DEC 19 2016

L-2016-155
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
NEI 12-06, Revision 2, Appendix G, G.4.2: Modifying FLEX Strategies, (MSA) report for the New Flood Hazard Information

References:

1. NEI 12-06, Revision 2, Diverse and Flexible Coping Strategies (FLEX) Implementation Guide, December 2015, ADAMS Accession Number ML16005A625.
2. JLD-ISG-2012-01, Revision 1, Compliance with Order EA-12-049, Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events, February 2016, ADAMS Accession Number ML15357A163.
3. FPL Letter L-2015-048 to NRC, FPL/St. Lucie Plant's Flooding Hazards Reevaluation for Information Pursuant to 10CFR50.54(f) Regarding Flooding Aspects of Recommendations 2.1 of the Near-Term Task Force Review of Insights from the Fukushima Dai-Ichi Accident, dated March 10, 2015, ADAMS Accession No. ML15083A264.
4. NRC Interim Staff Response to Reevaluated Flood Hazards Submitted in Response to 10CFR 50.54(f) Information Request – Flood-Causing Mechanism Reevaluation (TAC NOS. MF6114 and MF6114), Dated September 3, 2015, ADAMS Accession No. ML15224B449.
5. JLD-ISG-2012-01, Revision 1, Compliance with Order EA-12-049, Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events, Dated February 2016, ADAMS Accession No. ML15357A163.
6. NRC Request for Information Pursuant to 10 CFR 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, ADAMS Accession No. ML12056A046.
7. PSL Evaluation PSL-ENG-SEMS-14-005, Rev. 3 St. Lucie FLEX Final Integrated Plan Document

The purpose of this letter is to provide the results of the assessment for St. Lucie Unit 1 and Unit 2, performed to determine if the FLEX strategies developed, implemented and maintained in

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accordance with NRC Order EA-12-049, can be implemented, considering the impacts of the reevaluated flood hazard. The assessment was performed in accordance with the guidance provided in Appendix G of NEI 12-06 Revision 2 (Reference 1), which was endorsed by the NRC (Reference 2). Consistent with Section G.4.2 of Reference 1, this Mitigating Strategies Assessment (MSA) concluded that with respect to the finalized reevaluated flood hazards impact (e.g. Local Intense Precipitation and Probable Maximum Storm Surge), the St. Lucie FLEX mitigation strategies (Ref. 7) can be implemented with relatively minor modification. The assessment is summarized in the Enclosure.

NRC has completed the "Staff Assessment" (Ref. 4) related to PSL Flood Hazard Risk Reevaluation (Ref. 3). In Reference 4 the NRC concluded the PSL response (Ref. 3) was suitable for the assessment of mitigating strategies developed in response to NRC Order EA-12-049 (Ref. 5) and was performed in accordance with regulatory requirements of NTTF Recommendation 2.1 of the NRC 10 CFR 50.54(f) (Ref. 6).

This letter contains no new regulatory commitments and no revisions to existing regulatory commitments.

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 December 19, 2016.

Sincerely,

Christopher R Costanzo

Christopher R. Costanzo
Site Vice President
St. Lucie Nuclear Plant

Enclosure 'A' 2016 MSA for Flooding Documentation Requirements

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

**2016 Mitigating Strategies Assessments for Flooding**
**Documentation Requirements**
**(G.4.2 Modifying FLEX Strategies)**

**List of Acronyms:**

- AMS – Alternative Hazard Mitigating Strategies
- DB – Design Basis
- ELAP – Extended Loss of AC Power
- FIP – Final Integrated Plan
- FHRR – Flood Hazard Reevaluation Report
- FLEX DB – FLEX Design Basis (flood hazard)
- LIP – Local Intense Precipitation
- MSFHI – Mitigating Strategies Flood Hazard Information (from the FHRR and MSFHI letter)
- MSL – Mean Sea Level
- OIP – Overall Integrated Plan
- PMP – Probable Maximum Precipitation
- PMSS- Probable Maximum Storm Surge
- PSL – St Lucie Nuclear Plant
- RAB – Reactor Auxiliary Building
- SWEL – Surface Water Elevation
- SWL – Still Water Level
- THMS – Targeted Hazard Mitigating Strategies

**Definitions:**

- FLEX Design Basis Flood Hazard: The controlling flood parameters used to develop the FLEX flood strategies.

## 1. Executive Summary

The MSFHI provided in the PSL FHRR (Ref.1) has concluded that the Local Intense Precipitation (LIP) and hurricane induced Probable Maximum Storm Surge (PMSS) could challenge implementation of the FLEX strategies. The existing FLEX strategies for these events were modified to address the impacts of the MSFHI. Other reevaluated flood hazard mechanisms (i.e.: tsunami, channel migrations/diversions, etc.), are bounded by the FLEX design basis and have no impact on the site.

The MSFHI LIP flooding levels develop a depth above critical door sills for a limited period of time. Door seals were updated and will be maintained to limit water intrusion (Ref. 2) and prevent challenging the FLEX strategies. Personnel and equipment transport will be delayed during the flooding period. FLEX mitigation strategy timelines have been verified to not be challenged by the LIP affects (Ref. 4 & 5).

The MSFHI Hurricane storm surge delays transportation of portable equipment beyond the period tabulated in the FIP (Ref. 12).

The FLEX deployment timeline has been modified and verified to ensure FLEX strategies can be implemented to address the Probable Maximum Storm Surge with wave run-up (PMSS) generated by a hurricane storm surge (Ref. 12).

The hardened FLEX equipment storage building and the power block were constructed at an elevation that exceeds the MSFHI results.

Ample hurricane warning time allows for a controlled shut down of the Reactor, implementation of storm preparation activities, and mobilizing additional on -site personnel and resources. Extended coping time, increased resources (personnel, fuel, water and equipment) and the reduced number of required FLEX activities during and after the storm lessen the challenge of the storm surge.

## 2. Characterization of the MSFHI (NEI 12-06, Rev. 2, Section G.2 )

NRC has completed the "Staff Assessment" (Ref. 7) related to PSL FHRR (Ref.1). In Reference 7 the NRC concluded the PSL response (Ref. 1) was suitable for the assessment of mitigating strategies developed in response to NRC Order EA-12-049 (Ref. 8) and was performed in accordance with regulatory requirements of NTTF Recommendation 2.1 of the NRC 10 CFR 50.54(f) (Ref. 9). However, additional actions were required to perform this Mitigating Strategies Assessment (MSA) with respect to the reevaluated flood hazards impact on FLEX Strategies (Ref. 13). The following summaries these hazards for PSL:

### Local Intense Precipitation (LIP)

**Flood Height**
The reevaluated LIP analysis, documented in the PSL FHRR (Ref.1), is for a suite of durations (1, 6, 12, 24, 48, 72 hours). The maximum flooding depth of accumulated water in the power block area is 3.20 ft.

**Flood Event Duration**
Based upon the LIP effect on Plant Internal Flooding evaluation (Ref.3) and FLEX deployment strategy (Ref. 4) the flood water maintains a depth above critical door sills for a maximum of 2.6hrs.

**Relevant Associated Effects**
The bounding calculated water level inside RAB 1 is 2.4 inches (Ref. 3). This value is acceptable as the bottom height of the critical equipment is at least 6 inches above the building floor (19.5 ft PSL-datum). The maximum volume of water conveyed to the lower levels (-0.5 ft PSL-datum) was evaluated to be on the order of 90,000 gallons. This value is also acceptable because the volume of water that can be safely accommodated in the lower level was previously calculated at 135,000 gallons (Ref 3).

For RAB 2 the bounding water level inside is 0.9 in. This value is deemed acceptable because the critical equipment bottom is at least 6 inches above the building floor (+19.5 ft PSL-datum). The volume of water conveyed downstairs to the lower levels (-0.5 ft PSL-datum) was evaluated to reach a maximum of 16,700 gallons. This amount of water can be safely accommodated within the lower levels because it is significantly less than the calculated safe maximum of 135,000 gallons (Ref 3).

**Warning Time**
An LIP event resulting from a Synoptic Storm (i.e. large frontal system) provides limited warning time; therefore, the FLEX deployment strategy was evaluated, and it was concluded that sufficient time margin exists to delay deployment until LIP flood waters have receded (Ref 4).

***Probable Maximum Storm Surge (PMSS)***

**Flood Height**
The reevaluated PMSS analysis, documented in the PSL FHRR (Ref.1), determined an SWL of 15.86' MSL (18.3 ft-PSL Datum). PMSS with wave run-up was also analyzed; however, waves dissipate before reaching the powerblock.

**Flood Event Duration**
Based upon the FHRR (Ref.1) and FLEX deployment strategy (Ref. 4 & 5) the flood water restricts FLEX equipment deployment for approximately 6 hrs.

**Relevant Associated Effects**
The flooding reevaluation determined that the maximum wave run-up occurs at the discharge canal and would result in overtopping of the steel sheet-piling barrier at the nose of the discharge canal, but this overtopping discharge volume is deemed insignificant. The reevaluated wave run-up analyses concluded the Powerblock is protected from wave run-up by the discharge canal steel sheet-piling barrier (Ref. 1). The FLEX equipment storage building is elevated and also protected. The storm surge does flood the redundant travel paths from the equipment storage building and the Powerblock for approximately 6 hours after which there is sufficient time (2 hrs) to deploy the initial FLEX equipment (FLEX 480V Diesel Generators) and then subsequent FLEX equipment.

**Warning Time**
Hurricane based events provide sufficient warning time (12-72 hrs) that allows the plant to be Shutdown to Mode 3, 4 or 5 (with Steam Generators available) at least 2 hrs prior to projected onset of hurricane force winds (Ref. 4).

**3. Basis for Mitigating Strategy Assessment (NEI 12-06, Rev. 2, Section G.3 )**

*Table 1a – Flood Causing Mechanism A (LIP) or Bounding Set of Parameters*

| Flood Scenario Parameter | | Plant Current Design Basis | FLEX Design Basis Flood Hazard | MSFHI LIP | Bounded (B) or Not Bounded (NB) by FLEX DB |
|---|---|---|---|---|---|
| Flood Level and Associated Effects | 1. Max Stillwater Elevation (ft. MSL) | 19.5 ft. Plant Datum | See Note 1 | Maximum Flood Depth 3.16' Unit 1 2.07' Unit 2 | NB |
| | 2. Max Wave Run-up Elevation (ft. MSL) | Not included | 16.36' MSL 18.8' Plant Datum | See note 2 | B |
| | 3. Max Hydrodynamic /Debris Loading (psf) | Not included | See Note 3 | See Note 3 | NB |
| | 4. Effects of Sediment Deposition/Erosion | Not included | See Note 4 | See Note 4 | B |
| | 5. LIP associated effects | Not calculated | See Note 5 | 3.16 ft Unit 1 2.07 ft Unit 2 | NB |
| | 6. Concurrent Site Conditions | Not included | N/A | See Note 6 | N/A |
| | 7. Effects on Groundwater | Not included | N/A | N/A | N/A |
| Flood Event Duration | 8. Warning Time (hours) | Not included | 0 | 0 | B |
| | 9. Period of Site Preparation (hours) | Not included | 0 | 0 | B |
| | 10. Duration of Significant Flooding (hours) | Not included | See Note 7 | 2.6 | NB |
| | 11. Period of Recession (hours) | Not included | See Note 7 | 1.3 | NB |
| Other | 12. Plant Mode of Operations | Not included | All | All | B |
| | 13. Other Factors | Not included | - | - | - |

Additional notes, 'N/A' justifications (why a particular parameter is judged not to affect the site), and explanations regarding the bounded/non-bounded determination.

1. MSFHI LIP water levels were not considered during the FLEX strategies and therefore are not bounded.
2. Wave run-up was evaluated for the spectrum of waves that can potentially impact PSL coincident with the PMSS event. LIP wave run-up is considered bounded by this analysis (Refs. 10 & 11).
3. The FLEX DB did not consider hydraulic or debris loading due to LIP; therefore, the reevaluated LIP loading conditions is considered not bounded. Further evaluation (Ref. 3) concludes the FLEX strategies will not be challenged. The potential debris generation caused by the LIP event will be from unsecured materials located inside the plant Powerblock. Procedurally controlled housekeeping practices (Ref. 6) minimize the amount of material/debris that can be moved by LIP runoff. The flow velocities inside the Powerblock are low, minimizing the ability for waterborne projectiles to adversely affect plant and flood protection features (Ref. 3).
4. The maximum velocities around the PSL site during the LIP/PMP generally occur

throughout the canal. For scour and erosion to occur, the water velocity must be greater than permissible velocities for the ground cover materials (smooth asphalt 15 ft/s, rough asphalt 12ft/s and natural earth w/ vegetation 6 ft/s). The highest predicted velocities are located in areas already occupied by water, where runoff drains into a body of water or occurs in remote places far outside the power block. Given that all velocities greater than 6 ft/s occur on asphalt and/or paved areas, and that the only area where velocities are greater than 12 ft/s occurs inside an existing pond, it was concluded qualitatively that scour/erosion from an LIP or PMP event is insignificant (Ref. 3).

5. The MSFHI LIP results were not considered in the FLEX strategies and therefore are not bounded. A Synoptic Storm provides limited warning time; therefore, the FLEX deployment strategy has been assessed to ensure sufficient time margin exists to delay deployment until LIP flood waters recede (Ref. 3). Penetrations that limit water intrusion into the Powerblock have been updated and maintained to ensure FLEX strategies are not challenged (Ref 2).
6. MSFHI LIP and hurricane storm surge hazards bound the flooding hazards at the site and do not occur simultaneously.
7. LIP results in approximately 2.6 hour duration of flooding including 1.3 hours of recessions. The period of flooding and recession was not considered in the FLEX strategies therefore it was considered not bounding. All FLEX strategy required actions can be completed indoors during this period of time. Equipment mobilization is not prohibited because transport is scheduled after the flood has receded prior to the time required by the original time-line (Ref. 5)

*Table 1b – Flood Causing Mechanism A (PMSS) or Bounding Set of Parameters*

| | Flood Scenario Parameter | Site Current Design Basis | FLEX Design Basis Flood Hazard | MSFHI Hurricane | Bounded (B) or Not Bounded (NB) by FLEX DB |
|---|---|---|---|---|---|
| Flood Level and Associated Effects | 1. Max Stillwater Elevation (ft. MSL) | 19.5 ft (Plant Datum) | 17.2' (Plant Datum) 14.76' MSL | 18.3' (Plant Datum) 15.86' MSL | NB See Note 1 |
| | 2. Max Wave Run-up Elevation (ft. MSL) | 18.1 ft- plant island southeast corner<br>18.5 ft- south discharge canal<br>18.8 ft- north Unit 1<br>28.0 ft- north of discharge canal | 18.8' (Plant Datum) 16.36' MSL | 18.3' (Plant Datum) 15.86' MSL | B See Note 2 |
| | 3. Max Hydrodynamic/Debris Loading (psf) | Not considered | See Note 3 | See Note 3 | B |
| | 4. Effects of Sediment Deposition/Erosion | Not considered | See Note 4 | See note 4 | B |
| | 5. Other associated effects (Not including LIP) | See Note 5 | N/A | N/A | B |
| | 6. Concurrent Site Conditions | Not considered | No Impact | N/A | N/A |
| | 7. Effects on Groundwater | Not considered | No Impact | N/A | N/A |
| n t | 8. Warning Time (hours) | Not considered | 12-72 | 12-72 | B |

| | | | | | |
|---|---|---|---|---|---|
| | | | | | See Note 6 |
| | 9. Period of Site Preparation (hours) | Not considered | 12-72 | 12-72 | B<br>See Note 6 |
| | 10. Duration of Significant Flooding (hours) | Not considered | 3 | 7 | NB<br>See Note 7 |
| | 11. Period of Recession | | 2 | 4 | NB<br>See Note 7 |
| Other | 12. Plant Mode of Operations | | Modes 3, 4 or 5 | Modes 3, 4 or 5 | B<br>See Note 8 |
| | 13. Other Factors | - | - | - | - |

Additional notes, 'N/A' justifications (why a particular parameter is judged not to affect the site), and explanations regarding the bounded/non-bounded determination.

1. The travel paths between the FLEX storage building and the Powerblock flooded longer than the period considered for the FLEX strategies and therefore considered not bounded.
2. The CLB is exceeded, but the new levels are below the physical level of protection for critical plant equipment. The reevaluation includes a sea level rise of 0.20 ft for the remainder of the current license. The available physical margin is 1.2 ft (19.5 ft – 18.3 ft = 1.2 ft) for still water and wave run-up.
3. The PMSS event does not result in Hydrodynamic/Debris Loading in Powerblock since the grade is located above the highest probable SWEL, there would be no threat of Hydrodynamic/Debris Loading that could impact safety-related structures in that area (Ref.1). For sections of the FLEX equipment deployment route that are located outside the Powerblock the FLEX DB accounted for debris removal time in the FLEX strategy (Ref. 5).
4. Debris and sedimentation accumulation resulting from a PMSS is expected to have the largest impact on the east side (ocean side) of the plant site due to wave run-up. Because the PSL Powerblock grade is located above the highest probable SWEL, there would be no threat of debris and sedimentation that could impact safety-related structures in that area. Since sections of the FLEX equipment deployment route are located outside the Powerblock the FLEX DB accounted for debris removal time in the FLEX strategy.
5. Tsunami flooding was not considered in the CLB. The tsunami maximum wave runup evaluation determined a surge elevation of EL +17.62 ft-PSL Datum. However, the available physical margin of 1.88 ft (19.5 ft –17.62 ft = 1.88 ft) remains during the event; therefore, the tsunami would not affect critical SSCs.
6. The preparation and time required for the MSFHI hurricane are unchanged and therefore bounded. Hurricane based events provide sufficient warning time to ensure the site is in a hardened state that is well prepared to cope with the events by having the site tanks filled with water, both units shut down and on-site resources augmented (Ref. 4).
7. The MSFFHI hurricane storm surge and recession is greater than the time considered in the FLEX strategies and is therefore considered not bounded. The increased period of storm surge delays the transport of the Portable FLEX equipment for up to 6 hours. FLEX strategy timelines have been adjusted and response margins verified acceptable (Ref. 5).
8. Hurricane based events provide sufficient warning time (12-72hrs) that allows the plant to be Shutdown to Mode 3, 4 or 5 (with Steam Generators available) at least 2 hrs prior to projected onset of hurricane force winds (Ref. 4).

**4. Evaluation of Mitigating Strategies for the MSFHI (NEI 12-06, Rev. 2, Section G.4 )**

NEI 12-06, Rev. 2, Section G.4.2 – Assessment for Modifying FLEX Strategies:

The existing FLEX mitigation strategies can be implemented with relatively minor modifications.

The MSFHI LIP event provides limited warning time and produces rainfall amounts that challenge the current FLEX mitigation strategies. LIP water levels exceed some critical door thresholds and channels in the equipment deployment roadways.

Door seals have been modified and will be maintained to ensure LIP water in-leakage will not challenge the existing FLEX strategies (Ref. 2). The current mitigation strategy timeline contains sufficient margin for local floodwaters to recede prior to the required deployment of FLEX equipment as described in the FIP.

Hurricane preparation activities as described in the FIP are unchanged. Hurricane warning times allow ample time for event preparation which includes maximizing inventories and resources. Existing procedures also require the reactor to be shut down in advance which extends the coping times and reduces the number of required FLEX activities during the event (i.e. RCS cooldown, boration).

The MSFHI hurricane storm surge delays the portable equipment deployment. The most limiting mitigating strategy time constraint is the deployment of the FLEX 480V generators required to repower one battery charger on each unit. Existing battery management strategies extend life to 14 hours on Unit 2 and 21 hours on Unit 1 (Ref.5). The portable equipment deployment timeline has been modified to reflect the period needed for the hurricane flood water to recede and repowering batteries prior to voltage depletion (Ref 5).

Additional on-site personnel provide more resources than previously used to demonstrate that equipment deployment activities meet timeline requirements and therefore the deployment activities will not require re-validation.

**5. Documentation (NEI 12-06, Rev. 2, Section G.6 )**

Reference 5, has been revised to demonstrate that modifications to the FLEX deployment timeline enable FLEX strategies be implemented based on the impacts of the MSFHI.

## 6. References

1. FPL Letter L-2015-048 to NRC, FPL/St. Lucie Plant's Flooding Hazards Reevaluation for Information Pursuant to 10CFR50.54(f) Regarding Flooding Aspects of Recommendations 2.1 of the Near-Term Task Force Review of Insights from the Fukushima Dai-Ichi Accident, dated March 10, 2015, ADAMS Accession No. (ML15083A264)
2. PSL Preventive Maintenance Door Seal Inspection (PMs 82687 & 82688)
3. Enercon Report NEE-131-PR-001, Rev 1, Effects of Local Intense Precipitation (LIP) on Plant Internal Flooding Report, dated November 23, 2015
4. FPL Letter L-2016-057 to NRC, Florida St. Lucie FLEX Final Integrated Plan Document, dated March 21, 2016, ADAMS Accession No. (ML16096A338)
5. PSL Program document ADM-17.34 Rev. 7, Diverse and Flexible Coping Strategies (FLEX) Program
6. PSL Maintenance Procedure MA-AA-100-1008, Rev. 12, Station Housekeeping and Material Control.
7. NRC Interim Staff Response to Reevaluated Flood Hazards Submitted in Response to 10CFR 50.54(f) Information Request – Flood-Causing Mechanism Reevaluation (TAC NOS. MF6114 and MF6114), Dated September 3, 2015, ADAMS Accession No. (ML15224B449)
8. JLD-ISG-2012-01, Revision 1, Compliance with Order EA-12-049, Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events, Dated February 2016, ADAMS Accession No. (ML15357A163)
9. NRC Request for Information Pursuant to 10 CFR 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, ADAMS Accession No.(ML12056A046)
10. Unit 1 UFSAR, Revision 27, St. Lucie Unit 1 Updated Final Safety Analysis Report.
11. Unit 2 UFSAR, Revision 23, St. Lucie Unit 2 Updated Final Safety analysis Report.
12. PSL Evaluation PSL-ENG-SEMS-14-005, Rev. 3 St. Lucie FLEX Final Integrated Plan Document.
13. NEI 12-06, Revision 2, Diverse and Flexible Coping Strategies (FLEX) Implementation Guide, December 2015, ADAMS Accession Number ML16005A625.