VIRGINIA ELECTRIC AND POWER COMPANY
RICHMOND, VIRGINIA 23261

June 29, 2017

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

Serial No. 17-275
NRA/WDC R0
Docket Nos. 50-338/339
License Nos. NPF-4/7

VIRGINIA ELECTRIC AND POWER COMPANY (DOMINION ENERGY VIRGINA)
NORTH ANNA POWER STATION UNITS 1 AND 2
FLOODING FOCUSED EVALUATION SUMMARY

On March 12, 2012, the Nuclear Regulatory Commission (NRC) issued, "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," to all power reactor licensees and holders of construction permits in active or deferred status. Flooding Recommendation 2.1 requires licensees to perform a flood hazard reevaluation and provide a final report documenting the results, as well as pertinent site information and detailed analysis. This information was provided to the NRC in a flood hazard reevaluation report (FHRR) on March 11, 2013.

In September 2015, subsequent to the FHRR submittal, the NRC issued a letter to the industry indicating that new guidance was being prepared to provide for a graded approach to flooding reevaluations, allowing for more focused evaluations of local intense precipitation and available physical margin in lieu of an integrated assessment. The guidance, prepared by Nuclear Energy Institute as NEI 16-05, was endorsed by the NRC in JLD-ISG-2016-01 (ML16162A301). The guidance directs that each flood-causing mechanism not bounded by the design basis flood should follow the appropriate flooding evaluation path.

Dominion Energy Virginia's responses to the NRC March 2012 Near-Term Task Force (NTTF) 10 CFR 50.54(f) request for information are captured in a Flooding Focused Evaluation in alignment with the guidance provided in NEI 16-05. The Flooding Focused Evaluation documents the North Anna Power Station response to the unbounded reevaluated flood hazard mechanisms.

Attachment 1 provides the North Anna Power Station Units 1 and 2 Flooding Focused Evaluation Summary. Attachment 2 provides the list of commitments related to the NAPS Flooding Focused Evaluation.

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NRR

If you have any questions regarding this information, please contact Diane Aitken at (804) 273-2694.

Sincerely,

Mark D. Sartain
Vice President - Nuclear Engineering and Fleet Support

Vicki L. Hull
NOTARY PUBLIC
Commonwealth of Virginia
Reg. # 140542
My Commission Expires May 31, 2018

COMMONWEALTH OF VIRGINIA)

COUNTY OF HENRICO)

The foregoing document was acknowledged before me, in and for the County and Commonwealth aforesaid, today by Mark D. Sartain, who is Vice President – Nuclear Engineering and Fleet Support of Virginia Electric and Power Company. He has affirmed before me that he is duly authorized to execute and file the foregoing document in behalf of that company, and that the statements in the document are true to the best of his knowledge and belief.

Acknowledged before me this 29TH day of June, 2017.

My Commission Expires: 5-31-18

Vicki L. Hull
Notary Public

Commitments made in this letter: Regulatory commitments are provided in Attachment 2.

Attachments:
1. Flooding Focused Evaluation Summary, North Anna Power Station Units 1 and 2
2. List of Commitments

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ATTACHMENT 1

FLOODING FOCUSED EVALUATION SUMMARY

VIRGINIA ELECTRIC AND POWER COMPANY (DOMINION ENERGY VIRGINIA)
NORTH ANNA POWER STATION UNITS 1 AND 2

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NORTH ANNA POWER STATION UNITS 1&2 FLOODING FOCUSED EVALUATION SUMMARY

1 EXECUTIVE SUMMARY

Dominion Energy Virginia has reevaluated the external flooding hazard at the North Anna Power Station (NAPS) in accordance with the NRC March 12, 2012, 10 Code of Federal Regulations (CFR) 50.54(f) request for information (RFI) (Ref. 1) to address recommendation 2.1 of the NRC Near-Term Task Force (NTTF) report. The RFI was issued as part of implementing lessons learned from the Fukushima Dai-ichi accident. This information was submitted to the NRC in a Flood Hazard Reevaluation Report (FHRR) in March 2013 (Ref. 2). After resolution of requests for additional information (RAIs), in September 2015 the NRC determined that the FHRR information was a suitable input for other external flood assessments. The NRC determination regarding the suitability of the FHRR is documented in the NRC "Staff Assessment of Response to 10 CFR 50.54(f) Information Request- Flood-Causing Mechanism Reevaluation" (Ref. 11). The NRC noted in Reference 11 that there are three flood-causing mechanisms not bounded by the Current Licensing Basis (CLB) at NAPS:

1. Stream and River Flooding

2. Local Intense Precipitation (LIP)

3. Dam Failure

The NRC noted that either an integrated assessment or focused evaluation (FE) is expected to be submitted by Dominion Energy Virginia to address the three "non-bounded" flood mechanisms. This submittal provides the focused evaluation of the site-specific response to these mechanisms.

Associated effects and flood event duration parameters were assessed and submitted as a part of the FHRR. This FE concludes that the combination of current and planned flood protection features provides adequate available physical margin (APM), and the overall site response plan is reliable and maintains key safety functions (KSFs) during Stream and River Flooding, site-specific LIP, and Dam Failure events. A site-specific LIP mechanism was developed to reduce conservatism and improve realism of the flood hazard, and is used to evaluate the LIP mechanism rather than the FHRR reevaluated LIP flood hazard information. As described in the Dominion North Anna Mitigating Strategies Assessment (Reference 16), the site-specific LIP analysis more accurately predicts site flooding because it is based on updated data and meteorological analysis as well as characteristics specific to the site. This FE follows Path 2 of NEI 16-05, Rev. 1 (Reference 9), and uses Appendices B and C of that reference for guidance on demonstration of effective flood protection. Path 2 guidance includes NEI 16-05 Attachment B for evaluation of passive and active features, and Attachment C for the evaluation of site response.

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

2 BACKGROUND

On March 12, 2012, the NRC issued Reference 1 as a request for information (RFI) associated with NTTF Recommendation 2.1 for flooding. The RFI directed licensees, in part, to submit a FHRR to assess the external flood hazards using present-day methods and the guidance used to evaluate applications for new plant early site permits and combined operating licenses. The FHRR for North Anna Units 1 and 2 was submitted on March 11, 2013 (Ref. 2). Additional information was provided by the NRC in References 3, 4, and 5.

Following the NRC staff issuance of guidance on the integration of mitigating strategies in response to the reevaluation of external flood hazards (Ref. 6) in November 2014, and the Commission's partial endorsement of the guidance in March 2015 (Ref. 7), the NRC issued a letter to the industry (Ref. 8) indicating that new guidance was being prepared to replace instructions in Reference 4 and provide for a "graded approach to flooding re-evaluations" and "more focused evaluations of local intense precipitation and available physical margin in lieu of proceeding to an integrated assessment." Nuclear Energy Institute (NEI) prepared the new "External Flooding Assessment Guidelines" in NEI 16-05 (Ref. 9), which was endorsed by the NRC in Reference 10. NEI 16-05 states that each flood-causing mechanism not bounded by the design basis flood (using only stillwater and/or wind-wave runup level) should follow one of five assessment paths.

Non-bounded flood-causing mechanisms in Paths 1, 2, or 3 would require a FE to address plans to complete the actions related to external flooding required by the March 12, 2012 10 CFR 50.54(f) letter. Mechanisms in Paths 4 or 5 require an Integrated Assessment. The NAPS FE follows Path 2, Demonstrate Effective Flood Protection, for the three unbounded flooding mechanisms.

This attachment provides a summary of the external flooding analyses completed for the NAPS in response to the March 12, 2012 request for information from the NRC NTTF review of insights from the Fukushima Dai-ichi accident.

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.

2. Virginia Electric and Power Company Letter to USNRC, "North Anna Power Station Units 1 and 2 Flood Hazard Reevaluation Report in Response to March 12, 2012 Information Request Regarding Flooding Aspects of Recommendation 2.1" (ML13074A925), dated March 11, 2013. Dominion Serial No. 13-121.

3. NRC Letter, "Supplemental Information Related to Request for Information Pursuant to Title 10 of the Code of Federal Regulations 50.54(f) regarding Flooding Hazard Reevaluations for Recommendation 2.1 of the Near Term Task Force Review of Insights from the Fukushima Dai-ichi Accident" (ML13044A561), dated March 1, 2013.

4. 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" (ML12326A912), dated December 3, 2012.

5. U.S. Nuclear Regulatory Commission, JLD-ISG-2012-05, "Guidance for Performing the Integrated Assessment for External Flooding" (ML12311A214), dated November 30, 2012.

6. COMSECY-14-0037, "Integration of Mitigating Strategies for Beyond-Design-Basis External Events and the Reevaluation of Flooding Hazards" (ML14238A616), dated November 21, 2014.

7. NRC Staff Requirements Memoranda to COMSECY-14-0037, "Integration of Mitigating Strategies for Beyond-Design-Basis External Events and the Reevaluation of Flooding Hazards" (ML15089A236), dated March 30, 2015.

8. NRC Letter, "Coordination of Requests for Information Regarding Flooding Hazard Reevaluations and Mitigating Strategies for Beyond-Design-Basis External Events" (ML15174A257), dated September 1, 2015.

9. Nuclear Energy Institute (NEI), Report NEI 16-05 [Rev 1], "External Flooding Assessment Guidelines" (ML16165A178), dated June 30, 2016.

10. 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" (ML16162A301), dated July 11, 2016.

11. NRC Letter, "North Anna Power Station, Units 1 and 2- Staff Assessment of Response to 10 CFR 50.54(f) Information Request - Flood-Causing Mechanism

Reevaluation (TAC NOs. MF1106 and MF1107) (ML15238A844)," dated September 25, 2015. Dominion Serial No. 15-490.

12. Dominion ETE-NA-2015-0060, Rev. 1, "North Anna Beyond Design Basis (BDB) Flooding Site-Specific Phase 2B Local Intense Precipitation (LIP) Assessment," dated April 28, 2016.

13. NRC, Office of Nuclear Regulatory Research, NUREG/CR-7046, "Design-Basis Flood Estimation for Site Characterization at Nuclear Power Plants in the United States of America," dated November 2011 [ML11321A195].

14. Dominion ETE-NA-2014-0029, Rev. 3, "Conduit / Piping Penetrations and Flood Protection Features Identification," dated May 26, 2016.

15. Dominion, North Anna Power Station, Procedure, "Severe Weather Conditions" (0-AP-41, Rev. 67).

16. Virginia Electric and Power Company (Dominion) Letter to USNRC, "North Anna Power Station Units 1 and 2 Mitigating Strategies Assessment (MSA) Report," dated December 16, 2016. Dominion Serial No. 16-355.

17. Dominion Procedure, "Hurricane Response Plan (Nuclear)" (CO-PROC-000-HRP-NUCLEAR, Rev. 12).

18. Calculation, "NAPS Units 1&2 Local Intense Precipitation (LIP) Monitoring and Trigger Determination" (25784-000-H0C-HY00-00001, Rev. 000)," dated March 24, 2016 (Dominion approval date June 18, 2016).

19. Nuclear Energy Institute (NEI) 12-06, Rev. 4, "Diverse and Flexible Coping Strategies (FLEX) Implementation Guide," dated December 12, 2016 [ML16354B421].

20. Dominion ETE-NA-2017-0008, Rev. 0, "Focused Evaluation of BDB External Flood Hazards at North Anna Power Station," dated June 6, 2017.

21. Virginia Electric and Power Company (Dominion) Letter to the USNRC, "North Anna Power Station Units 1 and 2, Response to Request for Additional Information for Flood Hazard Reevaluation in Response to March 12, 2012, Information Request Regarding Flooding Aspects of Recommendation 2.1," dated December 13, 2013 (ML13357A102) Dominion Serial No. 13-640.

4 TERMS AND DEFINITIONS

- APM – Available Physical Margin
- BDB – Beyond Design Basis
- CLB – Current Licensing Basis
- DB – Design Basis
- ELAP – Extended Loss of AC Power
- ETE – Engineering Technical Evaluation
- FE – Focused Evaluation
- FHRR – Flood Hazard Reevaluation Report
- FLEX – Diverse and Flexible Coping Strategies
- HHA – Hierarchical Hazard Assessment
- KSF – Key Safety Function
- LIP – Local Intense Precipitation
- LOCA – Loss of Coolant Accident
- MSA – Mitigating Strategies Assessment
- NAPS – North Anna Power Station
- NEI – Nuclear Energy Institute
- NGVD – National Geodetic Vertical Datum
- NOAA – National Oceanic and Atmospheric Administration
- NTTF – Near-Term Task Force
- NWS – National Weather Service
- PMF – Probable Maximum Flood
- PMP – Probable Maximum Precipitation
- PMSS – Probable Maximum Storm Surge
- PQPF – Probable Quantitative Precipitation Forecast
- RAI – Request for Additional Information
- RFI – Request for Information
- SSC – Structures, Systems, and Components
- SWR – Service Water Reservoir
- TSA – Time Sensitive Action
- UFSAR – Updated Final Safety Analysis Report

5 FLOOD HAZARD PARAMETERS FOR UNBOUNDED MECHANISMS

The NRC has completed the "Staff Assessment of Response" (Ref. 11) which summarizes the NAPS FHRR (Ref. 2). The NRC staff concluded that the licensee's reevaluated flood hazard information is suitable input for the focused evaluations associated with NTTF Recommendation 2.1 'Flooding'. The enclosure to the FHRR includes a summary of the current licensing basis and reevaluated flood hazard parameters.

In Table 4.0-2 of Reference 11, "Staff Assessment of Response to 10 CFR 50.54(f) Information Request – Flood-causing Mechanism Reevaluation," the NRC lists the flood hazard information for the following flood mechanisms that are not bounded by the current licensing basis hazard flood level:

- Local Intense Precipitation;
- Streams and Rivers;
- Failure of Dams and Onsite Water Control/Storage Structures;

Flooding hazards from the eight flood causing mechanisms were evaluated for NAPS Units 1 and 2 in accordance with Enclosure 2 of Reference 1, and documented in the FHRR. The flooding hazard reevaluation for NAPS Units 1 and 2 was performed in accordance with the hierarchical hazard assessment (HHA) process described in NUREG/CR-7046 (Ref. 13). A summary of current, reevaluated, and site-specific LIP flood elevations at NAPS Units 1 and 2 is provided in Table 5-1. Tables 5-2 through 5-4 provide additional information related to the three flood-causing mechanisms that were not bounded by the current design-basis hazards.

Table 5-1 – Evaluation Results of Unbounded Flood Mechanisms

Flood Causing Mechanism	Current Design Basis Flood Elevation	FHRR Evaluation	Difference FHRR from CLB	Site-Specific Evaluation	Difference Site-Specific from CLB
LIP (Protected Area)	Ground level with no accum.[1]	Ranges from 271.3 ft to 274.5 ft NGVD29	Ranges from 0.3 ft to 2.9 ft	Ranges from 271.0 ft to 274.4 ft NGVD29[2]	Ranges from 0.0 ft to 1.7 ft
LIP (West Basin Area)	256.1 ft NGVD29	>257.0 ft NGVD29	>0.9 ft	>257.0 ft NGVD29	>0.9 ft
Flooding in Streams and Rivers	267.3 ft NGVD29	267.4 ft NGVD29	0.1 ft	N/A	N/A
Dam Failures	No impact identified	No impact identified	N/A	N/A	N/A

[1] Grade varies; nominal Protected Area elevation is 271.0 ft.
[2] Site-specific evaluation maximum flood elevation of 274.4 ft NGVD is at a location where grade elevation is 274.0 ft NGVD

Table 5-2 - Detailed Parameters for Site-Specific LIP

Flood Mechanism Parameters for Site Specific LIP		
	Parameter Description	**Values/Discussion**
1	Max Stillwater Elevation	274.4 ft NGVD29 (Protected Area) >257.0 ft NGVD29 (West Basin)
2	Max Wave Run-up Elevation	N/A
3	Max Hydrodynamic/Debris Loading	N/A (Hydrodynamic Loading) Minimal (Debris Loading)
4	Effects of Sediment	Minimal
5	Other Associated Effects	Minimal
6	Concurrent Site Conditions	Minimal
7	Effects on Groundwater	Minimal
8	Warning Time	12 hours
9	Period of Site Preparation	6 hours
10	Period of Inundation	6 hours
11	Period of Recession	< 1 hour
12	Plant Mode of Operation	1, 2, 3, 4, 5, 6
13	Other Factors	Minimal

Table 5-3 - Detailed Parameters for Dam Failures

Flood Mechanism Parameters for Dam Failures		
	Parameter Description	**Values/Discussion**
1	Max Stillwater Elevation	267.4 ft NGVD29
2	Max Wave Run-up Elevation	267.8 ft MGVD29
3	Max Hydrodynamic/Debris Loading	Water level never reaches buildings containing Key SSCs
4	Effects of Sediment	Water level never reaches buildings containing Key SSCs
5	Other Associated Effects	Water level never reaches buildings containing Key SSCs
6	Concurrent Site Conditions	Water level never reaches buildings containing Key SSCs
7	Effects on Ground Water	Water level never reaches buildings containing Key SSCs
8	Warning Time	Water level never reaches buildings containing Key SSCs
9	Period of Site Preparation	Water level never reaches buildings containing Key SSCs
10	Period of Inundation	Water level never reaches buildings containing Key SSCs
11	Period of Recession	Water level never reaches buildings containing Key SSCs
12	Plant Mode of Operation	Water level never reaches buildings containing Key SSCs
13	Other Factors	Water level never reaches buildings containing Key SSCs

The dam failure mechanism includes both failures in upstream dams and consideration of a failure in onsite water control and storage structures, and is described in References 2 and 20. The NRC, in Reference 11, describes the following subsets of Dam Failures and Onsite Water Control / Storage Structures:

Dam Failure Flooding in North Anna River

Dominion Energy Virginia and NRC each completed conservative analyses that presumed the simultaneous failure of a number of upstream dams with reservoirs at full capacity, followed by direct and instant translation of water to Lake Anna without loss. The results of the analyses indicated the resulting lake level would remain nearly 3 feet below plant grade. The NRC concluded that the failure of the upstream dams would not inundate the plant site.

Service Water Reservoir Impounding Dike Failures- Overtopping

Dominion Energy Virginia determined that only direct precipitation reaches the service water reservoir (SWR), which was designed with approximately 5 feet of freeboard above the maximum reservoir operating water level. As a result, Dominion Energy Virginia concluded that the probable maximum precipitation (PMP) will not overtop the SWR impounding dike.

The NRC completed a confirmatory analysis that determined the combination of PMP and wind effects would slightly exceed the freeboard. However, the NRC determined that an overtopping failure of the reservoir dike will not occur because the depth of overflow is small and the duration of the run-up would be short (several minutes).

Service Water Reservoir Impounding Dike Failures- Piping Failure

The FHRR indicated that the required inspection and maintenance requirements for the SWR and impounding dike will identify early indications of the presence of trees, rodent intrusion, or potential erosion areas to prevent weakening. As a result, Dominion Energy Virginia concluded that dike design characteristics along with inspection and maintenance measures preclude issues associated with impounding dike failure by means of piping.

However, NRC determined that a "sunny-day" piping failure of the SWR impounding dike cannot be screened out. As a result, NRC evaluated the effectiveness of the Emergency Dike and Intercepting Channel system in protecting against flooding resulting from a potential piping failure of the SWR impounding dike.

Service Water Reservoir Impounding Dike Failures- Capacity of Intercepting Channel

The FHRR provided NRC information related to a hydraulic analysis performed during the site planning and design stage for Units 1 and 2. An additional analysis with more conservative inputs (e.g., larger size and shape of breach in impounding dike) was performed by NRC. Both analyses determined that the channel flow caused by the breach outflow from the SWR would not overtop the Emergency Dike. As a result, NRC noted that the only scenario that could impact the Units 1 and 2 power block area is a combined failure of both SWR impounding dike and Emergency Dike simultaneously because of a seismic event.

Service Water Reservoir Impounding Dike Failures- Seismic Dike Failure

The FHRR provided NRC information related to the seismic qualification of the SWR impoundment dike. The NRC reviewed the information submitted in References 2 and 21, and performed hydraulic calculations that determined a specific portion of the impounding dike would need to be breached for any flooding of the power block to occur in response to a seismic dike failure. The NRC confirmed the Dominion Energy Virginia conclusion that seismically induced failure of the SWR impounding dike would not inundate the plant site (Ref. 11).

The NRC performed a confirmatory analysis of the multiple dam failure flooding scenarios and agrees with the Dominion Energy Virginia conclusion that any upstream dam failure flooding and its combined and associated effect flooding in Lake Anna would not inundate the plant site. In addition, NRC reviewed Dominion Energy Virginia information related to the seismic dike failure analyses as well as its own hydraulic calculation, and confirmed the conclusion that seismically induced failure of the SWR impounding dike would not inundate the plant site.

Table 5-4 - Detailed Parameters for Stream and River Flooding

Flood Mechanism Parameters for Stream and River Flooding		
	Parameter Description	**Values/Discussion**
1	Max Stillwater Elevation	264.3 ft NGVD29
2	Max Wave Run-up Elevation	267.4 ft MGVD29
3	Max Hydrodynamic/Debris Loading	Water level never reaches buildings containing Key SSCs
4	Effects of Sediment Deposition/Erosion	Water level never reaches buildings containing Key SSCs
5	Other Associated Effects	Water level never reaches buildings containing Key SSCs
6	Concurrent Site Conditions	Water level never reaches buildings containing Key SSCs
7	Effects on Ground Water	Water level never reaches buildings containing Key SSCs
8	Warning Time	Water level never reaches buildings containing Key SSCs
9	Period of Site Preparation	Water level never reaches buildings containing Key SSCs
10	Period of Inundation	Water level never reaches buildings containing Key SSCs
11	Period of Recession	Water level never reaches buildings containing Key SSCs
12	Plant Mode of Operation	Water level never reaches buildings containing Key SSCs
13	Other Factors	Water level never reaches buildings containing Key SSCs

Although the reevaluated probable maximum flood (PMF) level with wind effect is 267.4 feet NGVD29, which exceeds the design basis PMF water level by 0.1 feet, the level remains more than 3 feet below plant grade. As a result, no flood hazard of the power block exists from this mechanism.

6 OVERALL SITE FLOODING RESPONSE

6.1 DESCRIPTION OF OVERALL SITE FLOODING RESPONSE

As discussed in Section 5, there are three flooding mechanisms that are not bounded by the current licensing basis and thus require further evaluation. The site response to each of the flooding mechanisms is described below.

6.1.1 SITE RESPONSE FOR LIP

The site response to a LIP flood event will be addressed in Dominion Energy Virginia procedures associated with severe weather conditions and hurricanes (References 15 and 17). When the procedures are activated in response to the potential for a LIP at North Anna, additional personnel will be assigned to monitor projected meteorological conditions and, as necessary, undertake preparation (e.g., installation of temporary flood barriers) and post-event actions. The procedures will be revised as part of the implementation of design changes to address LIP flood protection. Details to be added include information regarding the anticipated number of personnel and barrier design-specific expected installation times required to complete LIP flood preparation activities.

6.1.2 SITE RESPONSE FOR Dam Failure and Stream and River Flooding

No doors, buildings, or propagation pathways that contain key SSCs are challenged by flood waters during the Dam Failures or Stream and River Flooding flood mechanisms. The calculated maximum water heights (including wave action) are several feet below plant grade.

6.2 SUMMARY OF PLANT MODIFICATIONS AND CHANGES

The only flooding mechanism that requires plant modifications is LIP. A list of planned modifications is provided in Reference 20. Procedural changes will be required to implement the response strategy.

7 FLOOD IMPACT ASSESSMENT

7.1 LOCAL INTENSE PRECIPITATION - PATH 2

7.1.1 Description of Flood Impact

The LIP flood mechanism has a reevaluated flood hazard of 274.4 ft NGVD29 for the Protected area (>257.0 ft. NGVD29 for the West Basin.), including associated effects and site drainage. Plant vulnerabilities include building doors and plant penetrations (e.g., manholes, drains). During the LIP event, flood water will enter the unprotected plant vulnerabilities and migrate down to the lowest building elevations, potentially compromising key SSCs.

To prevent compromising the SSCs listed in Reference 20, plant modifications will provide flood barriers at key locations and qualified seals in unprotected penetrations. With seals and barriers installed, flooding from the LIP flood mechanism will not compromise key SSCs.

7.1.2 Adequate APM Justification and Reliability Flood Protection

The APM determination is made using the guidance provided in Appendix B of NEI 16-05, "External Flooding Assessment Guidelines" (Ref. 9). At NAPS, adequate APM against the LIP is provided by the use of flood barriers, both temporary and permanent, in strategic locations throughout the plant.

Flood protection barriers will be designed to conform to accepted engineering practices. Flood feature reliability will be measured and validated through appropriate training and maintenance activities, field-testing, and analysis. Installation requirements will be proceduralized.

7.1.3 Adequate Overall Site Response

The evaluation of adequate overall site response is performed in accordance with Appendix C of NEI 16-05 (Ref. 9). The following components are used to provide a comprehensive site response plan:

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

The critical path for the overall site response to a LIP event begins with monitoring of National Weather Service 95th percentile Probabilistic Quantitative Precipitation Forecasts (PQPF), which are typically issued every 6 hours. As the time period of heavy precipitation nears, preparation activities are triggered. At 12 hours prior to the predicted onset of the LIP event, actions to install removable flood barriers will be undertaken. The severe weather procedure will be revised to add information regarding the design,

installation/removal, and personnel requirements needed to install the removable flood barriers. Operator actions required during a LIP event at the Auxiliary Feed Water Pump Houses (Ref. 16) will also be addressed in a revision of the severe weather procedure.

7.1.3.2 Demonstration the TSAs are Feasible

Once an action trigger has initiated the installation of flood protection measures, the barrier installations must be completed within the specified timeframe identified in the applicable procedure. The guidance provided in Appendix E of NEI 12-06 (Reference 19) will be applied to validate TSAs and determine that the TSAs are feasible and can be performed under the reevaluated flood hazard parameters contained in the NRC Staff Assessment (Ref. 11).

7.1.3.3 Establishing Unambiguous Procedural Triggers

Procedures will be updated to include the requirements and procedures for a trigger threshold. The requirements are anticipated to be based on those provided in NEI 12-06 (Ref. 19), which recommends monitoring of the PQPF and activation of various procedural actions when PQPF conditions are met.

The warning time value of 12 hours is a stepped process of routine monitoring of weather forecasts and the NOAA/NWS 95th percentile Probabilistic Quantitative Precipitation Forecasts (PQPF), which are typically issued every 6 hours. The potential precipitation rates and necessary warning times have been evaluated (Ref. 18). The monitoring and trigger process is summarized as follows:

- When 3 inches or more of liquid precipitation in a 6-hour forecast period is projected for the NAPS site within the next 48 hours, a monitoring trigger is initiated.

- When 3 inches or more of liquid precipitation within a 6-hour forecast period is projected for the NAPS site within the next 24 hours, the monitoring trigger remains in effect and is supplemented by site activities to assess personnel needs and availability in anticipation of the need to undertake flood protection measures.

- At 12 hours prior to the expected start of the precipitation event, if 3 inches or more of liquid precipitation in a 6-hour forecast period is expected, an action trigger will be initiated to complete measures related to protection from external flood. These measures are anticipated to take no more than 6 hours to complete, resulting in a 6-hour margin prior to the start of the precipitation event.

7.1.3.4 Proceduralized and Clear Organizational Response to a Flood

Site procedures will be updated to establish clear responsibility for command and control of station personnel, and installation of required flood protection features. The procedures will clearly define the roles and responsibilities for each function of the NAPS organization with respect to implementing the critical response action plan before, during,

and after the LIP event. The guidance provided in the procedures will include detailed checklists to ensure appropriate measures are taken to respond to the LIP event.

Existing procedures have been determined to have clear guidelines for severe weather preparations and organizational response to CLB events. Revisions to these procedures to incorporate the response to the reevaluated LIP event are expected to be similarly organized and clear.

7.1.3.5 Detailed Flood Response Timeline

The detailed flood response timeline will be described in the applicable station procedures. The strategy for the successful timeline response will consider the following:

- Monitoring and action triggers
- Lead time to event and margin for preparation
- Inspection activities
- Flood protection installation activities
- Event duration
- Flood protection removal activities

When the action trigger is initiated, the site will begin actions to install flood protection features with a predicted window of 12 hours prior to the earliest initiation of the consequential event. If installation and verification of the planned flood protection features is completed within 6 hours, a margin of 6 hours will be maintained.

Validation of flood protection installation and response margin will be performed per the guidance in NEI 12-06, Appendix E.

7.1.3.6 Accounting for the Expected Environmental Conditions

The environmental conditions at NAPS during the deployment of the flood protection features in response to the LIP event trigger are expected to be minimal. Advanced warning of the storm will provide sufficient time for personnel to install barriers and protect the station against flooding effects prior to the onset of severe weather. If determined necessary following planned modifications to the plant, protective measures associated with any expected environmental condition will be proceduralized, and will follow the guidance provided in NEI 16-05, Rev. 1, Appendix C.

7.1.3.7 Demonstration of Adequate Site Response

The site response to a LIP flood event will be consistent with the guidance in Appendix C of NEI 16-05 after revision of site procedures that detail the timeline of the station response to a possible LIP event, the locations where actions are required and necessary equipment is stationed, staffing requirements, and actions to be taken. The time margin for response to a LIP flood event was calculated as 6 hours. Actions are initiated at 12 hours prior to the forecasted onset of the potential LIP, and are expected to take 6 hours to complete. The organizational structure and command and control will be implemented in accordance with station procedures. Finally, the environmental conditions are not expected to be adverse at the time of site preparation activities, because the trigger event is the forecasted start of the precipitation event resulting in the LIP flood.

7.2 Failure of Dams and Onsite Water Control/Storage Structures - PATH 2

7.2.1 Description of Flood Impact

The Failure of Dams and Onsite Water Control/Storage Structures mechanism will not impact any structures that contain key SSCs. Table 5-3 illustrates that although the maximum water level slightly exceeds the current design water level, the water is not expected to approach the plant grade elevation of 271 ft. NGVD29. There are no key SSCs identified for this flooding mechanism that could be impacted by the flood water. Protection of the key SSCs is provided by the plant grade itself, which is permanently-installed and passive.

7.3 Stream and River Flooding - PATH 2

7.3.1 Description of Flood Impact

The Stream and River flooding mechanism will not impact any structures that contain key structures, systems and components (SSCs). Table 5-4 illustrates that although the maximum water level slightly exceeds the current design water level, the water is not expected to approach the plant grade elevation of 271 ft. NGVD29. There are no key SSCs identified for this flooding mechanism that could be impacted by the flood water. Protection of the key SSCs is provided by the plant grade itself, which is permanent and passive.

8 CONCLUSION

The NAPS FHRR and NRC Staff Assessment indicated that for the Beyond Design Basis analysis, three flood mechanisms exceed the current license basis. Of the three mechanisms, two ((1) Dam Failures and Onsite Water Control/Storage Structures, and (2) Rivers and Streams flooding) were found to have maximum wave run-up flood elevations of 267.8 and 267.4 ft. NGVD29, respectively. Plant grade elevation at North Anna Units 1 and 2 is 271 ft. NGVD29. As a result, neither mechanism presents a flood hazard risk to the plant.

The LIP flooding mechanism generates flood water levels up to 274.4 ft NGVD29 at the power block, which will challenge door thresholds and yard penetrations. To provide protection against the flooding challenge, both permanent and temporary flood barriers have been established or are in development for key locations around the site to establish a reliable flood protection boundary. These protection measures, as well as the timeline for installation, will be detailed and proceduralized. The FE has demonstrated that the planned site response will be adequate for this flooding mechanism.

This submittal completes the actions related to external flooding required by NRC in the March 2012 Request for Information under 10 CFR 50.54 (f).

ATTACHMENT 2

LIST OF COMMITMENTS

VIRGINIA ELECTRIC AND POWER COMPANY (DOMINION ENERGY VIRGINIA)
NORTH ANNA POWER STATION UNITS 1 AND 2

The following table identifies those actions committed to by Dominion Energy Virginia in response to the Flooding Focused Evaluation for North Anna Power Station. All other statements in the Flooding Focused Evaluation Summary are provided for information.

Commitment	Due Date
Develop and /or update applicable Station and Dominion Energy fleet procedures to provide appropriate guidance to station personnel on the actions required to respond to a beyond design basis unbounded flood mechanism event.	End of second refueling outage for each unit after NRC approval of the North Anna Power Station Flooding Focused Evaluation.
Provide training to station personnel in order to understand and implement the appropriate response and actions during a beyond design basis unbounded flood mechanism event. Supplement procedural compliance training with maintenance activities, field testing, inspection, and analysis as appropriate.	End of second refueling outage for each unit after NRC approval of the North Anna Power Station Flooding Focused Evaluation.
Design, store, stage, and install flood protection barriers (including penetration seals) at key locations throughout the plant as described in Reference 20 to the Flooding Focused Evaluation. The installation of the flood barriers must align with the actionable timeline described in the applicable site procedures.	End of second refueling outage for each unit after NRC approval of the North Anna Power Station Flooding Focused Evaluation.
Define plant protective measures, validate time sensitive actions, provide installation and response timelines (including warning time and period of site preparation), and confirm site strategy in accordance with NEI 12-06, NEI 16-05, and the NEI document "Warning Time for LIP Events," ML15104A157.	End of second refueling outage for each unit after NRC approval of the North Anna Power Station Flooding Focused Evaluation.