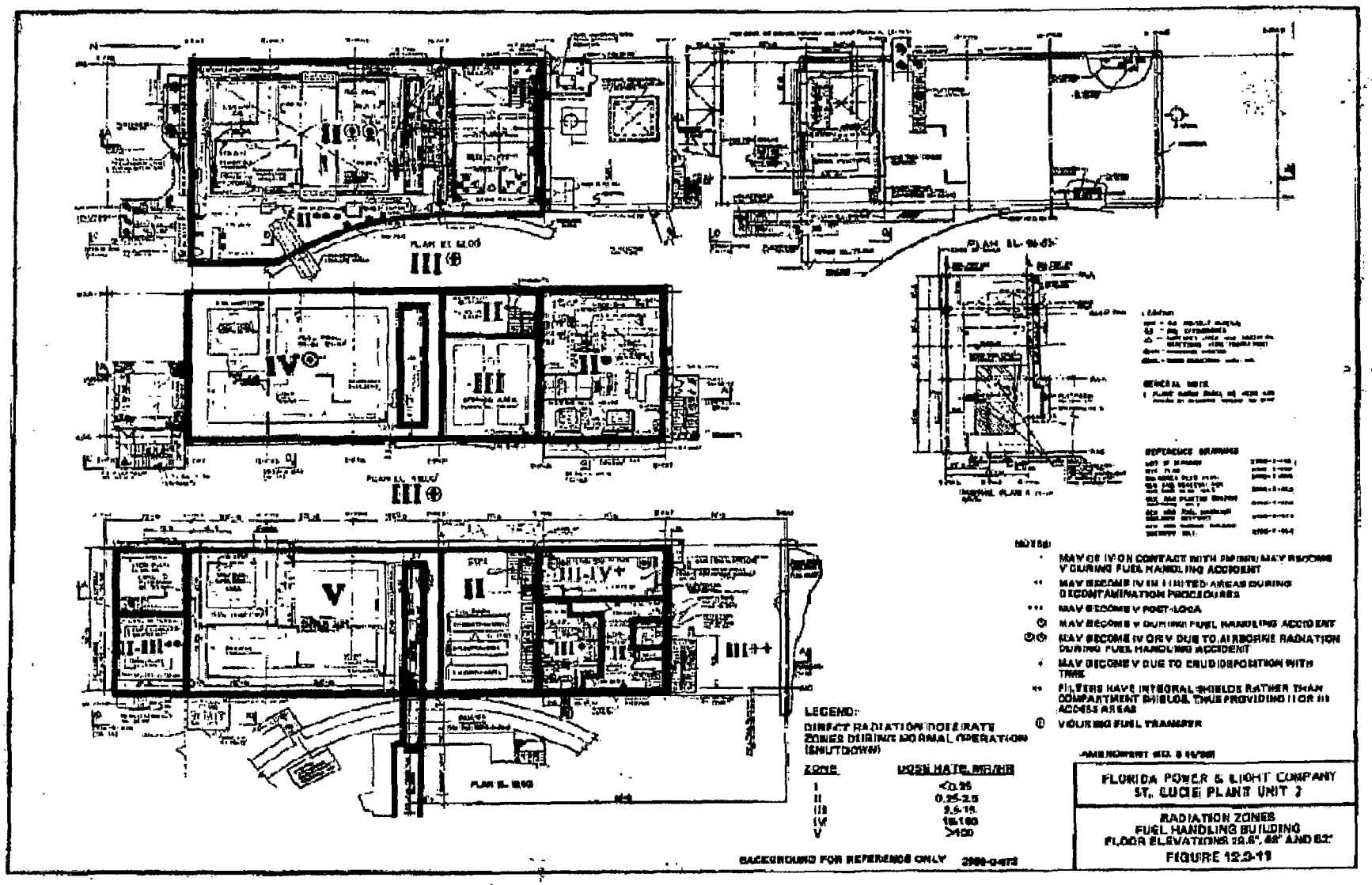
I ≤ 0.25 MR/HR
II ≤ 2.5
III ≤ 15.0
IV ≤ 100.0
V > 100.0

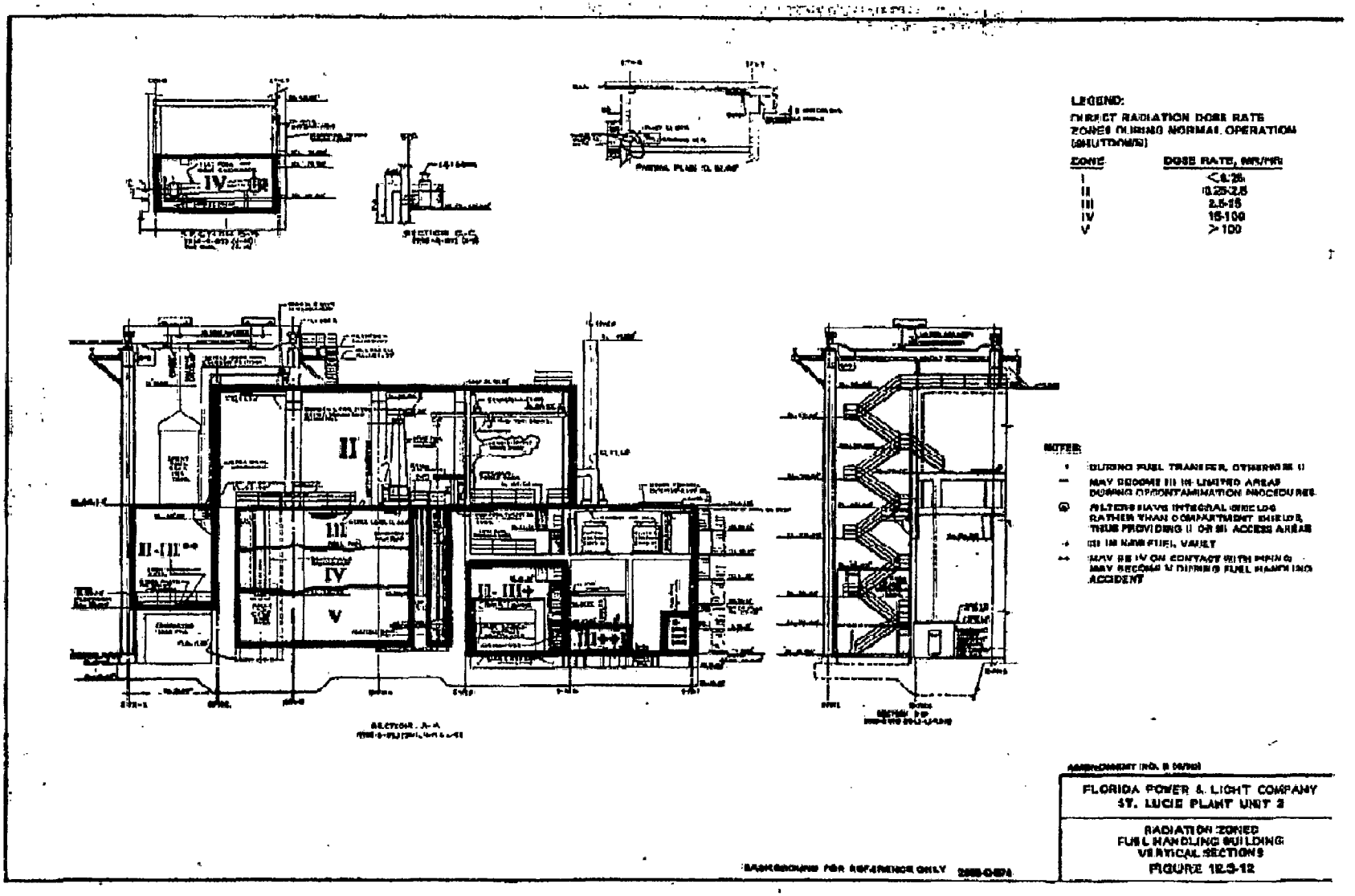
*DURING FUEL TRANSFER, OTHERWISE III
**DURING DECONTAMINATION PROCEDURE
+III IN NEW FUEL VAULT

BACKGROUND FOR REFERENCE ONLY - 8770-G-074

FLORIDA POWER & LIGHT COMPANY
ST. LUCIE PLANT UNIT 1
MAXIMUM DOSE RATE LEVELS - FUEL HANDLING BUILDING VERTICAL SECTIONS
FIGURE 12.1-5

Amendment No. 22 (05/07)


LEGEND:
ZONE
DOSE RATE MR/HR
I
II
III
IV
V
FLORIDA POWER & LIGHT COMPANY
ST. LUCIE PLANT UNIT 2
RADIATION ZONES
FUEL HANDLING BUILDING
FIGURE 12.3-11


LEGEND:
DIRECT RADIATION DOSE RATE ZONES DURING NORMAL OPERATION (SHUTDOWN)
ZONE | DOSE RATE, MR/HR
I | <0.25
II | 0.25-2.5
III | 2.5-15
IV | 15-100
V | >100
NOTES:
FLORIDA POWER & LIGHT COMPANY
ST. LUCIE PLANT UNIT 2
RADIATION ZONES
FUEL HANDLING BUILDING
VERTICAL SECTIONS
FIGURE 12.3-12

Engineering Evaluation of Environmental Testing Level Sensor Electronics Housing – Outside SFP

1.0 EXECUTIVE SUMMARY

Note: All References are shown on Page 12 above.

AR 1961497 documents a condition where previously transmitted device environmental specifications were changed from 170°F and 100% RH to 140°F and 95% RH. The device in question is a K-Tek model MT5000 guided wave radar transmitter being used in the Spent Fuel Pool Level Indication System (SFPLIS) being provided through Westinghouse for the NextEra fleet in response to Fukushima NRG Order EA 12-051 (Reference 1). Each Unit will have two of these transmitters installed.

A Gothic based environmental analysis was performed in December 2013 for the St. Lucie Units by Numerical Applications Incorporated (NAI) to determine the post event conditions in the different areas of interest within the fuel handling building where SFPLIS components could be installed (Reference 9). In addition, calculation NAI-1784-001 (Reference 8) determined the direct shine and scatter doses for the evaluation of radiological conditions in selected St. Lucie Units 1 and 2 Spent Fuel Pool (SFP) and Fuel Handling Building (FHB) locations.

Upgrades to the SFP level instrumentation prompted by the NRC Order EA-12-051 (Reference 1) are planned to implement robust water level instrumentation. The instrumentation, its cabling, and its connectors, are located in various levels and areas of the FHB. The radiological conditions were evaluated with the SFP water level at Level 3 (top of fuel racks) for a duration of 168 hours for abnormal conditions and a 10 year service life under normal conditions.

The results of both the environmental and dose analyses performed by NAI for the loop components located at the 48' elevation showed that the Westinghouse design limits for temperature, humidity and dose were exceeded.

Table 1 of Reference 8 notes that for the transmitter located at the fuel midpoint (the actual proposed location), the SkyShine model used by NAI, neglected the shielding between the FHB and the New Fuel Area. This inherent shielding includes steel plating on the floor, concrete walls, floors and a stainless steel enclosure for the transmitter electronics. FPL contracted Enercon Services to perform an additional calculation which included the inherent shielding noted above. Final results of the calculation (Reference 26) show a TID for the Unit 1 transmitters of 6.78E+02 rad and for Unit 2 transmitters of 7.86E+02 which is enveloped by the Westinghouse qualification.

2.0 PURPOSE

The purpose of this Evaluation is to justify the use of these components at the 48' elevation of the Reactor Auxiliary Buildings (RAB) for the environmental and radiological conditions determined by the NAI and Enercon calculations.

3.0 REVISION SUMMARY

Rev. No.	Date	Description of Revision
0	10/31/2014	Initial Issue.
1	02/06/2015	Incorporate final Enercon dose calculation for transmitters at 48' elevation.

4.0 EVALUATION

Table 4-1 provides the environmental conditions to which the K-Tek transmitters were qualified (Reference 16).

TABLE 4-1

	Normal	Abnormal	Abnormal Sensor Electronics only
Temperature	50-120°F	50 - 140 °F	50 - 140 °F
Pressure	Atmospheric	Atmospheric	Atmospheric
Humidity	0-95% RH	0-95% (Non-condensing)	0-95% (Non-condensing)
Radiation TID	≤ 1E+03 R γ	≤ 1E+03 R γ	≤ 1E+03 R γ
Duration (for single charge of system's installed batteries)	3 days (wired configuration) 4 days (wireless configuration or for 4-day battery life option) 7 days (for 7-day battery life option)	3 days (wired configuration) 4 days (wireless configuration or for 4-day battery life option) 7 days (for 7-day battery life option)	3 days (wired configuration) 4 days (wireless configuration or for 4-day battery life option) 7 days (for 7-day battery life option)

Numerical Applications, Incorporated (NAI) was contracted by FPL to develop 2 calculations which would determine the St. Lucie Units 1 & 2 area doses to the level instrumentation and the environmental conditions in the fuel handling building over a seven-day period during a beyond design basis event with the fuel pool level at the top of the fuel racks. A third document was produced which summarized the results (References 8, 9 and 10).

Table 4-2 provides the results of the calculations for the 48' elevations of Units 1 and 2 for Scenario 1. Table 4-3 provides the results of the calculations for the 48' elevations of Units 1 and 2 for Scenario 2. Only temperature and humidity are impacted by the 2

different scenarios. Note that the results shown in Tables 4-2 and 4-3 relate to the Abnormal conditions of Table 4-1. Also note pressure and battery duration are not addressed in the following tables since these two parameters are not part of the evaluation. Tables 4-2 and 4-3 have been updated to provide the final results of the Enercon calculation which included the inherent shielding noted above.

TABLE 4-2

	Unit 1	Unit 2
Temperature (maximum)	175°F	169°F
Humidity (maximum)	101%	101%
Radiation TID	6.78E+02 Rad (scatter dose)	7.86+02 (scatter dose)
	1.13E-08 Rad (direct shine dose)	1.13E-08 Rad (direct shine dose)

TABLE 4-3

	Unit 1	Unit 2
Temperature (maximum)	143°F	132°F
Humidity (maximum)	100%	100%
Radiation TID	6.78E+02 Rad (scatter dose)	7.86E+02 Rad (scatter dose)
	1.13E-08 Rad (direct shine dose)	1.13E-08 Rad (direct shine dose)

The difference between the 2 Scenarios has to do with the doors that are opened as a result of FLEX mitigating strategies and are as follows:

Scenario 1

- Full-height door on the south wall of the Spent Fuel Pool room open.
- Personnel door at the north end of the Spent Fuel Pool open.
- Personnel door at the south end of the new fuel area (62' level) opening onto the H&V room roof open.
- Roll-up door on the east side of the new fuel area (19'-6" level) open.

Scenario 2

- Full-height door on the south wall of the Spent Fuel Pool room open (but not required per calculation).
- Spent Fuel Pool room north door (for cask moves) at the 62'-0" elevation open.

At this time, it has been determined that due to the difficulty in opening the Spent Fuel Pool Room north door; ELAP procedures will invoke Scenario 1. However, both scenarios will be addressed should situational changes occur.

As stated in Section 1, the three level instrumentation parameters shown to be outside the Westinghouse design limits based on NAI calculations, are temperature, humidity and total irradiated dose. For clarity, each will be evaluated separately.

Temperature

Information contained in References 18 and 19, provides the overall environmental test conditions that the transmitter was subjected to during the environmental qualification testing. The only reported anomaly occurred on day 10 and thereafter, where the temperature profile exceeded 158°F. Review of Reference 20, shows that the transmitter output was erratic above this temperature, but self-recovered when the test temperature ramped below 158°F. This self-recovery behavior is important. The actual documented failure limit is shown to be 158°F per Reference 20 since the instrument performed properly before and after the excursion above 158°F.

The NAI evaluation temperature profile results for Unit 1, Scenario 1, are summarized on Figures 8-1 and 8-2 of Reference 9. Figure 8-2 shows extremely brief spikes just above 140°F at approximately 5 and 22 minutes into the event, with a spike up to 175°F that exceeds 140°F for approximately 4 minutes, starting 36 minutes into the event. (For the purposes of the analysis, the "event" starts when the pool starts to boil). Subsequently, at about 44 minutes, the area cools to less than 100°F and remains there for the remainder of the seven-day event.

Unit 1, Scenario 2, temperature results are shown in Figures 8-7 and 8-8 of Reference 9. The maximum temperature of 143°F occurs approximately 37 minutes after the pool starts to boil and remains above 140°F for approximately 5 minutes. The 158°F limit is never challenged. Subsequently, the area cools to less than 125°F approximately 1 ½ days into the event.

Unit 2, Scenario 1, temperature results are shown in Figures 8-12 and 8-13 of Reference 9. There are two spikes above 140°F. The first occurs approximately 18 minutes after the pool begins to boil and is a momentary spike to approximately 158°F. The second spike of approximately 169°F occurs at approximately 34 minutes into the event with a duration of approximately 4 minutes. Subsequently, the area cools to less than 100°F by approximately 37 minutes into the event and remains there for the remainder.

Unit 2, Scenario 2, temperature results are shown in Figures 8-18 and 8-19 of Reference 9. The temperature never exceeds 132°F.

The worst case described above results in temperatures exceeding 140°F up to 175°F for a relatively short duration (approximately 4 minutes). If the FHB doors are positioned in accordance with Scenario 2 the temperature does not exceed 143°F. The short duration temperature spikes postulated above will not likely result in transmitter failure and are considered more of a long term reliability issue by shortening the life of the electronics. The data shown in Reference 20 demonstrates that under test

conditions the transmitter provided an erratic output for a very short duration and then self-recovered without operator action. This is deemed acceptable, see Section 5.0, Conclusions, below.

Humidity

The Westinghouse Final Summary Design Verification Report (Reference 16) states that "During this test program it was determined that the existing design specification for 100% Humidity (non-condensing) and 170 deg. F for the level sensor electronics housing is not physically possible." Review of References 18 and 19 indicates that failure of the transmitter did not occur above 95% humidity; only that it was not tested above that value by the Westinghouse test program. The transmitter housing has previously been certified to EN 60529 IP66/IP67 as documented on EPSILON Certificate 08-TEST-2373 (Reference 22). IP67 certification requires full submersion to a depth of 1 meter for a minimum of 30 minutes, which is comparable to a NEMA 6 rating.

Unit 1 Scenario 1 humidity results are shown on NAI Figures 8-5 and 8-6 of Reference 9. Figure 8-5 shows humidity increasing to 100% for approximately 25 minutes, then oscillating for a few more minutes before decreasing to 48% to 58%.

Unit 1 Scenario 2 humidity results are shown on Figure 8-10 of Reference 9. For the first five days of the event, the relative humidity oscillates between 50% and 100% with the excursions to 100% being very short momentary spikes. Afterwards, at the beginning of Day 5, the relative humidity remains below 65%.

Unit 2 Scenario 1 humidity results are shown in Figures 8-15 and 8-16 of Reference 9. Except for the first thirty five minutes of the event, where the relative humidity is at or near 100% along with 5 momentary spikes to 101%, the relative humidity oscillates between 48% and 60%.

Unit 2 Scenario 2 humidity results are shown in Figure 8-21 of Reference 9. For the first two days of the event, the humidity remains at or near 100%. Afterwards, beginning at about day 2 ½, it oscillates between 0% and 30%.

As discussed above, the capability of the transmitter housing to with stand a relative humidity environment above 95% was indeterminate since the testing profile did not exceed the 95% relative humidity threshold. Based on the certification of the transmitter housing to IP66/IP67 (Reference 22), there is reasonable assurance of performance above 95% RH and even beyond 100% RH. In addition, per the current Westinghouse design, these transmitters will be mounted in a NEMA 4X enclosure for EMC reasons which will provide additional protection and another layer of defense against humidity.

Total Irradiated Dose (TID)

As shown in Table 4-1, the maximum TID for which the transmitters were qualified is 1E+03 R γ under all conditions. Per Reference 8, the calculated TID for the location in which the transmitters are to be mounted is 1.12E+04 Rad. However, based on the final results of the Enercon calculation which includes the inherent shielding of the structure and shows a TID for the transmitter of 6.78E+02 rad for Unit 1 and 7.86E+02 rad for Unit 2, the locations are acceptable.

5.0 CONCLUSIONS

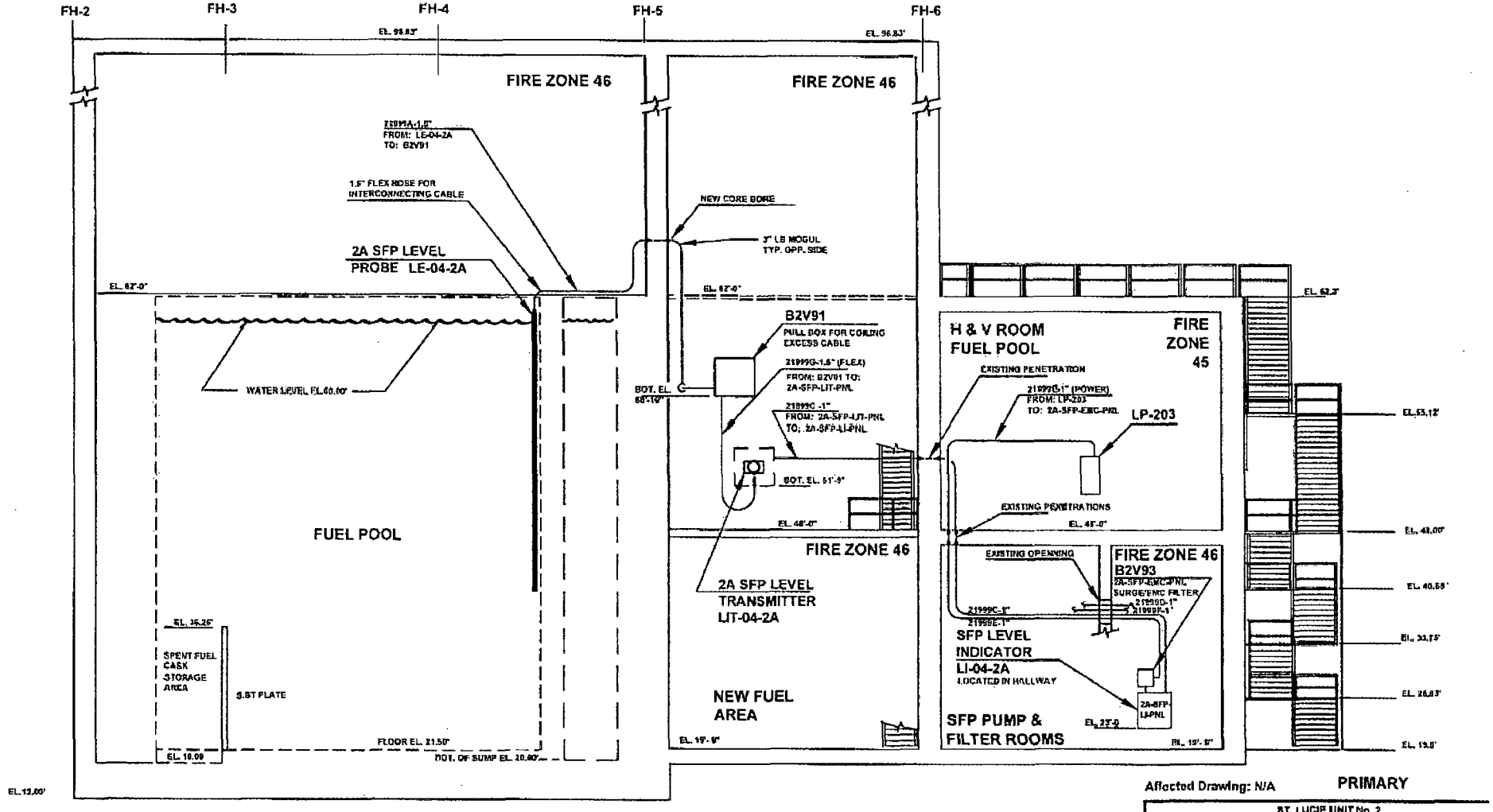
For the reasons described above, the proposed location for these transmitters on the 48' elevation in the new fuel storage area is deemed acceptable. In the worst postulated case, the transmitter output will be unavailable for a period of approximately 4 minutes out of the total 7 day mission duration and will self-recover without operator or maintenance interaction. Due to the volume of the spent fuel pool and the various postulated drain down/boil-off scenarios, it is extremely unlikely that significant changes in SFP level will occur during this short interruption of indication. Also, the transmitter began to respond erratically just prior to the ramp down to 140°F meaning that the components were at the 170°F elevated temperature for close to 24 hours allowing them to "soak" at the high temperature. With the short excursion time of approximately 4 minutes above 140°F, it is unlikely the transmitter will even enter into an erratic behavior period. The NEMA 4X and electronics IP67 certified enclosures will likely act as heat sinks and therefore insulate the actual electronics during this brief period.

A similar evaluation relates to the transmitter housing regarding the 100% humidity requirement. The short term duration excursions above 95% are coupled with oscillations to levels significantly below the publish limit. The transmitter housing's EN 60529 IP67 Certification, has confirmed satisfactory performance at a submergence of 1 meter for at least 30 minutes. NEMA 4X is defined as being watertight and able to withstand at least 65 GPM of water from a 1-in. nozzle delivered from a distance not less than 10 ft. for 5 min. Therefore, based on duration and defense in depth, the enclosure is deemed satisfactory to mitigate the postulated humidity in the area.

TID from direct isotope shine is well below the limits stated in the Westinghouse design specification. The new calculation performed by Enercon has shown that the TID for the transmitters at the 48' elevation is enveloped by the Westinghouse qualifications when the inherent shielding of the building structure is considered.

6.0 REQUIRED ACTIONS

No further actions are required.



Affected Drawing: N/A

PRIMARY

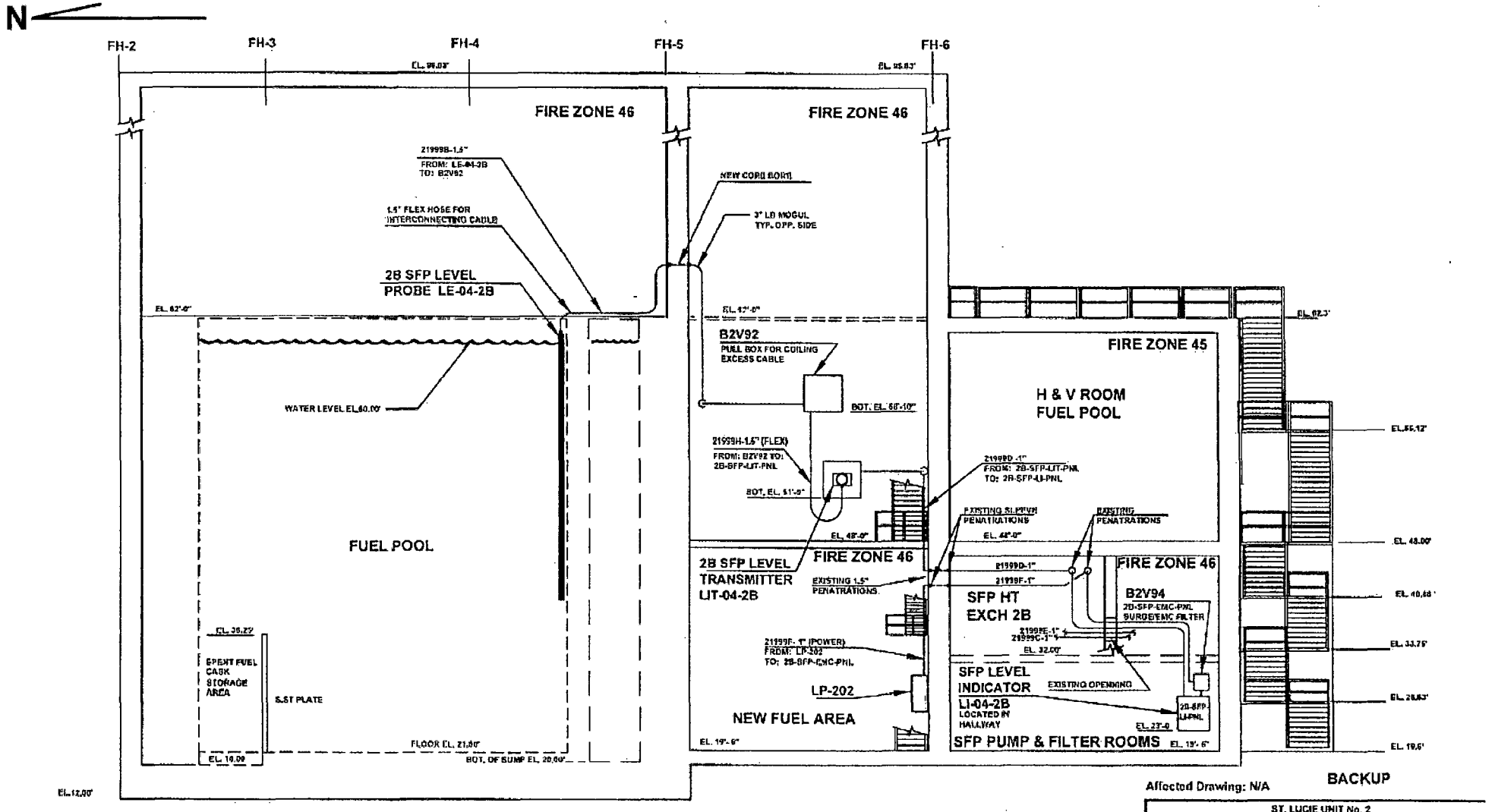
UNIT 2 - FUEL HANDLING BUILDING

ELEV LOOKING WEST, N.T.S.

ST. LUCIE UNIT No. 2
FUEL HANDLING BUILDING
(2A) CABLE ROUTE - BLOCK DIAGRAM

REV	DATE	REVISION	CH	APP	AP
0		ISSUED FOR USE EC280520	MRB	WFZ	

EC280520-E-002



Affected Drawing: N/A

BACKUP

UNIT 2 - FUEL HANDLING BUILDING

ELEV LOOKING WEST, N.T.S.

ST. LUCIE UNIT No. 2
FUEL HANDLING BUILDING
(2B) CABLE ROUTE - BLOCK DIAGRAM

REV	DATE	REVISION	CH	APP	APP
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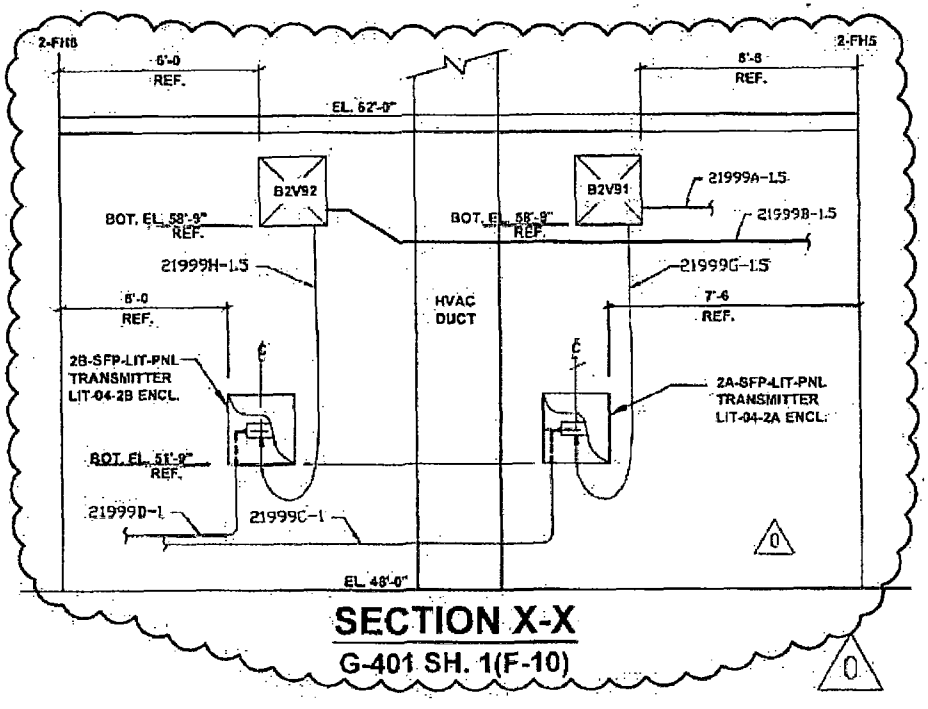
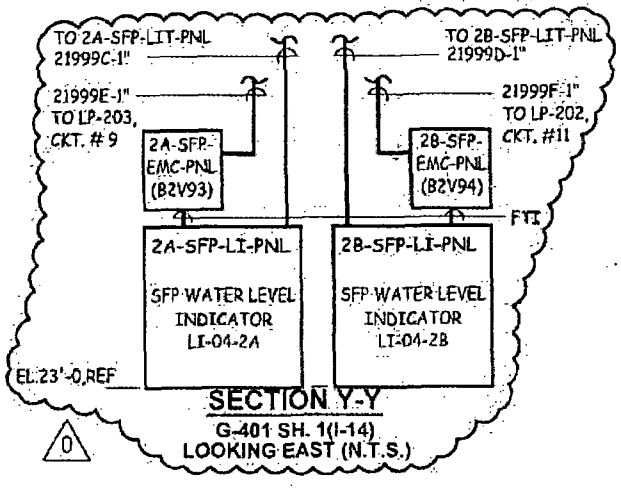
EC280520-E-003

CADD FILE: EC280520-E-003_2B SFP Level Instr. Block Dia. DWG





Affected Drawing: 2998-G-402, R11

ST. LUCIE UNIT No. 2
FUEL HANDLING BUILDING
SECTIONS & DETAILS

REV	DATE	REVISION	BY	CH	APP
0		ISSUED FOR USE EC280520	MRB	WEP	

2998-G-402 - EC280520 SH 2