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

May 2, 2017

Vice President, Operations
Entergy Operations, Inc.
River Bend Station
5485 U.S. Highway 61N
St. Francisville, LA 70775

SUBJECT: RIVER BEND STATION, UNIT 1 – FLOOD HAZARD MITIGATION STRATEGIES ASSESSMENT (CAC NO. MF7968)

Dear Sir or Madam:

By letter dated March 12, 2012 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML12053A340), the U.S. Nuclear Regulatory Commission (NRC) issued a request for information to all power reactor licensees and holders of construction permits in active or deferred status, pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR), Section 50.54(f), (hereafter referred to as the "50.54(f) letter"). The request was issued in connection with implementing lessons learned from the 2011 accident at the Fukushima Dai-ichi nuclear power plant, as documented in the NRC's Near-Term Task Force (NTTF) report (ADAMS Accession No. ML111861807).

Enclosure 2 to the 50.54(f) letter requested that licensees reevaluate flood hazards for their sites using present-day methods and regulatory guidance used by the NRC staff when reviewing applications for early site permits and combined licenses (ADAMS Accession No. ML12056A046). Concurrent with the reevaluation of flood hazards, licensees were required to develop and implement 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" (ADAMS Accession No. ML12054A735). In order to proceed with implementation of Order EA-12-049, licensees used the current licensing basis flood hazard or the most recent flood hazard information, which may not be based on present-day methodologies and guidance, in the development of their mitigating strategies.

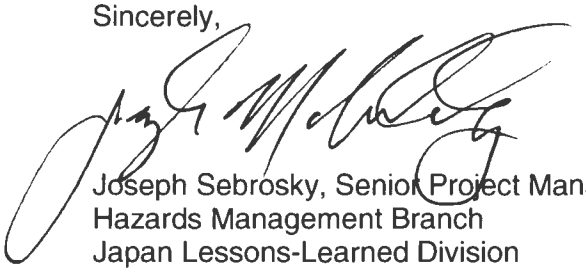
By letter dated October 24, 2016 (ADAMS Accession No. ML16302A158), Entergy Operations, Inc. (the licensee) submitted the mitigation strategies assessment (MSA) for River Bend Station, Unit 1 (River Bend). The MSAs are intended to confirm that licensees have adequately addressed the reevaluated flooding hazard(s) within their mitigating strategies for beyond-design-basis external events. The purpose of this letter is to provide the NRC's assessment of the River Bend MSA.

The NRC staff has concluded that the River Bend MSA was performed consistent with the guidance described in Appendix G of NEI 12-06, Revision 2, as endorsed by Japan Lessons-Learned Division (JLD) interim staff guidance (ISG) JLD-ISG-2012-01, and that the licensee has demonstrated that the mitigation strategies, if appropriately implemented, are reasonably

protected from reevaluated flood hazards conditions for beyond-design-basis external events. This closes out the NRC's efforts associated with CAC No. MF7968.

If you have any questions, please contact me at 301-415-1132 or at Joseph.Sebrosky@nrc.gov.

Sincerely,



Joseph Sebrosky, Senior Project Manager
Hazards Management Branch
Japan Lessons-Learned Division
Office of Nuclear Reactor Regulation

Enclosure:
Staff Assessment Related to the
Mitigating Strategies for River Bend

Docket No. 50-458

cc w/encl: Distribution via Listserv

STAFF ASSESSMENT RELATED TO THE

MITIGATION STRATEGIES FOR

RIVER BEND STATION, UNIT 1

AS A RESULT OF THE REEVALUATED FLOODING HAZARDS REPORT

NEAR-TERM TASK FORCE RECOMMENDATION 2.1- FLOODING

CAC NO. MF7968

1.0 INTRODUCTION

By letter dated March 12, 2012 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML12053A340), the U.S. Nuclear Regulatory Commission (NRC) issued a request for information to all power reactor licensees and holders of construction permits in active or deferred status, pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR), Section 50.54(f), (hereafter referred to as the "50.54(f) letter"). The request was issued in connection with implementing lessons learned from the 2011 accident at the Fukushima Dai-ichi nuclear power plant, as documented in the NRC's Near-Term Task Force (NTTF) report (ADAMS Accession No. ML111861807). Enclosure 2 to the 50.54(f) letter requested that licensees reevaluate flood hazards for their sites using present-day methods and regulatory guidance used by the NRC staff when reviewing applications for early site permits and combined licenses (ADAMS Accession No. ML12056A046).

Concurrent with the reevaluation of flood hazards, licensees were required to develop and implement 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" (ADAMS Accession No. ML12054A735). That order requires holders of operating reactor licenses and construction permits issued under 10 CFR Part 50 to modify the plants to provide additional capabilities and defense-in-depth for responding to beyond-design-basis external events, and to submit to the NRC for review a final integrated plan that describes how compliance with the requirements of Attachment 2 of the order was achieved. In order to proceed with implementation of Order EA-12-049, licensees used the current licensing basis flood hazard or the most recent flood hazard information, which may not be based on present-day methodologies and guidance, in the development of their mitigating strategies.

The NRC staff and industry recognized the difficulty in developing and implementing mitigating strategies before completing the reevaluation of flood hazards. The NRC staff described this issue and provided recommendations to the Commission on integrating these related activities in COMSECY-14-0037, "Integration of Mitigating Strategies for Beyond-Design-Basis External Events and the Reevaluation of Flood Hazards," dated November 21, 2014 (ADAMS Accession No. ML14309A256). The Commission issued a staff requirements memorandum on March 30, 2015 (ADAMS Accession No. ML15089A236), affirming that the Commission expects licensees for operating nuclear power plants to address the reevaluated flood hazards, which are considered beyond-design-basis external events, within their mitigating strategies.

Nuclear Energy Institute (NEI) 12-06, Revision 2, "Diverse and Flexible Coping Strategies (FLEX) Implementation Guide" (ADAMS Accession No. ML16005A625), has been endorsed by the NRC as an appropriate methodology for licensees to perform assessments of the mitigating strategies against the reevaluated flood hazards developed in response to the March 12, 2012, 50.54(f) letter. The guidance in NEI 12-06, Revision 2, and Appendix G in particular, supports the proposed Mitigation of Beyond-Design-Basis Events rulemaking. The NRC's endorsement of NEI 12-06, including exceptions, clarifications, and additions, is described in NRC Japan Lessons-Learned Division (JLD) interim staff guidance (ISG) JLD-ISG-2012-01, Revision 1, "Compliance with Order EA-12-049, Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events" (ADAMS Accession No. ML15357A163). Therefore, Appendix G of NEI 12-06, Revision 2, describes acceptable methods for demonstrating that the reevaluated flooding hazard is addressed within the River Bend Station, Unit 1 (River Bend) mitigating strategies for beyond-design-basis external events.

2.0 BACKGROUND

By letter dated September 24, 2015 (ADAMS Accession No. ML15230A010), the NRC issued an interim staff response (ISR) letter for River Bend. The ISR letter provided the reevaluated flood hazards that exceeded the current design basis (CDB) for River Bend and were suitable input for the mitigating strategies assessment (MSA) (i.e., defines the mitigating strategies flood hazard information (MSFHI) described in NEI guidance document NEI 12-06). The mechanisms listed as not bounded by the CDB in the letter (ISR flood levels) are listed below:

- Local intense precipitation (LIP) – the ISR flood level was higher than the CDB level;
- West Creek probable maximum flood (PMF) – the PMF event on West Creek ISR flood level was higher than the CDB level; and
- Mississippi River PMF – the PMF event on the Mississippi River ISR flood level was higher than the CDB level.

The letter also stated that NRC staff would evaluate, as applicable, the flood event duration (FED) parameters (including warning time and period of inundation) and flood-related associated effects (AE) developed by the licensee during the NRC staff's review of the MSA. This is consistent with the guidance provided in Revision 2 of NEI 12-06. By letter dated October 24, 2016 (ADAMS Accession No. ML16302A158), Entergy Operations, Inc. (Entergy, the licensee) submitted its MSA for River Bend for review by the NRC staff. The MSA also included the relevant information regarding the FED and AEs needed to complete the review.

3.0 TECHNICAL EVALUATION

3.1 Mitigating Strategies under Order EA-12-049

The NRC staff evaluated the River Bend strategies as developed and implemented under Order EA-12-049. This evaluation is documented in a safety evaluation issued by letter dated August 11, 2016 (ADAMS Accession No. ML15292A508). The safety evaluation concluded that River Bend has developed guidance and proposed designs that, if implemented appropriately, will adequately address the requirements of Order EA-12-049.

A brief summary of the licensee's FLEX strategies are as follows:

- For Phase 1, the reactor core isolation cooling (RCIC) system is initiated at the beginning of the extended loss of alternating current power (ELAP) event and is aligned to automatically take suction from the suppression pool for core cooling, assuming the

condensate storage tank is not available. After operating for about four hours in this alignment, RCIC is realigned to take suction from the upper containment pool (UCP). If available, the UCP can provide enough water to provide make-up to the reactor pressure vessel (RPV) up to approximately the 34 hour point in the event.

- For Phase 2, suppression pool cooling (SPC) is utilized to cool the suppression pool and eventually the RPV through the SPC heat exchanger. The portable 500 kilowatt (kW) FLEX diesel generator (DG) will be used to power the SPC pumps. The portable 500kW FLEX DG will be placed in the "west canyon" outside the Auxiliary Building.

  One of two 2500 gallon per minute FLEX pumps will be used to provide cooling water to the SPC heat exchanger. The FLEX pump 1 is permanently staged (but not connected) in the "G" tunnel, which runs from the standby service water (SSW) basin to the Auxiliary Building. This location is a safety-related structure that is protected from the external hazards determined to be applicable to River Bend. Protection against seismically-induced flooding in the tunnel is provided by administrative controls to isolate susceptible piping,

- For Phase 3, the licensee will use equipment from the National SAFER Response Center (NSRC) to establish shutdown cooling. The equipment from the NSRC will be transported to its staging area near the site and will utilize the same deployment pathways as the Phase 2 equipment.

3.2 Evaluation of FLEX Strategies

River Bend's current FLEX strategy is described in the document, "Final Integrated Plan [FIP] Document - River Bend Station" (ADAMS Accession No. ML15279A345). The FIP describes how the mitigating strategies were developed considering a maximum flood height elevation of 98.3 feet (ft.) mean sea level (MSL). This flood height is considered the FLEX design-basis (DB).

The ISR letter concluded that the LIP flood, the Mississippi River PMF, and the West Creek PMF are not bounded by the CDB. The licensee stated in the MSA that the FLEX strategies can still be implemented considering the reevaluated flood levels for the Mississippi River and West Creek PMF events, but the FLEX strategy would need to be modified for the reevaluated LIP flood event.

The West Creek PMF is bounded by the FLEX DB and does not challenge the deployment pathways and/or doorways required to ensure FLEX strategies can be implemented successfully. The Mississippi River PMF is 35 ft. below plant grade and does not affect any safety-related equipment. The maximum flood height for a LIP event is bounded by the FLEX DB. However, the period of inundation and the period of recession is not bounded by the FLEX DB. A LIP event causes certain areas along the deployment routes to become significantly flooded and challenges the deployment of certain Phase 2 equipment. Also, flood levels could be above several doorways required to be opened for Phase 2 implementation.

Local Intense Precipitation

Section 2.1 of the MSA describes the MSFHI LIP maximum flood height of 98.3 ft. MSL, which is 2.3 ft. higher than the CDB LIP flood height of 96 ft. MSL. The LIP flood height is bounded by (i.e., equals) the FLEX DB flood height of 98.3 ft. MSL. However, the period of inundation and period of recession is not bound by the FLEX DB. The flooding levels near the staging areas and deployment routes do not recede sufficiently during the period that Phase 2 equipment is being deployed and challenges the deployment of this equipment. The licensee noted that

there is no challenge to the deployment of Phase 3 equipment, as this equipment is deployed later in the event (after 24 hours), when water levels have receded.

The FLEX storage buildings are not impacted by the LIP flood height. The northern FLEX storage building is located at an elevation of 132 ft. MSL and the southern FLEX storage building is located at an elevation of 110 ft. MSL, which are above the LIP maximum flood height of 98.3 ft. MSL. Both are constructed on a concrete 12 inch slab and have a 6 inch curb inside the building walls. Additionally, grading and drainage direct storm water runoff away from the buildings and towards the existing plant storm drainage system.

The NRC staff reviewed the licensee's assessment of the reevaluated LIP event as compared to existing FLEX strategies in the MSA and in the FIP. The determination of trigger points, prestaging locations of FLEX equipment, and validation of operator actions as well as integration into the severe weather procedures and FLEX support guidelines (FSGs) are captured in the MSA as future actions that will be covered under the licensee's engineering change (EC) process. The NRC-endorsed guidance concerning Warning Time for Local Intense Precipitation Events (ADAMS Accession No. ML15110A080) allows a 24-hour warning time to be credited for a LIP event, which uses a trigger condition of one-half of the calculated consequential rainfall. Therefore, a warning time of at least 24 hours can be credited for the LIP event. The NRC staff finds that using a 24-hour warning time to pre-deploy the mechanical and electrical trailers to the proposed locations that offer flood protection is acceptable based upon the condition that the FLEX procedures will account for the utilization of the weather triggering factors and accountability of the FLEX equipment to be moved. The NRC staff also finds that the utilization of sandbags would allow further diversion of the LIP floodwater to reduce the accumulation near both door sills and allow for the water recession period to be reduced so that deployment of FLEX equipment would be available ahead of 2 hours after ELAP initiation.

The NRC staff finds the licensee has adequately assessed the MSFHI for the LIP flood event. The staff also concludes that that the applicable FLEX strategies can be implemented if the procedures and guidance are developed and implemented appropriately.

West Creek PMF

Section 2.1 of the MSA described the West Creek reevaluated PMF maximum flood height as 95.1 ft. MSL, which is 0.8 ft. higher than the CDB flood height of 94.3 ft. MSL. The PMF flood event is bounded by the MSFHI LIP flood event, discussed above, as related to the FLEX storage buildings and there is no adverse impact on equipment. However, the revised PMF flood will cause certain deployment pathways along the west side of the River Bend site to become inundated. This includes a portion of the alternate route from the northern FLEX storage building and primary route for the southern FLEX storage building. However, the licensee stated that the primary route for the northern FLEX storage building and alternate route for the southern FLEX storage building remain accessible. The licensee determined that the FLEX strategy for deployment would remain unaffected due to each FLEX storage building having an alternative deployment pathway available.

The NRC staff reviewed the licensee's assessment of the MSFHI West Creek PMF. The West Creek PMF inundates a section along the western deployment route, but at least one pathway from both FLEX storage buildings is still available. As discussed in the FIP, all FLEX equipment is redundant between the two FLEX storage buildings, with the exception of the Diesel Driven FLEX SSW pump (FLEX 1 pump) and the Diesel Driven FLEX Generator. The FLEX 1 pump is permanently staged in the "G" tunnel. The FLEX 1 pump is an electric motor driven pump powered by the Diesel Driven FLEX Generator that is stored in the south FLEX storage building. A portable diesel-driven pump that is kept in the north FLEX storage building, the FLEX 2 pump, is an alternative to using the FLEX 1 pump and Diesel Driven FLEX generator. Both pieces of

FLEX equipment would still be accessible with the alternate pathways from each location. Since the deployment routes from both FLEX storage buildings remain available for the West Creek PMF, pre-deployment is not required for this flood event. The NRC staff concurred that the accessibility of both FLEX storage buildings would not prohibit the deployment of FLEX equipment after the PMF flood event. The NRC staff also concurred that redundancy of the FLEX equipment between both FLEX Storage Buildings will also allow for operators to determine the most accessible pathway for deployment.

Based on the deployment pathways available from each FLEX Storage Building and the redundancy of the FLEX equipment, the NRC staff finds the licensee has adequately assessed the MFSHI for the West Creek PMF flood event and the applicable FLEX strategies can be implemented as currently designed.

Mississippi River PMF

Section 2.1 of the MSA described the Mississippi River reevaluated PMF maximum flood height as 59.7 ft. MSL, which is 5.2 ft. higher than the CDB flood height of 54.5 ft. MSL. However, the River Bend CDB grade is 95 ft. MSL, which is well above the reevaluated PMF flood event from the Mississippi River. The NRC staff reviewed the reevaluated PMF event in the MSA and concurred with the licensee's assessment that the MSFHI PMF flood will remain below the site elevation of 95 ft. MSL. No further evaluation was required for the Mississippi River PMF event.

3.2.1 Evaluation of Flood Event Duration

The staff reviewed information provided by Entergy in the flood hazard reevaluation report (FHRR) dated March 12, 2014 (ADAMS Accession No. ML14073A649), responses to request for additional information dated March 12, 2014, June 17, 2014, May 5, 2015, and May 27, 2015 (ADAMS Accession Nos. ML14073A648, ML14178A024, ML15155A602, and ML15162A272, respectively), and the MSA for flooding dated October 24, 2016 (ADAMS Accession No. ML16302A158). The FED parameters for the flood-causing mechanisms not bounded by the CDB at buildings containing structures, systems, and components are summarized in Table 3.2.1-1.

3.2.1.1 Local Intense Precipitation

For the LIP flood-causing mechanism, the licensee stated that the water surface elevation exceeds the Auxiliary Building floor elevation of 97.21 ft. MSL at door AB-098-03 for approximately 2 hours. The licensee reported a warning time of 24 hrs for the LIP event in its MSA. The period of inundation for this door is also reported to be about 2 hours and the period of recession is estimated to be about 4 hours. The MSA also discusses the FED for door CB-098-17 and notes that the water level rises above the elevation for this door sill for a maximum of 2 hours. In the March 12, 2014, FHRR the licensee provides a graph that shows that the period of inundation for this door is actually less than 1 hour.

3.2.1.2 Streams and Rivers

For the streams and rivers flood-causing mechanism at West Creek, which is based on the PMF and with 2-year wind-driven wave being negligible due to insufficient fetch, the maximum water surface elevation is 95.1 ft. MSL. This flood level is above the site grade of 95.0 ft. MSL, but the periods of inundation and recession would be minimal as the flooding does not impact any safety-related buildings on the site.

The licensee used results from a 2-dimensional numerical modeling method, as described in the FHRR, to determine the inundation duration and period of recession parameters for LIP and

streams and rivers flood events. The staff confirmed that the licensee's reevaluation of the inundation periods for LIP and streams and rivers flood-causing mechanisms use present-day methodologies and regulatory guidance.

3.2.1.3 Conclusions

In summary, the staff agrees with the licensee's conclusion related to determining the FED parameters as the approach is consistent with guidance provided by Appendix G of NEI 12-06, Revision 2 (NEI, 2015). Based on this review, the staff determined that the licensee's FED parameters are reasonable and acceptable for use in the MSA. The effect of these paramaters on the mitigating strategies is discussed in Section 3.2.1.4 of this assessment.

3.2.1.4 Effect on Mitigating Strategies

The impact of the LIP flood height will be floodwaters exceeding 3 ft. for certain areas along the deployment routes. The licensee determined that the time periods of inundation and recession of the floodwaters can potentially challenge the deployment and staging of Phase 2 FLEX equipment. Therefore, the licensee reassessed the impact of the flood heights along the deployment paths for each piece of FLEX equipment from the FLEX support buildings, considering the inundation and recession times. The licensee determined that most of the FLEX equipment would not be affected by the reevaluated LIP floodwater, with the exception of the pick-up truck, mechanical trailer, and electrical trailer.

The licensee stated that front-end loaders can be used in place of the pick-up truck to tow FLEX equipment and trailers. This does not conflict with the need for the front-end loaders for debris removal, which occurs prior to the time the front-end loaders would be needed to move FLEX equipment.

The mechanical and electrical trailers contain FLEX equipment that can be impacted by floodwater if deployed in areas where the LIP floodwater has not receded completely. The licensee documented a commitment in the MSA to pre-deploy the mechanical and electrical trailers using a 24-hour warning time prior to the LIP flood event. The FLEX equipment on both trailers will be pre-deployed inside areas closer to the staging areas that will provide flood protection. The licensee asserts that they can complete this action within the 24-hour warning time for a LIP event. The licensee established a regulatory commitment to modify Section 2.6.2 of the FIP to reflect the equipment deployment and staging challenges during Phase 2, discuss pre-staging of the mechanical and electrical trailers, and updating the appropriate procedures and FSGs to implement the modified strategies.

The licensee's procedure RBS-FSG-005, "Initial Assessment and FLEX Equipment Staging," provides instruction for staging Phase 2 FLEX equipment. This procedure includes identification of doors that need to be opened during the staging of this equipment. The licensee compared the FHRR results to the doors that would be used for FLEX strategies. The reevaluated LIP flood level may rise above the door sills for two doors (one each for the Auxiliary Building and Control Building). The floodwater exceeds the door sills by 0.3 ft. for about 2 hours after the initiation of the LIP flood event. The door associated with the Auxiliary Building (door AB-098-03) is a watertight door and no water intrusion is expected. The door associated with the Control Building (door CB-098-17) is not watertight, but the area with crucial equipment is protected by another door (door CB-098-14), which is watertight, and the amount of water intrusion will be minimal. Any deployment and staging of FLEX equipment near these locations will begin at the 3-hour mark after the ELAP event is initiated. The MSA states that the LIP floodwater will recede from these doorways within 2 hours from an ELAP event associated with the flood. The licensee also stated that sandbags will be available and are integrated into RBS-FSG-005 to provide additional protection for both doors prior to the LIP flood event. The

sandbags are not expected to be needed to prevent floodwaters from entering these open doors, but will be stored in both the mechanical and electrical trailers as an enhancement to the strategy. There are no other flood protection features near the doorways that are credited.

3.2.2 Evaluation of Associated Effects

The staff reviewed information provided by Entergy in the FHRR dated March 12, 2014, responses to request for additional information dated March 12, 2014, June 17, 2014, May 5, 2015, and May 27, 2015, and the MSA for flooding dated October 24, 2016. The AE parameters associated with water surface elevation are discussed below and are summarized in Table 3.2.2-1.

3.2.2.1 Local Intense Precipitation

For the LIP flood-causing mechanism, the licensee stated in the October 24, 2016, MSA that hydrostatic and hydrodynamic loading were not considered credible effects (i.e., are minimal) based on the results of a 2-dimensional numerical model that was used to analyze LIP flooding and described in the FHRR. The licensee stated in its MSA that the potential debris generation caused by the LIP event will be limited inside the protected area. The flow depth and velocities inside the protected area are low, thus making the hazard from waterborne projectiles minimal. The licensee described that some FLEX equipment requires the movement of equipment from the storage location to the deployment location via the use of two trailers. Due to the LIP modeling assumption of blocked culverts and consequent water ponding on-site, the route used for deployment of FLEX equipment would be inundated. The licensee described details of a change required to this deployment in the MSA. The two trailers will be pre-deployed based on a pre-determined trigger. Upon a 24-hr quantitative precipitation forecast of one half of the consequential rainfall or more, pre-deployment of the equipment will be triggered.

3.2.2.2 Streams and Rivers

For the Streams and Rivers flood-causing mechanism, the licensee stated in its FHRR and MSA that water does not inundate any safety-related plant structures on the site.

The staff confirmed the licensee's statements by reviewing the licensee-provided documents and the LIP and Streams and Rivers models' input and output files. The staff verified that inundation depths and flow velocities are accurate and the modeling is reasonable for use as part of the MSA. As a result, the staff agrees with the licensee's assessment of the AE parameters for LIP and Streams and Rivers flooding events. The licensee provided tables in the MSA describing the AE of LIP and Streams and Rivers flooding hazards.

3.2.2.3 Conclusions

In summary, the staff concludes the licensee's methods were appropriate and the AE parameter results are reasonable for use in the MSA.

3.2.2.4 Effect on Mitigating Strategies

The AE from a local intense precipitation event and the streams and rivers flood causing mechanism are not expected to have more than a minimal effect on mitigating strategies. Such AE include: hydrodynamic loading; debris loading; sediment loading; and ground water ingress. The staff agrees with the licensee's assessment that a revision to the mitigating strategies based on AE is not necessary.

3.2.3 Evaluation of Flood Protection Features

No additional flood protection features were necessary as a result of the MSA. However, as discussed above, sandbags will be available and are integrated into RBS-FSG-005 to provide additional protection for two doors prior to the LIP flood event. The sandbags are not expected to be needed to prevent floodwaters from entering these open doors as the floodwater will have receded before the doors need to be opened. The sandbags will be stored in both the mechanical and electrical trailers as an enhancement to the strategy. There are no other flood protection features near the doorways that are credited.

3.2.4 Conclusion

The NRC staff has reviewed the information provided in the River Bend MSA related to the original FLEX strategies, as evaluated against the reevaluated hazards described in Section 2 of this Staff Assessment, and found that for the West Creek PMF and the Mississippi River PMF:

- the sequence of events for the FLEX strategies is not affected by the impacts of the MSFHI (including impacts due to the environmental conditions created by the MSFHI) in such a way that the FLEX strategies cannot be implemented as currently developed; and

- the validation performed for the deployment of the FLEX strategies is not affected by the impacts of the MSFHI.

Therefore, the NRC staff concludes that the licensee has demonstrated the capability to deploy the original FLEX strategies, as designed, against a postulated beyond-design-basis event for the West Creel and Mississippi River PMF flood-causing mechanisms, including AEs and FED, as described in NEI 12-06, Revision 2 and ISG-2012-01, Revision 1.

In addition, the NRC staff found that for the LIP flood hazard:

- the sequence of events for the FLEX strategies is affected by the impacts of the ISR flood level in such a way that the FLEX strategies cannot be implemented as currently developed; and

- the validation performed for the deployment of the FLEX strategies is affected by the impacts of the ISR flood levels.

As a result of the information provided in the MSA, the NRC staff agrees with the conclusion that FLEX strategies, as designed, cannot be demonstrated to be effectively deployed to mitigate against a postulated beyond-design-basis event for the LIP flood hazard. Therefore, the licensee is expected to modify the original strategy to address the impacts of the LIP flood hazard level at the site.

3.3 Evaluation of Modified FLEX Strategies

The licensee stated in its MSA, that the overall plant response strategies to an ELAP and LUHS event using the current FLEX procedures, equipment, and personnel can be implemented as intended provided appropriate procedures and FSGs are changed to predeploy the mechanical and electrical trailers and prestage their contents inside a flood-protected structure in the event of an impending LIP. In addition, the licensee intends to use sandbags to enhance the

mitigating strategies by diverting water from potentially affected doorways. The staff notes that the changes that the licensee describes in its MSA are subject to future NRC inspection.

4.0 CONCLUSION

The NRC staff has reviewed the information provided in the River Bend MSA related to the original FLEX strategies, as evaluated against the reevaluated hazards described in Section 2 of this staff assessment, and found that the licensee has adequately assessed the MFSHI for the reevaluated LIP flood, West Creek PMF, and Mississippi River PMF events. The NRC staff made its determination based upon:

- plans for pre-deployment to flood-protected locations of the mechanical and electrical trailers that carry flood susceptible FLEX equipment, initiated 24 hours prior to the LIP flood event;
- the planned revision of severe weather and FLEX procedures to identity the FLEX equipment to be moved and the factors that will trigger those actions prior to the LIP flood event;
- the use of sandbags to enhance the mitigating strategies by diverting water from potentially affected doorways;
- the availability of pathways for deployment of FLEX equipment for the West Creek PMF flood event; and
- sufficient redundancy of FLEX equipment between both FLEX Storage Buildings and pre-staged locations on the site.

Therefore, the NRC staff concludes that the licensee has followed the guidance in NEI 12-06, Revision 2. Assuming the licensee implements the program and procedural changes as described, the licensee has demonstrated the capability to deploy FLEX strategies against a postulated beyond-design-basis event for the LIP and PMF events, including AEs and FED. The staff notes that the implementation of the licensee's program and procedural changes described above is subject to verification by a future NRC inspection.

The NRC staff confirmed that the licensee's flood hazard MSA was performed consistent with the guidance in Appendix G of NEI 12-06, Revision 2, as endorsed by JLD-ISG-2012-01, Revision 1. Based on the licensee's appropriate hazard characterization, methodology used in the MSA evaluation, and the description of its combination of strategies (i.e., current FLEX strategy and modified FLEX strategy); the staff concludes that the licensee has demonstrated that the mitigation strategies, if appropriately implemented, are reasonably protected from reevaluated flood hazard conditions.

Table 3.2.1-1. Flood Event Durations for Flood-Causing Mechanisms Not Bounded by the CDB

Flood-Causing Mechanism	Time Available for Preparation for Flood Event	Duration of Inundation of Site	Time for Water to Recede from Site
Local Intense Precipitation and Associated Drainage	24 h	2 h (Auxiliary Building)	4 h
Streams and Rivers	1.2 h	Minimal	Minimal

TABLE 3.2.2-1. ASSOCIATED EFFECTS PARAMETERS NOT DIRECTLY ASSOCIATED WITH TOTAL WATER HEIGHT FOR FLOOD-CAUSING MECHANISMS NOT BOUNDED BY THE CDB

Associated Effects Parameter	Local Intense Precipitation and Associated Drainage	Streams and Rivers(1)
Hydrodynamic loading at plant grade	Minimal	Not Applicable
Debris loading at plant grade	Minimal	Not Applicable
Sediment loading at plant grade	Minimal	Not Applicable
Sediment deposition and erosion	Minimal	Not Applicable
Concurrent conditions, including adverse weather – Winds	Not Applicable	Not Applicable
Groundwater ingress	Minimal	Not Applicable
Other pertinent factors (e.g., waterborne projectiles)	Not Applicable	Not Applicable

Notes:

(1) The plant site will not be inundated by this flood-causing mechanism.

RIVER BEND STATION, UNIT 1 – FLOOD HAZARD MITIGATION STRATEGIES ASSESSMENT, May 2, 2017

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RidsOpaMail Resource
RidsAcrsAcnw MailCtr Resource
RidsNroDsea Resource
RidsRgn4MailCenter Resource
SBailey, NRR
MHalter, NRR
GBowman, NRR
JSebrosky, NRR
GArmstrong, NRR

ADAMS Accession No. ML17075A059 *via email

OFFICE	NRR/JLD/JHMB/PM	NRR/JLD/LA	NRR/JLD/JERB/BC	NRO/DSEA/RHM1/BC
NAME	JSebrosky	SLent	SBailey	CCook*
DATE	5/2/17	3/17/17	4/17/17	3/14/17
OFFICE	NRR/JLD/JOMB/PM	NRR/JLD/JHMB/BC	NRR/JLD/JHMB/PM	
NAME	PBamford	NSanfilippo	JSebrosky	
DATE	4/25/17	4/26/17	5/2/17	

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