Tennessee Valley Authority, 1101 Market Street, Chattanooga, Tennessee 37402

CNL-16-177

December 27, 2016

10 CFR 50.54(f)

ATTN: Document Control Desk
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001

Browns Ferry Nuclear Plant, Units 1, 2 and 3
Renewed Facility Operating License Nos. DPR-33, DPR-52, and DPR-68
NRC Docket Nos. 50-259, 50-260, and 50-296

Subject: **Mitigating Strategies Assessment for Flooding for Browns Ferry Nuclear Plant, Units 1, 2 and 3 - Response to NRC 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**

References:

1. TVA letter to NRC, "Flood Hazard Reevaluation Report for Browns Ferry Nuclear Plant, Response to NRC 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, 2015 (ML15072A130)

2. NRC letter to TVA, "Browns Ferry Nuclear Plant, Units 1, 2 and 3 - Interim Staff Response to Reevaluated Flood Hazards Submitted in Response to 10 CFR 50.54(f) Information Request - Flood-Causing Mechanism Reevaluation (TAC Nos. MF6034, MF6035 and MF6036)," dated September 3, 2015 (ML15240A183)

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

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

5. NEI 12-06, “Diverse and Flexible Coping Strategies (FLEX) Implementation Guide,” Revision 2, dated December 2015 (ML16005A625)

6. NRC Interim Staff Guidance JLD-ISG-2012-01, “Compliance with Order EA-12-049, Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events,” Revision 1, dated January 22, 2016 (ML15357A163)

7. TVA letter to NRC, “Tennessee Valley Authority - Hydrologic Engineering Center River Analysis System (HEC-RAS) Project Milestones,” dated June 22, 2016 (ML16175A518)

On March 12, 2015, TVA submitted the Flooding Hazard Reevaluation Report (FHRR) for Browns Ferry Nuclear Plant, Units 1, 2 and 3 (Reference 1). On September 3, 2015, NRC provided its summary of the NRC staff’s assessment of the reevaluated flood-causing mechanisms described in the March 12, 2015 Browns Ferry FHRR, as well as supplemental information for requests for additional information and audits (Reference 2).

In Reference 2, the NRC concluded that the "…reevaluated flood hazards information, as summarized in the Enclosure [to Reference 2], is suitable for the assessment of mitigating strategies developed in response to Order EA-12-049 (i.e., defines the mitigating strategies flood hazard information described in the guidance documents currently being finalized by the industry and NRC staff) for Browns Ferry.”

Concurrent with the development of the flood hazard reevaluation, Browns Ferry 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 Staff Requirements Memorandum for COMSECY-14-0037 (Reference 3), the NRC indicated that licensees needed to address the reevaluated flooding hazards within their mitigating strategies for beyond-design-basis external events, including the reevaluated flood hazards. This was affirmed by NRC in a letter dated September 1, 2015 (Reference 4).

Industry guidance for performing mitigating strategies assessments of the impact of the reevaluated flood hazard is contained in Appendix G of Reference 5. This guidance was endorsed by NRC in Reference 6. The Mitigating Strategies Assessment for Flooding provided by this letter was performed in accordance with this guidance.

As discussed with NRC in a public meeting on April 4, 2016 (ML16117A551 and ML16102A330), TVA identified an issue with the storage volumes utilized in the HEC-RAS model used to develop the Browns Ferry FHRR. The enclosed Mitigating Strategies Assessment for Flooding utilized the flood values as provided in the Browns Ferry FHRR (Reference 1) and reviewed by NRC (Reference 2). The plan for resolution of the storage volume issue is expected to result in lower flood levels at Browns Ferry.

The reevaluated probable maximum flood warning time analysis described in the enclosed Mitigating Strategies Assessment for Flooding results in a reduced time for site preparation for a Probable Maximum Flood (PMF) compared to the current design basis. This variance between the reevaluated warning time results and the design basis results has been document in Condition Report 1234555. The final resolution plan for this will utilize newly determined flood levels based on the correction of the HEC-RAS storage volume issue. TVA will provide a revised BFN warning time analysis using updated precipitation data to the NRC within the Focused Evaluation described in the HEC-RAS Project Milestones letter (Reference 7).

Based on the assessment performed in the enclosed Mitigating Strategies Assessment for Flooding, TVA has concluded that the Browns Ferry overall strategy and timeline for the staging and deployment of FLEX equipment in these events are unaffected by the results of the Browns Ferry FHRR. The Browns Ferry FLEX Mitigating Strategies can be implemented as designed.

Enclosure 1 to this letter provides the Mitigating Strategies Assessment for Flooding for the Browns Ferry Nuclear Plant, Units 1, 2 and 3.

Enclosure 2 of this letter provides a new regulatory commitment.

If you have any questions regarding this submittal, please contact Russell Thompson at (423) 751-2567.

I declare under penalty of perjury that the foregoing is true and correct. Executed on the 27th day of December 2016.

Respectfully,

J. W. Shea
Vice President, Nuclear Licensing

Enclosures

cc: See Page 4

Enclosures

1. Mitigating Strategies Assessment for Flooding, Browns Ferry Nuclear Plant, Units 1, 2, and 3

2. Commitment

cc (Enclosures):

NRR Director - NRC Headquarters
NRO Director - NRC Headquarters
NRR JLD Director - NRC Headquarters
NRC Regional Administrator - Region II
NRC Project Manager - Browns Ferry Nuclear Plant
NRC Senior Resident Inspector - Browns Ferry Nuclear Plant

ENCLOSURE 1

Mitigating Strategies Assessment for Flooding
Browns Ferry Nuclear Plant, Units 1, 2 and 3

Mitigating Strategies Assessment for Flooding

Tennessee Valley Authority
Browns Ferry Nuclear Plant
Units 1, 2 and 3

December 23, 2016

Contents

1. Summary

The Mitigating Strategies Flood Hazard Information (MSFHI) provided in the BFN Flood Hazard Reevaluation Report (FHRR) (Reference 1) has concluded that the Local Intense Precipitation (LIP) height in the East Switchyard Channel and Lower Plant is not bounded by the current design basis (CDB). The LIP results in the inundation of the outdoor areas in the vicinity of SSCs important to safety. The MSFHI also concluded flood event duration parameters (including warning time and period of inundation) will be assessed in the Mitigating Strategies Assessment (MSA).Therefore, an evaluation of potential impacts of the re-evaluated flood hazards on the Diverse and Flexible Coping Strategies (FLEX) design basis (Reference 2) is necessary to determine if implementation of BFN FLEX strategies is challenged.

Warning time, flood event duration and period of inundation, event parameters not addressed in the BFN FHRR, are provided in this MSA and evaluated for potential impact to the BFN FLEX Mitigation Strategies. The impact to the BFN FLEX Mitigating Strategy bases is documented in BFN Condition Report CR# 1231022 (Reference 3).

The reevaluated warning time analysis results in a reduced time for site preparation for a Probable Maximum Flood (PMF) compared to the current design basis. The variance between the reevaluated warning time analysis results and the design basis has been documented in a BFN Condition Report. Final resolution of this variance in PMF warning time trigger values will be completed using the newly determined flood level based on the correction of the HEC-RAS storage volume issue. TVA will provide a revised warning time analysis using updated precipitation data in the BFN Focused Evaluation.

Based on the assessments performed in Section 3.3, Tennessee Valley Authority (TVA) has concluded that the BFN overall strategy and timeline for the staging and deployment of FLEX equipment in these events are unaffected by the results of the BFN FHRR (Reference 1) and can be implemented as designed.

2. List of Acronyms

- BFN – Browns Ferry Nuclear
- CDB – Current Design Basis
- DG- Diesel Generator
- EDG – Emergency Diesel Generator
- EECW – Emergency Equipment Cooling Water
- ELAP – Extended Loss of AC Power
- FED – Flood Event Duration
- FESB – FLEX Equipment Storage Building
- FLEX – Diverse and Flexible Coping Strategies
- FHRR – Flood Hazard Reevaluation Report
- FLEX DB – FLEX Design Basis (flood hazard)
- LIP – Local Intense Precipitation
- MSFHI – Mitigating Strategies Flood Hazard Information (from the FHRR and MSFHI letter)
- MSL – Mean Sea Level
- NSRC – National SAFER Response Center
- PMF – Probable Maximum Flood
- PMP – Probable Maximum Precipitation
- PMWE – Probable Maximum Water Elevation

- RHRSW – Residual Heat Removal Service Water
- SSC – Structures, Systems and Components
- SWE – Stillwater Elevation

3. Documentation

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

The results of the BFN FHRR (Reference 1) are provided in Table 3-1 below. The Interim Staff Response issued by the NRC (Reference 5) identified that LIP in the Switchyard and Lower Plant Area are not bounded by the CDB flood elevation. LIP in the West Channel and PMF from streams and rivers are bounded by the CDB flood elevation. The FHRR also analyzed the watershed associated with a single seismic failure of Guntersville Dam and multiple dam failures due to a Douglas Dam centered seismic event combined with a 500-year flood and determined that there is no impact on the BFN plant site (flood still water elevation did not reach plant grade). Other flood hazard mechanisms (e.g., tsunami, channel migrations/diversions, etc.) were not evaluated as they are not considered credible flood-causing mechanisms at the site.

Table 3-1 –Comparison of Current Design Basis Elevations and Reevaluation Results (Reference 1)

Flood Causing Mechanism	Design Basis (ft.) (msl)	Reevaluation (ft.) (msl)	Bounded (Yes/No)	Comments
Local Intense Precipitation	<592	590.4	Yes	West Channel
	<578	578.2	No	East Switchyard Channel
	<565	566.6	No	Lower Plant
Flooding from Rivers and Streams	572.5	572.1	Yes	7,980 sq. mi. Bulls Gap centered event
Flooding from Dam Breaches or Failures	N/A	558.6	No	Resulting from a single seismic failure of Guntersville Dam
Flooding from Storm Surges or Seiches, Tsunamis, Ice-Induced Events, and Channel Diversion or Migration Toward the Site	N/A	N/A	N/A	Not a credible flood-causing mechanism at this site.
Flooding from Combined Effects	578.0	577.2	Yes	Design Basis was PMF plus wind waves
	N/A	560.9	No	Controlling combination - Half 10,000 Year Douglas Centered Seismic Event during a 500-year June flood event

N/A – Not applicable

3.1.1. Local Intense Precipitation (LIP)

3.1.1.1. Flood Height

In this section, potential impacts to the BFN current design basis flood protection measures are evaluated for the re-evaluated LIP flood height. The current design basis flood and the FLEX design basis flood have the same flood levels. Potential impacts to FLEX Mitigating Strategies due to the re-evaluated LIP are reviewed in Section 3.3.1.

The re-evaluated LIP flood height elevations from the BFN FHRR (Reference 1) are provided in Table 3-2 below:

Table 3-2 – Results of BFN LIP Analysis (Reference 1)

Area	Maximum SWE (ft.)(msl)	Critical Elevation
West Channel (Station 16)	590.4	592.0
West Channel (Station 6)	576.7	578.0
East Switchyard Channel	578.2*	578.0
BFN Plant Area (Lower Mid)	565.2*	565.0
BFN Plant Area (Lower West)	566.2*	565.0
BFN Plant Area (Lower East)	566.6*	565.0

* Not bounded by the CDB

East Switchyard Channel: The LIP reevaluation of the BFN East Switchyard Channel resulted in a flood elevation of up to 578.2 ft. (msl) which exceeds the CDB LIP flood elevation of 578.0 ft. (msl). Overflow from the East Switchyard Channel is fully contained in the Cooling Tower hot water discharge channel and in the switchyard area. There are no plant safety impacts due to this increased flow in the Cooling Tower discharge channel. The tailwater effects of the increase in the discharge channels were considered in the reevaluation of LIP floodwater run-off from the lower plant area. Overflow from the BFN East Switchyard Channel will also enter the switchyard area north of the plant main site. However, the elevation of the site north of the BFN turbine building is at least 578.6, which prevents the overflow from the East Switchyard Channel from reaching the lower plant areas (Reference 1). The East Switchyard Channel overflow does not impact the BFN current design basis flood protection plans.

Lower Plant Area: The LIP reevaluation of the lower plant area, as reported in Reference 1 and shown in Table 3-2 above, resulted in flood elevations up to 566.6 ft. (msl) at the exterior doors leading to the Reactor Buildings, Diesel Generator Buildings, Intake Pumping Station, and Radwaste Building. The re-evaluated LIP flood elevation exceeds the CDB LIP flood elevation of 565.0 ft. (msl) at these locations.

To evaluate the potential plant impacts due to the re-evaluated LIP flood elevation, access doors and other openings at or below the LIP flood height that would allow water ingress into the Reactor Buildings, Diesel Generator Buildings, Intake Pumping Station and Radwaste Building were reviewed using site drawings. In addition, these potential flood water ingress paths were observed during a site walkdown performed in February 2015 (Reference 1).

The Reactor Building has a floor level of 565.0 ft. (msl) and has an access point through equipment/personnel airlock at the south side of the building (Reference 6). The LIP flood exceeds

the floor elevation at the airlock by 0.2 ft. (2.4 inches). The equipment airlock is a secondary containment boundary and consists of a large equipment door at each end (Doors 226 and 229). The equipment doors use inflatable seals to maintain an air seal and are interlocked such that only one door may be opened at a time (Reference 7). Given the airtight/watertight design of the doors, the very limited flood height above the door, and the short duration of flood exposure, no water would be expected in the Reactor Building. A small side door provides personnel access. This door is a normally closed watertight door and has a 3 ½ inch threshold (Reference 8). Therefore, the Reactor Building would not be jeopardized.

The Reactor Building doors on the north side would potentially be exposed to flood water when the outside LIP flood levels from the Lower East area exceed the Turbine Building floor elevation of 565.0 ft. (msl). The re-evaluated LIP peak flood elevation in the Lower East area exceeds the Turbine Building floor elevation by up to 1.6 ft. The Reactor Building wall at the Turbine Building interface is an interior wall and not subjected to wind and wave action (Reference 1). This area is designed for a PMF of 572.5 ft. (msl). The re-evaluated LIP flood elevations are much lower than the design watertight elevation, thus LIP flood water would not enter the Reactor Building through these doors.

The Intake Pumping Station has a floor elevation of approximately 564.7 ft. (msl) (Reference 8) with access door curb elevations of 565.2 ft. (msl). The re-evaluated LIP flood would exceed the floor elevation by 1.9 ft. in the Lower East area. The Intake Pumping Station has four similar exterior doors, each accessing one of the four RHRSW pump compartments (Reference 9). The external doors are normally closed, watertight doors designed for the PMF water height of 578.0 ft. (msl) (Reference 7). Since the re-evaluated LIP flood level in this area is less than the flood level the watertight doors are design to protect against, no LIP flood water would enter the pump compartments through the doors. The pump compartments are open at the roof and two sump pumps per compartment are provided to remove rain and other potential water inputs. A single sump pump is capable of removing the PMP with coincident RHRSW pump seal failure and gross EECW strainer leakage with margin (References 10, 11, 12, 13, 14, and 15). Given the watertight design of the door, the limited flood height, and the short duration of flood exposure, any leakage will be small and within the sump pump capacity margin. The LIP flood will not jeopardize RHRSW pump operation (Reference 1).

The Radwaste Building has a floor elevation of 565.0 ft. (msl). The LIP flood would exceed the finished floor elevation by 1.2 ft. at the two exterior doors to the Radwaste Building (Doors 182 and 183) and the one exterior door to the Radwaste Evaporator Building (Door 383), which connects directly to the Radwaste Building through unprotected openings (Reference 16). The external doors are watertight doors designed for the PMF water elevation of 578.0 ft. (msl) (Reference 7). Equipment in the Radwaste Building is not considered essential to maintaining the reactors in a safe configuration.

The Diesel Generator Buildings have a floor elevation of 565.5 ft. (msl). The re-evaluated LIP event exceeds the DGB floor elevation at the exterior doors by up to 1.1 ft. (msl). Both buildings have five similar exterior doors (Doors 272-276 U1/U2, Doors 800-804 U3), each accessing one of the four diesel generator bays or the CO_2 room (References 17 and 18). The external doors are normally closed, watertight doors designed for the PMF water elevation of 578.0 ft. (msl) (Reference 7). Given the watertight design of the doors, the limited flood height and the short duration of exposure, little or no LIP flood water would enter the Diesel Generator Buildings through these exterior doors.

The Unit 1/2 and Unit 3 Diesel Generator Building design includes an emergency drain line(s) in the corridor outside the diesel generator bays to drain water from the building interior in the event of an Emergency Equipment Cooling Water (EECW) header break inside the building. The emergency drain lines have normally open shutoff valves and are routed to valve pits, located at 565.0 ft. (msl), just outside the diesel generator building. The re-evaluated LIP flood water in the lower plant areas could potentially backflow through the emergency drain lines into the diesel generator bay compartments through the floor drain piping and exceed the critical elevation of 566.17 ft. (msl) or approximately 8 inches above the 565.5 ft. (msl) floor elevation. Backflow of LIP flood water into the diesel building would result in a Diesel Generator Floor Drain Sump Level High alarm in the control room. The alarm response procedure requires Operations personnel to be dispatched to investigate the cause of the alarm. Each diesel generator bay has a normally closed door between the corridor and the safety related components inside the diesel bay (Doors 280-284 U1/U2, Doors 805-809 U3), limiting the potential flow of water directly from the corridor into the diesel bays (References 17 and 18).

TVA committed to an Interim Action in the FHRR (Reference 1) to determine a resolution to the potential for LIP flood water backflow into the Diesel Generator Buildings through the emergency drain lines. After reviewing multiple options including physical plant modifications, TVA determined that BFN plant specific procedures would be developed and implemented to close the emergency drain line isolation valves based on weather forecast warnings, Diesel Generator Building sump level alarms, meteorological tower water accumulation alarms and/or other plant flooding indications. In addition, TVA supplemented the HEC-HMS LIP reevaluation provided in the FHRR submittal with a two-dimensional LIP event analysis of the Lower Plant Area using the FLO-2D computer code (Reference 19). The supplemental analysis provided a more precise LIP flood event duration at various site locations as well as flood hydrographs at the emergency drain valve pits supporting the determination of the time required to respond to the LIP event and close the drain line isolation valves. Although case studies were performed utilizing various inputs including application of updated precipitation data from Applied Weather Associates, the Mitigating Strategies Assessment is based on analysis using precipitation input from Hydrometeorological Report No. 56 (HMR 56). In the supplemental FLO-2D analysis, the LIP event flood height increased in many locations in the vicinity of the main plant. The impact of the increased LIP flood height was evaluated for the Reactor Building, Intake Pumping Station, Radwaste, and the Diesel Generator Buildings. Since the increased heights are significantly below the exterior protected flood height of 578.0 ft. (msl) and plant procedure isolate the Diesel Generator Building emergency drain lines, BFN safety-related components required for safe shutdown are not impacted by the increased LIP event flood height.

BFN Abnormal Operating Instruction, 0-AOI-100-7, R38, *Severe Weather* (Reference 20)**,** has been established to provide guidance to BFN Operations to close the emergency drain line isolations valve before the re-evaluated LIP flood waters could exceed the critical flooding elevation inside the Diesel Generator Building. Since LIP flooding protection credits plant critical exterior doors being in the closed position during the LIP event, 0-AOI-100-7 also includes direction to check the status of exterior flood protection doors when significant precipitation events are anticipated.

3.1.1.2. Flood Event Duration

Using the updated FLO-2D LIP simulation model (Reference 19), the duration for the re-evaluated LIP event and the period of inundation is up to 4 hours in areas where equipment is deployed. As discussed in 3.1.1.1, BFN is required to close the isolation valves for the EDG building emergency drain lines before floodwaters reach critical elevations inside the EDG building.

Therefore, the re-evaluated LIP event duration does not impact BFN design basis flood protection plans since safety related SSCs are protected.

3.1.1.3. Relevant Associated Effects

The LIP associated effects, such as debris loads, hydrodynamic and hydrostatic loads, wind wave and wave setup, and sediment and erosion are negligible to the low flow velocities and shallow water depths.

3.1.1.4. Warning Time

The BFN FHRR, Section 12 (Reference 1) identified potential backflow through the EDG Building emergency drain line in the LIP event. As discussed above in Section 3.1.1.1, BFN has instituted a BFN severe weather operating instruction to provide for closure of the emergency drain line isolation valves located in an open valve pit just outside the Unit 1/Unit 2 and Unit 3 EDG buildings' exterior doors. This action is a BFN protective action required to mitigate the potential effects of the re-evaluated LIP event on BFN safety related systems, structures and components (SSCs).

Warning time protocols established in BFN procedure 0-AOI-100-7 are consistent with NEI LIP Warning Time guidance (Reference 21). BFN Operations implements the LIP procedure for closure of the emergency drain line isolation valves based on the following inputs: NWS severe weather forecast, TVA Meteorologist significant rainfall warning, BFN meteorological tower rainfall accumulation alarms or reports of local flooding in buildings at plant grade. When the threat level is high, Operations directs personnel to the EDG buildings to monitor for any backflow through the emergency drains.

Sump level alarms in the EDG building sump also provide operations indications that backflow is potentially occurring. When backflow is observed into the EDG building, closure of the three isolation valves is performed.

There is no impact to BFN design basis flood protection plan for the re-evaluated LIP event.

3.1.2. Flooding on Rivers and Streams with Combined Effects

As noted in Table 3-1, the re-evaluated PMF (Flooding on Rivers and Streams) is bounded by the BFN design basis for this event and need not be addressed in the BFN MSA. However, since warning time, event duration, and period of inundation were not addressed in the BFN FHRR, these re-evaluated PMF attributes will be addressed in the BFN MSA.

3.1.2.1. Warning Time

BFN PMF flood warning protocols are defined in 0-AOI-100-3, Flood Above Elevation 558' (Reference 22). Per Section 4.2 of this procedure, flood protection activities are initiated and BFN Units 1, 2 and 3 are taken to Cold Shutdown when (1) the Wheeler reservoir reaches elevation 558 ft. (msl) and (2) TVA River Operations forecasting model projects that plant grade, 565.0 ft. (msl), will be exceeded. Based on the controlling design basis PMF flood hydrograph shown in BFN UFSAR Figure 16, more than 5 days of warning are provided before BFN plant grade is exceeded by the rising floodwaters associated with the spring (March) downstream centered

storm on the 21,400 sq. mi. watershed above Chattanooga, Tennessee, as defined in HRM No. 41.

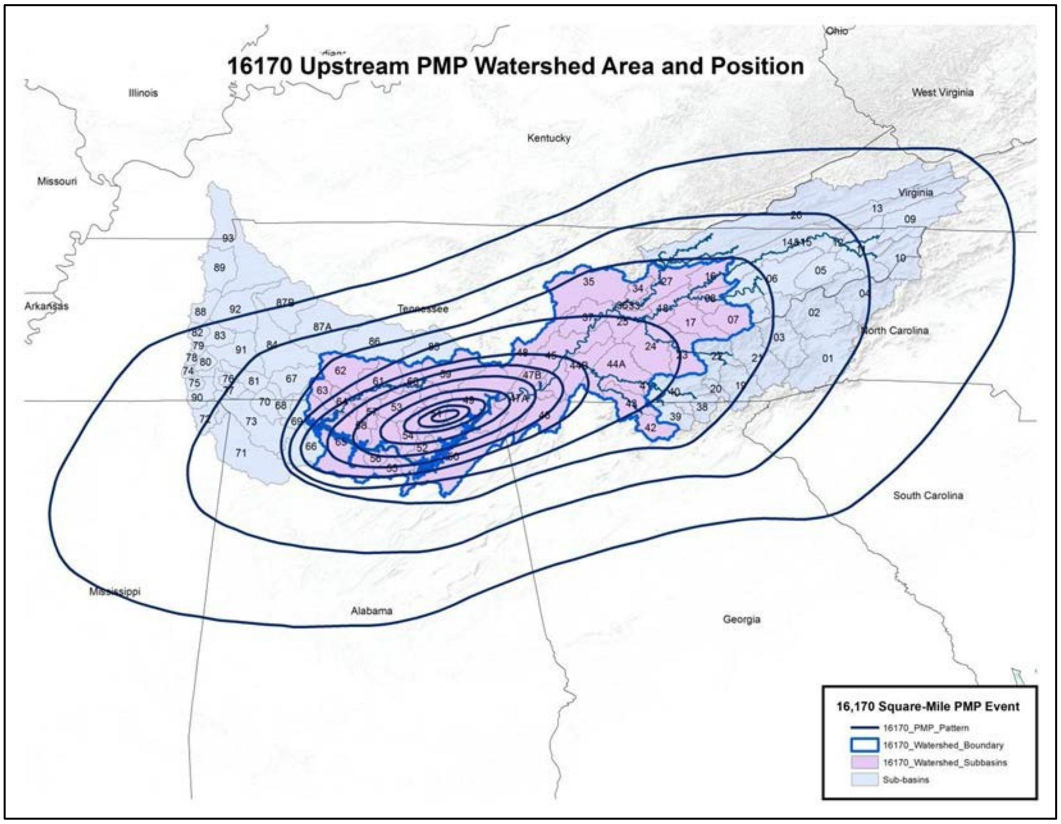
BFN flood protection barriers are designed ensure safety-related SSCs are protected up to the maximum design basis PMF stillwater flood level plus wind effects (578.0 ft. (msl)). BFN site activities required during the warning time before the PMF reaches plant grade included ensuring access doors/hatches are secured in their flood protection configuration, drain valves closed to prevent backflow into the plant, sump pumps are energized and plant equipment expected to be submerged is de-energized. These activities for preparation of the plant site for a design basis flood above grade are accomplished in less than 12 hours (Reference 23), well within the more than 5 days warning time.

The BFN design basis warning time has been re-assessed for the re-evaluated PMF event (Reference 24). For this reassessment, the probable maximum precipitation (PMP) for storms having the potential to create maximum flood conditions at operating TVA nuclear sites, defined for TVA by the Hydrometeorological Branch of the National Weather Service (NWS) in Hydrometeorological Report (HMR) No. 41 and HMR No. 47, were considered.

A series of candidate storms were reviewed to identify a bounding condition for the re-evaluation PMF warning time. The base storms considered were (1) a fixed 21,400 sq. mi. storm on the watershed above Chattanooga, Tennessee, (2) a fixed 16,170 sq. mi. storm on the watershed above Wheeler Dam but below the major tributary dams and (3) a 7,980 sq. mi. storm moveable along the long axis of the storm. In addition, seasonal and rainfall temporal distribution variations of the base storms were considered.

A 72-hour storm, 3 days antecedent to the main storm, was assumed to occur in all PMP situations with storm depths equivalent to 40 percent of the main storm as outlined in HMR 41. A three-day period with no rainfall is assumed prior to the 72-hour main storm.

Figure 3-1 – 16170 Upstream PMP Watershed Area and Position



A total of eight candidate storms were evaluated with HEC RAS model simulations (Reference 24) and the time for the flood stillwater elevation for each storm to rise from the initial warning at Wheeler reservoir elevation 558.0 ft. (msl) to BFN plant grade at elevation 565.0 ft. (msl) was determined. The HEC RAS model simulation applying the 16,170 sq. mi. March storm (Figure 3-1) with a late temporal peak, resulted in the 39 hour warning time (Reference 25) shown in Table 3-3. The provided 39-hour warning exceeds the less than 12 hours (Reference 23) required to complete the activities required for the BFN design basis flood protection plan.

Table 3-3 - BFN Warning Time Rain on Ground

Station	Hours After Event Start SWE=558	Hours After Event Start SWE = 565	Warning Time (hours)
7980J-2 EP	31.83	105.58	73.75
7980J-2 MP	42.33	119.42	77.08
7980J-2 LP	63.42	142.25	78.83
7980M-1 MP	47.83	119.67	71.83
21400USM MP	75.17	176.92	101.75
16170M EP	13.31	61.58	48.28
16170M MP	29.06	72.17	43.11
16170M LP	51.17	90.54	39.38

NOTE: if hours > 72, rainfall has concluded

There are no impacts to the BFN design basis flood protection activities due to the re-evaluated PMF warning time (Note: since combined effects of flooding and seismic events do not reach plant grade, warning time for these events is not required and are not addressed herein).

The re-evaluated BFN PMF warning times in Table 3-3 were derived using the flood model which contains the HEC-RAS modeling error as presented to the NRC in a public meeting on April 4, 2016 (ML16117A551/ML16102A330). As discussed with the NRC, the resolution of the HEC-RAS modeling error is expected to result in lower flood levels and result in increased warning time for BFN. TVA will provide a revised warning time analysis using updated precipitation data to the NRC within the submittals described in the milestone letter (Reference 26) for BFN.

3.1.2.2. Flood Event Duration and Flood Inundation Time

The re-evaluated PMF inundation time is the period of time when flood waters exceed plant grade. At BFN, the PMF reaches plant grade 327 hours into the PMF event and recedes from plant grade 505 hours into the event for a total inundation of 178 hours (7.4 days) (Reference 27).

The re-evaluated PMF flood event duration is the inundation time plus the duration from BFN flood operating procedure entry until the flood reaches plant grade. As noted above, the inundation period is approximately 7.4 days (Reference 27). The bounding time for entry into the flood operating procedure until the flood reaches plant grade is 3.8 days (Reference 28, Appendix G) for a total flood event duration of 11.2 days.

The inundation and flood event duration times have no impact on BFN design basis flood protection plans. The warning time provided as discussed in 3.1.2.1 provides sufficient time to implement the required BFN site design basis flood protection activities prior to the re-evaluated flood water reach plant grade.

3.2. NEI 12-06, Rev. 2, Section G.3 – Comparison of the MSFHI and FLEX DB Flood

Tables 3-4 and 3-5 reflect data from the FHRR for the East Switchyard Channel LIP and Lower Plant Area LIP, respectively, compared to the site’s CDB and FLEX design basis flood.

A table is not included for the LIP in the West Channel or PMF from rivers and streams because, as stated in Section 3.1, they are bounded by the CDB (Reference 5).

Any parameters where the FLEX DB flood does not bound the MSFHI are evaluated in Section 3.3.

Table 3-4 – Local Intense Precipitation (LIP) for East Switchyard Channel (LIP)

Flood Scenario Parameter		Plant's Current Design Basis	FLEX Design Basis	MSFHI	Bounded (B) or Not Bounded (NB)
Flood Level and Associated Effects	1. Max Stillwater Elevation (ft.) (msl)	<578.0	578.0	578.2	NB
	2. Max Wave Run-up Elevation (ft.) (msl)	N/A	N/A	N/A	B
	3. Max Hydrodynamic/Debris Loading (psf)	N/I	N/I	N/A	B
	4. Effects of Sediment Deposition/Erosion	N/I	N/I	N/A	B
	5. Other Associated effects (identify each effect)	N/I	N/A	N/A	B
	6. Concurrent Site Conditions	N/I	N/I	N/A	B
	7. Effects on Groundwater	N/I	N/I	N/A	B
Flood Event Duration	8. Warning Time (hours)	N/I	N/I	N/A	B
	9. Period of Site Preparation (hours)	N/I	N/I	N/A	B
	10. Period of Inundation (hours)	N/A	N/A	N/A	B
	11. Period of Recession (hours)	N/A	N/A	N/A	B
Other	12. Plant Mode of Operations	Any	Any	Any	B
	13. Other Factors	N/A	N/A	N/A	B

N/A = Not Applicable.

Additional notes, 'N/A' justifications (why a particular parameter is judged not to affect the site), and explanations regarding the bounded/non-bounded determination. The note numbers below correspond to the parameter number in the table.

1. Reflects that plant design basis LIP and FLEX design basis LIP elevations are the same and that the FHRR LIP elevations exceed the FLEX basis PMF elevations by 0.2 ft. The MSFHI LIP elevation is not bounded by the design basis for FLEX design basis.
2. Consideration of wind-wave action for the LIP event is not explicitly required by NUREG/CR-7046 and is judged to be negligible because of limited fetch lengths and flow depths.
3. Hydrodynamic and debris loading is judged to be negligible because of limited fetch lengths and flow depths.
4. The low velocities are not expected to transport sediment and cause significant deposition during the LIP event.
5. See Section 3.1.1.3 for evaluation of associated effects.
6. See Note 2 for concurrent wind and LIP effects.
7. Due to the LIP events short duration and extent of impermeable land cover, ground water levels around structures are not significantly affected.
8. Adequate time and guidance is available to prepare for the effects of storms, based on severe storm forecast evaluations by plant personnel (Reference 20).
9. No special preparation has been identified.
10. Since no FLEX equipment needs to go through the East Switchyard Channel, period of inundation was not analyzed.
11. Since no FLEX equipment needs to go through the East Switchyard Channel, period of recession was not analyzed.
12. A LIP even could occur in any of the six Modes of Operation.
13. Other factors are not applicable – N/A.

Table 3-5 – Local Intense Precipitation (LIP) for Lower Plant Area

Flood Scenario Parameter		Plant's Current Design Basis	FLEX Design Basis	MSFHI	Bounded (B) or Not Bounded (NB)
Flood Level and Associated Effects	1. Max Stillwater Elevation (ft.) (msl)	565.0	565.0	566.6	NB
	2. Max Wave Run-up Elevation (ft.) (msl)	N/A	N/A	N/A	B
	3. Max Hydrodynamic/Debris Loading (psf)	N/I	N/I	N/A	B
	4. Effects of Sediment Deposition/Erosion	N/I	N/I	N/I	B
	5. Other Associated effects (identify each effect)	N/A	N/A	N/A	B
	6. Concurrent Site Conditions	N/I	N/I	N/A	B
	7. Effects on Groundwater	N/I	N/I	N/I	B
Flood Event Duration	8. Warning Time (hours)	N/I	N/I	N/A	B
	9. Period of Site Preparation (hours)	N/I	N/I	N/A	B
	10. Period of Inundation (hours)	N/I	N/I	1.5	B
	11. Period of Recession (hours)	N/I	N/I	3	NB
Other	12. Plant Mode of Operations	Any	Any	Any	NB
	13. Other Factors	N/A	N/A	N/A	B

N/A = Not Applicable

Additional notes, 'N/A' justifications (why a particular parameter is judged not to affect the site), and explanations regarding the bounded/non-bounded determination. The note numbers below correspond to the parameter number in the table.

1. Since the evaluation of LIP in the FHRR (Reference 1), a new calculation has been developed that evaluates the flooding depths around exterior doors at the power house structures. Some of these depths surpass 566.6 feet. Discussion of these depths is contained in Section 3.1.1.1.
2. Consideration of wind-wave action for the LIP event is not explicitly required by NUREG/CR-7046 and is judged to be negligible because of limited fetch lengths and flow depths.
3. Hydrodynamic and debris loading is judged to be negligible because of limited fetch lengths and flow depths.
4. The low velocities are not expected to transport sediment and cause significant deposition during the LIP event.
5. See Section 3.1.1.3 for evaluation of associated effects.
6. See Note 2 for concurrent wind and LIP effects.
7. Due to the LIP events short duration and extent of impermeable land cover, ground water levels around structures are not significantly affected.
8. Adequate time and guidance is available to prepare for the effects of storms, based on severe storm forecast evaluations by plant personnel (Reference 20).
9. See Section 3.1.1.4 for discussion of warning time to mitigate backflow through the EDG Building emergency drain line.
10. Since recession time is location dependent, the deepest water depth of the FLEX staging areas used was chosen for evaluation. It was determined that that portion of the path would be inundated for approximately 1.5 hours. See Reference 29 and Section 3.3.1.1 for details.
11. Since recession time is location dependent, the deepest water depths at the FLEX staging areas used were chosen for evaluation. It was determined the water would recede 3 hours after the peak water depth. See Reference 29 and Section 3.3.1.1 for details.
12. A LIP event could occur in any one of the six Modes of Operation.
13. Other factors are not applicable – N/A.

3.3. NEI 12-06, Rev. 2, Section G.4 – Evaluation of Mitigating Strategies for the MSFHI

3.3.1. NEI 12-06, Rev. 2, Section G.4.1 – Assessment of Current FLEX Strategies

3.3.1.1. LIP Assessment

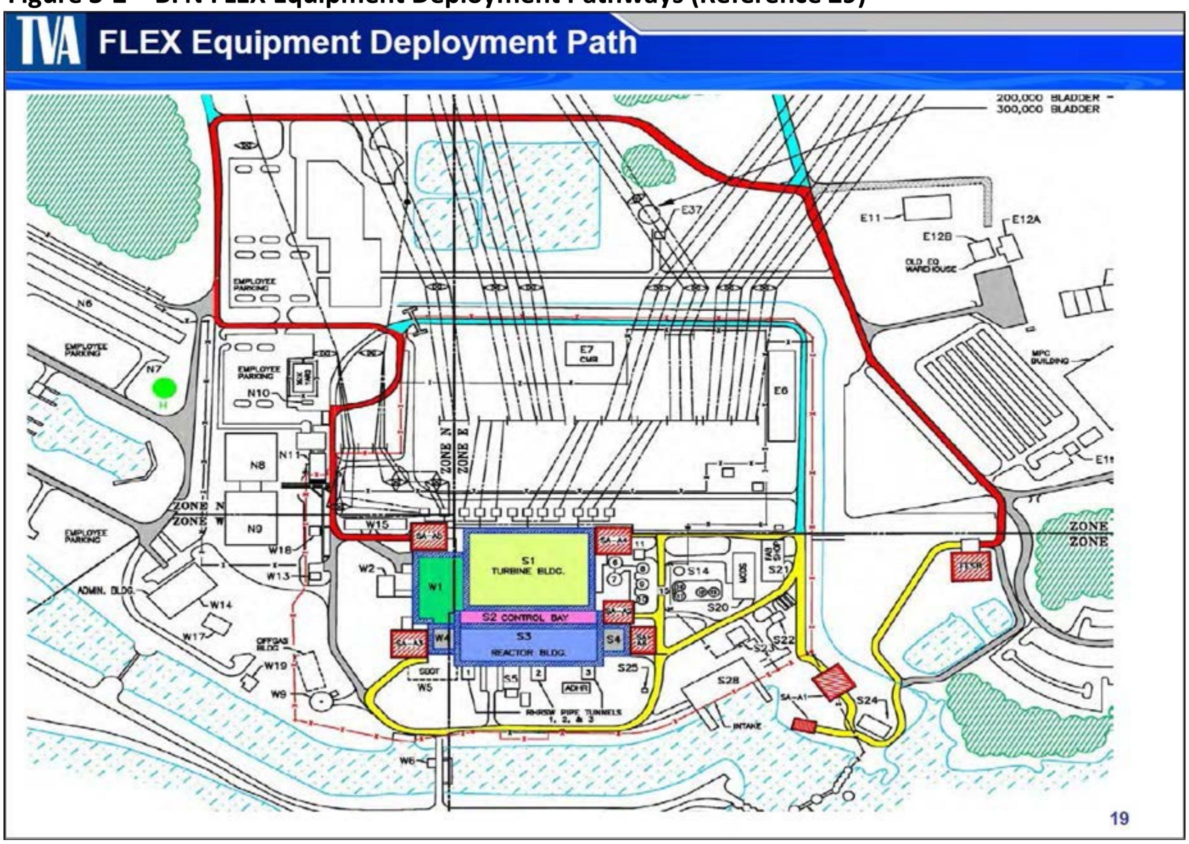
Since re-evaluated LIP simulations result in an increased flood height compared to the plant and FLEX design basis, an assessment of the BFN FLEX Mitigating Strategies, as defined in Reference 30, is necessary. Potential impacts of the re-evaluated LIP event on the BFN design basis flood protection plan are addressed in Section 3.1.1.1.

An ELAP could occur at any time during the LIP event. The most constraining case for FLEX deployment would be for the ELAP event to take place at the start of the one hour LIP event with a late peak in the rainfall temporal distribution.

a. Flood Height

The FESB is positioned to be above the re-evaluated LIP event flood height. Deployment routes shown in Figure 3-2 will be utilized to transport FLEX equipment to the staging areas from the FLEX storage building. The re-evaluated LIP flood hydrographs for FLEX equipment stating areas and deployment paths are provided in Reference 29.

Figure 3-2 – BFN FLEX Equipment Deployment Pathways (Reference 29)



- The 480V FLEX generator is staged at SA-A2. Peak water depth of 0.56 feet will occur approximately one hour into the LIP event. The water falls below 2 inches 0.7 hours after the peak water depth, and is completely receded 2.3 hours after the peak water depth. The flood height along the path to SA-S2 does not exceed 1.5 ft. of water, and in most areas the flooding is below a foot. It takes 5 hours and 45 minutes to fully deploy the 480V FLEX generator (Reference 31). Since

there is less than 2 inches of water remaining 2 hours after the LIP starts, the 480V FLEX generator will be able to be deployed in the maximum 8 hour time frame described in the FLEX Program Bases Document (Reference 2). The deployment of the 480V FLEX Generator is governed by procedure 0-FSI-3A (Reference 32). Given the shallow depths and recession time, this procedure can be implemented as designed.

- FLEX Pumps are staged at SA-A1. The path to SA-A1 does not see any flooding, and one of the pump pads is at elevation 578 ft. This is well above the re-evaluated LIP height of 566.6 ft. (msl) in the Lower Plant Area. The peak flood height in the area hoses are run from SA-A1 to the Intake Pumping Station is 0.65 ft. at 1 hour. An hour later the water is receded to 0.04 ft. The maximum flood height where the cables enter the Intake Pumping Structure is 1.89 ft., 1 hour after the start of the LIP event. Flood waters are around 0.3 ft., 2.5 hours after the peak water height. It takes 4 hours and 1 minute to fully deploy a FLEX Pumping System (Reference 31), which is well within the 8 hour time frame provided in the FLEX Program Bases Document (Reference 2). The deployment of FLEX Pumps is governed by procedures 0-FSI-2A (Reference 33), 0-FSI-2B (Reference 34), and 0-FSI-2C (Reference 35). Given the shallow depths and recession time, these procedures can be implemented as designed.

- One or two 4KV FLEX generators are staged at SA-A4 (preferred area) and/or SA-A5 during flooding events (References 2 and 36). SA-A4 will be under 1.09 ft. of water in some areas one hour into the LIP event. Water recedes to less than 6 inches 0.4 hours after its peak and is completely receded 3 hours after the peak water height. The flood height along the path to SA-S4 does not exceed 1.5 ft. of water, and in most areas the flooding is below a foot. It takes 4 hours and 4 minutes to fully deploy the 4KV FLEX generators (Reference 31). Since the water recedes fairly quickly and SA-A4 is the preferred staging area for the 4KV FLEX generators, the FLEX equipment can be deployed in the 8 hour time frame described in the FLEX Program Bases Document (Reference 2). The deployment of 4KV FLEX generators is governed by procedure 0-FSI-3C (Reference 36). Given the shallow depths and recession time, this procedure can be implemented as designed.

- As mentioned above, SA-A5 is an alternate staging area for the 4KV FLEX generators. SA-A5 reaches a peak flood height of 0.27 feet one hour into the LIP event, and water is almost completely receded (0.03 feet per Reference 29) 1 hour later. Parts of the path to SA-A5 will also potentially be under 2 ft. of water for approximately 1.5 hours.

- Staging areas SA-A3 and SA-A6 and the pathways around SA-A3 will possibly exceed 2 ft. of water for several hours during the LIP event (Reference 29). However, no equipment needs to be deployed to these staging areas during a LIP flood event.

Conclusion: Based on the flood levels shown in Reference 29, flooding levels along the haul paths and at the SA-A1, SA-A2, and SA-A4 staging areas necessary for FLEX deployment is minimal. The Ford F550 and trailers (Reference 2) used in the deployment of FLEX equipment will be able to traverse such shallow depths. Equipment will be able to be deployed and mobilized as required. However, once the FLEX implementation timeline is finalized, the ability to deploy and mobilize FLEX equipment within the allotted timeframe from the final FLEX documents will be verified to ensure the BFN FLEX strategies can be implemented as designed. Condition Report CR#1231026 has been initiated to track completion of this activity (Reference 3).

b. Potential FLEX Timeline Impacts

The initial and extended load shed actions are conducted within the Control Buildings and are not impacted by the LIP event. The LIP event is of such a short duration, the FLEX strategy deployment time may be delayed but does not prevent successful deployment as described below.

- The first time critical deployment starts at T_0 + 0.5 hours, where T_0 is the start of the ELAP and the LIP. At T_0 = 0.5 hours an ELAP is declared and 0-FSI-1 (Reference 37) is initiated.

- Deployment of the 480V FLEX generator to SA-A2
  - At T_0 + 0.9 hours: Teams 1 and 2 are briefed (Team 1, performing connections, begins connection activities; Team 2, performing deployment and staging, holds deployment, based on 0-FSI-6A assessments (Reference 38)).
  - At T_0 + 1 hour: LIP rainfall stops. There is 0.6 ft. of water at SA-A2 and less than 1.5 ft. of water on the deployment path.
  - At T_0 + 2.2 hours: Team 2 begins.
  - At T_0 + 3.9 hours: Team 1 is ready for the 480V FLEX generator/fuel trailer and Team 2 is ready for connections.
  - At T_0 + 6.3 hours: activity is complete.

  Conclusion: The deployment of the FLEX generator must be complete in 8 hours. Team 2 is delayed for 1 hour and 17 minutes while water recedes to less than 2 inches on the path to the FESB and at SA-A2. A margin of 1 hour and 45 minutes is provided.

- Deployment of FLEX Pump Systems to SA-A1
  - At T_0 + 0.8 hours: Team 2 is briefed but, based on 0-FSI-6A assessments, delayed while water recedes from path to the FESB and between the SA-S1 location and the IPS RHRSW/EECW headers.
  - At T_0 + 1 hour: LIP rainfall stops. There is less than 1.5 feet on the walk to FESB and 1.89 ft. of water around the IPS in the hose hook up area.
  - At T_0 + 2.2 hours: Team 2 begins travel to FESB.
  - At T_0 + 3.5 hours: two FLEX Pump Systems are set up.
  - At T_0 + 5.6 hours: hose routing and connection activities are complete.

  Conclusion: Deployment of FLEX Pump Systems must be complete within 8 hours. Team 2 is delayed for 1 hour and 22 minutes while water recedes on the path to the FESB and the hose routing area. A margin of 2 hours and 27 minutes is still provided.

- Deployment of the 4kV FLEX generator to SA-A4 (if used over the 480V FLEX generator)
  - At T_0 + 0.9 hours: Teams are briefed (Team 1, performing connections, begins connection activities; Team 2, performing deployment and staging, holds, based on 0-FSI-6A assessments (Reference 38)).
  - At T_0 + 1 hour: LIP rainfall stops. There is less than 1.5 feet of water on walk to FESB.
  - At T_0 + 2.2 hours: Team 2 begins.
  - At T_0 + 4 hours: the cable trailer is staged.
  - At T_0 + 4.8 hours: a 4kV FLEX generator is staged.

- At T_0 + 5.6 hours: the 4kV fuel trailer is staged.
- At T_0 + 6.15 hours: the activity is complete.

Conclusion: The 4 kV FLEX generator in this scenario must be deployed within 8 hours. Team 2 is delayed for 1 hour and 17 minutes while water recedes on the path to the FESB and at SA-A4. A margin of 1 hour and 51 minutes is still provided.

Conclusion: As a result of 0-FSI-6A assessments, teams briefed to deploy and stage the FLEX 480V or 4kV diesel generators and the LP FLEX pumps may be delayed minutes while LIP floodwaters recede. This delay does not impact the required 8 hour completion time for these activities**.** All other outdoor FLEX deployment actions take place sufficiently after the LIP waters have receded to levels such that there will be no constraints on deployment activities.

For Phase 3, the NSRC's ability to transport equipment to Staging Area B (site location where equipment will be pre-staged, parked, or placed prior to movement into the final location) is discussed in Section 3.1. Since deployment of NSRC equipment occurs later in the event (after 24 hours), the LIP will have receded and no further analysis is necessary.

3.3.1.2. Flooding on Rivers and Streams with Combined Effects Assessment

The re-evaluated PMF (Flooding in Rivers and Streams) flood height is bounded by the BFN design basis for this event and need not be addressed in the BFN MSA. However, since warning time was not addressed in the BFN FHRR, potential warning time impacts to BFN FLEX Mitigating Strategies will be addressed.

a. PMF Warning Time

As described in Section 3.1.2.1, warning time from notification of Wheeler reservoir at 558.0 ft. (msl) and entry into BFN 0-AOI-100-3 until the re-evaluated PMF reaches BFN plant grade at 565.0 ft. (msl) is approximately 39 hours. As directed by 0-AOI-100-3, Step 1.1.2, BFN FLEX equipment will be deployed (0-AOI-100-3, Attachment 3) when the initial warning is given. FLEX pre-flood deployment activities and design basis flood protection activities will be completed in less than 12 hours (Reference 23). Therefore, the re-evaluated warning time does not impact pre-flood FLEX deployment activities credited in the BFN FLEX Mitigating Strategies.

Conclusion: The re-evaluated warning time does not impact pre-flood FLEX deployment activities credited in the BFN FLEX Mitigating Strategies. However, other BFN FLEX procedures are potentially impacted by the reduced warning time associated with the re-evaluated PMF. Existing FLEX strategies, discussed in Reference 30, assume more than 5 days are available before the BFN site is flooded after the initial warning is given, based on the design basis PMF flood hydrograph (BFN FSAR Section 2.4a, Figure 16). The impact to BFN procedure 0-AOI-100-3 has been documented in BFN Condition Report CR#1234555. Other procedures will be updated as necessary.

b. PMF Flood Event Duration and Inundation

The re-evaluated PMF flood event duration is the inundation time plus the duration from BFN flood operating procedure entry until the flood reaches plant grade. As noted in Section 3.1.2.2, the inundation period is approximately 7.4 days (Reference 27). The bounding time for entry into the flood operating procedure until the flood reaches plant grade is 3.8 days (Reference 28, Appendix G) for a total flood event duration of 11.2 days.

Staging area SA-A1 for the FLEX equipment has concrete pads at elevations 558 ft. (msl) and 578 ft. (msl). The pad at 558 ft. will be flooded during the PMF, but the 578 ft. pad will be above the maximum PMF elevation of 572.1 ft. (msl). Staging area SA-A2 for the 480V FLEX diesel generator is a concrete pad at elevation 578 ft. (msl). Staging area SA-A4 for the 4kV FLEX diesel generator is a concrete pad at elevation 578 ft. (msl). All three staging areas are above the PMF flood height.

As defined in Reference 2, the FLEX Program Bases Document, an ELAP is assumed to occur at the peak of the PMF. Per Reference 24, the PMF peak flooding elevation is 572.1 ft. (msl). The PMF flood recedes to plant grade, 565.0 ft. (msl), 98 hours after the ELAP occurs. It is conservatively assumed the diesel driven FLEX pumps and FLEX generators begin operation at the start of the ELAP event. The usage rate of each of the two FLEX generators is 128 gallons per hour. The total usage rate of all of the FLEX pumps is 129 gallons per hour. Including minimal fuel usage from the tow/fuel devices and debris removal device, the total FLEX equipment consumption rate is 394 gallons per hour (Reference 2). Tanker trucks or Fuel Oil Storage Tanks, stored in the FESB, are used as a fuel source during flooding events (Reference 39). As a precaution, in the event there is an ELAP during the PMF, additional fuel tanker trucks will be obtained from off-site locations during the 39-hour PMF warning time to supplement the on-site fuel storage until the EDG 7-day storage tanks are accessible. These fuel trucks and storage tanks will be stationed at locations which will permit refueling of the FLEX equipment during the site inundation period.

Long term fuel supply/replenishment supplies are assured through existing contracts with Mansfield Oil Company of Gainesville, Inc. (TVA Contracts 6992 and 6993). Additional fueling/refueling equipment is provided by the NSRC for backup and use during Phase 3 (Reference 2).

The BFN SAFER Response Plan (Reference 40) includes multiple methods (i.e., trucks, airplanes, helicopters, boats, etc.) and paths to transport additional diesel fuel, supplies, and redundant FLEX equipment to the site. Therefore, this FED will not impact FLEX implementation strategies. The FED is not addressed in the CLB.

Conclusion: The FHRR PMF flood event duration does not impact BFN FLEX Mitigating Strategies.

c. Flood Event Inundation Time – Access Roads

An evaluation of travel routes from both Huntsville and Northwest Alabama Regional Airport to BFN was conducted. The evaluation determined that PMF flood waters would prohibit some key road access to BFN beginning at approximately 239 hours into the event and would recede to a point where road access is restored no less than 571 hours into the event. Although access from offsite is partially restricted for nearly 14 days (Reference 27), the BFN SAFER Response Plan (Reference 40) includes multiple methods (i.e., trucks, airplanes, helicopters, boats, etc.) and paths to transport equipment to the site.

Conclusion: The inundation of BFN site access roads will not impact FLEX implementation strategies.

3.3.1.3. Review and Conclusions

BFN FLEX Mitigation Strategies in response to an ELAP and loss of ultimate heat sink event have been developed in accordance with the BFN flooding reevaluation (Reference 1).

For the re-evaluated LIP event, BFN revised procedure 0-AOI-100-7 (Reference 20) to mitigate the potential backflow through the Diesel Generator interior flooding drain lines into the Diesel Generator Buildings during a LIP event. The re-evaluated LIP event impact to the FLEX deployment

timeline activities is acceptable, and the main FLEX deployment path remains available for the deployment and mobilization of FLEX equipment.

The re-evaluated warning time, flood event duration, and flood inundation assessed for PMF have been assessed for impacts to FLEX Strategies for the re-evaluated PMF event. Although no impacts to pre-flood deployment of equipment credited in BFN FLEX Mitigating Strategies were identified, there are potential impacts to procedures associated with the reduced warning time. The warning time will be updated in procedure 0-AOI-100-3 and is documented in BFN Condition Report CR#1234555. Other procedures will be revised as necessary.

Therefore, except for the reduced warning time for PMF, the flooding reevaluation has no impact on the BFN FLEX strategy. Equipment and personnel will be available such that the BFN FLEX Strategies can be implemented as described in the Overall Integrated Plan (Reference 30).

3.3.2. NEI 12-06, Revision 2, Section G.4.2 – Assessment for Modified FLEX Strategies

Browns Ferry FLEX Mitigation Strategies as presented in Reference 2 are acceptable without modification.

4 References

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2. Tennessee Valley Authority, Report 0-TPP-ENG-632 BASES, Revision 1, Diverse and Flexible Coping Strategies (FLEX) Program Bases Document, October 21, 2016.

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4. Nuclear Energy Institute, NEI 12-06, Revision 2, Diverse and Flexible Coping Strategies (FLEX) Implementation Guide, December 2015.

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6. Tennessee Valley Authority, Drawing 46W401-10, Revision 0, Architectural Plans El. 519.0 & El. 565.0, June 28, 1968.

7. Tennessee Valley Authority, Browns Ferry Updated Final Safety Analysis Report

8. Tennessee Valley Authority, Drawing 0-34N303, Revision 0, Watertight Personnel Access Doors, November 2, 1972.

9. Tennessee Valley Authority, Calculation MDQ0023870149, Revision 13, RHRSW Pump Compartment Sump and Sump Pump Capacity, March 31, 2016.

10. Tennessee Valley Authority, Drawing 1-47E225-110, Harsh Environment Data El. 565.0, Revision 2.

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13. Tennessee Valley Authority, Drawing 1-47E225-100, Harsh Environment Data Index, Revision 3.

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15. Tennessee Valley Authority, Drawing 3-47E225-100, Harsh Environment Data Index, Revision 7.

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17. Tennessee Valley Authority, Drawing 47W401-16, Revision 1, Architectural Plans El. 565.5 & El. 583.5, May 5, 1969.

18. Tennessee Valley Authority, Drawing 3-46W401-20, Revision 0, Architectural Plans – El. 565.5 & El. 583.5, February 7, 1973.

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20. Tennessee Valley Authority, Procedure 0-AOI-100-7, Revision 38, Abnormal Operating Instruction Severe Weather, August 1, 2016.

21. Nuclear Energy Institute, NEI 15-05, Revision 6, Warning time for Local Intense Precipitation Events, April 2015.

22. Tennessee Valley Authority, BFN Operating Procedure, 0-AOI-100-3, Revision 44, Flood Above Elevation 558', April 20, 2016.

23. Tennessee Valley Authority, BFN, Validation of 0-AOI-100-3 in accordance with BFN-ODM-4-43, October 20, 2016 (R40161020704).

24. Barge Waggoner Sumner and Cannon, Inc., BWSC Technical Paper, MSA Warning Time Analysis for WBN, SQN and BFN, Revision 1, August 8, 2016 (B41160815001).

25. Tennessee Valley Authority, Calculation CDQ0000002015000036, Revision 0, Warning Time Simulations.

26. Tennessee Valley Authority, Letter to U.S. Nuclear Regulatory Commission, Hydrologic Engineering Center River Analysis System (HEC-RAS) Project Milestones, CNL-16-083, June 22, 2016 (ML16175A518).

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33. Tennessee Valley Authority, BFN FLEX Support Instruction, 0-FSI-2A, Revision 1, FPS1 Setup and Operation (EECW Manifold).

34. Tennessee Valley Authority, BFN FLEX Support Instruction, 0-FSI-2B, Revision 0, FPS2 Setup and Operation (RHRSW B Manifold).

35. Tennessee Valley Authority, BFN FLEX Support Instruction, 0-FSI-2C, Revision 1, FPS3 Setup and Operation (RHRSW D Manifold).

36. Tennessee Valley Authority, BFN FLEX Support Instruction, 0-FSI-3C, Revision 1, 4KV FLEX Generator Setup and Operation.

37. Tennessee Valley Authority, BFN FLEX Support Instruction, 0-FSI-1, Revision 2, FLEX Response Instruction.

38. Tennessee Valley Authority, BFN FLEX Support Instruction, 0-FSI-6A, Revision 0, Damage Assessment.

39. Tennessee Valley Authority, BFN FLEX Support Instruction, 0-FSI-6B, Revision 0, FLEX Long Term Fueling Options.

40. Areva Engineering Information Record Document No. 51-9233061-000. Browns Ferry Nuclear Plant SAFER Response Plan, February 11, 2015.

41. Tennessee Valley Authority, Request for Information TVAEBFN060-RFI-002, BFN MSA Request for Information (W50 160803 001).

ENCLOSURE 2

COMMITMENT

1. TVA will provide a revised BFN warning time analysis using updated precipitation data to the NRC within the Focused Evaluation described in the HEC-RAS Project Milestones letter dated June 22, 2016. The current completion date for the Focused Evaluation is December 31, 2017.