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A SCANA COMPANY

June 30, 2017
RC-17-0089

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

Dear Sir/ Madam:

Subject: VIRGIL C. SUMMER NUCLEAR STATION (VCSNS), UNIT 1
DOCKET NO. 50-395
OPERATING LICENSE NO. NPF-12
FOCUSED EVALUATION FOR EXTERNAL FLOODING

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 Forces Review of Insights from the Fukushima Dai-ichi Accident*, dated March 12, 2012 [ML12053A340]

2. SCE&G letter, *South Carolina Electric & Gas Company (SCE&G) Flooding Hazard Reevaluation to 10 CFR 50.54(f) Regarding the Flooding Aspects of Recommendation 2.1 of the Near-Term Task Force Review of Insights from the Fukushima Dai-ichi Accident*, dated March 12, 2013 [ML13073A114]

3. SCE&G letter, *South Carolina Electric & Gas Company (SCE&G) Supplemental Response to NRC Request for Information Pursuant to 10 CFR 50.54(f) Regarding the Flooding Aspects of Recommendation 2.1 of the Near-Term Task Force Review of Insights from the Fukushima Dai-ichi Accident*, dated August 22, 2013 [RC-13-0118]

4. SCE&G letter, *South Carolina Electric & Gas (SCE&G) Response to NRC Request for Additional Information Associated with Near-Term Task Force Recommendation 2.1, Flooding Reevaluation*, dated March 26, 2014 [ML14093A320]

5. NRC Memorandum, *Staff Requirements – COMSECY-15-0019," Closure Plan for the Reevaluation of Flooding Hazards for Operating Nuclear Power Plants," dated* July 28, 2015 [ML15209A682]

6. 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]

7. Nuclear Energy Institute (NEI) Report NEI 16-05, Revision 1, *External Flooding Assessment Guidelines*, dated June 2016 [ML16165A178]

8. U.S. NRC, JLD-ISG-2016-01, Revision 0, *Guidance for Activities Related to Near-Term Task Force Recommendation 2.1, Flooding Hazard Reevaluation; Focused Evaluation and Integrated Assessment*, dated July 11, 2016 [ML16162A301]

9. NRC letter, *Virgil C. Summer Nuclear Station, Unit 1 – Staff Assessment of Response to 10 CFR 50.54(f) Information Request – Flood-Causing Mechanism Reevaluation (TAC NO. MF1112)*, dated December 23, 2014 [ML14356A002]

10. NRC letter, *Virgil C. Summer Nuclear Station, Unit 1 – Supplement to Staff Assessment of Response to 10 CFR 50.54(f) Information Request – Flood-Causing Mechanism Reevaluation (TAC NO. MF1112)*, dated November 3, 2015 [ML15296A377]

On March 12, 2012, the Nuclear Regulatory Commission issued Reference 1 to request information associated with Near-Term Task Force (NTTF) Recommendation 2.1 for flooding. One of the required responses in Reference 1 directed licensees to submit a Flood Hazard Reevaluation Report (FHRR). South Carolina Electric & Gas Company submitted the FHRR for Virgil C. Summer Nuclear Station (VCSNS) Unit 1 on March 12, 2013 (Reference 2). The VCSNS Unit 1 FHHR was also supplemented by References 3 and 4.

A second required response of Reference 1 directed licensees to submit an Integrated Assessment Report for any flood causing mechanism not bounded by the current design basis. In Reference 5, the NRC affirmed that licensees need to address the reevaluated flooding hazards not bounded by the current design basis by a revised integrated assessment process that applies a graded approach. This requirement was confirmed by the NRC in more detail in Reference 6. Guidance for performing the revised process is included in Reference 7 and endorsed by the NRC in Reference 8. The revised process applicable to VCSNS is the Focused Evaluation (FE). In References 9 and 10, the NRC concluded that the reevaluated flood hazards (Local Intense Precipitation and Streams and Rivers Flooding, including Storm Surge associated effects) information, as summarized in the enclosure, is suitable input for the FE.

Enclosure 1 to this letter provides the FE for External Flooding for VCSNS Unit 1. The Path 2 FE concluded that the strategy for maintaining key safety functions during Local Intense Precipitation, Streams and River Flooding, and Storm Surge events has effective flood protection through the demonstration of adequate Available Physical Margin and reliable flood protection features. Therefore, the overall site response is adequate.

New regulatory commitments are outlined in Enclosure 2 of this submittal. VCSNS will implement a permanent solution to maintain key safety functions during a Local Intense Precipitation event via an engineering change to perform plant modifications that will provide flood protection features (i.e. flood gates) to protect the building areas identified in Section 7.1 of Enclosure 1. When the permanent plant modifications are completed by December 2018, the

interim actions listed in Reference 3 may be terminated. However, until the modification implementation is completed, the interim actions to deploy sandbags upon receipt of a severe weather warning in accordance with Operations Administrative Procedure OAP-109.1, "Guidelines for Severe Weather," and to perform periodic inspections of the VCSNS Unit 1 storm drainage system will remain in place.

If you have any questions regarding this submittal, please contact Mr. Bruce L. Thompson at (803) 931-5042.

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

6/30/17
Executed on

For George Lippard
George A. Lippard

TS/GAL/hk

Enclosure 1: TR02060-005, External Flooding Focused Evaluation Summary for VCSNS
Enclosure 2: List of Regulatory Commitments

cc: Without Enclosures unless noted
K. B. Marsh
S. A. Byrne
J. B. Archie
N. S. Carns
J. H. Hamilton
S.M. Shealy
W. M. Cherry
C. Haney (with Enclosures)
L. K. Gibson (with Enclosures)
S. A. Williams (with Enclosures)
NRC Resident Inspector
K. M. Sutton
NSRC
RTS (CR-12-01098)
File (815.07)
PRSF (RC-17-0089) (with Enclosures)

VIRGIL C. SUMMER NUCLEAR STATION (VCSNS) UNIT 1
DOCKET NO. 50-395
OPERATING LICENSE NO. NPF-12

ENCLOSURE 1

TR02060-005, EXTERNAL FLOODING FOCUSED EVALUATION SUMMARY FOR VCSNS

SOUTH CAROLINA ELECTRIC & GAS COMPANY
VIRGIL C. SUMMER NUCLEAR STATION
NUCLEAR OPERATIONS

NUCLEAR OPERATIONS
COPY NO. _____

ENGINEERING SERVICES TECHNICAL REPORT

TR02060-005

EXTERNAL FLOODING FOCUSED EVALUATION SUMMARY FOR VCSNS

REVISION 0

ORIGINATOR – Jeremy R. Graham — 6/19/17 DATE

REVIEWER – Dale D. Krause — 6/19/17 DATE

APPROVAL AUTHORITY Simon C. Healy for Craig A. Calvert — 6/28/17 DATE

RECORD OF CHANGES

CHANGE LETTER	TYPE CHANGE	APPROVAL DATE	CANCELLATION DATE	CHANGE LETTER	TYPE CHANGE	APPROVAL DATE	CANCELLATION DATE

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1 EXECUTIVE SUMMARY

The Virgil C. Summer Nuclear Station (VCSNS) Unit 1 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. By letter dated March 12, 2013 (Reference 2), as supplemented by letters dated August 22, 2013 (Reference 3), and March 26, 2014 (Reference 5), SCE&G submitted its Flood Hazard Reevaluation Report (FHRR) for VCSNS Unit 1. By letter dated December 23, 2014 (Reference 6), the NRC provided the staff assessment of the FHRR. The staff assessment was supplemented by letter dated November 3, 2015 (Reference 7), which, together with the staff assessment, provided the mitigating strategies flood hazard information that was suitable for use in additional assessments related to Near-Term Task Force Recommendation 2.1. No changes to the flooding analysis methodology or inputs have been performed since the issuance of the NRC Staff Assessment and the previous flooding analysis will serve as the input to this Focused Evaluation (FE). The staff assessment and its supplements identified three (3) mechanisms that were found to exceed the Current Licensing Basis (CLB) at VCSNS. These mechanisms are listed below and included in this FE:

1. Local Intense Precipitation (LIP)
2. Streams and Rivers Flooding
3. Storm Surge (Included in Streams and Rivers as a Combined Effect)

Associated effects (AE) and flood event duration (FED) parameters were assessed and submitted as a part of the FHRR, and supplemental letters, and the Mitigating Strategies Assessment (MSA). The FE concludes that the strategy for maintaining key safety functions (KSFs) during LIP, Streams and River Flooding, and Storm Surge events has effective flood protection through the demonstration of adequate Available Physical Margin (APM) and reliable flood protection features and that the overall site response is adequate. This FE followed Path 2 of NEI 16-05, Rev. 1 (Reference 13) and utilized Appendices B & C 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 (Reference 1).

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. For VCSNS, Unit 1, the FHRR was submitted on March 12, 2013 (Reference 2). Additional information was provided to the NRC with References 3, 5, and 18.

Following the Commission's directive to NRC Staff in Reference 11, the NRC issued a letter to industry (Reference 12) indicating that new guidance is being prepared to replace instructions in Reference 8 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 13), which was endorsed by the NRC in Reference 14. NEI 16-05 indicates that each flood-causing mechanism not bounded by the design basis flood (using only stillwater and/or wind-wave run-up level) should follow one of the following five assessment paths:

- Path 1: Demonstrate Flood Mechanism is Bounded Through Improved Realism
- 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 (Reference 1). 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. [ML12053A340]

2. SCE&G 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 12, 2013. [RC-13-0038]

3. SCE&G Letter to USNRC, Supplemental Response to NRC Request for Information Pursuant to 10CFR50.54(f) Regarding Flooding Aspects of Recommendation 2.1 of the Near-Term Task Force Review of Insights from the Fukushima Dai-ichi Accident, dated August 22, 2013. [RC-13-0118]

4. NRC Letter, Request for Additional Information Regarding Fukushima Lessons Learned – Flood Hazard Reevaluation Report, dated January 30, 2014. [ML14023A740]

5. SCE&G Letter to USNRC, Response to Request for Additional Information Regarding Fukushima Lessons Learned – Flood Hazard Reevaluation Report, dated March 26, 2014. [RC-14-0050]

6. NRC Letter, Staff Assessment of Response to 10CFR50.54(f) Information Request – Flood-Causing Mechanisms Revaluation (TAC NO. MF1112), dated December 23, 2014. [ML14356A002]

7. NRC Letter, Supplement to Staff Assessment of Response to 10CFR50.54(f) Information Request – Flood-Causing Mechanisms Revaluation (CAC NO. MF1112), dated November 3, 2015. [ML15296A377]

8. Letter from David L. Skeen, U.S. Nuclear Regulatory Commission, to Joseph E. Pollock, Nuclear Energy Institute – Trigger Conditions for Performing an Integrated Assessment and Due Date for Response, dated December 3, 2012.

9. U.S. Nuclear Regulatory Commission, JLD-ISG-2012-05, Guidance for Performing the Integrated Assessment for External Flooding, dated November 30, 2012.

10. COMSECY-14-0037, "Integration of Mitigating Strategies for Beyond-Design-Basis External Events and the Reevaluation of Flooding Hazards", dated November 21, 2014.

11. 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.

12. NRC Letter, Coordination of Requests for Information Regarding Flooding Hazard Reevaluations and Mitigating Strategies for Beyond-Design-Basis External Events, dated September 1, 2015.

13. Nuclear Energy Institute (NEI), Report NEI 16-05 [Rev 1], External Flooding Assessment Guidelines, dated June 2016.

14. 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.

15. SCE&G Letter to USNRC, Report of Full Compliance and Final Integrated Plan in Response to March 12, 2012, Commission Order Modifying Licenses with Regard to Requirements of Mitigation Strategies for Beyond-Design Basis External Events (Order EA-12-049) for Virgil C. Summer Nuclear Station Unit 1, dated October 31, 2016. [ML16307A390]

16. NUREG/CR-7046, Design Basis Flood Estimation for Site Characterization at Nuclear Power Plants in the United States of America, November 2011.

17. VCSNS Technical Report, VCS Unit 1 FLEX Validation Document, TR00080-007, Rev. 1, March 27, 2017.

18. SCE&G Letter to USNRC, Mitigating Strategies Assessment (MSA) Report Submittal, VCSNS Unit 1 2016 Mitigating Strategies Assessment for Flooding, dated December 22, 2016. [RC-16-0170]

19. VCSNS Technical Report, Flood Hazard Reevaluation Report for VCSNS, TR02060-003, Rev. 1A, August 24, 2016.

20. VCSNS Operations Administrative Procedure, Guidelines for Severe Weather, OAP-109.1, Rev. 4G, April 2017.

21. VCSNS Operations Administrative Procedure, Control Room Conduct and Control of Shift Activities, OAP-100.6, Rev. 4G, April 2017.

22. Nuclear Energy Institute (NEI), Report NEI 12-06 [Rev 2], Diverse and Flexible Coping Strategies (FLEX) Implementation Guide, dated December 2015.

23. VCSNS Design Calculation, Stormwater Runoff from Fukushima NTTF Recommendation 2.1 PMP Event on Plant Site and Service Water Pond for Unit 1, DC02060-005, Rev. 1, August 25, 2015.

24. VCSNS Plant Modification, ECR 50890, External Flooding Protection.

4 TERMS AND DEFINITIONS

- APM – Available Physical Margin
- DBEE – Beyond Design Basis External Event
- BDB – Beyond Design Basis
- CLB – Current Licensing Basis
- DB – Design Basis
- EFW – Emergency Feedwater
- ELAP – Extended Loss of ac Power
- FE – Focused Evaluation
- FHRR – Flood Hazard Reevaluation Report
- FIAP – Flooding Impact Assessment Procedure
- FLEX – Diverse and Flexible Coping Strategies
- KSF – Key Safety Function
- LIP – Local Intense Precipitation
- LUHS – Loss of Normal Access to the Ultimate Heat Sink
- MSA – Mitigating Strategies Assessment
- MSFHA – Mitigating Strategy Flood Hazard Assessment
- MSFHI – Mitigating Strategy Flood Hazard Information
- MSL – Mean Sea Level
- NEI – Nuclear Energy Institute
- NRC – Nuclear Regulatory Commission
- NTTF – Near-Term Task Force
- PMF – Probable Maximum Flood
- PMP – Probable Maximum Precipitation
- RB – Reactor Building
- RFI – Request for Information
- RHR – Residual Heat Removal
- SSC – Structures, Systems, and Components
- SW – Service Water
- TSA – Time Sensitive Action
- VCSNS – Virgil C. Summer Nuclear Station, Unit 1
- UFSAR – Updated Final Safety Analysis Report

5 FLOOD HAZARD PARAMETERS FOR UNBOUNDED MECHANISMS

NRC has completed the "Staff Assessment for Reevaluated Flood Hazards" (Reference 6 and Reference 7) which contains the Mitigating Strategies Flood Hazard Information (MSFHI) related to the VCSNS Flood Hazard Reevaluation Report (FHRR) (Reference 2). In Reference 7, the NRC states the following:

"staff confirmed that the reevaluated flood hazard information defined in the sections above is appropriate input to other assessments or evaluations associated with Near- Term Task Force Recommendations, including the assessment of mitigation strategies developed in response to Order EA-12-049 (i.e., defines the mitigating strategies flood hazard information described in guidance documents currently being finalized by the industry and NRC staff)."

The VCSNS FHRR (Reference 2) includes a summary of the current design basis and reevaluated flood hazard parameters. In Section 3.1-1 of Reference 7, 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 4.0-2 of Reference 7, the NRC lists flood hazard information (specifically stillwater elevation and associated effects) for the following flood- causing mechanisms that are not bounded by the design basis hazard flood level:

- Local Intense Precipitation and Associated Drainage
- Streams and Rivers
- Storm Surge (Included in Streams and Rivers as a Combined Effect)

It should be noted that the Storm Surge flood-causing mechanism for the VCSNS site represents the NUREG/CR-7046 (Reference 16), Section H.3.2, Combined-Effects Flood (Floods along Shores of Open and Semi-Enclosed Bodies of Water (Streamside Location)). These are the reevaluated flood-causing mechanism that should be addressed in the external flooding assessment. The two non-bounding flood mechanisms, considering Storm Surge is included within the Streams and Rivers Flood Causing Mechanism, for the VCSNS Unit 1 site are described in detail in References 2 and 3, the FHRR submittals. Tables 5-1 through 5-4 summarize how each of these unbounded mechanisms was addressed in this external flooding assessment:

Table 5-1 – Summary of Flood Impact Assessment

	Flood Mechanism	Summary of Assessment
1	Local Intense Precipitation	This mechanism will follow FIAP Path 2, as described in Table 6.3 of NEI 16-05, based on reliability of current and planned flood protection features as well as adequate site response to the LIP event.
2	Rivers and Streams Flooding of the Monticello Reservoir	This mechanism will follow FIAP Path 2, as described in Table 6.3 of NEI 16-05, based on the reevaluated flood levels not reaching plant grade.

Table 5-2 –Flood Hazard Reevaluation Results

Mechanism	CLB Still Water Elevation	CLB Waves/ Runup	CLB Hazard Elevation	FHRR Still Water Elevation	FHRR Waves/ Runup	FHRR Hazard Elevation
Local Intense Precipitation	436.15 ft	N/A.	436.15 ft	436.6 ft to 437.6 ft	N/A.	436.6 ft to 437.6 ft
Streams and Rivers Flooding with Associated Effects for Monticello Reservoir	429.1 ft	7.5 ft	436.6 ft	431.07 ft	5.93 ft	437.0 ft

1. CLB does not include specific locations for calculated LIP values. The FHRR includes specific locations with 436.6 ft on the East Side of the Power Block and 437.6 ft on the West Side of the Power Block
2. No LIP associated effects are identified from debris, sediment deposition, or erosion, concurrent site conditions, or groundwater ingress (Reference 2 and 5).

Table 5-3 – Flood Mechanism Parameters for LIP

	Parameter Description	Values/Discussion
1	Max Stillwater Elevation	436.6 ft (East Side of Power Block) and 437.6 ft (West Side of Power Block)
2	Max Wave Run-up Elevation	N/A
3	Max Hydrodynamic/Debris Loading	Minimal
4	Effects of Sediment Deposition/Erosion	N/A
5	Other Associated Effects	N/A
6	Concurrent Site Conditions	N/A
7	Effects on Ground Water	None
8	Warning Time	24 hrs
9	Period of Site Preparation	12 hrs
10	Period of Inundation	7 hrs
11	Period of Recession	17 hrs
12	Plant Mode of Operation	Any
13	Other Factors	None

The table above for the LIP parameters shows the most bounding values on site. However, it should be noted that various locations around the site have different flooding depths. As noted in the FHRR (Reference 2), several features have maximum flood water elevations that exceed the current feature elevations (Reference 19, Attachment E). These locations require analysis in this Focused Evaluation.

Table 5-4 – Flood Mechanism Parameters for Streams and Rivers Flooding from Monticello Reservoir

	Parameter Description	Values/Discussion
1	Max Stillwater Elevation	431.07 ft
2	Max Wave Run-up Elevation	437.0 ft
3	Max Hydrodynamic/Debris Loading	Water level never inundates site due to protection from earthen berm.
4	Effects of Sediment Deposition/Erosion	Water level never inundates site due to protection from earthen berm.
5	Other Associated Effects	Water level never inundates site due to protection from earthen berm.
6	Concurrent Site Conditions	Water level never inundates site due to protection from earthen berm.
7	Effects on Ground Water	Water level never inundates site due to protection from earthen berm.
8	Warning Time	Water level never inundates site due to protection from earthen berm.
9	Period of Site Preparation	Water level never inundates site due to protection from earthen berm.
10	Period of Inundation	Water level never inundates site due to protection from earthen berm.
11	Period of Recession	Water level never inundates site due to protection from earthen berm.
12	Plant Mode of Operation	Water level never inundates site due to protection from earthen berm.
13	Other Factors	Water level never inundates site due to protection from earthen berm.

The Monticello Reservoir is located adjacent to and north of the VCSNS site, the Monticello Reservoir is formed by the Frees Creek Dams located to the North and West of the VCSNS site. The VCSNS site is protected from flooding of the Monticello Reservoir by the North Berm, having a design elevation of 438.0ft.

6 OVERALL SITE FLOODING RESPONSE

6.1 DESCRIPTION OF OVERALL SITE FLOODING RESPONSE

The site response for LIP is as follows:

The VCSNS site requires temporary flood protection features to be deployed to maintain key safety functions (KSFs) during a LIP event. Without the temporary flood protection features, water will accumulate against site exterior grade level pathways and water infiltration will occur into several areas (See Reference 19, Attachment E for listing of impacted pathways). Flood water infiltration is postulated thru these pathways and would challenge several VCSNS site KSFs should water accumulate enough to flood the lower building elevations. Therefore, temporary flood protection features will be installed upon receipt of a severe weather warning as described in VCSNS Operations Severe Weather Procedure, OAP-109.1 (Reference 20).

Currently, VCSNS employs interim actions, as described in VCSNS Letter to the NRC RC-13-0118 (Reference 3). The interim actions include deployment of sandbags in accordance with OAP-109.1 (Reference 20) and also periodic inspections of the storm drainage system as described in Reference 3. As noted in Reference 3, the interim actions are to remain in place until a permanent solution is implemented.

The permanent solution is an engineering change to perform the plant changes as identified in Reference 19, Attachment E, and as described in Section 6.2 of this report. Section 7 of this Focused Evaluation is performed with consideration of the future planned modifications discussed in Section 6.2.

The sandbags, or future flooding protection features, will keep water from entering into protected plant buildings and equipment areas. With the deployment of the sandbags, or future flooding protection features, all KSFs and Key Structures, Systems, and Components (SSCs) will remain available during the LIP event. Though not credited in this evaluation, additional defense-in-depth is provided by FLEX, as confirmed in the MSA (Reference 18).

The site response for Streams and Rivers from Monticello Reservoir is as follows:

This FE demonstrates that no doors, buildings, or propagation pathways that contain Key SSCs are challenged by flood waters during the Streams and Rivers flooding event. The Monticello Reservoir is located adjacent to and north of the VCSNS site, the Monticello Reservoir is formed by the Frees Creek Dams located to the North and West of the VCSNS site. The VCSNS site is protected from flooding of the Monticello Reservoir by the North Berm, having a design elevation of 438.0ft. Due to the protection provided by the permanent, passive, earthen embankments there is no inundation of the site due to flooding from the Monticello Reservoir. Therefore, there is no impact on key SSCs or equipment that would affect the ability to maintain any of the KSFs.

6.2 SUMMARY OF PLANT MODIFICATIONS AND CHANGES

VCSNS Technical Report TR02060-003 (Reference 19), specifically Section 4.5 and Attachment E, documents proposed plant modifications for site flooding remediation. Plant Modification, ECR 50890 (Reference 24), is in process to provide remediation to the site flooding issues identified in TR02060-003 and discussed within this Focused Evaluation. ECR05890 also provides other enhancements to site external flooding protection as identified within TR02060-003 Attachment E.

Once the plant modification is implemented, the interim actions may be terminated, as described in Reference 3.

Section 7 of this Focused Evaluation is performed considering the modifications summarized above are implemented.

7 FLOOD IMPACT ASSESSMENT

7.1 LOCAL INTENSE PRECIPITATION – PATH 2

7.1.1 Description of Flood Impact

TR02060-003 (Reference 19) lists pathways into the following structures to which the maximum water surface elevation exceeds the allowable pathway elevation:

- Auxiliary Building
- Intermediate Building and East Penetration Access Area
- Control Building
- Diesel Generator Building
- Service Water Pump House

If water accumulates on the exterior of the identified features (from Reference 19) to the above structures for an extended period of time, inundation into the rooms behind these doors will occur and water will accumulate in those structures.

Once the flood water enters into the above identified structures, the water will migrate through floor drains, over curbs, and thru various openings into the lower elevations of the identified structures. Flooding will then occur on the basement elevations of the identified structures. The Key SSCs that could potentially be affected for the impacted structures are listed below along with the respective structures:

- Auxiliary Building
  - RHR Pumps, RB Spray Pumps
- Intermediate Building and East Penetration Access Area
  - 1E Batteries, EFW Pumps, Safety Related Chillers, Service Water Booster Pumps
- Control Building
  - None Identified. Flooding of the Control Building migrates to the Auxiliary Building due to drain piping interconnections.
- Diesel Generator Building
  - EFW Pump Suction Pressure Transmitters, Emergency Diesel Generator Auxiliaries
- Service Water Pump House
  - SW Pump Discharge Valves and SW Instrumentation

Note: The above listings is not all-inclusive and provides only a summary of the primary equipment/functions which could be potentially impacted.

The site has decided to protect against water accumulation in the above structures/buildings.

7.1.2 Adequate APM Justification and Reliability Flood Protection

VCSNS Technical Report TR02060-003 (Reference 19), specifically Section 4.5 and Attachment E, documents proposed plant modifications for site flooding remediation. TR02060-003 recommends a design margin of 1 foot with respect to the maximum water elevation for the area of the installed flood protection feature. The 1 foot design margin, above the calculated water level, provides APM for the installed flood protection features. The plant modification to install the flood protection features, as discussed in Section 6.2, used TR02060-003 as the basis document. The modification installs only Passive or Temporary Flood Features (as defined in NEI 16-05 (Reference 13)), and the reliability of the features is assessed per NEI 16-05 Appendix B as part of the modification development.

7.1.3 Adequate Overall Site Response

This evaluation, performed in accordance with NEI 16-05 Appendix C, has demonstrated the overall site response to Local Intense Precipitation is conceptually adequate. The final determination of site response cannot be formalized until the plant modifications discussed in Section 6.2 have been implemented. The following sections outline the results of evaluating the criteria in NEI 16-05 Appendix C.

7.1.3.1 Defining Critical Path and Identifying Time Sensitive Actions (TSAs)

The overall strategy for protecting the VCSNS site from Local Intense Precipitation contains relatively simple and straightforward actions. The critical path actions and TSAs have been identified during the NEI 12-06 (Reference 22) Validation Process and performed in accordance with Appendix E of that document. The critical path and TSAs include:

1. Identifying a Severe Weather Event
2. Dispatching Crews to complete flood protection actions (currently in OAP-109.1 Enclosure E)

7.1.3.2 Demonstration all TSAs are Feasible

The TSAs for the VCSNS site response to LIP have been validated and evaluated for feasibility under the Order EA-12-049 and the MSA process. The guidance provided in NEI 12-06, Appendix E & G was followed to determine that all TSAs are feasible and can be performed under the reevaluated flood hazard parameters contained in the MSFHI letter. These evaluation results are the basis for determining the overall strategy as adequate (Reference 18).

7.1.3.3 Establishing Unambiguous Procedural Triggers

The site will receive a heavy rainfall or severe thunderstorm warning from contracted weather monitoring/forecast service. Also, Operations personnel are procedurally required to monitor the weather forecasts once per shift (12 hour shifts) per OAP-100.6 (Reference 21). Either the contracted weather service or operations monitoring will be the trigger for initiating the flood protection actions (currently in OAP-109.1). Per

the Shift Manager discretion, in accordance with OAP-109.1 (Reference 20), installation of the flood protection features is made when the threshold rainfall event forecast has been met.

7.1.3.4 Proceduralized and Clear Organizational Response to a Flood

OAP-109.1 provides clear guidance on the responsibilities for all groups at the station identified in Section 6.6 and Enclosure E of the procedure. The Duty Shift manager is ultimately responsible for all actions taken and delegates as required to keep track of items completed throughout the event.

OAP-109.1 has been determined to have clear guidelines for severe weather preparations and response. OAP-109.1 (or a replacement procedure), will be updated as a part of the plant modification described in Section 6.2 to include the permanent flood protection strategy for VCSNS. Clarification will be made if additional groups or procedural steps are required to implement the flood protection features installed by the plant modification.

7.1.3.5 Detailed Flood Response Timeline

The flood protection features required to protect Key SSCs and prevent the loss of a KSF will be either pre-staged adjacent to the location they are required to be placed, or pre-staged at a designated storage area within the FLEX Storage Building. The configuration and placement of the flood protection features (i.e. flood gates) in front of the doors will be completed in accordance with OAP-109.1 Enclosure E (or equivalent replacement procedure). These actions will be validated using the guidance in NEI 12-06 (Reference 22) Appendix E.

The validation performed per the guidance in NEI 12-06 Appendix E will confirm the flood mitigation actions can be performed, with acceptable margin, within the allotted "site preparation" time contained in Table 5-3. This demonstrates that there is ample time to complete the actions required to install the flood gates. The validation will be performed and documented as part of ECR50890 (Reference 24).

7.1.3.6 Accounting for the Expected Environmental Conditions

The environmental conditions expected during the deployment of the flood protection features (i.e. flood gates) are expected to be nominal. Advanced warning of a storm will provide sufficient time to have the flood protection features installed prior to the onset of severe weather. Given the short amount of time expected to complete the action, it is highly unlikely that conditions will deteriorate enough to impede installing the flood protection.

7.1.3.7 Demonstration of Adequate site response

The site response to a LIP is adequate by meeting the guidelines in NEI 16-05 Appendix C. As part of the plant modification implementation (discussed in Section 6.2), all TSAs will be identified and their feasibility will be determined per NEI 12-06 Appendix

E. The time margin will be determined by ensuring the flood protection actions can be performed within the allotted "site preparation" time provided in Table 5-3. The organizational structure and command & control is currently laid out in OAP-109.1 and will be updated as required following completion of the plant modification described in Section 6.2. Finally, the environmental conditions are expected to be insignificant even with the minimum warning time prior to the onset of intense rainfall.

Implementation of ECR 50890 including confirmation of the timelines for TSAs, will demonstrate that overall site response is adequate for LIP per the NEI 16-05 guidance. ECR 50890 documentation will serve as the Plant Record to demonstrate the adequacy of the site response. Accordingly, revision to this Technical Report upon completion of the installation and demonstration is not required.

7.2 Streams And Rivers Flooding – Path 2

7.2.1 Description of Flood Impact

The Streams and Rivers Flooding of the Monticello Reservoir, combined with the storm surge or wind/wave run-up, will not impact any structures that contain any Key SSCs. As noted in Table 5-4, maximum water elevation, including wind set-up and wave run-up will not inundate the site, or reach site grade, due to protection provided by the North Berm which separates the site from the Monticello Reservoir. There are no Key SSCs identified for this flooding mechanism that could be impacted by the streams and rivers flood waters. Protection to all Key SSCs is provided by the plant grade and earthen features (i.e. North Berm), which is inherently permanently-installed and passive. Adequate APM justification has been provided below and no further evaluation is required.

7.2.2 Adequate APM Justification and Reliability for Flood Protection

The Streams and River Flooding of the Monticello Reservoir, including wind set-up and wave run-up, is calculated to produce a maximum elevation of 437.0 ft msl, providing an approximate APM of 1.0 ft. However, this is not a constant water level as waves are periodic, so the minimum APM is only realized at each peak wave height. The maximum still water elevation only reaches 431.07 ft msl, which provides significant margin to the crest of the North Berm. Therefore, the APM has been determined as adequate based on the conditions required to produce this water elevation and the relatively short exposure time that the maximum water levels will pose a challenge to the site. The North Berm is also periodically inspected to ensure proper elevation (Reference 3) and acceptable condition of the rip-rap slope protection.

7.2.3 Adequate Overall Site Response for Flood Protection

There are no required human actions for this response to be successful and, therefore, an evaluation of the overall site response is not necessary.

8 NRC STAFF ASSESSMENT ISSUE RESOLUTION

The NRC Staff Assessment of Flooding Flood-Causing Mechanisms Reevaluation Response (Ref 6), specifically Table 5.0-1, contained two Integrated Assessment Open Items for VCSNS to resolve as part of the Integrated Assessment. As a result of NRC Correspondence included in References 10, 11, and 12, the NRC issued a Supplement to the Staff Assessment (Reference 7), which effectively removed the requirement for VCSNS to perform an Integrated Assessment and instead provided allowance for performance of a Focused Evaluation. Additionally, the supplement removed the Integrated Assessment Open Items. However, Section 3.2.5 of the supplement recommended VCSNS address the issues of roof drainage and also any increase if service water pond still-water elevation from LIP due to increased roof drainage, the related issues were discussed in detail in Section 3.2.3 and 3.3.4 of the supplement, respectively. Section 8.1 and 8.2 provide VCSNS resolution to the previously identified Integrated Assessment Open Items.

8.1 RESOLVE LIP NUMERICAL MODELING ISSUE

VCSNS used FLO-2D software application to perform storm water runoff and hydrologic routing. The issue noted in the NRC Staff Assessement (Reference 6) and Supplement to the Staff Assessment (Reference 7), of which rain water was being retained on building roofs was remediated via a revision to the FLO-2D software. Updated calculation, DC02060-005 (Reference 23), was issued following receipt of the initial NRC Staff Assessment (Reference 6), to in part, provide calculation re-simulation using an updated version of the FLO-2D Software (Version Pro Model – Build No. 14.03.07), which resolved the issue of the rain water on roofs becoming missing. The updated FLO-2D analysis software configuration, as described in DC02060-005, restricts water storage within the building/structure grid locations and forces water to runoff buildings. The updated results of VCSNS Design Calculation DC02060-005 have been incorporated into VCSNS Technical Report TR02060-003 (Reference 19).

8.2 EVALUATE A RANGE OF LIP RAINFALL DURATIONS

VCSNS updated DC02060-005 (Reference 23) to incorporate a range of rainfall durations associated with the LIP flood hazard. The range of rainfall durations selected was 5 minute, 15 minute, 30 minute, 1 hour, and 6 hour. The rainfall durations, intensities, and distributions were selected per NUREG/CR-7046 (Reference 16), which incorporates by reference NOAA Hydrometeorological Report No. 52. The updated results of VCSNS Design Calculation DC02060-005 have been incorporated into VCSNS Technical Report TR02060-003 (Reference 19).

9 CONCLUSION

The FHRR showed that two flooding mechanisms were not bounded by the CLB and were required to be evaluated in this FE. A LIP event was estimated to generate a water level that exceeds several threshold openings into KSF building areas which could adversely impact Key SSCs, if not mitigated.

Therefore, VCSNS Unit 1 will install flood protection features (i.e. flood gates) to protect building areas which contain KSF equipment upon receipt of a weather warning for extreme precipitation. This FE demonstrated the site response is adequate.

The second mechanism that was not bounded by the CLB is Streams and Rivers Flooding of the Monticello Reservoir, including storm surge associated effects. The FHRR estimated the Streams and Rivers Flooding of Monticello Reservoir would produce flooding elevations and wave action in exceedance of the CLB elevations. All buildings/plant areas that have Key SSCs have been shown to have adequate APM, since the design basis elevation of the North Berm (438 ft msl), which protects the site from flooding of the Monticello Reservoir, exceeds the maximum calculated flooding elevation of the Monticello Reservoir. Therefore, no water intrusion or accumulation is anticipated in rooms with Key SSCs and the plant will be able to maintain all KSFs throughout the event.

Finally, for both mechanisms, the MSA has demonstrated that mitigating strategies (FLEX) will be available to maintain/restore KSFs as a defense-in-depth measure. Additional information can be found in the MSA (Reference 18).

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

VIRGIL C. SUMMER NUCLEAR STATION (VCSNS) UNIT 1
DOCKET NO. 50-395
OPERATING LICENSE NO. NPF-12

ENCLOSURE 2

LIST OF REGULATORY COMMITMENTS

The following table identifies those actions committed to by the Virgil C. Summer Nuclear Station (VCSNS) in this document. Any other statements in this submittal are provided for information purposes and are not considered to be regulatory commitments. Please direct questions regarding these commitments to Mr. Bruce L. Thompson at (803) 931-5042.

COMMITMENT	DUE DATE
VCSNS will implement Engineering Change Request ECR-50890, "External Flooding Protection," for site flooding remediation as detailed in Section 6.2 of TR02060-005.	December 2018
VCSNS will update OAP-109.1, "Guidelines for Severe Weather," (or a replacement procedure) as part of the plant modification described in Section 6.2 of TR02060-005 to include the permanent flood protection strategy for VCSNS. In addition, clarification will be made if additional groups or procedural steps are required to implement the flood protection features installed by the plant modification.	90 Days after implementation of ECR-50890, "External Flooding Protection"
VCSNS will perform a validation, per NEI 12-06 Appendix E guidance, to confirm flood mitigation actions can be performed, with acceptable margin, within the allotted "site preparation" time contained in Table 5-3 of TR02060-005. The validation will be performed and documented as part of ECR-50890, "External Flooding Protection."	December 2018
As part of ECR-50890, "External Flooding Protection," implementation, VCSNS will identify all Time Sensitive Actions (TSAs). In addition, the feasibility of all (TSAs) will be determined per NEI 12-06 Appendix E.	December 2018
VCSNS will update, as required, the organizational structure and command & control currently described in OAP-109.1 following the completion of ECR-50890, "External Flooding Protection."	90 Days after implementation of ECR-50890, "External Flooding Protection"