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

July 13, 2017

Mr. Joseph W. Shea
Vice President, Nuclear Licensing
Tennessee Valley Authority
1101 Market Street, LP 3R-C
Chattanooga, TN 37402-2801

SUBJECT: SEQUOYAH NUCLEAR PLANT, UNITS 1 AND 2 – FLOOD HAZARD MITIGATION STRATEGIES ASSESSMENT (CAC NOS. MF7975 AND MF7976)

Dear Mr. Shea:

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*, Section 50.54(f), "Conditions of Licenses" (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 report (ADAMS Accession No. ML111861807).

Enclosure 2 to the 50.54(f) letter requested that licensees reevaluate flood hazards for their site(s) using present-day methods and regulatory guidance used by the NRC staff when reviewing applications for early site permits and combined licenses. 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 have been based on present-day methodologies and guidance, in the development of their mitigating strategies.

By letter dated December 27, 2016 (ADAMS Accession No. ML16363A382, non-publicly available), Tennessee Valley Authority (the licensee) submitted its flooding mitigation strategies assessment (MSA) for Sequoyah Nuclear Plant, Units 1 and 2 (Sequoyah). The MSAs are intended to confirm that licensees have adequately addressed the reevaluated flooding hazards within their mitigating strategies for beyond-design-basis external events. The purpose of this letter is to provide the NRC's assessment of the Sequoyah MSA.

The NRC staff has concluded that the Sequoyah MSA was performed consistent with the guidance described in Appendix G of Nuclear Energy Institute 12-06, Revision 2, as endorsed

Enclosure 1 transmitted herewith contains Security-Related Information. When separated from Enclosure 1, this document is decontrolled.

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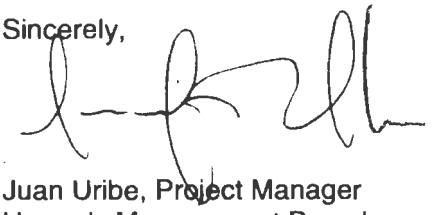
by Japan Lessons-Learned Division (JLD) interim staff guidance (ISG) JLD-ISG-2012-01, Revision 1, and that the licensee has demonstrated that the mitigation strategies are reasonably protected from reevaluated flood hazards conditions for beyond-design-basis external events. This closes out the NRC's efforts associated with CAC Nos. MF7975 and MF7976.

If you have any questions, please contact me at 301-415-3809 or at Juan.Uribe@nrc.gov

Sincerely,



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

Docket Nos. 50-327 and 50-328

Enclosures:
1. Staff Assessment Related to the Mitigating Strategies for Sequoyah (non-public)
2. Staff Assessment Related to the Mitigating Strategies for Sequoyah (public)

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STAFF ASSESSMENT BY THE OFFICE OF NUCLEAR REACTOR REGULATION RELATED TO MITIGATION STRATEGIES FOR SEQUOYAH NUCLEAR PLANT, UNITS 1 AND 2 AS A RESULT OF THE REEVALUATED FLOODING HAZARD NEAR-TERM TASK FORCE RECOMMENDATION 2.1 – FLOODING (CAC NOS. MF7975 AND MF7976)

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), "Conditions of Licenses" (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 respective site(s) using present-day methods and regulatory guidance used by the NRC staff when reviewing applications for early site permits and combined licenses. 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 have been 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 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). As discussed in JLD-ISG-2012-01, Appendix G of NEI 12-06, Revision 2, describes acceptable methods for demonstrating that the reevaluated flooding hazard is addressed within the Sequoyah Nuclear Plant, Units 1 and 2 (Sequoyah) mitigating strategies for beyond-design-basis external events.

2.0 BACKGROUND

By letter dated March 12, 2015 (ADAMS Accession No. ML15071A462), Tennessee Valley Authority (TVA, the licensee) submitted its flood hazard reevaluation report (FHRR) for Sequoyah. By letter dated September 3, 2015 (ADAMS Accession No. ML15240A163), the NRC issued an interim staff response (ISR) letter for Sequoyah. The ISR letter provided the reevaluated flood hazard mechanisms that exceeded the current design basis (CDB) for Sequoyah, which were to be used in conducting the mitigating strategies assessment (MSA), as described in NEI 12-06. For Sequoyah, the mechanisms listed as not bounded by the CDB in the ISR letter are local intense precipitation (LIP) and streams and rivers. By letter dated July 13, 2016 (ADAMS Accession No. ML16188A274), the NRC issued a FHRR staff assessment, which provided the documentation supporting the NRC staff's conclusions summarized in the ISR letter.

By letter dated December 27, 2016 (ADAMS Accession No. ML16363A382), TVA submitted the Sequoyah MSA for review by the NRC staff.

3.0 TECHNICAL EVALUATION

3.1 Mitigating Strategies under Order EA-12-049

By letter dated February 28, 2013 (ADAMS Accession No. ML13063A183), TVA submitted its Overall Integrated Plan (OIP) for Sequoyah in response to Order EA-12-049. At 6 month intervals following the submittal of its OIP, the licensee submitted reports on its progress in complying with Order EA-12-049. By letter dated August 28, 2013 (ADAMS Accession No. ML13234A503), the NRC notified all licensees and construction permit holders that the staff is conducting audits of their responses to Order EA-12-049 in accordance with NRC Office of Nuclear Reactor Regulation (NRR) Office Instruction LIC-111, "Regulatory Audits" (ADAMS Accession No. ML082900195). By letters dated February 19, 2014 (ADAMS Accession No. ML14002A113), and March 3, 2015 (ADAMS Accession No. ML15033A430), the NRC staff issued an Interim Staff Evaluation and audit report, respectively, on the licensee's progress. By letter dated February 11, 2016 (ADAMS Accession No. ML16049A635), TVA submitted its compliance letter and the Final Integrated Plan in response to Order EA-12-049. The compliance letter stated that the licensee had achieved full compliance with Order EA-12-049.

By letter dated October 12, 2016 (ADAMS Accession No. ML16270A517), the NRC staff issued a safety evaluation documenting the results of the NRC staff's review of the FLEX strategies for Sequoyah. The safety evaluation concluded that the integrated plans, if implemented as described, should adequately address the requirements of Order EA-12-049.

A brief summary of Sequoyah's FLEX strategies are listed below:

- Operators will take prompt actions to minimize Reactor Coolant System (RCS) inventory losses by isolating potential letdown paths. Decay heat is removed by steaming to the atmosphere from the steam generators (SGs) through the SG atmospheric relief valves or main steam safety valves, and makeup to the SGs is initially provided by the turbine-driven auxiliary feedwater pump (TDAFWP). The operators will perform direct current (dc) bus load stripping within 45 minutes hours following event initiation to ensure that safety-related battery life is extended up to 8 hours.

- Following dc load stripping and prior to battery depletion, 480-volt alternating current (Vac) generators will be aligned to the Sequoyah electrical distribution system. These pre-staged generators will be used to repower essential battery chargers within 1.25 hours of the extended loss of alternating current (ac) power (ELAP) initiation, as well various FLEX pumps and FLEX loads. The 6.9 kV 3 MW FLEX diesel generators (DGs) are also staged to power various plant systems if available.

- Procedures to initiate RCS makeup and boration will be initiated within 3.5 hours of the ELAP with loss of normal access to the ultimate heat sink event and injection will occur within 5 hours. Operators will provide reactor coolant makeup using the safety injection (SI) pumps from either the refueling water storage tank (RWST) or the boric acid tanks (BATs) and inject through the normal flow paths. The FLEX high-pressure motor-driven pumps, will be available at 8.5 hours to inject into the RCS from either the RWST or the BATs.

- Licensee calculations demonstrate that no actions are required to maintain the containment pressure and temperature below design limits for six days. In Phase 2, the licensee will power, if necessary, the hydrogen igniters inside containment to preclude the potential for hydrogen deflagration or detonation in the event of core damage. The igniters will be powered by a 6.9 kV DG and can be powered by a 480 Vac FLEX DGs. During Phase 3, containment cooling and depressurization would be accomplished by operating one lower compartment containment cooling fan, with water for cooling supplied by the LP FLEX pump deployed at the intake pumping station.

3.2. Licensee Evaluation of Current FLEX Strategies Against Reevaluated Hazard(s)

The licensee has assessed the potential impacts of the LIP and streams and rivers flood-causing mechanisms, as described in the ISR letter, against the mitigating strategies designed to meet Order EA-12-049. The purpose of the MSA was to determine if the licensee's mitigating strategies are adequate as-is, need to be modified, or new mitigating strategies need to be developed to address hazard exceedances as described in the ISR letter.

Overall, the licensee determined in its evaluation that LIP, and streams and rivers (which has been revised, as discussed below) do not impact the site and therefore, the current FLEX strategies can be deployed without any changes to the overall strategy at Sequoyah, including deployment and staging of equipment.

3.2.1 Summary of Mitigating Strategies Assessment

In its FIP, the licensee described that implementation of the FLEX strategies at Sequoyah is divided into three phases. In general, the first phase is to initially cope by relying on installed plant equipment and on-site resources, the second phase is to transition from installed plant equipment to the on-site FLEX equipment, and the third phase is to obtain additional capability and redundancy from off-site equipment. For reference, Sequoyah is located on the Tennessee River with plant grade at elevation 705 ft mean sea level (MSL).

For LIP, the licensee evaluated the current FLEX strategies against a reevaluated hazard of 706.3 ft MSL, as stated in the ISR letter. The licensee noted in its MSA that the flood height of most importance (given the potential impacts to the overall FLEX strategy) is the flood height along haul routes and at FLEX equipment staging pads for equipment deployed during the inundation period.

In Attachment 1 of the MSA titled, "Sequoyah LIP Effect on FLEX Timeline," the licensee provided a detailed sequence of events timeline describing the site's FLEX actions as a result of a reevaluated LIP hazard event. The licensee stated that the low pressure (LP) FLEX pumps are the only externally deployed FLEX equipment during the relatively short LIP inundation period (bounding timeframe). These pumps are deployed 1-hour after the initiating ELAP event, and the action takes 3 hours to complete. These pumps are deployed from the FLEX equipment storage building (FESB) to the Intake Pumping Station concrete staging pad, also referred to as deployment area 2 (see Sequoyah MSA Figure 3-3), where the LIP hydrograph shows a peak LIP event flood height of 704.1 ft MSL. The haul road adjacent to deployment location 2 is at elevation 703.75 ft MSL and the LP Flex pumps are staged on a concrete pad at elevation 704 ft MSL or higher.

The licensee also stated in its MSA that the inundation period for a LIP event is approximately 65 minutes; therefore, no impact to the FLEX deployment strategies is expected to occur when comparing this timeframe against the deployment timeline of the LP FLEX pumps (1 hour) and taking into account that floodwaters have receded based on runoff.

The licensee also described in its MSA that other time sensitive deployment activities occurring prior to 1 hour, such as aligning and placing in service the pre-staged 480v FLEX DGs, take place inside or on the roof of the Auxiliary Building and are not affected by the LIP event.

In regards to LIP event duration, the licensee stated that the longest inundation period occurs in Storage Area 4, which is south of the Auxiliary Building. In this area, flood waters peak at 706.3 ft MSL (corresponding to the elevation described in the ISR letter); however, no FLEX equipment is deployed through Storage Area 4 and therefore, is not expected to impact Sequoyah's overall FLEX strategy.

In regards to flooding from streams and rivers, the licensee provided additional information in the MSA which is intended to revise and clarify information that had been previously reviewed by the NRC staff in the FHRR. Specifically, this new information demonstrates that Sequoyah's current licensing basis bounds the reevaluated hazard stated in the ISR letter by providing additional details related to the wind wave height at critical structures and also clarifying the design basis probable maximum flood (PMF) combined with wind effect elevations at the Reactor Shield Building. Relevant information was previously provided to the NRC by letter dated August 10, 2012 (ADAMS Accession No. ML12226A561). As a result of this analysis, the

licensee concluded that flooding from streams and rivers is not expected to impact Sequoyah's overall FLEX strategy.

3.3 NRC Staff Technical Evaluation

The NRC staff has reviewed the information presented in the MSA, as well as supporting documentation. This included:

- Review of licensing documents and previous NTTF flooding submittals;
- Review of the topographical features of the site; and
- Review and documentation of existing mitigating strategies under Order EA-12-049.

The NRC staff reviewed the flood hazard elevations in the MSA in order to confirm if the elevations matched the values provided in the Sequoyah ISR letter. The ISR letter identified the following reevaluated flood-causing mechanisms as not bounded by the CDB: LIP, and streams and rivers.

For LIP, the NRC staff confirmed that the water surface elevation reported in the MSA matches the value in the ISR letter of 706.3 ft MSL. The NRC staff also evaluated if the reevaluated LIP hazard impacted any of the storage location(s) of FLEX equipment, any staging areas, haul paths, connection points, activities, etc. In its MSA, the licensee stated that Sequoyah requires no protective actions prior to the LIP event rainfall or before site inundation and that the LIP event does not impact the pre-staged equipment or the FESB. The NRC staff agrees that, based on an estimated period of inundation of 1.1-hours and the first externally deployed equipment occurring 1-hour after the event, LIP is not expected to impact the Phase 1 or Phase 2 FLEX response.

In addition to the water receding, the NRC staff agrees that the elevations of the haul path road and the staging area (FESB to deployment area 2) which are 703.75 ft MSL and 704 ft MSL or higher, respectively, provide reasonable protection against the expected LIP water elevation 1 hour after the ELAP event. The expected LIP flood elevation at the LP FLEX deployment location 1 hour after the ELAP event is approximately 704 ft MSL based on Figure 3-4 of the MSA. At this point during the event, the equipment deployed should not be impacted given that there should be little to no water left to affect the transfer of the LP FLEX pump from the FESB to its deployment location.

The NRC staff notes that the Phase 2 FLEX response (RCS makeup and boration, SG makeup) is scheduled to begin 1 hour after the initiating event. The RCS makeup activities are all located internal to the plant and are not affected by the LIP event. As a result, the NRC staff agrees that there appears to be sufficient time for flood waters to recede prior to the Phase 2 FLEX response activity taking place; and therefore, no impact is expected to occur as a result of the reevaluated LIP hazard. The NRC staff notes that RCS makeup and boration activities have been previously reviewed by the NRC and documented in the October 12, 2016, safety evaluation (Section 3.2.3.2, "Thermal-Hydraulic Analyses"). The other pumps and DGs used for the ELAP event are pre-staged and inside buildings. The LIP event does not impact the ability to set up and operate this FLEX equipment. The location and FLEX strategy was designed for the PMF that would be seen on site and is bounding for the reevaluated hazard.

For streams and rivers, the NRC staff concluded in the ISR letter that this flood causing mechanism would not be bounded by the CDB value because commitment # 2, as described in the FHRR, states that TVA would implement an Emergency Action Plan (EAP) (as an interim action until a permanent solution is determined) that consists of installing HESCO barriers across the crests of both Douglas Saddle Dams 1 and 3 in order to prevent overtopping of these saddle dams. During the review of the MSA, TVA confirmed that the EAP has subsequently been implemented at the Douglas Saddle Dam 1 and a permanent modification made to Douglas Saddle Dam 3. The EAP was inspected by the NRC and found acceptable, as discussed in the Integrated Report 05000390/2015003 (ADAMS Accession No. ML15310A360).

This modification and EAP reduces the maximum flood elevation at the site resulting from overtopping of the dams from [[ ]] to [[ ]] (See FHRR Table 11-1, Flooding from combined effects and the table footnotes). The NRC staff determined during its FHRR review that the re-evaluated flood elevation of [[ ]] is a reasonable value with the EAP implemented credited. The NRC staff also notes that the resulting flood elevation at the site with the EAP credited is still not bounded by the CDB value of 723.2 ft MSL (see Section 12.3 of the FHRR).

In the MSA, the licensee adopted the flood elevation at the Unit 1 Reactor Building of [[ ]], which is below the design basis elevation of 726.2 feet (MSA Table 3-1) and includes the effects of the Douglas Saddle Dams modification and EAP. The licensee's comparison of the reevaluated flood elevations at different buildings and the corresponding CDB values was included in Table 3-2 of the MSA, which shows that the Unit 1 Reactor Shield Building is bounded. The NRC staff notes that the current FLEX strategies were designed to withstand the CDB flood event and therefore, should be adequate to withstand the streams and rivers re-evaluated hazard (after crediting the Douglas Saddle Dam EAP) since this revaluated flood mechanism is lower than the CDB.

The NRC staff has reviewed the additional information in the MSA intended to clarify that the reevaluated flood hazard for streams and rivers is bounded by the CDB at the site and therefore, agrees that the current FLEX strategies are not expected to be impacted by this reevaluated hazard.

3.3.1 Evaluation of Flood Event Duration

The staff reviewed information provided by TVA regarding the flood event duration (FED) parameters for flood hazards not bounded by the CDB. The FED parameters for the flood-causing mechanisms not bounded by the CDB are summarized in Table 3.3.1-1.

For the LIP flood-causing mechanism, the licensee stated that warning time is not applicable because mitigation of the LIP event requires no site actions and has no impact on safety-related facilities. The licensee further states in its MSA that the period of inundation is 1.1 hours, which includes the period of recession. The NRC staff confirmed that the licensee's modeling and evaluation uses present-day methodologies and regulatory guidance as described in the FHRR staff assessment. The NRC staff agrees that the period of recession would be minimal according to the licensee's computational results of MSA. Therefore, the staff concludes that the licensee's FED parameters are acceptable for use in the MSA.

In its MSA, the licensee stated that the warning time for FLEX Stage 1 and 2 is 27-hours, the FLEX pre-stage warning time is 7 hours, and additional communication and forecasting

computational time is 4 hours; or, a total warning period for site preparation of 38 hours. This warning time differs from the available warning time calculations presented as part of the FHRR process. As part of the FHRR process, the licensee stated that the available warning time is 66 hours for this flood-causing mechanism, and an associated period of inundation of 169 hours. The staff agrees with the licensee's use of an estimated 38 hours of available warning time as described in the MSA, and notes that this available warning time is shorter than the 66 hours previously estimated and discussed in the FHRR staff assessment.

In its MSA, the licensee stated that the periods of inundation and recession are not included because all design-basis preparation activities to protect the plant facilities from the riverine flooding would be implemented prior to the site inundation. However, in the FLEX design-basis, the licensee adopted 169 hours as the inundation time. The staff agrees with the licensee's use of an estimated 169 hours of inundation time for FLEX design-basis since the same inundation period was previously reported in the FHRR staff assessment.

In its MSA, the licensee also stated that the riverine flood at Chattanooga would recede at a time when access to the main road from Sequoyah to Chattanooga is restored, and could be as long as 215 hours after the start of the site inundation. Based on inundation time at Sequoyah and the time required to restore accessibility of the main road (both values calculated using a hydraulic model), the NRC staff estimates a recession time of 30 hours at the plant site. The NRC staff confirmed, as part of its review of the FHRR, that the licensee's riverine flood modeling used presented-day methodologies and regulatory guidance, and the staff concludes that the licensee's FED parameters are acceptable for the purposes of the MSA.

3.3.2 Evaluation of Associated Effects

The staff reviewed the information provided by TVA regarding associated effects (AE) parameters for flood hazards not bounded by the CDB. The AE parameters related to water surface elevation (i.e., stillwater elevation with wind waves and runup effects) were previously reviewed by staff, and were transmitted to the licensee via the IRS letter dated September 3, 2015. The AE parameters not directly associated with water surface elevation are discussed below and are summarized in Table 3.3.2-1.

For the LIP flood-causing mechanism, the licensee did not provide hydrostatic and hydrodynamic loads in the FHRR and therefore, have not been previously reviewed by the NRC staff. However, the licensee stated in its MSA that all associated effects including hydrostatic and hydrodynamic loads, debris, erosion and deposition, groundwater ingress, and other associated effects are minimal for the LIP event due to shallow flow depths and relatively slow flow velocities. As a result, the licensee concluded that the flows do not have any impact on safety-related plant facilities.

The NRC staff confirmed the AE parameters by reviewing the LIP modeling input and output files, which were provided during the review of the FHRR. After reviewing the output files, the NRC staff confirmed that the inundation depths and flow velocities were reasonable and would produce minimal hydrostatic and hydrodynamic loads at the plant. Therefore, the NRC staff concluded that the licensee's AE parameters for the LIP flood-causing mechanism are acceptable for use in the MSA.

For the rivers and streams flood-causing mechanism, the licensee stated in its MSA that all AEs (including hydrostatic and hydrodynamic loads, sediment deposition and erosion, debris,

groundwater ingress, and other associated effects) are minimal due to the extended warning time period and site-preparation activities. These site-preparation activities would be completed prior to any site inundation. The staff reviewed the licensee's justifications and discussions related to these AE parameters and concludes they are reasonable for the purposes of the MSA. In summary, the staff concludes that the licensee's methods are appropriate and the AE parameters are therefore reasonable for the purposes of the MSA.

3.4 Conclusion

The NRC staff has reviewed the information provided in the Sequoyah MSA related to the original FLEX strategies, as assessed against the reevaluated hazards. The staff concludes that the licensee has reasonably demonstrated the capability to implement FLEX strategies, as designed, against the reevaluated hazards described in the ISR letter.

The NRC staff made its determination based upon:

- Consideration that a reevaluated LIP hazard is not expected to impact the storage, deployment and/or staging areas of FLEX equipment given the estimated floodwaters present during the deployment trigger and the physical characteristics of the haul paths and staging areas;

- Consideration that other time sensitive deployment activities occurring prior to 1 hour occur inside or on the roof of the Auxiliary Building and are not affected by the LIP event;

- All Phase 1 and 2 strategies, as currently designed, contain sufficient margin to allow local floodwaters to recede prior to any established FLEX actions or equipment deployment. As a result, implementation timelines should not be impacted; and

- A flood-causing mechanism (streams and rivers) that was determined to be not bounded in the ISR letter, was appropriately screened out of further review in the MSA given that additional information was provided that demonstrated that this reevaluated flood-causing mechanism is bounded by the CDB. This approach was consistent with guidance provided in Appendix G of NEI 12-06, Revision 2 (Section G.2).

Therefore, the NRC staff concludes that the licensee has demonstrated the capability to implement the original FLEX strategies, as designed, under the conditions associated with the reevaluated LIP and streams and rivers, including associated effects and flood event duration, as described in NEI 12-06, Revision 2, and JLD-ISG-2012-01, Revision 1.

4.0 CONCLUSION

The NRC staff has reviewed the information presented by the licensee in its MSA for Sequoyah. The NRC staff confirmed that the licensee's flood hazard MSA for Sequoyah 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 use of the hazards characterized in the NRC staff's ISR letter, the methodology used in the Sequoyah MSA evaluation, and the description of its current FLEX strategy in the Sequoyah MSA and supporting documentation, the NRC staff concludes that the licensee has demonstrated that the mitigation strategies appear to be reasonably protected from reevaluated flood hazards conditions.

Table 3.3.1-1. 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	Not Credited[3]	1.1 hours	Minimal
Streams and Rivers	27 hours per the CDB[1] and 38 hours per the FLEX Design Basis[2]	169 hours[2]	30 hours[2]

Notes:
(1): Based on values reported in the FHRR.
(2): Based on information provided in the MSA.
(3): If needed, develop warning time using the guidelines of NEI 15-05, "Warning Time for Local Precipitation Events"

TABLE 3.3.2-1. 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	Minimal Impact for MSA
Debris loading at plant grade	Minimal	Minimal Impact for MSA
Sediment loading at plant grade	Minimal	Minimal Impact for MSA
Sediment deposition and erosion	Minimal	Minimal Impact for MSA
Concurrent conditions, including adverse weather - Winds	Minimal	Minimal Impact for MSA
Groundwater ingress	Minimal	Minimal Impact for MSA
Other pertinent factors (e.g., waterborne projectiles)	Minimal	Minimal Impact for MSA

Source: TVA MSA

Note:

(1) Reasonable for the purposes of the MSA due to the duration of the warning time and site preparations prior to any site inundation.

SUBJECT: SEQUOYAH NUCLEAR PLANT, UNITS 1 AND 2 – FLOOD HAZARD MITIGATION STRATEGIES ASSESSMENT DATED JULY 13, 2017

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