UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

November 3, 2015

Mr. Thomas D. Gatlin, Vice President
Nuclear Operations
South Carolina Electric and Gas Company
Virgil C. Summer Nuclear Station
Post Office Box 88, Mail Code 800
Jenkinsville, SC 29065

SUBJECT: VIRGIL C. SUMMER NUCLEAR STATION, UNIT 1 – SUPPLEMENT TO STAFF ASSESSMENT OF RESPONSE TO 10 CFR 50.54(f) INFORMATION REQUEST – FLOOD-CAUSING MECHANISMS REEVALUATION (CAC NO. MF1112)

Dear Mr. Gatlin:

The purpose of this letter is to transmit a supplement to the U.S. Nuclear Regulatory Commission (NRC) staff's assessment for Virgil C. Summer Nuclear Station, Unit 1 (Summer) reevaluated flood hazard information that was issued to you by letter dated December 23, 2014 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML14356A002). The supplement updates the original NRC staff assessment to address changes in the NRC's approach to the steps following the review of the flood hazard reevaluations as directed by the Commission. The letter also addresses the next steps associated with the mitigation strategies assessment with respect to the reevaluated flood hazards.

By letter dated March 12, 2012 (ADAMS Accession No. ML12053A340), the NRC issued a request for information pursuant to Title 10 of the *Code of Federal Regulations*, Section 50.54(f) (hereafter referred to as the 50.54(f) letter). The request was issued as part of implementing lessons learned from the accident at the Fukushima Dai-ichi nuclear power plant. Enclosure 2 to the 50.54(f) letter requested licensees to reevaluate flood-causing mechanisms using present-day methodologies and guidance. By letter dated March 12, 2013 (ADAMS Accession No. ML13073A114), South Carolina Electric and Gas Company responded to this request for Summer. This response was supplemented by letters dated August 22, 2013, March 26, 2014, and November 24, 2014 (ADAMS Accession Nos. ML13240A005, ML14093A320, and ML14329B257. By letter dated December 23, 2014, the NRC staff transmitted to the licensee a staff assessment of the information provided in the aforementioned letters. The NRC staff has completed its review of the information provided, as documented in the staff assessment and the enclosed supplement to the staff assessment. This closes out the NRC's efforts associated with CAC No. MF1112.

The enclosed supplement to the staff assessment updates the NRC staff's conclusions in accordance with the flood hazard reevaluation approach described in NRC letter dated September 1, 2015 (ADAMS Accession No. ML15174A257), concerning the coordination of requests for information regarding flooding hazard reevaluations and mitigating strategies for beyond-design-basis external events. This letter describes the changes in the NRC's approach to the flood hazard reevaluations that were approved by the Commission in its Staff

Requirements Memorandum (ADAMS Accession No. ML15209A682) to COMSECY-15-0019 (ADAMS Accession No. ML15153A104) that described the NRC's mitigating strategies and flooding hazard reevaluation action plan.

As documented in the NRC staff assessment and the enclosed supplement, the staff has concluded that the licensee's reevaluated flood hazard 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 guidance documents currently being finalized by the industry and NRC staff) for Summer. Further, the licensee's reevaluated flood hazard information is suitable for other assessments associated with Near-Term Task Force Recommendation 2.1 "Flooding".

The reevaluated flood hazard results for local intense precipitation, streams and rivers, and storm surge, were not bounded by the current design-basis flood hazard. In order to complete its response to Enclosure 2 to the 50.54(f) letter, the licensee is expected to submit a revised integrated assessment or focused evaluation(s), as appropriate, to address these reevaluated flood hazards, as described in the NRC's September 1, 2015, letter.

If you have any questions, please contact me at (301) 415-6185 or email at Anthony.Minarik@nrc.gov.

Sincerely,

Anthony Minarik, Project Manager
Hazards Management Branch
Japan Lessons-Learned Division
Office of Nuclear Reactor Regulation

Docket No. 50-395

Enclosure:
Staff Assessment of Flood Hazard
Reevaluation Report

cc w/encl: Distribution via Listserv

SUPPLEMENT TO

STAFF ASSESSMENT BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO FLOODING HAZARD REEVALUATION REPORT

NEAR-TERM TASK FORCE RECOMMENDATION 2.1

VIRGIL C. SUMMER NUCLEAR STATION, UNIT 1

DOCKET NO. 50-395

1.0 INTRODUCTION

This document is a supplement to the U.S. Nuclear Regulatory Commission (NRC) staff assessment that was transmitted by letter dated December 23, 2014 (NRC, 2014d), to South Carolina Electric and Gas Company (SCE&G, the licensee) for Virgil C. Summer Nuclear Station, Unit 1 (Summer, VCSNS). With the exceptions of the Table 3.1-1 and the Reference section, this supplement only contains the sections that were changed to resolve the open items and reflect the changes in the NRC's approach to the flood hazard reevaluations that were approved by the Commission in its Staff Requirements Memorandum (SRM) (NRC, 2015a) to COMSECY-15-0019 (NRC, 2015b), which described the NRC's mitigating strategies and flooding hazard reevaluation action plan. Table 3.1-1 at the end of the supplement is copied from the staff assessment for convenience. Instead of repeating the Reference section in its entirety, only the additions to the list of references are included in the supplement.

2.0 REGULATORY BACKGROUND

There are no changes or updates to this section of the NRC staff assessment

2.1 Applicable Regulatory Requirements

There are no changes or updates to this section of the NRC staff assessment.

2.2 Enclosure 2 to the 50.54(f) Letter

By letter dated March 12, 2012 (NRC, 2012a) the NRC issued a request for information Pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR), Section 50.54(f) (hereafter referred to as the 50.54(f) letter). The 50.54(f) letter requests all power reactor licensees and construction permit holders reevaluate all external flooding-causing mechanisms at each site. The reevaluation should apply present-day methods and regulatory guidance that are used by the NRC staff to conduct early site permit (ESP) and combined license (COL) reviews. This includes current techniques, software, and methods used in present-day standard engineering

practice. If the reevaluated flood-causing mechanisms are not bounded by the current plant design-basis flood hazard, an integrated assessment or focused evaluation may be necessary.

2.2.1 Flood-Causing Mechanisms

There are no changes or updates to this section of the NRC staff assessment.

2.2.2 Associated Effects

There are no changes or updates to this section of the NRC staff assessment.

2.2.3 Combined Effects Flood

There are no changes or updates to this section of the NRC staff assessment.

2.2.4 Flood Event Duration

There are no changes or updates to this section of the NRC staff assessment.

2.2.5 Actions Following the flooding hazard reevaluation report (FHRR)

For the sites where the reevaluated flood probable maximum flood (PMF) elevation is not bounded by the current design-basis flood PMF elevation for all flood-causing mechanisms, the 50.54(f) letter (NRC, 2012a) requests licensees and construction permit holders to:

- Submit an Interim Action Plan with the FHRR documenting actions planned or already taken to address the reevaluated hazard(s).

- Perform an integrated assessment subsequent to the FHRR to (a) evaluate the effectiveness of the current design-basis (i.e., flood protection and mitigation systems), (b) identify plant-specific vulnerabilities, and (c) assess the effectiveness of existing or planned systems and procedures for protecting against and mitigating consequences of flooding for the flood event duration.

After issuance of the 50.54(f) letter, the NRC changed the approach to the steps following the review of the flood hazard reevaluations, as directed by the Commission, to permit use of focused evaluations as an alternative to an integrated assessment. The NRC letter dated September 1, 2015 (NRC, 2015c), describes the changes in the NRC's approach to the flood hazard reevaluations

If the reevaluated PMF elevation is bounded by the current design-basis PMF elevation for all flood-causing mechanisms at the site, licensees are not required to perform an integrated assessment or a focused evaluation at this time.

3.0 TECHNICAL EVALUATION

There are no changes or updates to this section of the NRC staff assessment.

3.1 Site Information

There are no changes or updates to this section of the NRC staff assessment.

3.1.1 Detailed Site Information

There are no changes or updates to this section of the NRC staff assessment.

3.1.2 Design-Basis Flood Hazards[1]

There are no changes or updates to this section of the NRC staff assessment.

3.1.3 Flood-related Changes to the Licensing Basis

There are no changes or updates to this section of the NRC staff assessment.

3.1.4 Changes to the Watershed and Local Area

There are no changes or updates to this section of the NRC staff assessment.

3.1.5 Current Licensing Basis Flood Protection and Pertinent Flood Mitigation Features

There are no changes or updates to this section of the NRC staff assessment.

3.1.6 Additional Site Details to Assess the Flood Hazard

There are no changes or updates to this section of the NRC staff assessment.

3.1.7 Plant Walkdown Activities

There are no changes or updates to this section of the NRC staff assessment.

3.2 Local Intense Precipitation and Associated Site Drainage

There are no changes or updates to this section of the NRC staff assessment.

3.2.1 Site Drainage and Elevations

There are no changes or updates to this section of the NRC staff assessment.

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[1] In its FHRR, the licensee used the terms "design-basis" and "licensing basis" interchangeably. Because the references to current licensing basis were to various elevations that were specific to each flood hazard, the NRC staff assumes in this document that the licensee intended the term "current licensing basis" in its FHRR to refer to the "current design-basis" since this is what the 50.54(f) letter, Enclosure 2, requested. The NRC staff will thus use the term "current design-basis", as appropriate, throughout this document.

3.2.2 Local Intense Precipitation Depths

There are no changes or updates to this section of the NRC staff assessment.

3.2.3 Modeling of Flood Levels

To estimate runoff and perform hydrologic routing, the licensee used the FLO-2D software application (SCE&G, 2013a; FLO-2D Software, Inc. 2009). The licensee used the 1-mi^2 (2.6-km^2), 1-h duration rainfall value of 19.0 in (48.3 cm) as input to the FLO-2D application.

Given the significant role that the FLO-2D model performs in the licensee's analysis of the PMF caused by local intense precipitation (LIP), the NRC staff requested that the licensee provide FLO-2D input files. The licensee provided a detailed description of the application of the FLO-2D model along with the model input files in its response to NRC's request for additional Information (RAI) (SCE&G, 2014b, RAIs 1 and 2 responses). The NRC staff reviewed model input configurations and the manner in which results of the FLO-2D analysis were used to predict water-surface elevations.

The VCSNS, Unit 1 FHRR (SCE&G, 2013a) stated that the roofs of safety-related buildings were designed to store up to 4 inches (10 cm) of precipitation. The licensee did not describe how or if this design feature was incorporated into the LIP analysis and did not characterize similar design features of non-safety-related buildings. The NRC staff reviewed the licensee's FLO-2D application and found that all precipitation falling on building roofs was retained on the roofs and did not enter the flow domain adjacent to the buildings. Water retained on building roofs would reduce the discharge adjacent to, and downstream of, the buildings. The portion of runoff from the plant site into the service water pond (SWP), with coincident wind setup and wave runup discussed later relative to streams and rivers in Section 3.3.4, is also impacted indirectly by the roof drainage issue in the FLO-2D model.

The licensee's reevaluation yielded a PMF water-surface elevation of 436.6 ft to 437.5 ft (133.1 m to 133.4 m) (SCE&G, 2013a), which is higher than the current design-basis stillwater-surface elevation of 436.15 ft (132.94 m). Elevation 436.6 ft (133.1 m) is at the east side, and elevation 437.5 ft (133.4 m) is at the west side of the powerblock (SCE&G, 2014b).

3.2.4 Flood Event Duration

The VCSNS, Unit 1 FHRR (SCE&G, 2013a) did not address flood warning time or the duration of inundation resulting from LIP flooding.

The NRC staff requested additional information from the licensee (NRC, 2014b) to supplement its FHRR (SCE&G, 2013a). The licensee's response (SCE&G, 2014b, RAI 6 response) stated that existing modeling indicates that most ponded water drains from the site within 7 hours. Warning time, based on meteorological warnings, is expected to be more than 24 hours. The NRC staff notes that longer duration probable maximum precipitation (PMP) events that deliver greater precipitation volumes, such as the 72-h PMP, generate greater volumes of runoff. Shorter-duration PMP events that have higher rates of precipitation, such as the 1-hour PMP, may however result in much shorter warning times and higher water levels.

The NRC staff notes that a reasonable estimate of the site's LIP PMP is application of an appropriate National Oceanic and Atmospheric Administration hydrometeorological report (HMR) estimate for any rainfall duration used in NUREG/CR-7046, regardless of temporal distribution of the rainfall. The licensee obtained 1-mi^2 (2.6-km^2), 1-h duration PMP value using HMR-52. Therefore, the NRC staff confirmed that the licensee selected an appropriate rainfall rate value to satisfy the 50.54(f) information request.

3.2.5 Conclusion

The NRC staff confirmed the licensee's conclusion that the reevaluated flood hazard for LIP and associated site drainage is not bounded by the current design-basis flood hazard. Therefore, the licensee is expected to submit a focused evaluation for LIP and associated site drainage consistent with the process outlined in COMSECY-15-0019 (NRC, 2015b) and associated guidance that will be issued. Under this approach, the NRC staff anticipates that licensees will perform and document a focused evaluation that evaluates the impact of the LIP hazard on the site and implements any necessary programmatic, procedural or plant modifications to address this hazard exceedance. The roof drainage and Service Water Pond issues that are discussed in Sections 3.2.3 and 3.3.4 should be addressed in the focused evaluation. The NRC staff anticipates that licensees will submit letters providing a summary of the evaluation and, if needed, regulatory commitments to implement and maintain appropriate programmatic, procedural or plant modifications to protect against the LIP hazard.

3.3 Streams and Rivers

There are no changes or updates to this section of the NRC staff assessment.

3.3.1 Additional Information

There are no changes or updates to this section of the NRC staff assessment.

3.3.2 Flooding Scenarios and Associated Effects

There are no changes or updates to this section of the NRC staff assessment.

3.3.3 Monticello Reservoir

There are no changes or updates to this section of the NRC staff assessment.

3.3.4 Service Water Pond

In the VCSNS, Unit 1 FHRR (SCE&G, 2013a), the SWP is described as a Seismic Category 1 impoundment that serves as the Ultimate Heat Sink for VCSNS, Unit 1. The SWP is adjacent to Monticello Reservoir (Figure 3.3-2). The SWP is separated from Monticello Reservoir by two islands and three Seismic Category 1 dams, which have crest elevations of 438.0 ft (133.5 m) on three sides. The crest elevation of the West Embankment is 435.0 ft (132.6 m). The West Embankment adjoins the VCSNS, Unit 1 plant yard grade, and therefore represents the land

elevation value critical for assessment of the PMF maximum water-surface elevation in the SWP.

In its FHRR, the licensee stated that water is supplied to the SWP from Monticello Reservoir by a pipe configured with a butterfly isolation valve. This isolation valve is kept closed during normal operations.

The FHRR states that the SWP normal pool elevation is 422.0 ft (128.6 m). Under normal operational conditions the pool elevation ranges from 420.5 ft to 425.0 ft (128.2 m to 129.5 m). The NRC staff confirmed that the description of the SWP is consistent with that provided in the VCSNS, Unit 1 UFSAR (SCE&G, 2010a).

Given the control of the SWP pool elevation by the operation of the SWP isolation valve on the interconnecting pipe between the SWP and Monticello Reservoir, the NRC staff requested that the licensee provide a detailed description of conditions leading to the valve's operation, frequency of operation, and any assumptions related to the state of the isolation valve used in the reevaluation of the PMF for the SWP (NRC, 2014b). The licensee provided a detailed description of the operation of the SWP isolation valve, frequency of operation, and the assumptions used by the licensee related to the state of the valve in its analysis of the PMF (SCE&G, 2014b, RAI 4 response).

The VCSNS, Unit 1 FHRR (SCE&G, 2013a), included a description of the runoff and stream-course models associated with the PMF flooding in streams and rivers related to LIP runoff from the plant area as it drains into the SWP. In response to the NRC's RAI (NRC, 2014b), the licensee described its analysis of water levels in the SWP resulting from the PMP on the site plus associated effects (SCE&G, 2014b, RAI 5 response). The SWP receives a portion of the LIP runoff from the plant area as mentioned in Section 3.2.3 above, and the issue within the FLO-2D model, related to lack of roof drainage, impacts the portion of runoff from the plant site to the SWP.

The VCSNS, Unit 1 FHRR (SCE&G, 2013a), referenced a full description of the coincident wind-wave effects associated with the PMF flooding in streams and rivers, contained in the VCSNS, Unit 1 UFSAR (SCE&G, 2010a). The VCSNS, Unit 1 FHRR (SCE&G, 2013a), Section 4.1.2.2.2.2, stated that the VCSNS, Unit 1 UFSAR (SCE&G, 2010a) PMF included wind effects that would result in a SWP water-surface elevation of 433.6 ft (132.2 m). The FHRR maximum water-surface elevation including wind-wave activity estimates are based, in part, on the stillwater-surface elevation in the SWP. The VCSNS, Unit 1 FHRR (SCE&G, 2013a), Section 4.2.2.2, stated that the reevaluated PMF elevation for the SWP at the West Embankment was determined to be 428.3 ft (130.5 m). The licensee used the FLO-2D model to estimate LIP and runoff from the site into the SWP and the associated rise in the stillwater-surface elevation.

3.3.5 Broad River

There are no changes or updates to this section of the NRC staff assessment.

3.3.6 Conclusion

The NRC staff confirmed the licensee's conclusion (SCE&G 2014c) that the reevaluated hazard for flooding from streams and rivers is not bounded by the current design-basis flood hazard when combined with wind setup and wave runup; therefore, the licensee should include flooding from streams and rivers with wind setup and wave runup from Monticello Reservoir within the scope of the integrated assessment or focused evaluation consistent with the process and guidance discussed in COMSECY-15-0019 (NRC, 2015b). Information on flooding from streams and rivers that is specific to the data needs of the integrated assessment or focused evaluation is described in Section 4 of this staff assessment.

3.4 Failure of Dams and Onsite Water Control/Storage Structures

There are no changes or updates to this section of the NRC staff assessment.

3.5 Storm Surge

The VCSNS, Unit 1 FHRR (SCE&G, 2013a) reported that the reevaluated PMF elevation, including associated effects, for site flooding due to the wind setup and wave runup aspects of storm surge is 437.0 ft (133.2 m) when combined with the PMF in the streams and rivers analysis. This flood-causing mechanism is described in the licensee's current design-basis.

This reevaluated PMF elevation exceeds the current design-basis PMF elevation for site flooding due to storm surge of 436.6 ft (133.1 m). The licensee stated that water level increases due to storm surge were included in the PMF determinations in the Monticello Reservoir and the SWP; no further analysis was performed specifically for storm surge without the PMP. The plant site is protected by the North Berm to elevation 438.0 ft (133.5 m).

In summary, the NRC staff confirmed the licensee's conclusion that flooding from storm surge does not inundate the site. However, this hazard mechanism exceeds the current design-basis. Therefore, the treatment of the storm surge should be addressed in the integrated assessment or focused evaluation consistent with the process and guidance discussed in COMSECY- 15-0019 (NRC, 2015c).

3.6 Seiche

There are no changes or updates to this section of the NRC staff assessment.

3.7 Tsunami

There are no changes or updates to this section of the NRC staff assessment.

3.8 Ice-Induced Flooding

There are no changes or updates to this section of the NRC staff assessment.

3.9 Channel Migrations or Diversions

There are no changes or updates to this section of the NRC staff assessment.

4.0 REEVALUATED FLOOD HEIGHT, EVENT DURATION AND ASSOCIATED EFFECTS FOR HAZARDS NOT BOUNDEDE BY THE CDB

The NRC staff confirms that for certain flooding mechanisms that the reevaluated hazard is not bounded by the current design-basis flood hazard. Therefore, the NRC staff concludes that an integrated assessment or focused evaluation(s) is necessary, and that it should consider the following flood-causing mechanisms: LIP, storm surge, and flooding in streams and rivers with wind setup and wave runup from Monticello Reservoir as a combined effect.

The NRC staff reviewed the following flood hazard parameters needed to perform the additional assessments or evaluations of plant response:

- Flood height and associated effects (see Table 4.0-2), as defined in JLD-ISG-2012-05 (NRC, 2012d)

- Flood event duration (see Table 4.0-1), including warning time and intermediate water surface elevations that trigger actions by plant personnel, as defined in JLD-ISG-2012- 05 (NRC, 2012d)

4.1 Flood Height and Associated Effects

The licensee estimated maximum water-surface elevations using its FLO-2D analysis (SCE&G, 2013a, 2014b). The NRC staff found that, in the licensee's FLO-2D application, precipitation was modeled as being retained on building roofs rather than discharged to the ground surface near the structure or an adjacent area, which could result in underestimation of the maximum water-surface elevation. Because the LIP flooding mechanism is being evaluated as part of a focused evaluation, the NRC staff determined that this numerical modeling issue should be resolved as part of the focused evaluation.

The streams and rivers flood-causing mechanism was combined with the storm surge flood-causing mechanism (wind setup and wave runup). This combined effect flood reevaluation is not bounded by the current design-basis, and results in an increase in the elevation of water impinging upon a flood protection structure (i.e., North Berm of the plant site at Monticello Reservoir). The NRC staff has observed that the increase in the combined effect flood has resulted in a reduction of margin that is quantitatively minor (0.4 ft (0.1 m)) and characterized by brief and intermittent impingement of waves on a passive low-head flood protection feature (a 3 ft (1 m) berm).

4.2 Flood Event Duration

Section 3.2.4 of this staff assessment discusses flood event duration. The NRC staff notes that a reasonable estimate of the site's LIP PMP is the application of an appropriate National Oceanic and Atmospheric Administration hydrometeorological report (HMR) estimate for any rainfall duration used in NUREG/CR-7046, regardless of temporal distribution of the rainfall. The licensee obtained a 1-mii^2 (2.6-km^2), 1-h duration PMP value using HMR-52. Therefore, the NRC staff confirmed that the licensee selected an appropriate rainfall rate value to satisfy the 50.54(f) information request.

4.3 Conclusion

Based upon the preceding analysis, the NRC 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).

5.0 CONCLUSION

The NRC staff has reviewed the information provided for the reevaluated flood-causing mechanisms of VCSNS, Unit 1. Based on its review, the NRC staff concludes that the licensee conducted the hazard reevaluation using present-day methodologies and regulatory guidance used by the NRC staff in connection with ESP and COL reviews.

Based on the preceding analysis, the NRC staff confirmed that the licensee responded appropriately to Enclosure 2, Required Response 2, of the 50.54(f) letter, dated March 12, 2012. In reaching this determination, the NRC staff confirmed the licensee's conclusions that (a) the reevaluated flood hazard results for local intense precipitation, streams and rivers, and storm surge are not bounded by the current design-basis flood hazard, (b) additional assessments of plant response will be performed for the local intense precipitation streams and rivers, and storm surge flood-causing mechanisms, and (c) the reevaluated flood-causing mechanism information is appropriate input to additional assessments or evaluations of plant response, as described in the 50.54(f) letter and COMSECY-15-0019 (NRC, 2015b), 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 NRC staff has no additional information needs at this time with respect to the FHRR.

6.0 REFERENCES

U.S. Nuclear Regulatory Commission (NRC) Documents and Publications:

NRC (U.S. Nuclear Regulatory Commission), 2014d, letter from Robert F. Kuntz , NRC, to Thomas D. Gatlin, Vice President, "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), December 23, 2014, ADAMS Accession No. ML14356A002.

NRC (U.S. Nuclear Regulatory Commission), 2015a, SRM – COMSECY-15-0019 – Closure Plan for the Reevaluation of Flooding Hazards for Operating Nuclear Power Plants,", July 28, 2015, ADAMS Accession No. ML15209A682.

NRC (U.S. Nuclear Regulatory Commission), 2015b, COMSECY-15-0019 "Closure Plan for the Reevaluation of Flooding Hazards for Operating Nuclear Power Plants,", June 30, 2015, ADAMS Accession No. ML15153A104.

NRC (U.S. Nuclear Regulatory Commission), 2015c, letter from William M. Dean, Director, to Power Reactor Licensees," Coordination of Requests for Information for Flooding Hazard Reevaluations and Mitigating Strategies for Beyond Design Basis External Events", September 1, 2015, ADAMS Accession No. ML15174A257.

Codes and Standards

There are no additions to the references in this section.

Other References:

There are no additions to the references in this section.

Table 3.1-1: Current Design-Basis (CDB) Flood Hazard

Flooding Mechanism	CDB Stillwater Level, NGVD29	CDB Associated Effects*	CDB Flood Level, NGVD29	Reference
Local Intense Precipitation and Associated Drainage	436.15 ft (132.94 m) based on maximum hour within 6 hrs PMP**	None	436.15 ft (132.94 m) based on maximum hour within 6 hr PMP	FHRR (SCE&G, 2013a) Sections 4.3.1 and 4.1.2.1.1. UFSAR (SCE&G, 2010a) Section 2.4.3.1.3
Streams and Rivers (including wave runup from Storm Surge)	429.1 ft (130.8 m), including 4.1 ft (1.25 m) from 48-hrs PMP on initial reservoir elevation of 425.0 ft (129.5 m)	7.5 ft (2.3 m) from wave runup	436.6 ft (133.1 m)	FHRR (SCE&G, 2013a) Section 4.1.2.2.1 UFSAR (SCE&G, 2010a) Section 2.4.3.6.2
Failure of Dams and Onsite Water Control/Storage Structures	<290 ft (88.4 m) No threat of flooding at site	No Impact Identified	<290 ft (88.4 m), Parr Shoals Reservoir / Broad River, No threat of flooding at site	FHRR (SCE&G, 2013a) Section 4.2.2.4
Storm Surge	See Streams and Rivers for combined effect	See Streams and Rivers for combined effect	See Streams and Rivers for combined effect	Included in Streams and Rivers as combined effect
Seiche	No Impact Identified	No Impact Identified	No Impact Identified	FHRR (SCE&G, 2013a) Section 4.2.2.6 UFSAR (SCE&G, 2010a) Section 2.4.5.5
Tsunami	No Impact Identified	No Impact Identified	No Impact Identified	FHRR (SCE&G, 2013a) Section 4.2.2.7
Ice-Induced	No Impact Identified	No Impact Identified	No Impact Identified	FHRR (SCE&G, 2013a) Section 4.2.2.8
Channel Migrations or Diversions	No Impact Identified	No Impact Identified	No Impact Identified	FHRR (SCE&G, 2013a) Section 4.2.2.9

* No associated effects are identified from debris, sediment deposition or erosion, concurrent site conditions (including adverse weather other than the associated PMP), or groundwater ingress.

** 436.15 ft (132.94 m) stillwater level represents nominal plant grade of 435.0 ft (132.6 m) with floodwater depth of 1.15 ft (0.350 m).

Table 4.0-1: Flood Event Duration for Reevaluated Flood-Causing Mechanisms Not Bounded by the Current Design Basis Hazard*

Flood-Causing Mechanism	Site Preparation for Flood Event	Period of Site Inundation	Recession of Water from Site	Total Event Duration
Local Intense Precipitation and Associated Drainage	>24 hr (Assuming all claimed warning time is used for site preparation}	7 hr (At Power Block West)	17 h	>48 hours (Resulting from 1-h PMP)
Streams and Rivers (Monticello Reservoir flooding)	> 24 hr warning time (Implied by local intense precipitation analysis; Monticello Reservoir is immediately adjacent to site, and warning time would be same as for local intense precipitation)	0 h (No site inundation; licensee analysis indicates that wind setup and wave runup impinge on North Berm flood protection feature for 72 seconds)	0 h (No site inundation)	N/A (No site inundation from 72-hrs PMP including wind setup and wave runup)
Storm Surge	See Streams and Rivers for combined effect	See Streams and Rivers for combined effect	See streams and Rivers for combined effect	See streams and Rivers for combined effect

* Elements of flood event duration are shown in Figure 2.2-1.

Table 4.0-2: Reevaluated Flood-Causing Mechanisms and Associated Effects Hazards Not Bounded by the Current Design Basis Hazard

Reevaluated Flood-Causing Mechanism	Stillwater Elevation	Associated Effects**	Reevaluated Flood Hazard Elevation (NGVD29)	Reference
Local Intense Precipitation and Associated Drainage	436.6 ft to 437.5 ft (133.1 m to 133.4 m)	None	436.6 ft to 437.5 ft (133.1 m to 133.4 m) (East side to west side of power block, from 1-hr PMP of 19 in [48 cm]) (Water depths of 1.6 ft to 2.5 ft [0.49 m to 0.76 m])	Maximum surface water elevation during PMP at main plant buildings and doors – see FHRR (SCE&G, 2013a, Section 4.2.1.2)
Streams and Rivers (Resulting from 72-hr PMP) including wind setup and wave runup from Monticello Reservoir	431.07 ft (131.39 m) (Includes effects of 6.07 ft [1.85 m] as direct PMP and basin runoff)	5.93 ft (1.81 m) wind setup and wave runup	437.0 ft (133.2 m) at North Berm (Remains below North Berm crest elevation of 438.0 ft [133.5 m] NGVD29)	Maximum PMF elevation for Monticello Reservoir at North Berm of plant – see FHRR (SCE&G, 2013a, Section 4.2.2.1) and RAI 3 response (SCE&G, 2014b)
Storm Surge	See Streams and Rivers for combined effect	See Streams and Rivers for combined effect	See Streams and Rivers for combined effect	See Streams and Rivers for combined effect

** No associated effects are anticipated from debris, sediment deposition or erosion, concurrent site conditions (including adverse weather other than the associated PMP), or groundwater ingress (SCE&G, 2013a; SCE&G, 2014b)

Table 5.0-1: Integrated Assessment Open Items

Deleted

Requirements Memorandum (ADAMS Accession No. ML15209A682) to COMSECY-15-0019 (ADAMS Accession No. ML15153A104) that described the NRC's mitigating strategies and flooding hazard reevaluation action plan.

As documented in the NRC staff assessment and the enclosed supplement, the staff has concluded that the licensee's reevaluated flood hazard 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 guidance documents currently being finalized by the industry and NRC staff) for Summer. Further, the licensee's reevaluated flood hazard information is suitable for other assessments associated with Near-Term Task Force Recommendation 2.1 "Flooding".

The reevaluated flood hazard results for local intense precipitation, streams and rivers, and storm surge, were not bounded by the current design-basis flood hazard. In order to complete its response to Enclosure 2 to the 50.54(f) letter, the licensee is expected to submit a revised integrated assessment or focused evaluation(s), as appropriate, to address these reevaluated flood hazards, as described in the NRC's September 1, 2015, letter.

If you have any questions, please contact me at (301) 415-6185 or email at Anthony.Minarik@nrc.gov.

Sincerely,

/RA/

Anthony Minarik, Project Manager
Hazards Management Branch
Japan Lessons-Learned Division
Office of Nuclear Reactor Regulation

Docket No. 50-395

Enclosure:
Staff Assessment of Flood Hazard
Reevaluation Report

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DATE	10/25/2015	10/26/2015	11/3/2015

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Letter to Thomas D. Gatlin from Anthony Minarik dated November 3, 2015

SUBJECT: VIRGIL C. SUMMER NUCLEAR STATION, UNIT 1 - STAFF ASSESSMENT OF RESPONSE TO 10 CFR 50.54(f) INFORMATION REQUEST – FLOOD-CAUSING MECHANISM REEVALUATION (CAC NO. MF1112)

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