



JUN 29 2017

L-2017-105  
10 CFR 50.54(f)

U. S. Nuclear Regulatory Commission  
Attn.: Document Control Desk  
Washington, D.C. 20555

Re: St. Lucie Unit 1 and Unit 2  
Docket Nos. 50-335 and 50-389  
Flooding Focused Evaluation Summary

References:

1. NRC Letter, 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; dated March 12, 2012. (ML12056A046)
2. FPL letter L-2015-048, St. Lucie Plant, Units 1 and 2, Response to March 12, 2012 Request for Information Enclosure 2, Recommendation 2.1, Flooding, Required Response 2, Flooding Hazard Reevaluation Report, dated March 10, 2015 (ML15083A264).
3. FPL letter L-2016-105, St. Lucie Plant, Units 1 and 2, NEI 12-06, Revision 2, Appendix G, G.4.2: Modifying FLEX Strategies, (MSA) report for the New Flood Hazard Information, dated December 19, 2016 (ML16365A005)
4. NRC Staff Requirements Memoranda to COMSECY-14-0037, "Integration of Mitigating Strategies for Beyond-Design-Basis External Events and the Reevaluation of Flooding Hazards", dated March 30, 2015. (ML15089A236)
5. Nuclear Energy Institute (NEI), Report NEI 16-05 [Rev 1], External Flooding Assessment Guidelines, dated June 2016. (ML16165A178)
6. U.S. Nuclear Regulatory Commission, JLD-ISG-2016-01, Guidance for Activities Related to Near-Term Task Force Recommendation 2.1, Flood Hazard Reevaluation; Focused Evaluation and Integrated Assessment, Revision 0, dated July 11, 2016. (ML16162A301)

On March 12, 2012, the NRC issued Reference 1 to request information associated with Near-Term Task Force (NTTF) Recommendation 2.1 for flooding. Reference 1 directed licensees, in part, to submit a Flood Hazard Reevaluation Report (FHRR) to reevaluate the flood hazards for their sites using present-day methods and guidance used for early site permits and combined operating licenses. The FHRR for St. Lucie Plant, Units 1 & 2, was submitted on March 10, 2015 (Reference 2). An interim evaluation was performed after issuance of the FHRR that evaluated in-leakage into the Reactor Auxiliary Buildings (RABs) during a LIP event and the results were referenced in the Mitigating Strategies Assessment (MSA) (Reference 3).

Following the Commission's directive to NRC Staff in Reference 4, the NRC issued a letter to industry indicating that new guidance is being prepared to replace instructions in Reference 4 and provide for a "graded approach to flooding reevaluations" and "more focused evaluations of local

intense precipitation and available physical margin in lieu of proceeding to an integrated assessment.” NEI prepared the new “External Flooding Assessment Guidelines” in NEI 16-05 (Reference 5), which was endorsed by the NRC per Reference 6. NEI 16-05 indicates that each flood-causing mechanism not bounded by the design basis flood (using only stillwater and/or wind-wave runup level) should follow one of the following five assessment paths:

- Path 1: Demonstrate Flood Mechanism is Bounded
- Path 2: Demonstrate Effective Flood Protection
- Path 3: Demonstrate a Feasible Response to LIP
- Path 4: Demonstrate Effective Mitigation
- Path 5: Scenario Based Approach

Non-bounded flood-causing mechanisms in Paths 1, 2, or 3 would only require a Focused Evaluation (FE) to complete the actions related to external flooding required by the March 12, 2012 10 CFR 50.54(f) letter. The enclosed FE followed path 2 of NEI 16-05, Rev. 1 and utilized NEI 16-05 Appendix B for guidance on evaluating the site strategy.

This submittal completes the actions related to External Flooding required by the March 12, 2012 10 CFR 50.54(f) letter.

Should you have any questions regarding this submittal, please contact Mr. Michael Snyder, St. Lucie Licensing Manager, at 772-467-7036.

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

Executed on

Sincerely,



Dan DeBoer  
Site Director  
St. Lucie Nuclear Plant

Enclosure: St. Lucie Plant, Units 1 & 2 - Flooding Focused Evaluation Summary

cc: USNRC Regional Administrator, Region II  
USNRC Project Manager, St. Lucie Nuclear Plant  
USNRC Senior Resident Inspector, St. Lucie Nuclear Plant



NUCLEAR ENERGY INSTITUTE

# **ST. LUCIE PLANT, UNITS 1 & 2 - FLOODING FOCUSED EVALUATION SUMMARY**

JUNE 28<sup>TH</sup>, 2017  
LETTER L-2017-105  
ENCLOSURE 1

**Florida Power & Light  
St. Lucie Plant, Units 1 & 2  
6501 S. Ocean Drive  
Jensen Beach, Fl. 34957**

## TABLE OF CONTENTS

<b>1 EXECUTIVE SUMMARY .....</b>	<b>2</b>
<b>2 BACKGROUND .....</b>	<b>3</b>
<b>3 REFERENCES .....</b>	<b>4</b>
<b>4 TERMS AND DEFINITIONS .....</b>	<b>6</b>
<b>5 FLOOD HAZARD PARAMETERS FOR UNBOUNDED MECHANISMS.....</b>	<b>7</b>
<b>6 OVERALL SITE FLOODING RESPONSE.....</b>	<b>8</b>
<b>6.1 DESCRIPTION OF OVERALL SITE FLOODING RESPONSE.....</b>	<b>8</b>
<b>6.2 SUMMARY OF PLANT MODIFICATIONS AND CHANGES .....</b>	<b>8</b>
<b>7 FLOOD IMPACT ASSESSMENT .....</b>	<b>9</b>
<b>7.1 LOCAL INTENSE PRECIPITATION (PATH 2 ASSESSMENT).....</b>	<b>9</b>
7.1.1 Description of Flood Impact.....	9
7.1.2 Adequate APM Justification and Reliability Flood Protection .....	9
<b>8 CONCLUSION .....</b>	<b>10</b>

## **ST. LUCIE NUCLEAR POWER PLANT FLOODING FOCUSED EVALUATION SUMMARY**

### **1 EXECUTIVE SUMMARY**

The St. Lucie Plant has reevaluated its flooding hazard in accordance with the NRC's March 12, 2012, 10 CFR 50.54(f) request for information (RFI) (Reference 1). The RFI was issued as part of implementing lessons learned from the Fukushima Dai-ichi accident; specifically, to address Recommendation 2.1 of the NRC's Near-Term Task Force report. This information was submitted to NRC in a flood hazard reevaluation report (FHRR) on March 10, 2015 and is provided in the Mitigating Strategies Flood Hazard Information (MSFHI) documented in NRC's "Interim Staff Response to Reevaluated Flood Hazards" letter dated September 3, 2015. An interim evaluation, NEE-131-PR-001 Effects of Local Intense Precipitation (LIP) on Plant Internal Flooding Report (Reference 10), was performed since the issuance of the MSFHI letter and results were referenced in the Mitigating Strategies Assessment (MSA) (Reference 11). The interim evaluation for the effects of LIP will serve as the input to this Focused Evaluation (FE). There is one mechanism that was found to exceed the design basis flood level at the St. Lucie Plant. This mechanism is listed below and included in this FE:

#### **1. Local Intense Precipitation**

Associated effects (AE) and flood event duration (FED) parameters were assessed in the interim evaluation and results referenced in the MSA. The interim evaluation concludes in-leakage volume into safety related buildings remains less than the calculated volume of an internal pipe break and the height of flood waters is below the height required to effect critical equipment. This FE followed Path 2 of NEI 16-05, Rev. 1 and utilized NEI 16-05 Appendix B for guidance on evaluating the site strategy. This submittal completes the actions related to External Flooding required by the March 12, 2012 10 CFR 50.54(f) letter.

## 2 BACKGROUND

On March 12, 2012, the NRC issued Reference 1 to request information associated with Near-Term Task Force (NTTF) Recommendation 2.1 for flooding. The RFI (Reference 1) directed licensees, in part, to submit a Flood Hazard Reevaluation Report (FHRR) to reevaluate the flood hazards for their sites using present-day methods and guidance used for early site permits and combined operating licenses. The FHRR for St. Lucie Plant, Units 1 & 2, was submitted on March 10, 2015 (Reference 2). An interim evaluation, NEE-131-PR-001 Effects of Local Intense Precipitation (LIP) on Plant Internal Flooding Report (Reference 10), was performed after issuance of the FHRR that evaluated in-leakage into the Reactor Auxiliary Buildings (RABs) during an LIP event.

Following the Commission's directive to NRC Staff in Reference 4, the NRC issued a letter to industry indicating that new guidance is being prepared to replace instructions in Reference 4 and provide for a "graded approach to flooding reevaluations" and "more focused evaluations of local intense precipitation and available physical margin in lieu of proceeding to an integrated assessment." NEI prepared the new "External Flooding Assessment Guidelines" in NEI 16-05 (Reference 5), which was endorsed by the NRC per Reference 6. NEI 16-05 indicates that each flood-causing mechanism not bounded by the design basis flood (using only stillwater and/or wind-wave runup level) should follow one of the following five assessment paths:

- Path 1: Demonstrate Flood Mechanism is Bounded
- Path 2: Demonstrate Effective Flood Protection
- Path 3: Demonstrate a Feasible Response to LIP
- Path 4: Demonstrate Effective Mitigation
- Path 5: Scenario Based Approach

Non-bounded flood-causing mechanisms in Paths 1, 2, or 3 would only require an FE to complete the actions related to external flooding required by the March 12, 2012 10 CFR 50.54(f) letter. Mechanisms in Paths 4 or 5 require an Integrated Assessment.

### 3 REFERENCES

1. NRC Letter, 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; dated March 12, 2012. (ML12056A046)
2. St. Lucie Plant, Units 1 and 2, Letter to USNRC, Response to March 12, 2012 Request for Information Enclosure 2, Recommendation 2.1, Flooding, Required Response 2, Flooding Hazard Reevaluation Report, dated March 10, 2015 (ML15083A264).
3. NRC Letter, Supplemental Information Related to Request for Information Pursuant to Title 10 of the Code of Federal Regulations 50.54(f) regarding Flooding Hazard Reevaluations for Recommendation 2.1 of the Near Term Task Force Review of Insights from the Fukushima Dai-ichi Accident, dated March 1, 2013. (ML13044A561)
4. NRC Staff Requirements Memoranda to COMSECY-14-0037, "Integration of Mitigating Strategies for Beyond-Design-Basis External Events and the Reevaluation of Flooding Hazards", dated March 30, 2015. (ML15089A236)
5. Nuclear Energy Institute (NEI), Report NEI 16-05 [Rev 1], External Flooding Assessment Guidelines, dated June 2016. (ML16165A178)
6. U.S. Nuclear Regulatory Commission, JLD-ISG-2016-01, Guidance for Activities Related to Near-Term Task Force Recommendation 2.1, Flood Hazard Reevaluation; Focused Evaluation and Integrated Assessment, Revision 0, dated July 11, 2016. (ML16162A301)
7. NRC Letter, Coordination of Requests for Information Regarding Flooding Hazard Reevaluations and Mitigating Strategies for Beyond-Design-Basis External Events, dated September 1, 2015. (ML15174A257)
8. Nuclear Energy Institute (NEI), Report NEI 12-06 [Rev 2], Diverse and Flexible Coping Strategies (FLEX) Implementation Guide, dated December 2015. (ML16005A625)
9. NRC Letter, St. Lucie Nuclear Power Plant – Interim Staff Response to Reevaluated Flood Hazards Submitted in Response to 10 CFR 50.54(f) Information Request – Flood-Causing Mechanism Reevaluation, dated September 3, 2015 (ML15224B451)
10. Enercon Report NEE-131-PR-001, Rev 1, Effects of Local Intense Precipitation (LIP) on Plant Internal Flooding Report, dated November 23, 2015

11. St. Lucie Plant, Units 1 and 2, NEI 12-06, Revision 2, Appendix G, G.4.2:  
Modifying FLEX Strategies, (MSA) report for the New Flood Hazard Information,  
dated December 19, 2016 (ML16365A005)
12. NRC Letter, St. Lucie Plant, Units 1 and 2 – Flood Hazard Mitigation Strategies  
Assessment, dated May 2, 2017 (ML17094A811)
13. St. Lucie Plant, Units 1 and 2, Preventive Maintenance – Door Seal Inspections  
PMs 82687-01 and 82688-01
14. St. Lucie Plant, Units 1 and 2, Work Orders – Drumming room door  
repair/replace WOs 40375255-02 & 40288725-01
15. St. Lucie Plant, Units 1 and 2, Calculation PSL-1OHM-15-001, Revision 0, PSL U1  
RAB Fire Main Leakage Break Flow Rate
16. St. Lucie Plant, Units 1 and 2, Letter L-2015-105, Flooding Focused Evaluation  
Summary



## 4 TERMS AND DEFINITIONS

- AE – Associated Effects
- AIMs – Assumptions, Inputs, and Methods
- APM – Available Physical Margin
- CLB – Current Licensing Basis
- DB – Design Basis
- ELAP – Extended Loss of AC Power
- FE – Focused Evaluation
- FED – Flood Event Duration
- FHRR – Flood Hazard Reevaluation Report
- FIAP – Flooding Impact Assessment Process
- FLEX – Diverse and flexible coping strategies covered by NRC order EA-12-049
- Key SSC – A System Structure or Component relied upon to fulfill a Key Safety Function
- KSF – Key Safety Function, i.e. core cooling, spent fuel pool cooling, or containment function.
- LIP – Local Intense Precipitation
- LUHS – Loss of Normal Access to the Ultimate Heat Sink
- MSA – Mitigating Strategies Assessment as described in NEI 12-06 Rev 2, App G
- MSFHI – Mitigating Strategies Flood Hazard Information
- NEI – Nuclear Energy Institute
- NRC – Nuclear Regulatory Commission
- NTTF – Near Term Task Force commissioned by the NRC to recommend actions following the Fukushima Dai-ichi accidents
- RAB – Reactor Auxiliary Building
- RFI – Request for Information
- SSC – Systems, Structures and Components
- TSA – Time Sensitive Action, as described in NEI 16-05 Appendix C

## 5 FLOOD HAZARD PARAMETERS FOR UNBOUNDED MECHANISMS

NRC has completed the "Interim Staff Response to Reevaluated Flood Hazards" (Reference 9) which contains the Mitigating Strategies Flood Hazard Information (MSFHI) related to St. Lucie Nuclear Plant Flood Hazard Reevaluation Report (Reference 2). Per NEI 12-06 (Reference 8), the NRC states that the "staff has concluded that the licensee's reevaluated flood hazards information is suitable for the assessment of mitigation strategies developed in response to Order EA-12-049 (i.e., defines the mitigating strategies flood hazard information described in Nuclear Energy Institute (NEI) guidance document NEI 12-06, 'Diverse and Flexible Coping Strategies (FLEX) Implementation Guide') for St. Lucie Nuclear Power Plant. Further, the NRC staff has concluded that the licensee's reevaluated flood hazard information is suitable input for the focused evaluations associated with Near-Term Task Force Recommendation 2.1 'Flooding.'" The enclosure to Reference 2 includes a summary of the current design basis and reevaluated flood hazard parameters, respectively. In Table 1 of the enclosure to Reference 9, the NRC lists the following flood-causing mechanisms for the design basis flood:

- Local Intense Precipitation
- Streams and Rivers
- Failure of Dams and Onsite Water Control/Storage Structures
- Storm Surge
- Seiche
- Tsunami
- Ice Induced Flooding; and
- Channel Migrations/Diversions.

In Table 2 of the enclosure to Reference 9, the NRC lists flood hazard information (specifically stillwater elevation and wind-wave runup elevation) for the following flood-causing mechanism that is not bounded by the design basis hazard flood level:

- Local Intense Precipitation

The following summarizes how the unbounded LIP flooding mechanism is addressed in this external flooding assessment:

	<b>Flood Mechanism</b>	<b>Summary of Assessment</b>
<b>1</b>	Local Intense Precipitation (LIP)	This mechanism will follow FIAP Path 2, as described in Table 6.3.3 of NEI 16-05 - FIAP Path Determination, since the LIP vulnerability is addressed by flood protection features. Reference 10 evaluated internal flood levels resulting from an LIP event and determines there is sufficient APM between SSCs and internal flood water levels.

## 6 OVERALL SITE FLOODING RESPONSE

### 6.1 DESCRIPTION OF OVERALL SITE FLOODING RESPONSE

Permanent protection features such as characterized topographic and man-made features that affected runoff from a LIP were modeled in the FHRR (Reference 2). The LIP accumulation depths at entrances to the safety-related structures (RABs) were calculated and were found to be higher than the door seal elevations of some doors for limited durations. Potential pathways for water intrusion into buildings through gaps in doors were evaluated for each unit in Effects of LIP on Plant Internal Flooding Report (Reference 10).

Analysis, as documented in, "Effects of LIP on Plant Internal Flooding Report" (Reference 10), was performed on the RABs (Elevation 19.5' and -0.5') to assess the potential impact to key SSCs when water enters these buildings through door thresholds. This room-by-room internal flooding analysis simulated (conservatively) that all floor drains of both Unit 1 and 2 RABs were plugged. The analysis concluded that the location of critical equipment inside the RABs is at a higher elevation than projected water in-leakage from the LIP flood. This analysis was referenced in the MSA and later provided to the NRC for review who concluded that the information provided by St. Lucie Plant was sufficient (References 11 & 12). Therefore, based on only existing permanent passive plant features and the room-by-room internal flooding analysis, it was determined that there is no adverse effects on key SSCs.

### 6.2 SUMMARY OF PLANT MODIFICATIONS AND CHANGES

The remaining actions necessary to implement flood strategy are to replace the Unit 1 and 2 RAB drumming room doors in order to minimize the in leakage caused during an LIP event. Sandbags have been placed at these doors as a mitigating strategy to ensure the door seal gaps are reduced in accordance with Reference 3. Work Orders 40375255-02 & 40288725-01 (Reference 14) have been created and identified as NRC commitments to ensure the doors are promptly replace/repared.

## **7 FLOOD IMPACT ASSESSMENT**

### **7.1 LOCAL INTENSE PRECIPITATION (PATH 2 ASSESSMENT)**

#### **7.1.1 Description of Flood Impact**

The FHRR (Reference 2) evaluated a suite of durations (1, 6, 12, 24, 48, 72 hours). The maximum external depth of accumulated water in the power block area is 3.20 ft. Interim evaluation was performed to determine the potential effects of LIP-related flooding into buildings containing SSCs (i.e., RAB 1 and RAB 2). The interim evaluation modeled the time series of hydrologic and hydraulic conditions at points of entry to the buildings and determined the influx and accumulation of water in the buildings.

Effects of LIP on Plant Internal Flooding Report (Reference 10) modeled water in-leakage into the door sills of the Unit 1 and 2 RABs. The report identified water in-leakage from the LIP flood into the Unit 1 and 2 RABs resulted in maximum internal flood water depths of 2.4 and 0.9 inches in the RABs. The critical equipment inside Unit 1 and 2 RABs are installed a minimum of 6 inches above the floor elevation. The volume of water associated with 2.4 and 0.9 inches amounts to 90,000 gallons (Unit 1 RAB) and 16,700 gallons (Unit 2 RAB) after the LIP flood. The design basis maximum amount of flood water that can be accumulated in both RAB lower levels is 135,000 gallons that is caused by an internal fire line break (Reference 15). Since the maximum flood volumes and associated elevations do not impact any key SSCs, there was no need to make any further physical modifications to the station other than routine preventative maintenance to maintain exterior door seals (Reference 13).

#### **7.1.2 Adequate APM Justification and Reliability Flood Protection**

Site topography of the St. Lucie Plant power block area was designed and constructed to mitigate (or minimize) the effects of a PMF from the surrounding washes and ponding effects of a LIP. St. Lucie Plant reviewed the information documented in the FHRR against the criteria of NEI 16-05 (Reference 5) and confirmed that these passive features meet the criteria of reliability.

There is no exterior APM resulting from an LIP event since the ponding depths developed exceed the elevation of the exterior door seal/gaps (Reference 10).

The Effects of LIP on Plant Internal Flooding Report and external LIP analysis (References 10 & 2) conservatively assumed that all interior floor drains and exterior storm drains were fully clogged and were not credited for mitigating the effects of rain water inflow into the key SSC compartments. Therefore, there are no active

flood protection features. The resulting APM for SSC's inside the Unit 1 and 2 RABs are approximately 3.6 and 5.1 inches.

## 8 CONCLUSION

Conclusions from the FHRR (Reference 2) concluded that no plant response (either operator or mitigation actions) is required to ensure the plant's safe shutdown equipment will be capable of performing their key safety functions. The FHRR also states that no additional actions or interim evaluations are required. The effect of Local Intense Precipitation (LIP) was not bounding by the Design Basis of the plant. This was the only flooding mechanism that was not bounded. The site's passive permanent flooding protection features were determined to be reliable, which includes the site topography that mitigated the effects of LIP in and around the power block. There are no active flooding protection features or required site response.

The site determined that all vulnerabilities due to the LIP mechanism are considered to be addressed by protection, and available physical margin was demonstrated to be adequate to protect Key SSCs. This evaluation verified the reliability of the flood protection features. This places St. Lucie Plant, Units 1 and 2, in Path 2 to address this unbounded flooding mechanism.

This submittal completes the actions related to External Flooding required by the March 12, 2012 10 CFR 50.54(f) letter (Reference 16).