FLOODING WALKDOWN REPORT FPL060-PR-001, Rev. 0

IN RESPONSE TO THE 50.54(f) INFORMATION REQUEST REGARDING NEAR-TERM TASK FORCE RECOMMENDATION 2.3: FLOODING

for the

St. Lucie Plant

Units 1 & 2

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1. EXECUTIVE SUMMARY

This report was developed to provide information requested by the United States Nuclear Regulatory Commission (NRC) pursuant to Title 10 of the Code of Federal Regulations, Section 50.54 (f) on March 12, 2012 for St. Lucie Plant Units 1 and 2. In response to the NRC request, Florida Power & Light Company performed walkdowns to verify that plant features credited in the current licensing basis (CLB) for protection and mitigation from external flood events are available, functional, and properly maintained. The walkdowns were performed to verify that permanent structures, systems, components (SSCs), portable flood mitigation equipment, and the procedures needed to install and or operate them during a flood are acceptable and capable of performing their design function as credited in the current licensing basis (CLB).

The walkdowns were performed in accordance with NEI 12-07 (Rev. 0-A), "Guidelines for Performing Verification of Plant Flood Protection Features," dated May, 2012. This document was endorsed by the NRC on May 31, 2012.

St. Lucie Plant configuration and procedures were compared to the flood protection features credited in the current licensing basis (CLB) documents for external flooding events. External flooding sources other than a Probable Maximum Hurricane (PMH) event were considered, but the PMH was determined to provide the greatest flooding threat. A summary of the St. Lucie CLB, the flood protection features, and the walkdown inspection results is provided below.

Current Licensing Basis

- The plant grade for Unit 1 of El+18 feet is above the highest Probable Maximum Hurricane (PMH) water level of 17.2 feet mean low water (MLW). The plant grade for Unit 2 of El+18.5 feet is above the highest probable maximum hurricane surge still water level of 17.2 feet MLW and wind induced waves to 18.0 feet MLW. Structures and components whose failure could prevent safe shutdown of the plant or result in significant uncontrolled release of radioactivity are protected from the effects of high water levels and wave runup associated with PMH and Probable Maximum Precipitation (PMP) conditions to elevation +19.5 feet.

Flood Protection Features

- Reinforced concrete flood walls have been provided around structures in the plant to elevation +22 feet MLW.
- The site drainage system is designed to preclude flooding of safety related structures and components under PMH conditions; however, total flooding of the drain lines will not cause water to backup into areas which would jeopardize the required function of a safety related system.
- Since there are no CLB credited structures on the south side of the Unit 2 Reactor Auxiliary Building (RAB), wave runup protection is provided by installing stop logs in the entrance on the south wall and the southern-most entrance on the east wall prior to a hurricane event.
- Electrical conduits penetrating safety related structures are constructed with seals to prevent flood water from entering connecting structures.
- Elevation of essential equipment in structures other than the Reactor Building and RAB are above the flood protection level of +19.5 feet.

Inspection Results

The flooding walkdowns verified that permanent structures, systems, components (SSCs), portable flood mitigation equipment, and the procedures needed to install and or operate them during a flood are acceptable

and capable of performing their design function as credited in the current licensing basis (CLB) with one exception.

- Missing and degraded conduit seals were determined in RAB-connected electrical manholes in Unit 1 and Unit 2.

Compensatory actions to prevent flooding of the manholes were put in place to ensure the deficiency did not create a potential operability or functionality concern. The missing and degraded seals on Unit 1 were considered to be inoperable, prior to the implementation of the compensatory actions, and Reportable to the NRC. This issue has been brought into full compliance in accordance with the guidance provided in Regulatory Information Summary (RIS) 2005-20 [Ref. 4].

2. PURPOSE

a. Background

In response to the nuclear fuel damage at the Fukushima-Dai-ichi power plant due to the March 11, 2011 earthquake and subsequent tsunami, the United States Nuclear Regulatory Commission (NRC) established the Near Term Task Force (NTTF) to conduct a systematic review of NRC processes and regulations, and to make recommendations to the Commission to clarify and strengthen the regulatory framework for protection against natural phenomena [Ref. 3]. On March 12, 2012, the NRC issued a request for information pursuant to Title 10 of the *Code of Federal Regulations*, Section 50.54 (f) (10 CFR 50.54(f) or 50.54(f)) [Ref. 2].

In Enclosure 4 of this document, the NRC requested that licensees 'perform flood protection walkdowns using an NRC-endorsed walkdown methodology to identify and address plant-specific degraded, nonconforming, or unanalyzed conditions and cliff-edge effects through the corrective action program and verify the adequacy of monitoring and maintenance procedures'. The flooding walkdowns have been completed and the results are described in this report.

b. Site Description

Florida Power & Light Company's (FPL) St. Lucie site is located on Hutchinson Island, St. Lucie County, Florida and contains two pressurized water reactor (PWR) steam generating stations-Unit 1 and Unit 2. The site for the St. Lucie Plant consists of approximately 1,132 acres. The unimproved area of the site is generally flat, covered with water and has a dense vegetation characteristic of Florida coastal mangrove swamps. At the ocean shore the land rises slightly in a dune or ridge to approximately 15 feet above mean low water (MLW). The eastern boundary of the site is the Atlantic Ocean and the western boundary is the Indian River, a tidal lagoon. The plant site is bounded by Herman Bay to the south and Big Mud Creek to the north. Big Mud Creek is not a flowing stream but rather an inlet off of the Indian River. Surface drainage from the site is either to the Atlantic Ocean, Indian River, or to Big Mud Creek and hence to the Indian River.

The "plant island" is defined as the area where all safety-related structures are located. The plant grade for Unit 1 of El+18 feet is above the highest probable maximum hurricane (PMH) water level of 17.2 feet MLW. The plant grade for Unit 2 of El+18.5 feet is above the highest probable maximum hurricane surge still water level of 17.2 feet MLW and wind induced waves to 18.0 feet MLW. The minimum entrance elevation to all safety related buildings is El+19.5 feet. The maximum elevation of roadways on the plant site is El+19.0 feet, thus any ponding of water that might result will be below the building entrances.

3. METHODOLOGY

The walkdowns were performed in accordance with NEI 12-07 (Rev. 0-A), "Guidelines for Performing Verification of Plant Flood Protection Features", dated May, 2012 [Ref. 1]. This document was endorsed by the NRC on May 31, 2012.

4. REQUESTED INFORMATION

The information requested in Reference 2, Enclosure 4, under paragraph 2 of the 'Requested Information' section, is provided below. The contents of each item were developed in accordance with Reference 1, Appendix D.

a. Requested Information Item 2(a) – Design Basis Flood Hazards

Describe the design basis flood hazard level(s) for all flood-causing mechanisms, including groundwater ingress.

During the probable maximum flood (PMF), which results from the Probable Maximum Hurricane (PMH) surge, the high water level is 17.2 feet mean low water (MLW). During the PMH, overtopping of the dune and beach by combined tide and wave action would occur for a period of about 4-1/2 hours duration. During the period prior to T-1-1/2 hours the erosive effect of waves breaking and overtopping the dune can be expected to lower the dune about 3 feet depending on variations in crest elevation, type of underlying material and other factors. The overflow water would move westward across the adjacent marsh and into Indian River, adding to its general water level. A maximum length of overflow of 6 miles along the beachfront is assumed, based on reconnaissance and the probable tide height distribution alongshore. Overflow would begin along an assumed 1-mile length of dune at time T-1-1/2 becoming progressively longer as tide and wave action builds up to a peak at T+0 hours. Since the PMH causing the maximum surge level approaches from the east, the western face of the plant island will not experience any significant wave runup. This is also true along the southern face of the plant island. Hence, the design basis flood level along both faces is 17.2 feet MLW. The flood protection level of El+19.5 feet MLW is maintained for all Category I structures.

During the PMH, a combination of heavy rain and wave runup could fill the storm drainage system to capacity. For the one hour period when wave runup reaches the catch basins on the plant island, each wave runup will flood the plant area momentarily before running off around the periphery of the plant island. Only the water which is trapped within the high points of each catch basin drainage area (crown of loop roads is El+19.0 feet; top of most catch basins is El +18.0 feet) will flow through the storm drainage system.

The St. Lucie Unit 2 Updated Final Safety Analysis Report contains a re-examination of the stalled PMH for the Hutchinson Island site. The analysis assumed that the existing beach dune fronting the plant site would be eroded to the existing ground level elevation of 4 to 5 feet MLW during a severe hurricane once the surge level exceeded 8 feet MLW. The 4 to 5 feet MLW is the elevation of the root system of the dense vegetation which fronts the plant site. No credit was taken in the latest (Unit 2 UFSAR) analysis for the ability of the vegetation to reduce wave heights or rate of erosion, nor was any credit taken for dune elevations. Therefore, the erosion estimates are valid regardless of the condition of the beach dunes and/or dense vegetation. Since these analyses pertain to the plant site, they are applicable to Unit 1. For the steady-state PMH, the maximum surge level is estimated to be 17.2 feet MLW which is well below the flood protection level of 19.5 feet MLW. Considering the effects of wave runup for the maximum postulated surge level of 17.2 feet MLW, the maximum water elevation is 18.8 feet MLW except for waves from the east over eroded areas (dunes and

mangroves), which propagate up the discharge canal approaching the nose where Unit 1 and Unit 2 canals join, where a maximum water elevation (surge level and runup) of 28.0 feet MLW is postulated.

The NRC staff previously reviewed the updated site specific analysis and issued the St. Lucie Unit 2 Safety Evaluation Report (NUREG-0843) which concluded in Section 2.4.7 that the analysis for the site is in conformance with the procedures in Regulatory Guide 1.59, "Design Basis Floods for Nuclear Power Plants" and that flooding does not present a credible threat to the plants with the exception of wave splash and spray at one entrance of the Fuel Handling Building. Also, the erosion analysis is considered to be conservative provided that the highway embankment and beach material assumed to exist and limit the breaching wave heights will be in place at the start of the storm.

For both units, the design basis flood level during a PMH event is +17.2 feet MLW. For Unit 2, the maximum hurricane surge results in a still water level of 17.2 feet MLW and wind induced waves to 18.0 feet MLW. The St. Lucie Unit 2 Updated Final Safety Analysis Report re-exams the stalled PMH and concludes the maximum water level, including wave run-up is 18.8 feet and as high as 28 feet at a limited location. However, the design basis for wave runup of 18 feet is maintained. External flooding sources other than a PMH event (PMF, LIP, seiche, and tsunami) were considered, but the PMH was determined to provide the greatest flooding threat.

b. Requested Information Item 2(b) – CLB Protection and Mitigation Features

Describe protection and mitigation features that are considered in the licensing basis evaluation to protect against external ingress of water into SSCs important to safety.

Common Site Protection and Mitigation Features

Reinforced concrete flood walls have been provided around structures in the plant site to elevation +22 feet MLW. All essential equipment on the intake structures are placed at elevation +22 feet MLW or higher. The design basis flood level of 17.2 feet is well below the minimum elevation of +19.5 feet of any Category I building openings. Additional flood protection is afforded by virtue of the layout of the roads, buildings and tornado missile protective structures permanently incorporated into the plant design. The minimum elevation of the crown of the perimeter plant road along the east face of the plant island is +19.0 feet. At elevation 19.0 feet, roads have the highest contours of plant island grading features. The structures along the immediate east face of the plant island form an effective concrete barrier with respect to inhibiting any wave runup. All of the barrier structures are seismic Category Class I and have been designed to withstand hurricane and tornado wind loadings.

In areas where drain lines carry storm water from both units, the lines are sized to accommodate the additional flow. The site drainage system and building drainage systems are designed to preclude flooding of safety related structures under PMH conditions except in the Component Cooling Water Structures where components are located above the wave runup elevation.

Waves propagating up the discharge canal approaching the nose where Unit 1 and Unit 2 canals join obtain a postulated water elevation (surge level and runup) of 28.0 feet MLW. The discharge canal nose area is protected by a steel sheet-piling barrier with its top at elevation 22 feet MLW. During the peak surge water level of 17.2 feet MLW, the refracted wave will break on the slope in front of the sheet piling and result in a wave runup of about 11 feet on a hypothetical extension of the slope of the canal nose. Overtopping of the barrier is expected and the resultant water behind the barrier will be drained off into the discharge canals. The temporary flooding around the nose is of no concern since there is no Category I structure located in that part of the plant site. For this surge and wave runup analysis, it is assumed that the fore dunes are completely washed away along the entire east coast of the site and that the incident wave propagates from the ocean without any attenuation prior to reaching Highway A1A. The presence of mangroves or the elevation of the

beach dunes do not affect the analysis and neither is required to mitigate the consequences of the design basis steady-state PMH.

The ultimate heat sink dam is a reinforced concrete buttressed retaining wall which extends across the ultimate heat sink canal connecting Big Mud Creek to the intake canal. Its function is to separate the waters of Big Mud Creek from the intake canal during normal operation, and through valved openings, provides an alternative source of cooling water in the unlikely event that the ocean intake becomes unavailable. In the unlikely event of blockage of the intake canal or pipes, emergency cooling water is taken from Big Mud Creek through the emergency cooling water canal. This emergency source of water is designed to withstand the design basis earthquake, tornado and probable maximum hurricane conditions.

Flooding of electrical manholes may occur through backup within the site drainage system. If flooding of an electrical manhole were to occur through backup within the site drainage system catch basins or in-leakage through manhole construction joints and manhole roof vents, the flood water is prevented from entering connecting structures because the construction openings within those structures are filled with concrete and constructed with seals.

Unit 1 Protection and Mitigation Features

As described in the Unit 1 UFSAR, structures and components whose failure could prevent safe shutdown of the plant or result in significant uncontrolled release of radioactivity are protected from the effects of high water levels and wave runup associated with PMH conditions by one or more of the following:

a) Design of structures and components to withstand such effects where functionally required.
b) Positioning of the structures and components such that they are located at sufficient grade to preclude inoperability due to external flooding.
c) Housing within waterproof structures.

For Unit 1, the maximum hurricane surge including wave runup results in a water level of 17.2 feet MLW. Flood protection criteria are established at elevation plus 19.5 feet MLW.

The Reactor Building and Reactor Auxiliary Building are the only seismic Class I structures with basements. These structures are completely waterproofed to finish grade with Nob-Lok waterproofing. All construction joints are waterstopped with 6 inch polyvinyl chloride. The Reactor Building contains no openings below El+22 feet, and Reactor Auxiliary Building contains no openings below El+19.5 feet. All external building penetrations are waterproofed and/or flood protected to preclude the failure of a safety related system or component due to external flooding. All penetrations for pipes or electrical ducts are either encased in concrete where they penetrate the wall, or, when sleeves are used, enclosed in a pipe boot designed to prevent seepage resulting in a completely waterproofed structure below grade.

All permanent door openings in the exterior walls of the reactor auxiliary, fuel handling and diesel generator buildings are provided with either roll-up or swing type doors for protection from rain, wind and other atmospheric effects. Large doors are furnished with a continuous, adjustable rubber stripping at jambs, head and floor to provide a positive weather-tight closure.

All interconnections between safety related structures that could be subjected to flooding are waterproofed. Additional flood protection beyond what is provided by the elevations of the openings of the safety related structures is not required to protect any of the safety related structures from wave runup or wind driven rain, even during a probable maximum hurricane. Therefore, the use of gasketed aluminum stop logs and/or sandbags and plastic sheeting is not required. All buildings with the exception of the Turbine Building are of the enclosed building type. The Turbine Building will be subjected to wind driven water spray, consequently, all equipment inside this building is designed for outdoor service.

The two Diesel Oil Storage Tank foundations have a top elevation of +22.2 feet MLW and are surrounded by a one-foot thick reinforced concrete retaining wall extending to elevation +24.5 feet. The operating floor of the Unit 1 Diesel Generator Building is at elevation +22.67 feet, thus providing a safety margin of 4.67 feet against the maximum calculated wave runup.

The Component Cooling Water Heat Exchanger and Pump Area is surrounded by a 2 feet thick reinforced concrete wall extending to an elevation of +23.5 feet. The base elevation of principal equipment is +24 feet leaving a safety margin of 5.5 feet against the maximum calculated wave runup.

The Unit 1 RAB north-side openings are protected by the Fuel Handling Building, Reactor Building and Steam Trestle. The west side is protected by the turbine building. The east side is protected by the effective barrier formed by the structures immediately east of the RAB. The south side of the Unit 1 RAB has two openings near the west end of the structure. The additional margin of safety is provided by the length of the high fill area to the east and south of these openings. Approximately 1200 feet of fill at elevation +15 feet extends to the east; about 1700 feet of fill varying in elevation from +15 to +10 extends to the south. Because of the fill elevation, it is not possible for there to be any significant wave runup on the RAB from the south.

Unit 2 Protection and Mitigation Features

As described in the Unit 2 UFSAR, Seismic Category I structures and safety related systems, and components are protected from the effects of high water level and wave runup that are associated with probable maximum hurricane (PMH) conditions by one or more of the following:

a) Designing structures and components to withstand such effects where functionally required.
b) Positioning of the structures and components such that they are located at sufficient grade to preclude inoperability due to external flooding.
c) Housing within waterproof structures.

For Unit 2, the maximum hurricane surge results in a still water level of 17.2 feet MLW and wind induced waves to 18.0 feet MLW. Flood protection criteria are established at elevation plus 19.5 feet MLW.

The Reactor Building and Reactor Auxiliary Building are the only seismic Category I structures with basements. The Reactor Building and Reactor Auxiliary Building are constructed with waterproofing to elevation 17.0 feet and therefore protected from in-leakage from phenomena such as cracks in exterior walls. The remaining seismic Category I structures are founded above the groundwater table and therefore waterproofing is not required. Construction joints within seismic Category I structures, except the Component Cooling Water Structure, contain polyvinyl chloride waterstops up to elevation 17.0 feet. The Reactor Building contains no openings below El+22 feet.

The Component Cooling Water Structure is not designed as a waterproof structure since all equipment is located above elevation 23.66 feet on pedestals. Penetrations for pipes or electrical ducts are either encased in concrete where they penetrate the wall, or, where sleeves are used, enclosed in a pipe boot designed to prevent seepage. Boots are not used below the normal groundwater table.

Wave runup protection is provided to the entrances of the Fuel Handling Building and Reactor Auxiliary Building by the presence of adjacent buildings and structures. Since no permanent structures were located on the south side of the Reactor Auxiliary Building, additional wave runup protection has been provided by installing stop logs in the entrance on the south wall and the southern-most entrance on the east wall. Rectangular aluminum stop logs would be stacked to El+22.0 feet and secured with bolts. Gaskets provide a seal at both the bottom and sides of the protected openings. The stop logs are stored onsite in a manner that reserves their readiness for use. When a hurricane watch is posted for the plant, the stop logs are removed from storage and prepared for installation; with actual installation occurring when the "hurricane warning" is posted for the plant.

There are two cases where storm water, resulting from coincident PMH and PMP conditions, could back up into any structure containing safety-related equipment or system; electrical manholes and the Component Cooling Water Building. Back flooding of electrical manholes would result only if manhole drain line check valves failed to operate properly. The cables can function in a submerged condition. Due to the arrangement of the Component Cooling Water Building, back flooding would occur from the site drainage system through the building sump. Back flooding of the Component Cooling Water Building cannot be greater than the elevation of water within the catch basins. Assuming that the catch basins fill to grade elevation, the water within the catch basins and building will be approximately elevation 18.5 feet. Electrical conduits and mechanical piping and valves located below elevation 18.5 feet can function in a submerged condition.

For the remaining seismic Category I buildings with roof drains (Reactor Building, Reactor Auxiliary Building and Diesel Oil Storage Tank Building), interconnection between roof drain piping and interior floor slab drainage system does not occur. The Fuel Handling Building has an exterior curb and leader system. DG Building and Condensate Storage Tank Building allow rain water to runoff the edge of the building to grade.

c. Requested Information Item 2(c) – Flood Warning Systems

Describe any warning systems to detect the presence of water in rooms important to safety.

Internal room water-level warning systems (e.g., alarms) are not credited for their external flood protection function in the St. Lucie Plant CLB. Mitigation for internal flooding is addressed for Unit 1 and Unit 2 by the RAB flooding procedure and the severe weather preparations procedure. These procedures provide instructions and equipment required to be operated to mitigate internal flooding.

See Section 4.d for discussion of additional existing SSCs that are not part of the external flooding CLB, but could be used to mitigate an external flood.

d. Requested Information Item 2(d) – Flood Protection System/Barrier Effectiveness

Discuss the effectiveness of flood protection systems and exterior, incorporated, and temporary flood barriers. Discuss how these systems and barriers were evaluated using the acceptance criteria developed as part of Requested Information Item 1.h [in Enclosure 4 of the March 12, 2012, 50.54(f) letter]

In accordance with NEI 12-07, the following general criteria were used as acceptance criteria for flood protection features:

- Flood protection configuration was in accordance with as-built drawings, as-built installation records, inspection records, and vendor documents.
- Visual inspection was utilized to identify any material degradation and indication of water leakage.
- Instructions contained within the implementation procedures can be implemented as written and within the allowed time considering the warning time available for the applicable flood hazard and expected conditions during the event.
- When applicable, PMs or periodic inspections were in place, within their required periodicity, and of adequate scope.
- There were no unresolved adverse PM or periodic inspection implementation results.
- No topography changes, including security barrier installations, adversely affected the site drainage plan.

All observations not immediately judged as acceptable were entered into the St. Lucie Corrective Action Program (CAP) where an evaluation of the observation was made.

For both units, the design basis flood level during a PMH event is +17.2 feet MLW. For Unit 2, the maximum hurricane surge results in a still water level of 17.2 feet MLW and wind induced waves to 18.0 feet MLW. Structures and components whose failure could prevent safe shutdown of the plant or result in significant uncontrolled release of radioactivity are protected from the effects of high water levels and wave runup associated with PMP and PMH conditions to elevation +19.5 feet.

The site drainage system is designed to preclude flooding of safety related structures and components under PMH conditions; however, total flooding of the drain lines will not cause water to backup into areas which would jeopardize the required function of a safety related system.

Reinforced concrete flood walls have been provided around structures in the plant to elevation +22 feet MLW.

Since there are no CLB credited structures on the south side of the Unit 2 Reactor Auxiliary Building, wave runup protection is provided by installing stop logs in the entrance on the south wall and the southern-most entrance on the east wall. The St. Lucie severe weather preparation procedure and Unit 2 Tech Spec Section 3/4.7.6 [Ref. 9] provides for installation of the stop logs upon issue of a hurricane warning. Procedural installation of the stop logs was validated by St. Lucie site engineering in the INPO IERL1-11-1 procedure validations dated March 28 and March 30, 2011 [Ref. 10]. Using this reasonable simulation, staffing levels were verified to be adequate, material condition was acceptable, and the flooding protection procedure could be implemented as written for performance of these activities prior to storm arrival.

If flooding of an electrical manhole were to occur through backup within the site drainage system catch basins or in-leakage through manhole construction joints and manhole roof vents, the flood water is prevented from entering connecting structures because the construction openings within those structures are filled with concrete and constructed with seals. Visual inspection determined missing conduit flood seals and/or material degradation of many of the seals for electrical manholes in Unit 1 and Unit 2 RAB. Missing conduit seals and material degradation was also noted at the corresponding penetrations on the interior walls of Unit 1 and Unit 2 RAB. All observations not immediately judged as acceptable were entered into the St. Lucie Plant Corrective Action Program (CAP) where an evaluation of the observation was made.

Elevation of essential equipment in structures other than the Reactor Building and RAB were determined to be above the flood protection level of +19.5 feet. Although all essential equipment in the Unit 2 Condensate Storage Tank Building was above its stated flood protection level of +22 feet, several openings were determined to be below this level. This observation was placed in the St. Lucie Plant CAP for evaluation where it was determined that it was not a reportable deficiency.

Mitigation for internal flooding in Unit 1 and Unit 2 RAB is addressed by the RAB flooding procedure and severe weather preparations procedure. These procedures provide instructions and equipment required to be operated to mitigate internal flooding. These procedures and available equipment could be used to mitigate limited external flooding events, but is not a credited feature.

New structures along the immediate east and south face of the plant island (South Services Building, Unified Maintenance Building, Vehicle Barrier System) that are not CLB credited structures form an effective concrete barrier with respect to inhibiting any wave runup to the plant island.

e. Requested Information Item 2(e) – Implementation of Walkdown Process

Present information related to the implementation of the walkdown process (e.g., details of selection of the walkdown team and procedures) using the documentation template discussed in Requested Information Item 1.j [in Enclosure 4 of the March 12, 2012, 50.54(f) letter], including actions taken in response to the peer review.

Consistent with Section 5.3 of NEI 12-07, walkdown teams consisted of at least two trained individuals with a complementary set of skills. ENERCON selected four experienced and knowledgeable engineers to perform walkdown inspection activities and presented their qualifications to FPL for review. Personnel completing parts A, B, C, and E of Appendix B, Walkdown Record Form, were knowledgeable of the St. Lucie site current licensing basis, and were experienced in performing visual inspections of plant structures, systems, and components. All walkdown personnel completed the training outlined in Table 1 of Appendix C (Sample Training Content) for the walkdown activities performed (refer to Part A, B, C, D, or E of the Appendix B, Walkdown Record Form). The St. Lucie Plant conducted a walkdown team challenge meeting to assess how assigned individuals met experience or knowledge requirements for the walkdown process. Additional specific expectations were outlined by the St. Lucie Plant in a walkdown kickoff meeting. ENERCON used the training developed by the NEI Fukushima Flooding Task Force and available on INPO's NANTEL website to familiarize the personnel performing the activities in this guideline (see Appendix C). Walkdown teams performing visual inspections of features not subject to a regular surveillance program consisted of a minimum of two people with a complementary set of skills (such as previous walkdown experience, operations, knowledge of flooding design basis, knowledge of design, construction and performance of flood protection features).

ENERCON walkdown teams were supported by site and craft personnel during the walkdown because of their familiarity with SSCs and protective measures. A pre-job brief was performed prior to conducting the walkdowns using plant human performance procedures and was tailored to the walkdown task. Each walkdown performed a specified inspection to assess the capability of the item to perform its required function. Performance of these activities was reported on the Walkdown Record Form (Appendix B). The results of the walkdowns conducted in response to INPO IER 11-1,"Fukushima Daiichi Nuclear Station Fuel Damage caused by Earthquake and Tsunami" [Ref. 10], or other comprehensive walkdowns conducted to validate flood protection features in 2011 were used to satisfy some of the walkdown requirements for a flood protection feature if the previously performed walkdown performance and documentation met the expectations in this guideline (see Section 4, Scope) and any changes addressed that may have affected the feature since the time of the previously performed walkdowns. For the previously performed results used for any feature, the walkdown record form (Appendix B) for the associated flood protection feature stated that the previously performed inspection was the source of the information and the documentation from the previously performed walkdown is either attached to or referenced on the record form.

A peer review of the overall evaluation of the walkdown results including station staff and the aggregate effect to assure all actions can be completed as required resulted in no change to the walkdown process or methodology.

f. Requested Information Item 2(f) – Findings and Corrective Actions Taken/Planned

Results of the walkdown including key findings and identified degraded, non-conforming, or unanalyzed conditions. Include a detailed description of the actions taken or planned to address these conditions using the guidance in Regulatory Issues Summary 2005-20, Rev 1, Revision to NRC Inspection Manual Part 9900 Technical Guidance, "Operability Conditions Adverse to Quality or Safety," including entering the condition in the corrective action program.

Structures and components whose failure could prevent safe shutdown of the plant or result in significant uncontrolled release of radioactivity are protected from the effects of high water levels and wave runup associated with PMH and PMP conditions to elevation +19.5 feet.

If flooding of an electrical manhole were to occur through backup within the site drainage system catch basins or in-leakage through manhole construction joints and manhole roof vents, the flood water is

prevented from entering connecting structures because the conduits penetrating waterproofed, safety related structures are constructed with seals. Visual inspection determined material degradation of many of the seals for electrical manholes connecting to Unit 1 RAB and Unit 2 RAB. All observations not immediately judged as acceptable were entered into the St. Lucie Plant Corrective Action Program (CAP). The deficiency identified in the table below has been evaluated to ensure that there are no operability or functionality concerns. This issue has been brought into full compliance in accordance with the guidance provided in Regulatory Information Summary (RIS) 2005-20 [Ref. 4].

An additional recommendation was made to provide periodic monitoring of the material condition of seals for conduits penetrating waterproofed, safety related structures. This observation was entered into the St. Lucie Plant Corrective Action Program (CAP).

Description of Deficiency	Feature Category	St. Lucie Disposition	Status
Unit 1 and Unit 2 degraded and missing seals in electrical manholes	Incorporated Passive Feature	Compensatory actions, as part of a Potential Operability Assessment, were put into place to prevent water from getting into the manholes and potential flooding until the permanent manhole seals could be installed or repaired in accordance with design requirements.	The repairs to the degraded and missing conduit flood seals have been completed.

There were no restricted access or inaccessible external flooding protection features determined for the St. Lucie site.

g. Requested Information Item 2(g) – Cliff –Edge Effects and Available Physical Margin

In accordance with NEI 12-07, Available Physical Margins have been collected and documented in the Walkdown Record form (Appendix B). The guidance provided in FAQ-006 [Ref. 11] was also followed. This information will be used in the flood hazard reevaluations performed in response to Item 2.1: Flooding in the 50.54(f) letter [Ref. 2].

h. Requested Information Item 2(h) – Planned/Newly-Installed Flood Protection Enhancements

Describe any other planned or newly installed flood protection systems or flood mitigation measures including flood barriers that further enhance the flood protection. Identify results and any subsequent actions taken in response to the peer review.

Periodic inspection was not in place for seals in conduits penetrating waterproofed, safety related structures. Monitoring or testing should be considered to periodically verify the component is able to perform its credited CLB flood protection function. A Preventative Maintenance Change Request (PMCR) was initiated to develop this monitoring program, and the PMCR is being tracked under the St. Lucie CAP until completion.

A peer review of the overall evaluation of the walkdown results including station staff and the aggregate effect to assure all actions can be completed as required resulted in no change to the walkdown process or methodology.

5. CONCLUSIONS

Walkdowns were performed in accordance with NEI 12-07 (Rev. 0-A), "Guidelines for Performing Verification of Plant Flood Protection Features", dated May, 2012 [Ref. 1]. This document was endorsed by the NRC on May 31, 2012. St. Lucie Units 1and 2 configuration and procedures were compared to the flood protection features credited in the current licensing basis documents [Ref. 5, 6, 7, and 8] for external flooding events.

Inspection Results

Site-specific features credited for protection and mitigation against external flooding events were identified and evaluated.

- Reinforced concrete flood walls have been provided around structures in the plant to elevation +22 feet MLW.
- The site drainage system is designed to preclude flooding of safety related structures and components under PMH conditions; however, total flooding of the drain lines will not cause water to backup into areas which would jeopardize the required function of a safety related system.
- Since there are no CLB credited structures on the south side of the Unit 2 Reactor Auxiliary Building (RAB), wave runup protection is provided by installing stop logs in the entrance on the south wall and the southern-most entrance on the east wall prior to a hurricane event. Using reasonable simulation, staffing levels were verified to be adequate, material condition was acceptable, and the flooding protection procedure could be implemented as written for performance of these activities prior to storm arrival.
- Electrical conduits penetrating waterproofed, safety related structures are constructed with seals to prevent flood water from entering connecting structures.
- Elevation of essential equipment in structures other than the Reactor Building and RAB are above the flood protection level of +19.5 feet.
- New structures along the immediate east and south face of the plant island (South Services Building, Unified Maintenance Building, Vehicle Barrier System) that are not CLB credited structures form an effective concrete barrier with respect to inhibiting any wave runup to the plant island.

Inspection Deficiencies

The flooding walkdowns verified that permanent structures, systems, components (SSCs), portable flood mitigation equipment, and the procedures needed to install and or operate them during a flood are acceptable and capable of performing their design function as credited in the current licensing basis (CLB) with one exception.

- Missing and degraded conduit seals were determined in RAB-connected electrical manholes in Unit 1 and Unit 2.

Compensatory actions to prevent flooding of the manholes were put in place to ensure the deficiency did not create a potential operability or functionality concern. The missing and degraded seals on Unit 1 were

considered to be inoperable, prior to the implementation of the compensatory actions, and Reportable to the NRC. This issue has been brought into full compliance in accordance with the guidance provided in Regulatory Information Summary (RIS) 2005-20 [Ref. 4].

6. REFERENCES

1. Nuclear Energy Institute (NEI), Report 12-07 [Rev 0-A]. *Guidelines for Performing Verification Walkdowns of Plant Protection Features*. May 2012 [NRC endorsed May 31, 2012; updated and re-issued June 18, 2012].
2. U.S. Nuclear Regulatory Commission. Letter to Licensees. *Request for Information Pursuant to Title 10 of the Code of Federal Regulations 50.54(f) Regarding Recommendations 2.1, 2.3, and 9.3 of the Near Term Task Force Review of Insights from the Fukushima Dai-ichi Accident*. March 12, 2012.
3. U.S. Nuclear Regulatory Commission. *Recommendations for Enhancing Reactor Safety in the 21st Century, The Near Term Task Force Review of Insights from the Fukushima Dai-ichi Accident*. July 12, 2011.
4. U.S. Nuclear Regulatory Commission. *Operability Determinations & Functionality Assessments for Resolution of Degraded or Nonconforming Conditions Adverse to Quality or Safety*. NRC Inspection Manual. Part 9900: Technical Guidance. Regulatory Issues Summary 2005-20, Revisions 1. September 26, 2005.
5. Unit 1 UFSAR, Amendment 025, Chapter 2.0, Site Characteristics
6. Unit 1 UFSAR, Amendment 025, Chapter 3.0, Design Criteria-Structures, Components, Equipment and Systems.
7. Unit 2 UFSAR, Amendment 020, Chapter 2.0, Site Characteristics
8. Unit 2 UFSAR, Amendment 020, Chapter 3.0, Design Criteria-Structures, Components, Equipment and Systems.
9. Unit 2 Tech Specs, Revision 163, Section 3/4.7.6, Flood Protection
10. FPL Letter L-2011-151, NextEra Energy Response to INPO Level 1 Event Report 11-1 (Revision 1), Fukushima Daiichi Nuclear Station Fuel Damage Caused by Earthquake and Tsunami
11. FAQ-006, Inquiry Form-NRC Submittal, Revision 4, Applicable Features for Quantifying APM, September 13, 2012.

7. ATTACHMENTS

FAQ-006, Inquiry Form-NRC Submittal, Revision 4 (Ref. 11)

A. TOPIC: **Applicable Features for Quantifying APM**

Source document: NEI 12-07 Section: 3.13 & 5.8

B. DESCRIPTION:

Sections 3.13 and 5.8 provide a definition, description, and examples for Available Physical Margin (APM). In Section 3.13, APM is defined as "the difference between licensing basis flood height and the flood height at which water could affect an SSC important to safety". This inquiry is intended to clarify the latter part of this definition, considering that that some features will not have a clearly defined exceedance height.

D. RESOLUTION: (Include additional pages if necessary. Total pages: 2)

Inquiry number: 006 Priority: H

Sections 3.13 and 5.8 provide a definition, description, and examples for Available Physical Margin (APM). In Section 3.13, APM is defined as "the difference between licensing basis flood height and the flood height at which water could affect an SSC important to safety". The latter (underlined) part of the definition can be interpreted as the height at which the flood protection capability of a feature is exceeded. For some features, the exceedance height can be clearly defined (e.g. flood walls, levees, dikes, cofferdams, flood gates, the elevation of unsealed penetrations or other openings, etc.). For other features (e.g. seal, plug, or water-tight door pressure ratings, pump flow rates, etc.), the exceedance height cannot be clearly defined without performing an engineering analysis that is beyond the scope of the flooding walkdowns. As a result, it is appropriate to record APM as a simple measurement of height difference, however additional considerations apply.

There is a concern that recording a large APM on the Walkdown Record Form could be misleading if the APM is interpreted as margin that is available for additional flood protection without further evaluation. For example, for a flood protection wall that is 10-ft high and the CLB water height is 9.5-ft., it is reasonable to state that the APM is 6-inches for the wall. However, if the previous wall is now 20-ft high and CLB water height is still 9.5-ft, it cannot be stated that the wall's APM is 10.5-ft based on engineering judgment alone. In order to verify a large APM that is not already defined in the existing design documents, an analysis would have to be performed to evaluate the effect of the additional flood height on wall loads and pressure retention capability for any associated penetration seals. As a result, the manner in which an APM should be recorded on the Walkdown Record form depends upon whether the APM is considered large (an interpretation of what constitutes a "large" APM is at the discretion of the utility).

The following guidance applies.

For walkdowns that have not yet been performed and/or documented:

Recording APMs on the Walkdown Record Sheet as a difference in height is a reasonable statement of the available margin based on engineering judgment unless the APM is large. For large APMs , three options are available: (1) record a smaller, but defensible, APM value based on engineering judgment with a corresponding note in the "comments" section; (2) record no

value for the APM with a corresponding note in the "comments" section that an engineering analysis is necessary to determine the maximum APM the wall can withstand before a functional failure; or (3) reference the existing FSAR section or design document that supports the APM.

Note that this notation should be made in the response to Q11, Q23, or Q27 of the Walkdown Record Form, as applicable.

For walkdowns that have been completed:

Recognizing that it is not resource effective to revise completed paperwork, it is not necessary to change the way the APM was recorded in completed portions of the Walkdown Record Form. In these cases, APMs that have been recorded as simple measurements of height differences are acceptable as long as the APM determination process did not result in overlooking some potential small margins, as defined by the site per Section 5.8 of NEI 12-07.

For Walkdown Reports:

Indicate in the walkdown report if any APM information was recorded before the large APM approach described in this FAQ was developed.

Notes:

1. Typically, the CLB for the site will indicate what the probable maximum flood level is and the level to which the SSC important to safety is protected. If the recorded APM exceeds the difference between these two values and the margin is to be credited for additional flood protection, the margin must be justified by one of the following methods:
    a. Documented application of reasonable and independently verified engineering judgment
    b. Performance of new engineering analysis
    c. Reference to an existing document or analysis that supports the higher protection level

Revision: 4 Date: 9/13/12

E. NRC Review:

Not Necessary_____ Necessary X

Explanation:_____

F. Industry Approval:

Documentation Method: Sept 13, 2012 meeting Date:_____

G. NRC Acceptance:

Interpretation X Agency Position_____

Documentation Method: Sept 13, 2012 meeting Date:__