RS-16-181 10 CFR 50.54(f)

November 9, 2016

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

Calvert Cliffs Nuclear Power Plant, Units 1 and 2
Renewed Facility Operating License Nos. DPR-53 and DPR-69
NRC Docket Nos. 50-317 and 50-318

Subject: Mitigating Strategies Flood Hazard Assessment (MSFHA) Submittal

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. Constellation Energy Nuclear Group Letter to USNRC, Calvert Cliffs Nuclear Power Plant, Units 1 and 2, Flood Hazard Reevaluation Report, dated March 12, 2013

3. Constellation Energy Nuclear Group Letter to USNRC, Calvert Cliffs Nuclear Power Plant, Units 1 and 2, Response to NRC 10CFR50.54(f) Request for Information Regarding Near-Term Task Force Recommendation 2.1, Flooding – Flood Hazard Reevaluation, dated February 10, 2014

4. Constellation Energy Nuclear Group Letter to USNRC, Calvert Cliffs Nuclear Power Plant, Units 1 and 2, Additional Response to NRC 10CFR50.54(f) Request for Information Regarding Near-Term Task Force Recommendation 2.1, Flooding – Flood Hazard Reevaluation, dated March 7, 2014

5. Exelon Generation Company, LLC 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 September 23, 2015 (RS-15-247)

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

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", 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, dated September 1, 2015

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

10. U.S. Nuclear Regulatory Commission, JLD-ISG-2012-01, Revision 1, Compliance with Order EA-12-049, Order Modifying Licenses with Regard to Requirements for Mitigating Strategies for Beyond-Design-Basis External Events, dated January 22, 2016

11. NRC Letter, Calvert Cliffs Nuclear Power Plant, Units 1 and 2 – Supplement to Staff Assessment of Response to 10 CFR 50.54(f) Information Request – Flood-Causing Mechanism Reevaluation (TAC Nos. MF3097 and MF3098), dated October 21, 2015

On March 12, 2012, the NRC 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). For Calvert Cliffs Nuclear Power Plant, Units 1 and 2 the FHRR was submitted on March 12, 2013 (Reference 2). Additional information was provided with References 3 and 4. The Calvert Cliffs Nuclear Power Plant, Units 1 and 2 amended FHRR was provided in Reference 5 and incorporated new information resulting from a site specific meteorological study performed to more accurately characterize the flooding hazard. Per Reference 6, the NRC considers the reevaluated flood hazard to be "beyond the current design/licensing basis of operating plants".

Concurrent to the flood hazard reevaluation, Calvert Cliffs Nuclear Power Plant, Units 1 and 2 developed and implemented mitigating strategies in accordance with NRC Order EA-12-049, "Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events". In Reference 7, the NRC affirmed that licensees need to address the reevaluated flooding hazards within their mitigating strategies for beyond-design-basis (BDB) external events. This requirement was confirmed by the NRC in Reference 8. Guidance for performing mitigating strategies flood hazard assessments (MSFHAs) is contained in Appendix G of Reference 9, endorsed by the NRC in Reference 10. In Reference 11, the NRC concluded that the "reevaluated flood hazards information, as summarized in the Enclosure [Summary Table of the Reevaluated Flood Hazard Levels], is suitable for the assessment of mitigating strategies developed in response to Order EA-12-049" for Calvert Cliffs Nuclear Power Plant, Units 1 and 2.

The enclosure to this letter provides the flooding MSFHA for the Calvert Cliffs Nuclear Power Plant, Units 1 and 2. This assessment concluded that the current FLEX design remains valid (including aspects related to the storage and deployment of FLEX equipment, validation of FLEX actions, and viability of FLEX connection points) since FLEX was designed for the more conservative flood hazard (developed with the original flood hazard reevaluation submitted with Reference 2), which bounds the amended flood hazard submitted with Reference 5. The flood-causing mechanisms specifically relevant to Calvert Cliffs (producing floodwaters above plant grade) include Local Intense Precipitation (LIP) and a hurricane-generated Probable Maximum

Storm Surge (PMSS). Since the amended LIP flood could have location-specific impacts and was not fully included in the plant DB and was not considered by the NRC in the Supplemental Staff Assessment (Reference 11), an assessment was conducted to further verify that the FLEX strategy, as designed, is not adversely impacted by the amended LIP flood. In summary, the current FLEX strategies can be successfully implemented as designed for all applicable flood-causing mechanisms, specifically LIP and PMSS, and no further actions, including modifications to FLEX, are required.

This letter contains no new regulatory commitments. If you have any questions regarding this report, please contact Ron Gaston at (630) 657-3359.

I declare under penalty of perjury that the foregoing is true and correct. Executed on the 9th day of November 2016.

Respectfully submitted,

James Barstow
Director - Licensing & Regulatory Affairs
Exelon Generation Company, LLC

Enclosure: Calvert Cliffs Nuclear Power Plant, Units 1 and 2, Mitigating Strategies Assessments for Flooding, dated November 9, 2016

cc: Director, Office of Nuclear Reactor Regulation
NRC Regional Administrator - Region I
NRC Senior Resident Inspector – Calvert Cliffs Nuclear Power Plant
NRC Project Manager, NRR – Calvert Cliffs Nuclear Power Plant
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Enclosure

Calvert Cliffs Nuclear Power Plant, Units 1 and 2

Mitigating Strategies Assessments for Flooding

dated November 9, 2016

(19 Pages)

Mitigating Strategies Assessments for Flooding

Calvert Cliffs Nuclear Power Plant

Exelon

November 9, 2016

Contents

1 Executive Summary

This Mitigating Strategies Assessment (MSA) evaluates the impact of the reevaluated flood hazard on FLEX strategy implementation. For Calvert Cliffs Nuclear Power Plant (CCNPP), the FLEX design basis (DB) flood hazard is based on the March 12, 2013 Flood Hazard Reevaluation Report (FHRR). The March 2013 FHRR submittal resulted in the Local Intense Precipitation (LIP) and Probable Maximum Storm Surge (PMSS) flood-causing mechanisms being not bounded by the corresponding DB flood hazards. On September 23, 2015, CCNPP submitted an amended FHRR to incorporate new information resulting from a site-specific meteorological study that more accurately characterized the flood hazard. The amended FHRR submittal indicates that the site-specific LIP and PMSS are bounded by the plant's DB (except for areas outside the Emergency Diesel Generator Building that were not included for LIP in the plant's DB). The amended site-specific PMSS and LIP are also bounded by the original March 2013 FHRR. The higher flood levels resulting from the original March 2013 FHRR were used as the basis for the FLEX design. However, since the amended LIP flood could have location-specific impacts and was not fully included in the plant DB and was not considered by the NRC in the Supplemental Staff Assessment (Reference 11), an assessment was conducted to further verify that the FLEX strategy, as designed, is not adversely impacted by the amended LIP flood. The assessment resulted in no changes to the FLEX strategy or new/modified operator actions.

2 List of Acronyms

- AFW – Auxiliary Feedwater
- AMS – Alternate Mitigation Strategy
- BDBEE – Beyond Design Basis External Event
- CCNPP – Calvert Cliffs Nuclear Power Plant
- CLB – Current Licensing Basis
- CST – Condensate Storage Tank
- DB – Design Basis
- DGB – Diesel Generator Building
- EDG – Emergency Diesel Generator
- ELAP – Extended Loss of A/C Power
- EOP – Emergency Operating Procedure
- FHRR – Flood Hazard Reevaluation Report
- FIP – Final Integrated Plan
- FLEX – Strategy response to an ELAP and LUHS, postulated from a BDBEE
- FLEX DB – FLEX Design Basis (flood hazard)
- FSG – FLEX Support Guideline
- FSCB – FLEX Storage Commercial Building
- FSRB – FLEX Storage Robust Building
- LIP – Local Intense Precipitation
- LUHS – Loss of Ultimate Heat Sink
- MSA – Mitigating Strategies Assessment
- MSFHA – Mitigating Strategy Flood Hazard Assessment
- MSFHI – Mitigating Strategy Flood Hazard Information
- MSL – Mean Sea Level
- NGVD29 – National Geodetic Vertical Datum of 1929
- NRC – Nuclear Regulatory Commission
- NSRC – National SAFER Response Center

- NTTF – Near-Term Task Force
- PMF – Probable Maximum Flood
- PMP – Probable Maximum Precipitation
- PMSS – Probable Maximum Storm Surge
- RCS – Reactor Coolant System
- SFP – Spent Fuel Pool
- S/G – Steam Generators
- SIT – Safety Injection Tank
- SSCs – Structures, Systems, and Components
- TDAFW – Turbine Driven Auxiliary Feedwater pump
- THMS – Targeted Hazard Mitigating Strategy
- TSA – Time Sensitive Action
- UFSAR – Updated Final Safety Analysis Report

3 Background

3.1 Purpose

This MSA evaluates the ability to implement FLEX for the reevaluated flood hazard as defined by the MSFHI. It is performed in accordance with NEI 12-06, Rev 2, Appendix G and contains the following elements:

- Section G.2 – Characterization of the MSFHI
- Section G.3 – Basis for Mitigating Strategy Assessment (MSFHI-FLEX DB Comparison)
- Section G.4.1 – Assessment of current FLEX Strategy (if necessary)
- Section G.4.2 – Assessment for modifying FLEX Strategy (if necessary)
- Section G.4.3 – Assessment of AMS (if necessary)
- Section G.4.4 – Assessment of THMS (if necessary)

On March 12, 2012, the NRC issued Reference 1 to request information associated with NTTF Recommendation 2.1 for Flooding. One of the required responses in Reference 1 directed licensees to submit a FHRR. The original CCNPP FHRR was submitted on March 12, 2013 (Reference 2) with additional information provided with References 3 and 17. On September 23, 2015, CCNPP submitted a FHRR amendment to incorporate new information resulting from a site-specific meteorological study (Reference 4). Per Reference 5, the NRC considers the reevaluated flood hazard to be "beyond the design/licensing basis of operating plants".

Concurrent to the flood hazard reevaluation, CCNPP developed and implemented mitigating strategies in accordance with NRC Order EA-12-049, "Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events". Those strategies are described in the CCNPP Implementation of Diverse and Flexible Coping Strategies (FLEX) and Spent Fuel Pool Instrumentation Program (Reference 13).

In Reference 6, the Commission affirmed that licensees need to address the reevaluated flooding hazards within their mitigating strategies for BDBEE's. This requirement was confirmed by the NRC in Reference 7. Guidance for performing MSFHAs is contained in Appendix G of Reference 8, endorsed by the NRC in Reference 9. For the purpose of the MSFHAs and in Reference 7, the NRC termed the reevaluated flood hazard as the MSFHI.

Per NEI 12-06, Rev. 2, Appendix G, if a Section G.3 assessment shows that the FLEX DB flood completely bounds the reevaluated flood (i.e. MSFHI), only documentation for Sections G.2 and G.3 are required; assessments and documentation for the remaining sections (G.4.1 through G.4.4) are not necessary.

3.2 Site Description

The CCNPP site is located in Calvert County, Maryland, approximately 10.5 miles southeast of Prince Frederick, Maryland, and on the western shore of the Chesapeake Bay, approximately 110 miles north from the Chesapeake Bay entrance. The CCNPP site covers approximately 2,057 acres. The CCNPP Units 1 & 2 plant and ancillary facilities are located on approximately 962 acres.

The topography at the CCNPP site is gently rolling with steeper slopes along stream banks. Local relief ranges from the sea level up to an approximate elevation of 130 feet, with an average relief of approximately 100 feet. Along the northeastern (relative to true north) perimeter of the CCNPP site, the Chesapeake Bay shoreline consists mostly of steep cliffs with a narrow beach area. The CCNPP site is well drained by short, ephemeral streams.

The CCNPP Units 1 & 2 safety-related and important-to-safety SSCs were constructed across three terraces as described in the Flooding Walkdown Report (Reference 14): (1) the safety-related intake structure is located at a deck elevation of 10 feet NGVD29, (2) safety-related and important-to-safety SSCs in the main plant area are located at a grade elevation of about 45 feet NGVD29, and (3) plant substation (switchyard) is located at a grade elevation of about 70 feet NGVD29. Multiple doorway access points along the West Road are located at the 45 foot NGVD29 terrace. All open slopes between the intake level and the main plant level are riprap protected, while the open slope between the switchyard level and the main plant level are protected with ripraps and gabion mattresses.

Note that, as discussed in Reference 4, Enclosure 1, Section 2.4.2.1, the plant's DB elevations are provided in the MSL vertical datum. However, elevations for the PMSS are reported in the NGVD29 datum. A conversion factor of "NGVD29 = MSL + 0.64 feet" was used to relate the two data elements.

3.3 Overview of FLEX Strategy

The CCNPP FLEX strategy consists of the storage of 'N' FLEX equipment in a dedicated building that provides protection for all hazards. Spare equipment ('N+1') are stored in a seismically protected structure. For CCNPP with 2 units, N=2. In the event of an ELAP and LUHS this equipment is transported via a predefined deployment primary path (or alternative secondary paths) that have been evaluated to remain viable for all applicable hazards. Equipment is available to clear the deployment path of any debris that may result from the event. Following relocation of equipment to the pre-established deployment location, electrical cables and hoses are connected to the FLEX equipment. These cables and hoses are deployed in parallel with equipment transport and are connected to plant systems via standard plug-in or hose couplings. Procedures have been developed and the staffing necessary for implementation have been verified. The CCNPP FLEX response strategies to maintain Core Cooling/Core Inventory, Containment, Spent Fuel Pool Cooling, and Safety Function Support are summarized below. This summary is derived from the CCNPP Final Integrated Plan (FIP) (Reference 15) and CC-CA-118, Calvert Cliffs Implementation of Diverse and Flexible Coping Strategies (FLEX) and Spent Fuel Pool Instrumentation Program, Revision 1 (Reference 13).

Phase 1 (0 to 6 hours):

<u>Core Cooling/Core Inventory</u> – Using installed plant equipment, initially stabilize the plant and then commence RCS cooldown. If ELAP/LUHS occurs while in shutdown modes, FLEX strategy activities mentioned below will occur at the same locations (See Reference 15 Section 5 for details)

The strategy for Core Cooling/Core Inventory is to maintain heat removal using the steam generators (S/Gs) via turbine driven auxiliary feedwater (TDAFW) pumps and steaming to atmosphere via the atmospheric dump valves (ADVs). The suction source for TDAFW is from the fully protected #12 condensate storage tank (CST) located at the 45 ft. elevation in the Tank Farm.

For core inventory, an early and extensive RCS cooldown is initiated at approximately two (2) hours into the event. The cooldown significantly increases inventory coping time by reducing the probability of RCP seal failure. The depressurization of the RCS which accompanies the cooldown, reduces the RCS inventory loss from any leak and measurably increases coping time. Additionally, plant depressurization also allows safety injection tank (SIT) injection to add borated water volume to the RCS, helping to restore inventory and maintain reactor shutdown margin.

Key reactor parameter instrumentation will be maintained by the 125 VDC station batteries and the associated vital DC and AC instrument buses. Station battery coping is extended by performing deep DC load shedding. Key parameters will be monitored using installed instrumentation powered from vital instrument power or use of portable instrumentation connected to designated connection points in the Control Room or at the containment electrical penetrations.

Containment – Monitor containment pressure and temperature.

Containment pressure and temperature are expected to remain below peak design limits over the first 72 hours of the ELAP event. Consequently, no Containment Air Cooling or Containment Spray is required for 72 hours following initiation of an ELAP.

Key containment parameter instrumentation will be maintained by the 125 VDC station batteries and the associated vital DC and AC instrument buses. Station battery coping is extended by performing deep DC load shedding. Key parameters are monitored using installed instrumentation powered from vital instrument power or use of portable instrumentation connected to designated connection points in the Control Room or at the containment electrical penetrations.

Spent Fuel Pool (SFP) Cooling – Monitor SFP level and temperature, establish SFP area vent path.

Per Station Blackout EOP, actions are initiated early in Phase 1 to place in service the wide range SFP level instrumentation system to monitor SFP level. Portable instrumentation is placed in the SFP to monitor SFP temperature from a remote location outside of the SFP Area. Heat up and eventual boiling of SFP water during an ELAP event results in an extremely hot and humid environment as well as higher radiation hazards on the 69-foot elevation in the area of the SFP. Personnel access into this area could be hazardous without actions to mitigate the rise in temperature and humidity. For this reason, per FSG actions, by time two hours into the event doors in the Auxiliary Building on elevation 69 feet are blocked open to establish a vent flow path for the SFP area. Additionally, doors are blocked open on the 45-foot elevation to establish natural circulation air cooling for the SFP wide range level instrument system transmitters and to establish the SFP surface makeup hose pathway to the SFP edge at the 69-foot elevation.

Safety Function Support

- Electrical

  Within 2 hours of ELAP event initiation, operators complete deep DC load shedding of loads supplied from the four vital 125 VDC buses and their associated DC power panels per the ELAP DC Load Shed and Management FSG. This FSG provides actions to remove loads from the 125 VDC batteries, as well as the associated 120 VAC instrument buses, to extend battery life during an ELAP. 125 VDC battery coping is extended to between 7 hours to greater than 12 hours depending on the battery and its load. These actions are implemented inside the Unit 1 and 2 Cable Spreading Rooms located on the 27-foot elevation of the Auxiliary Building below the Control Room.

The approach for vital 480 VAC load center and vital 480 VAC reactor MCC repower comprises preferred and alternate strategies. The preferred strategy utilizes FLEX 500 KW, 480 VAC DGs to repower one vital 480 VAC load center on each unit. If the vital 480 VAC load centers that supply power to either vital 480 VAC reactor MCC on either Unit 1 or Unit 2 are not available, then the vital reactor MCCs will be re-powered directly from a FLEX 480 VAC 100 KW DG. The alternate strategy utilizes FLEX 100 KW, 480 VAC DGs to repower vital 480 VAC reactor MCCs-104R on Unit 1 and/or MCC-204R on Unit 2. The FLEX equipment needed for the primary strategy is deployed during Phase 1.

- FLEX Equipment Deployment

  Concurrent with deep DC load shedding and plant cooldown, on-site minimum shift staff personnel will begin FLEX equipment deployment per the Initial Assessment and FLEX Equipment Staging FSG. The FLEX equipment is deployed from the fully protected FLEX Storage Robust Building (FSRB) which is located west of the 500 KV switchyard at elevation 130 feet NGVD 29. FLEX equipment is deployed in a specified order to the associated FLEX setup areas inside and outside of the plant protected area. Deployment pathway is along the Calvert Cliffs Parkway to the intersection with Camp Canoy Road. The primary pathway follows Camp Canoy road west of the switchyard to Road G, then traveling south of the switchyard. A restored gate into the protected area dedicated to FLEX allows access to the protected area. Alternate Pathways include the North Road, Independent Spent Fuel Storage Installation Haul path, or through the site parking lot to the normal sallyport access as shown in Reference 13.

Figure 1: CCNPP Deployment Pathways (Reference 15)

Path 1 (Green) – (Preferred) Calvert Cliffs Parkway to Camp Canoy Road to road along switchyard to FLEX Primary PA Access north of Warehouse 1.

Path 2 (Orange) – (Alternate 1) Calvert Cliffs Parkway to Camp Canoy Road to ISFSI Haul Route to NSF Sallyport.

Path 3 (Blue) – (Alternate 2) Lake Davies Road by the ISFSI to ISFSI Haul Route to NSF Sallyport.

Path 4 (Red) – (Alternate 3) Old North Road to North Perimeter gate. (Bypasses 500 KV Highlines)

Equipment initially deployed comprises FLEX 500 KW DG and associated cable cart trailers for vital load center repower, hose manifold trailers with hoses and booster pump for #12 CST makeup, FLEX AFW pumps for S/G makeup, and FLEX RCS make-up pumps with onboard hoses for RCS makeup. Setup locations are at the 45 ft. and 10 ft. elevations; along the West Road, north and south of the Turbine Building, along the south side of the Tank Farm, and at the north end of the 10 ft. elevation waterfront. FLEX deployment includes, if needed, debris removal along the primary or alternate deployment routes into the plant protected area, as well as debris removal inside the protected area.

Electrical cable paths are from the 500KW DG north and south of the Turbine Building into the 45' Elevation of the Turbine Building to the 45' Switchgear Room or 27' Cable Spreading Room. Diagrams of the Unit 1 pathways are included in Reference 15, CCNPP Final Integrated Plan, Mitigation Strategies for a Beyond-Design-Basis External Event (NRC Order EA-12-049), July 2016, Revision 1, Section 14. Alternate pathway for the 100 KW DG are on the West Road to the Auxiliary Building 45' elevation.

- S/G Makeup

  The strategy for maintaining S/G makeup via installed TDAFW hinges on providing makeup water to #12 CST in less than ten hours and relies on deploying two FLEX hose manifold trailers and a FLEX booster pump to FLEX setup areas adjacent to the Tank Farm at the north end of the plant protected area such that suction can be taken from any surviving water storage tank in the Tank Farm, or if needed from well water, or from the Chesapeake Bay (Ultimate Heat Sink) as a last resort. Two FLEX hose manifolds are installed to form a ring header for a more reliable feedwater source. Hoses carry water to the West Road, where they enter the Auxiliary Building on the 45' Elevation. Connection to the AFW system is on the 5' Elevation to hose connections on the AFW Motor cross-connect lines.

Phase 2 (6 to 24 hours)

Core Cooling/Core Inventory – Continue to maintain core cooling using installed plant equipment and deploy FLEX equipment in support of maintaining core cooling and restoring core inventory.

During Phase 2, as in Phase 1, core cooling is maintained by steaming from the S/Gs via local manual operation of the ADVs and feeding S/Gs using TDAFW with suction from the fully protected #12 CST.

Per the Station Blackout EOP, if AFW flow is lost or cannot be established, then the Alternate Low Pressure Feedwater FSG is concurrently implemented. This FSG provides actions to establish an alternate low pressure source to feed S/Gs through the AFW system when the TDAFW pumps are not available. The FLEX AFW Pumps are deployed to the Tank

Farm per the Initial Assessment and FLEX Equipment Staging FSG. Hoses will run from the Tank Farm to the West Road, then enter the Auxiliary Building on the 45' Elevation through Door 419.

Initial RCS makeup and boration is accomplished by lowering RCS temperature and therefore RCS pressure to the point at which SIT injection into the RCS will begin from the four SITs.

Long-term RCS makeup and boration is accomplished per the Long Term RCS Inventory Control and Alternate RCS Boration FSGs. Once one of the designated vital 480 VAC load center for that unit is repowered, the installed charging pump associated with that load center is started to commence RCS refill and RCS boration from the boric acid storage tanks.

If an installed charging pump is not available, then the FLEX RCS Makeup Pump is used for RCS makeup and boration. The suction source for the FLEX RCS Makeup Pump is either unit's RWT. The FLEX RCS Makeup Pumps are deployed per the Initial Assessment and FLEX Equipment Staging FSG into the PA to the West Road outside of 11 RWT and 21 RWT pump rooms respectively.

Key reactor parameter instrumentation will be maintained by the 125 VDC station batteries and the associated vital DC and AC instrument buses. Station battery coping is extended by deep DC load shedding completed in Phase 1. Key parameters are monitored using installed instrumentation powered from vital instrument power or use of portable instrumentation connected to designated connection points in the Control Room or at the containment electrical penetrations.

Containment – Monitor containment pressure and temperature.

Containment pressure and temperature are expected to remain below peak design limits over the first 72 hours of the ELAP event. Consequently, no Containment Air Cooling or Containment Spray is required for 72 hours following initiation of an ELAP.

Key containment parameter instrumentation will be maintained by the 125 VDC station batteries and the associated vital DC and AC instrument buses. Station battery coping is extended by deep DC load shedding completed in Phase 1. Key parameters are monitored using installed instrumentation powered from vital instrument power or use of portable instrumentation connected to designated connection points in the Control Room or at the containment electrical penetrations.

Spent Fuel Pool (SFP) Cooling – Monitor SFP level and temperature, prepare for SFP makeup.

Using the most conservative SFP heat load and an initial temperature of 120°F, the SFP reaches boiling conditions in approximately 10 hours. Per the Initial Assessment and FLEX Equipment Staging FSG, the hoses needed for surface makeup to the SFP are deployed within the first eight hours of an ELAP from the 45-foot elevation truck bay area of the Auxiliary Building to the 69-foot SFP area. This will minimize personnel having to enter a hazardous area later in the event. As soon as manpower resources are available and prioritized with Core Cooling/Core Inventory strategies, the SFP Cooling (SFPC) System makeup spool piece will be installed in the SFPC System located in the SFPC heat exchanger room on the 27-foot elevation of the Auxiliary Building. The FLEX SFP Makeup pump will be deployed to the 10 ft. elevation waterfront area and connected, taking suction from the Chesapeake Bay, ready to provide SFP makeup before SFP level lowers to 50 feet.

Safety Function Support

- Electrical

As described in Phase 1 for vital 480 VAC load center repower, cable connection to a FLEX 500 KW DG, and re-powering of the first vital 480 VAC load center is expected to be completed in approximately 6 hours from time "0". The second vital 480 VAC load center is expected to be re-powered at approximately 6.5 hours from the second 500 KW DG.

- FLEX Equipment Deployment

  Deployment of all major FLEX equipment from the FSRB to the designated FLEX equipment setup areas is completed in Phase 2. If needed and if available, FLEX N+1 equipment located in the FLEX Storage Commercial Building (FSCB) can be deployed for use. The FSCB is located in the main parking lot at 66 ft NGVD 29 elevation.

  Debris removal is expected to be completed as deployment paths and setup areas are cleared.

- S/G Makeup

  As described above in Phase 1, the strategy for maintaining S/G makeup is by providing makeup water to #12 CST in less than ten hours. Connection of the Tank Farm water storage tank hoses to FLEX hose manifolds is completed in the last hour of Phase 1. Final connection of hoses between #12 CST, the two hose manifold trailers, and the FLEX booster pump spans the Phase 1 and Phase 2 transition and is completed early in Phase 2 by hour 9 such that #12 CST makeup is in progress by hour 10.

Phase 3 (24 to 72 hours)

<u>Core Cooling/Core Inventory</u>– Continue to maintain core cooling using both installed plant equipment and FLEX equipment.

During Phase 3, as in Phases 1 and 2, core cooling is maintained by steaming from the S/Gs via local manual operation of the ADV and feeding S/Gs using TDAFW with suction from the fully protected #12 CST.

Per the Station Blackout EOP, if AFW flow is lost or cannot be established, then the Alternate Low Pressure Feedwater FSG is concurrently implemented. The FSG provides actions to establish an alternate low pressure source to feed S/Gs through the AFW system when the TDAFW are not available.

When available, NSRC supplied equipment will be used to backup installed equipment and site FLEX equipment.

As in Phase 2, long-term RCS makeup and boration is accomplished per the Long Term RCS Inventory Control and Alternate RCS Boration FSGs. Once one of the designated vital 480 VAC load center for that unit is repowered, the installed charging pump associated with that load center is started to commence RCS refill and RCS boration from the boric acid storage tanks.

If an installed charging pump is not available, then the FLEX RCS Makeup Pump is used for RCS makeup and boration. The suction source for the FLEX RCS Makeup Pump is either unit's RWT. The FLEX RCS Makeup Pumps are deployed per the Initial Assessment and FLEX Equipment Staging FSG into the PA to the West Road outside of 11 RWT and 21 RWT pump rooms respectively. If needed the NSRC supplied high pressure RCS injection pump and boration skid will be used for RCS makeup and boration.

Key reactor parameter instrumentation will be maintained by the 125 VDC station batteries and the associated vital DC and AC instrument buses. Key parameters are monitored using installed instrumentation powered from vital instrument power or use of portable instrumentation connected to designated connection points in the Control Room or at the containment electrical penetrations.

Containment – Monitor containment pressure and temperature. Establish containment air cooling at approximately 72 hours.

Containment pressure and temperature are expected to remain below peak design limits over the first 72 hours of the ELAP event. Consequently no Containment Air Cooling or Containment Spray is required for 72 hours following initiation of an ELAP. However, when NSRC supplied 4160 VAC generators and low pressure, high flow saltwater pumps become available at 24 hours the strategy is to restore electrical power to vital buses, a saltwater train heat sink, and service water cooling water flow such that one Containment Air Cooling (CAC) unit can be started on each unit to maintain containment parameters.

Key containment parameter instrumentation will be maintained by the 125 VDC station batteries and the associated vital DC and AC instrument buses. Key parameters are monitored using installed instrumentation powered from vital instrument power or use of portable instrumentation connected to designated connection points in the Control Room or at the containment electrical penetrations.

Spent Fuel Pool (SFP) Cooling – Monitor SFP level and temperature, and initiate SFP makeup prior to level at 50 feet.

Following the onset of boiling in the SFP boiling, using the most conservative bounding SFP heat load, and an initial level of 66.5 ft., the SFP level will lower to 50 ft. in 58.8 hours. Makeup to the SFP via either surface makeup or direct injection into the SFP Cooling system is initiated using water drawn from the Chesapeake Bay prior to SFP level lowering to 50 ft.

Safety Function Support

- Electrical

  NSRC supplied 4160 VAC generators become available at 24 hours. The strategy is to use these machines to restore electrical power to additional vital buses to establish; containment air cooling as described above, SFPC System flow for long term SFP cooling, and shutdown cooling for long term decay heat removal.

- S/G Makeup

  As described above in Phase 2, the strategy for maintaining S/G makeup is by continuing to provide makeup water to #12 CST. In Phase 3 the strategy is to use installed TDAFW as long as reactor decay heat is sufficient to maintain adequate S/G steam pressure to support TDAFW pump operation. When needed the Low Decay Heat Temperature Control FSG is implemented to control RCS temperature with intermittent TDAFW operation or low pressure S/G feed using the FLEX AFW pumps.

  NSRC supplied water purification equipment and associated auxiliary equipment will be utilized as needed to provide long term water storage tank makeup.

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

NRC has completed the "Staff Assessment" (Reference 10) and "Supplement to Staff Assessment" (Reference 11), related to CCNPP's original FHRR (References 2 and 3). In

Reference 11, the NRC concluded that, "as documented in the NRC staff assessment and the enclosed supplement, the NRC 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 [NEI 12-06, Rev 2 (Reference 8)] for Calvert Cliffs". The enclosure to Reference 11 includes a summary of the plant DB and reevaluated flood hazard parameters. In Table 3.1-2 of the enclosure to Reference 11, the NRC lists the following flood-causing mechanisms and how each mechanism was considered for the plant's DB:

- 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 Tables 4.0-1 through 4.0-3 of the enclosure to Reference 11, the NRC lists flood hazard information (including stillwater elevation, wind-wave runup elevation, flood event duration, and associated effect parameters) for the LIP and PMSS flood-causing mechanisms as being not bounded by the DB flood hazard. However, the NRC's "Staff Assessment" (Reference 10) and "Supplement to Staff Assessment" (Reference 11) are based on the original (March 2013) FHRR parameters in References 2 and 3. CCNPP submitted an amended FHRR for LIP and PMSS, based on a site-specific meteorological study, in September 2015 (Reference 4). The amended LIP and PMSS flood parameters, including stillwater and wind-wave runup levels, associated effects, and flood event duration parameters, are addressed in Tables 3.0-3 and 3.0-4 of the enclosure to Reference 4, respectively. Reference 4 indicates that the amended FHRR LIP and PMSS flood parameters are bounded by the DB flood (with the exception of the LIP locations not included in the plant's DB) at CCNPP.

1. **Local Intense Precipitation (LIP)**

   The amended FHRR peak flood elevation for LIP of 43.6 feet MSL at the EDG Building is bounded by the DB elevation of 44.8 feet MSL at the same location. Other critical structures were not analyzed for LIP in the DB. Therefore, LIP was considered to be not bounded by the plant's DB in these areas. However, the amended FHHR (Reference 4) LIP water surface includes the entire power block area and ranges in elevation from 43.6 to 44.9 feet MSL, which are below grade or finish floor elevation of safety related structures at 45.0 feet MSL. This peak flood elevation for the amended LIP occurs along the site's West Road, below the doorway access points to safety-related SSCs. The amended LIP flood levels in the power block area are also lower than the March 2013 FHRR results of between 45.1 to 47.0 feet MSL.

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

   The amended FHRR peak water surface elevation for the PMSS is 26.2 feet MSL (26.8 feet NGVD29), including wind-wave runup, which is below the DB of 27.5 feet MSL (28.1 feet NGVD29). The amended PMSS flood level is also lower than the original March 2013 FHRR level of 30.7 feet MSL (31.3 feet NGVD29).

Consistent with Table 3.1-2 of the enclosure to Reference 11, the CCNPP FLEX DB considered all flood-causing mechanisms listed above associated with the plant's DB floods and also incorporated the original March 2013 FHRR for LIP and PMSS flood-causing mechanisms, described in References 2 and 3, which were not bounded by the plant DB flood hazard. See Section 5 for further discussion regarding the FLEX DB.

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

As described in the FLEX Design Criteria (Reference 12), Final Integrated Plan (Reference 15), and FLEX Validation Integrated Review (Reference 16), CCNPP incorporated the March 2013 FHRR (References 2 and 3) flood parameters for LIP and PMSS as design inputs into the FLEX strategies. As discussed in the previous section, the March 2013 FHRR flood levels are higher than the amended FHRR flood levels for LIP and PMSS. Therefore, since all aspects of FLEX (including storage and deployment of FLEX equipment, validation of FLEX actions, and viability of FLEX connection points) utilize the more limiting LIP and PMSS flood hazards from the March 2013 FHRR, the amended FHRR flood hazard is considered to be bounded by the FLEX DB and no further assessment of the LIP and PMSS flooding impacts on the FLEX strategy is required. However, since the amended LIP flood could have location-specific impacts and was not fully included in the plant DB and was not considered by the NRC in the Supplemental Staff Assessment (Reference 11), an assessment was conducted to further verify that the FLEX strategy, as designed, is not adversely impacted by the LIP flood. See Section 6 below [G.4.1].

6 Assessment of Current FLEX Strategy (NEI 12-06, Rev 2, Section G.4.1)

Since the CCNPP DB did not analyze LIP for structures other than the EDG building, an assessment was conducted to further verify that the FLEX strategy, as designed, is not adversely impacted by the LIP flood. As discussed further below, the assessment of the LIP impact concluded that the current FLEX strategies, as described in References 12, 15, and 16, can be successfully implemented without modification for the LIP flood mechanism.

Two methods demonstrate that the CCNPP FLEX strategies are not impacted by the amended site-specific flood hazard. First, the site topography, higher physical height of safety-related structures (Auxiliary Building, 45.0 feet MSL) compared to the amended LIP peak level of 44.9 feet MSL, shows no impact on permanently installed FLEX equipment connections. Secondly, the amended LIP levels in Reference 4 are lower than the FLEX DB LIP levels. Therefore, the amended LIP flood causes no change to the CCNPP FLEX strategies as described above in Section 3.3. Additional details are provided below.

6.1 Assessment Methodology and Process

This assessment reviews the effect of a LIP event and concurrent ELAP/LUHS on the FLEX strategy. The assessment addresses the following key aspects of the FLEX strategy from NEI 12-06, Rev 2, Section G.4.1 (Reference 9):

- In the sequence of events for the FLEX strategies, if the reevaluated flood hazard does not cause the ELAP/LUHS, then the time when the ELAP/LUHS is assumed to occur should be specified and a basis provided (e.g., the ELAP/LUHS occurs at the peak of the flood).

Effect from LIP: Initiation of an ELAP will result in the deployment of FLEX equipment to the Turbine Building Rollup doors at approximately 3 hours. The peak LIP flood elevation, from the amended reevaluation, is below the DB flood elevation at the Diesel Generator Building as well as below the 45 foot NGVD29 elevation of the power block structures, thus no protection is required for existing structures. The assumed time for the ELAP/LUHS is at the peak LIP flood, defined as time t=0. This time is when the LIP flood would have the most impact upon the site. However, since the amended peak flood occurs at a level below the physical height of the doorways leading into the plant SSCs on the West Road, it was determined there is no impact on the SSCs from the peak LIP flood.

- The impacts of the MSFHI should be used in place of the FLEX DB flood to perform the screening and evaluation per Section 6 of NEI 12-06, Rev 2:
  - Protection of FLEX Equipment (Section 6.2.3.1 of NEI 12-06, Rev 2)
    - Confirm that the guidance for protection of FLEX equipment (NEI 12-06, Rev 2, Section 11.3) was followed. Confirm that FLEX equipment is not impacted by MSFHI.

      Effect from LIP: FLEX equipment has been stored and designed to the requirements of NEI 12-06. The protection of FLEX equipment will not be affected by a LIP event. The FLEX equipment storage locations are at elevations 130 feet NGVD29 for the FSRB (N FLEX Equipment) and 70 feet NGVD29 for the FSCB (N+1 FLEX Equipment). The FSRB is at one of the highest elevations on site, with drainage direct to the Chesapeake Bay north of the power block. The immediate grounds of the FLEX storage Buildings (FSRB & FSCB) contain drywells, drainage channels and positive grade to ensure drainage away from structures to prevent flooding in the buildings.
    - If applicable, document that any flood protection features credited in the FLEX strategy meet the performance criteria (NEI 12-06, Rev 2, Section G.5). How were the flood protection features evaluated? Confirm that the flood protection features are not impacted by MSFHI.

      Effect from LIP: Flood protection features are not required for FLEX. The maximum elevation of the amended reevaluated LIP flood level adjacent to Auxiliary Building is 44.9 feet MSL, compared to door sill elevations at or above 45.0 feet MSL.
  - Deployment of FLEX Equipment (Section 6.2.3.2 of NEI 12-06, Rev 2)
    - Document that deployment of FLEX Equipment is not impacted by MSFHI – e.g., warning time, ability to move equipment and re-stock supplies, and availability of fuel.

      Effect from LIP: The ability to deploy the FLEX equipment is not impacted by amended LIP flood. LIP floodwaters recede after time=0 as the peak LIP occurs at t=0. The topography of the site is comprised of 3 tiers (Switchyard at 70 feet NGVD29, Power Block at 45 feet NGVD29, and Waterfront at 10 feet NGVD29), which promotes water flow away from the power block area and towards the Chesapeake Bay. The deployment paths from the FLEX equipment storage building(s) to the deployment locations also have been evaluated. (See Figure 1 in Section 3.3) The elevations of FLEX equipment deployment locations and cable and hose deployment paths are above the *amended reevaluated LIP flood levels for the duration of the event. All areas required for FLEX implementation, such as refueling of FLEX generators and diesel driven pumps, are also above the amended reevaluated LIP levels and remain fully accessible during the event.*

        - Document that availability and access to all connection points is not impacted by the MSFHI.

          Effect from LIP: The availability and access to all connection points are not impacted by the amended reevaluated LIP flood since the connection points are in the Auxiliary Building and the Turbine Building, which are both above the amended reevaluated LIP flood level.

        - Document that deployment of temporary flood barriers is not impacted by MSFHI.

          Effect from LIP: FLEX does not credit the deployment of temporary flood barriers and is therefore not impacted by the amended reevaluated LIP flood.

    - Procedural Interfaces (Section 6.2.3.3 of NEI 12-06, Rev 2)

        - Confirm that no procedural changes are required due to MSFHI.

          Effect from LIP: Procedural changes were not required due to the amended reevaluated LIP flood. The FLEX Strategies (and FSGs) were developed using the original reevaluated LIP flood as a consideration. The FLEX Strategies were determined to be able to be implemented if the original LIP flood were to occur. Upon completion of the amended LIP flood reevaluation, the FSGs remained unchanged as the original LIP flood bounds the amended LIP flood. Therefore, no changes to the FSGs were required due to the MSFHI.

    - Utilization of Off-site Resources (Section 6.2.3.4 of NEI 12-06, Rev 2)

        - Confirm that site access routes are not impacted by MSFHI.

          Effect from LIP: The amended reevaluated LIP flood will not impede site access routes and the functionality of FLEX deployment. Site access routes are at the higher (125 to 130 feet NGVD29) elevations on the site. Access to the plant by offsite resources will not be impeded by low lying areas, small streams or other obstructions. Debris removal equipment is available to remove debris from site pathways.

- The equipment storage guidance of Section 11.3 should be reassessed based on the impacts of the MSFHI.

  Equipment storage was designed using the MSFHI (original reevaluated) LIP flood and, since the amended reevaluated LIP flood levels are lower, it is not impacted.

- The impacts of the MSFHI should be used in place of the FLEX DB flood in the consideration of robustness of plant equipment as defined in Appendix A of NEI 12-06. For determining robustness only, the MSFHI should be used as the applicable hazard.

  Effect from LIP: MSFHI (original reevaluated) LIP flood was considered in the FLEX DB flood and has no impact on plant equipment since the amended reevaluated LIP flood levels are below the elevation of plant equipment.

- The impacts of the MSFHI should be used to evaluate the location of connection points in accordance with Section 3.2.2.17 of NEI 12-06, Rev 2.

  Effect from LIP: The amended reevaluated LIP flood does not impact the location of the FLEX connection points in the Auxiliary Building, Turbine Building or Tank Farm located north of the plant since connection points are higher than amended LIP flood Level.

- Any flood protection features credited in the FLEX strategies meet the performance criteria in Section G.5.

  Effect from LIP: The current FLEX strategy does not credit any flood protection features.

6.2 Results

- Confirm that boundary conditions and assumptions in the initial FLEX design are maintained. If not, describe the differences. Describe the basis for this determination.

  The boundary conditions and assumptions in the initial FLEX design are maintained and do not change based on amended reevaluated LIP flood. The FLEX DB included the original reevaluated LIP flood. The FLEX Strategies were developed using the original reevaluated LIP flood as a consideration. The FLEX Strategies were determined to be able to be implemented if the original LIP flood were to occur. Upon completion of the amended LIP flood reevaluation, the FLEX Strategies remained unchanged as the original LIP flood bounds the amended LIP flood. Therefore, no changes to the FLEX Strategies were required as the boundary conditions and assumptions remained as input to the FLEX DB. Below is a list of key FLEX DB assumptions and the impact of the amended reevaluated LIP flood:

  - *Beyond-design-basis external event occurs impacting all units at site – Flooding is maintained as the boundary condition for the amended reevaluated flood hazard.*
  - *All reactors on-site initially operating at power, unless site has procedural direction to shut down due to the impending event. – This boundary condition is not affected by the amended reevaluated LIP flood and is maintained, other than DB emergency response procedures when a flood is forecasted to reach a reactor shut-down trigger.*
  - *Each reactor is successfully shut down when required (i.e., all rods inserted, no ATWS). – This boundary condition is not affected by the amended LIP flood and is maintained.*
  - *On-site staff is at site administrative minimum shift staffing levels. – The amended reevaluated LIP flood did not create a need to increase staffing levels before, during, and after the flood.*
  - *No independent, concurrent events, e.g., no active security threat. – The MSFHI introduces seismically induced upstream dam failure. However, the seismic event was related to the failure of upstream dams, not occurring directly at the plant concurrent with a flood.*
  - *All personnel on-site are available to support site response. – The amended LIP flood did not create a need for additional on-site resources to support the site response.*

- *Spent fuel in dry storage is outside the scope of FLEX. – No change to this boundary condition.*

- Confirm that the sequence of events for the FLEX strategies is not impacted by MSFHI (including impacts due to the environmental conditions created by amended flood hazard) in such a way that the FLEX strategies cannot be implemented as currently developed. If yes, describe the impacts. Describe the basis for this determination.

  The sequence of events was reviewed with the occurrence of the amended reevaluated LIP flood-causing mechanism. No new or re-ordered tasks were identified as a result of this event. Time to dispatch operators did not need to be accelerated to accomplish a task within the required time constraint. Thus, the sequence of events for the FLEX strategies is not impacted by amended reevaluated LIP flood as no changes are needed to the FLEX strategies and the higher levels in the original FHRR (MSFHI) was considered in the development of the FLEX strategies and sequence of events.

- Confirm that the validation performed for the deployment of the FLEX strategies is not impacted by MSFHI. If yes, describe the impacts. Describe the basis for this determination.

  - *The FLEX strategies, including actions/steps in the Validation Plan, were reviewed to determine the impact of the amended reevaluated LIP flood. The FLEX equipment deployment validation considered additional time as part of task completion for debris removal and clearing undefined obstacles from the deployment pathways. As discussed above, the ELAP/LUHS is assumed to occur at peak LIP flood level. Each of the TSA's were reviewed, including subtasks, "Other Considerations", "Performance Attributes", and "Conclusion", to assess the impacts from the amended reevaluated LIP flood. CCNPP concluded that all TSA's are not impacted by the amended LIP flood. The integrated sequence of events included all required actions by minimum staffing during Phase 1 and Phase 2 of the ELAP response. Debris removal times were evaluated for specific actions and included considerations of receding flood waters as the peak floods occurred at time t=0. During the first hour of the response, plant personnel remain inside the power block to establish and verify initial plant shutdown conditions. The first set of personnel deploy to the FSRB at t=1 hour, and return to the 45-foot elevation at t=3.5hrs, after the time the MSFHI (FLEX design basis) LIP flood would recede into the Chesapeake Bay. This review is documented in CCNPP FLEX Validation Report, Reference 16.*

6.3 Conclusions

FLEX was designed using parameters from CCNPP's March 2013 FHRR, which bounds the amended reevaluation for LIP and PMSS. Since the amended reevaluated LIP is the basis for the MSA and has a peak below FLEX DB for LIP, as well as the physical height of the DB plant structures, the amended LIP has no impact on the FLEX strategies. Therefore, the current FLEX strategies can be successfully implemented as designed for all applicable flood-causing mechanisms, specifically the PMSS and LIP flood-causing mechanisms, and no further actions, including modifications to FLEX, are required. CCNPP considers the MSA as complete with no further actions required.

7 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. Constellation Energy Nuclear Group Letter to USNRC, Calvert Cliffs Nuclear Power Plant, Units 1 and 2, Flood Hazard Reevaluation Report, dated March 12, 2013.
3. Constellation Energy Nuclear Group Letter to USNRC, Calvert Cliffs Nuclear Power Plant, Units 1 and 2, Response to NRC 10CFR50.54(f) Request for Information Regarding Near-Term Task Force Recommendation 2.1, Flooding - Flood Hazard Reevaluation, dated February 10, 2014.
4. Exelon Generation Company, LLC Letter to USNRC, Response to March 12, 2012, Request for Information Enclosure 2, Recommendation 2.1, Flooding, Required Response 2, Flooding Hazard Reevaluation Report [Amendment 1], dated September 23, 2015.
5. NRC Letter, Supplemental Information Related to Request for Information Pursuant to Title 10 of the Code of Federal Regulations 50.54(f) regarding Flooding Hazard Reevaluations for Recommendation 2.1 of the Near Term Task Force Review of Insights from the Fukushima Dai-ichi Accident, dated March 1, 2013.
6. 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.
7. NRC Letter, Coordination of Requests for Information Regarding Flooding Hazard Reevaluations and Mitigating Strategies for Beyond-Design-Basis External Events, dated September 1, 2015.
8. Nuclear Energy Institute (NEI), Report NEI 12-06 [Rev 2], Diverse and Flexible Coping Strategies (FLEX) Implementation Guide, dated December 2015.
9. U.S. Nuclear Regulatory Commission, JLD-ISG-2012-01, Revision 1, Compliance with Order EA-12-049, Order Modifying Licenses with Regard to Requirements for Mitigating Strategies for Beyond-Design-Basis External Events, dated January 22, 2016 [Effective February 29, 2016 per Federal Register / Vol. 81, No. 39].
10. NRC Letter to Exelon, "Calvert Cliffs Nuclear Power Plant, Units 1 and 2 - Staff Assessment of Response to 10 CFR 50.54(f) Information Request - Flood-Causing Mechanism Reevaluation (TAC NOS. MF3097 and MF3098)", dated April 16, 2015.
11. NRC Letter to Exelon, "Calvert Cliffs Nuclear Power Plant, Units 1 and 2 - Supplement to Staff Assessment of Response to 10 CFR 50.54(f) Information Request - Flood-Causing Mechanism Reevaluation (TAC NOS. MF3097 and MF3098)", dated October 21, 2015.
12. Design Criteria Calvert Cliffs Nuclear Power Plant (CCNPP) Fukushima Dai-ichi Tier 1 Requirement Implementation of Diverse and Flexible Coping strategies (FLEX), Rev. 0, dated July 29, 2014.
13. Calvert Cliffs Nuclear Power Plant, Implementation of Diverse and Flexible Coping Strategies (FLEX) and Spent Fuel Pool Instrumentation Program (CC-CA-118).
14. Constellation Energy Nuclear Group, LLC, Flooding Walkdown Report, Report No: SL-011462, Revision 0, November, 2012.

15. Calvert Cliffs Nuclear Power Plant, Final Integrated Plan, Mitigation Strategies for a Beyond-Design-Basis External Event (NRC Order EA-12-049), July 2016, Revision 1.

16. Calvert Cliffs Nuclear Power Plant FLEX Validation Integrated Review, April 7, 2016.

17. Constellation Energy Nuclear Group Letter to USNRC, Calvert Cliffs Nuclear Power Plant, Units 1 and 2, Response to NRC 10CFR50.54(f) Request for Information Regarding Near-Term Task Force Recommendation 2.1, Flooding – Flood Hazard Reevaluation, dated March 7, 2014.