Electric Generating Plant Units 1 & 2

Integrated Assessment for External Flooding

Response to Request for Information Pursuant to Title 10 of the Code of Federal Regulations 50.54(f) Regarding Recommendation 2.1 of the enclosure to SECY-11-0093, "Recommendations for Enhancing Reactor Safety in the 21st Century, the Near-Term Task Force Review of Insights from the Fukushima Dai-ichi Accident"

June 2013

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Acronyms and Abbreviations

Preface

The following Integrated Assessment example intends to meet the guidance established in the Japan Lessons-Learned Directorate (JLD) – Interim Staff Guidance (ISG) 2012-05, "Guidance for Performing the Integrated Assessment for External Flooding." This Integrated Assessment example analyzes a "simple" case where a nuclear power plant site was re-evaluated for flooding hazards using NRC NTTF Recommendation 2.1 (Enclosure 2 of the March 12, 2012 10 CFR 50.54(f) letter), and the results of the Flooding Hazards Re-evaluation Report (FHRR) determined there was a slight water level increase above the current design basis flooding elevation for one or more flood causing mechanisms.

Strategies included in this example do not necessarily represent endorsed actions for a particular event, but rather focus on the level of detail required to describe and justify the adequacy of a proposed external flood simple example.

1.0 Overview

Following the accident at the Fukushima Dai-ichi nuclear power plant resulting from the 2011 Great Tohoku Earthquake and tsunami, the Nuclear Regulatory Commission (NRC) established the Near- Term Task Force (NTTF) and tasked it with conducting a systematic and methodical review of NRC processes and regulations to determine whether improvements are necessary.

The resulting NTTF report concludes that continued U.S. nuclear plant operation does not pose an imminent risk to public health and safety and provides a set of recommendations to the NRC. The NRC directed the staff to determine which recommendations should be implemented without unnecessary delay (Staff Requirements Memorandum [SRM] on SECY-11-0093).

The NRC issued its request for information pursuant to 10 CFR 50.54(f) on March 12, 2012, based on the following NTTF flood-related recommendations:

- Recommendation 2.1: Flooding

- Recommendation 2.3: Flooding

Enclosure 2 of the NRC 10 CFR 50.54(f) letter addresses Recommendation 2.1 for the following purposes:

1. To gather information with respect to NTTF Recommendation 2.1, as amended by the SRM associated with SECY-11-0124 and SECY-11-0137, and the Consolidated Appropriations Act, for 2012 (Pub Law 112-74), Section 402, to reevaluate seismic and flooding hazards at operating reactor sites.

2. To collect information to facilitate NRC's determination if there is a need to update the design basis and systems, structures, and components (SSCs) important to safety to protect against the updated hazards at operating reactor sites.

3. To collect information to address Generic Issue 204 regarding flooding of nuclear power plant sites following upstream dam failures.

Recommendation 2.1 (Enclosure 2 of the NRC 10 CFR 50.54(f) letter) contains a "Requested Information" section detailing two items being requested from each licensed reactor site. The first requested item is the Flooding Hazard Re-evaluation Report (FHRR), which has already been submitted to the NRC by the Electric Generating Plant Units 1 & 2 (Units 1 & 2).

The second requested item of Recommendation 2.1 is an Integrated Assessment (IA) report. Enclosure 2 of the NRC 10 CFR 50.54(f) letter addresses the situation in which an Integrated Assessment should be provided and the information the Integrated Assessment should contain.

An Integrated Assessment report should be developed for plants where the current design basis floods do not bound the re-evaluated hazard for all flood causing mechanisms, and the report should include the following:

a. Description of the integrated procedure used to evaluate integrity of the plant for the entire duration of flood conditions at the site

b. Results of the plant evaluations describing the controlling flood mechanisms and its effects, and how the available or planned measures will provide effective protection and mitigation. Discuss whether there is margin beyond the postulated scenarios.

c. Description of any additional protection and/or mitigation features that were installed or are planned, including those installed during the course of reevaluating the hazard. The description should include the specific features and their functions.

d. Identify other actions that have been taken or are planned to address plant-specific vulnerabilities.

The FHRR for Units 1&2 reveals the current design basis floods do not bound all re-evaluated flood causing mechanisms at the plant site, and, therefore, this report represents the Integrated Assessment required by NTTF Recommendation 2.1. The FHRR determined two flood causing mechanisms – 1) Local Intense Precipitation (LIP) using Probable Maximum Precipitation (PMP) methods and 2) Dam Breaches and Failures– exceed the current design basis for flooding at the plant site. The LIP/PMP analysis generated the bounding flood elevation at the plant site (hereinafter, LIP will be referred to as "PMP").

2.0 Integrated Assessment Procedure

The Site did not prepare a specific procedure for the development of this Integrated Assessment (IA). The content for this IA report was developed to meet the requirements of NTTF Recommendation 2.1 and follow the guidance set forth by the NRC in the Japan Lessons-Learned Project Directorate (JLD) - Interim Staff Guidance (ISG)-2012-05, "Guidance for Performing the Integrated Assessment for External Flooding," Revision 0. Section 8 of JLD-ISG-2012-05 was followed in documenting the analyses and results of this IA. Specifically, the methodologies are described to demonstrate the effectiveness of flood

protection features and systems at the plant and any modeling performed to evaluate the overall flood protection capability.

3.0 Peer Review

An independent peer review of this IA was performed to provide assurance of the determined scope, employed methodologies, technical adequacy of input parameters, flood protection analyses, and consistency with the guidance of JLD-ISG-2012-05. Attachment 1 to this Integrated Assessment provides the necessary information regarding the peer review, as required by JLD-ISG-2012-05, Appendix B.

Given the simplistic nature of this Units 1 & 2 IA, the peer review was not provided by a team of independent reviewers. Rather, the peer review consisted of one qualified technical reviewer providing consultation and input regarding the scope of the IA, methodologies employed, input parameters utilized, plant configurations considered in the IA, and the adherence of the IA to JLD-ISG-2012-05.

Since the Units 1 & 2 IA consists of a simple comparison between re-evaluated flood elevations and the plant elevation with a result of no safety-related structures, systems, or components being challenged by external flood water, the peer review was comprised of one qualified reviewer with collective, sufficient expertise in all areas considered within the IA. Notably, the peer reviewer has sufficient expertise in hydrology, structural engineering, and environmental protection strategies. The desired objectives of the peer review process were met by having one peer reviewer.

Once the development of the Units 1 & 2 IA was finalized, the IA was provided to the peer reviewer for his/her review. Prior consultation with the peer reviewer only consisted of the desired scope of his review and the objectives he was tasked with accomplishing. Those objectives were derived from Section 4 and Appendix B of JLD-ISG-2012-05. An in-process review of the IA with the peer reviewer was not considered necessary due to the limited review scope and analysis required by the IA for this simple case.

The required information regarding the peer reviewer's credentials, relevant experience, review methodology, findings/comments, and conclusions from his/her Units 1 & 2 IA peer review are described in Attachment 1 to this report.

4.0 Site Information Related to Flooding

The Site consists of 2,000 acres located on a coastal plain bluff on the southwest side of a river. The mouth of the river is approximately 150 river miles from the site. The contributing drainage area of the river at the site is 6,500 square miles, as estimated from digital mapping.

The river basin and its sub-basins, as delineated by the National Weather Service (NWS) and further subdivided into U.S. Geological Survey (USGS) Hydrologic Unit Code (HUC-12) Watershed Boundary Dataset, are shown in the Plants Updated Final Safety Analysis Report (UFSAR) Figure 2.4.

The plant consists of two, pressurized water reactors -- Units 1&2 -- that began commercial operation in April 1986 and May 1987, respectively. Two additional reactors, Units 3 & 4, are new nuclear power generating units under construction and are located adjacent to the current Units 1 & 2 operating plant site. Units 3 & 4 will be located west of and adjacent to the existing Units 1 & 2 as shown in Units 3 & 4

UFSAR Figure 1.1. The combined license (COL) under 10 CFR 52 for Units 3 & 4 was issued by the NRC in 2012. The March 12, 2012 10 CFR 50.54(f) letter excludes 10 CFR 52 plants from the information requested by stating, "For combined license (COL) holders under 10 CFR 52, the issues in NTTF Recommendation 2.1 and 2.3 regarding seismic and flooding reevaluations and walkdowns are resolved."

The Electric Generating Plant Units 1 & 2 site is a dry site, which is not subject to flooding from the nearby streams and the river (including postulated dam break scenarios). The normal water elevation of the river is approximately 80 feet from mean sea level (msl).

Since the site was originally licensed to construct four units, the Units 3 & 4 site area was included in the grading plan during the construction of Units 1 & 2. The Units 3 & 4 area was rough-graded to the plan, which included a drainage ditch south- southwest of the Units 3 & 4 area, designed to accommodate the runoff from the 100-year storm. This ditch also functions as the local PMP drainage path for the Units 3 & 4 area during storms and a postulated PMP event.

The site grade elevation for all safety-related structures of all four units is located at nominal design elevation (NDE) 220 feet above mean sea level (msl).

5.0 Hazard Definition -- Controlling Flood Mechanism

Section 5 of JLD-ISG-2012-05 was used to define applicable flood mechanisms to Units 1 & 2 and identify the bounding flood parameters. No flood hazards exist for the Units 1 & 2 site resulting from the FHRR. For each postulated flood hazard mechanism, the flood surface elevation is below the Units 1 & 2 power block floor elevation containing the SSCs important to safety. However, the controlling flood mechanism analyzed in the Units 1 & 2 FHRR that yields the highest flood elevation is the local intense PMP event at the Units 1 & 2 site.

5.1 Local Intense PMP

JLD-ISG-2012-05, Section 5.2 provides flood parameters to consider from the results of the FHRR. Local intense PMP is the controlling flood mechanism for the Units 1 & 2 site. The Units 1 & 2 current design basis calculation determined the local intense PMP flood elevation to be 219.1 feet msl. The FHRR for the Units 1 & 2 PMP was recalculated with a higher 1-hour rainfall intensity to correspond with the assumed 1-hour rainfall intensity utilized in the COL application for Units 3 & 4. The PMP re-evaluation for Units 1 & 2 reported a finalized increase in flood height of 0.2 feet. Therefore, the Units 1 & 2 current design basis has a PMP flood height of elevation 219.1 feet msl and a re-evaluated flood height of 219.3 feet msl, accounting for beyond design basis rainfall intensity.

This re-evaluated local intense PMP flood height with the updated rainfall event provides 0.3 feet of margin between the re-evaluated flood height (219.3 feet msl) and the lowest elevation of the openings into the Units 1 & 2 power block structures, systems, and/or components (219.6 feet msl).

The Units 1 & 2 power block was designed and constructed to have a floor NDE of 220 feet msl. During the recent site survey for the FHRR, the lowest power block floor elevation was measured to actually be 219.6 feet msl, accounting for settlement (discussed below in Section 6.1). From the results of the FHRR, a 0.3 feet APM exists between the peak flood height during the local intense PMP event and the lowest SSC floor elevation important to safety. Therefore, safety-related SSCs at the plant are not in a flooded condition during a local intense PMP event.

The local intense PMP for Units1 & 2 was analyzed for use in the FHRR considering a plant site configuration that would generate the highest flood elevation. The high flood water configuration at Units 1 & 2 would include a double row Vehicle Barrier System (VBS) around the Units 1 & 2 power block perimeter and would be during the Units 3 & 4 construction phase period.

After the construction phase for Units 3 & 4 was initiated, a second perimeter VBS row was added and security features were implemented at Units 1 & 2, and the effects of PMP on site drainage were again evaluated. From a PMP analysis standpoint, the construction phase of Units 3 & 4 is more onerous than the operational phase of Units 3 & 4 because permanent site drainage features to be installed at the plant site after construction of Units 3 & 4 are not in existence during the Units 3 & 4 construction phase. The VBS rows were added at different times so that currently there are two VBS rows surrounding the Units 1 & 2 power block. The newer VBS row is primarily located outside the older VBS row but not at all locations.

All changes to the Units 3 & 4 construction site drainage design and configuration are controlled appropriately under the Units 1 & 2 operational impact program requiring full evaluations of the proposed changes to the protection and operability of Units 1 & 2.

Units 1 & 2 is subject to tropical storms, heavy rains, and hurricanes. Units 1 & 2 procedure 1234-B, “Severe Weather Checklist,” provides instructions for preparing the plant to withstand the effects of a severe weather event such as a hurricane, tornado, or heavy rain event. No manual actions are relied upon for plant preparation as a component of this checklist. Entry into this checklist is performed for the following conditions:

- A tornado warning issued for either the County or for the River Site,
- Weather anticipated that will result in a Notification of Unusual Event in accordance with the Plant Emergency Plan,
- Or as deemed necessary by the Shift Manager

Preparation in advance of adverse weather conditions is governed by site procedures, which require plant shutdown as a precaution when appropriate. No in-room water detection systems are relied upon for external flooding in the Units 1 & 2 licensing basis, and no such systems are required due safety-related SSCs being located at an elevation above all postulated flood heights. Access to the Ultimate Heat Sink, the Nuclear Service Cooling Water system, is maintained throughout the duration of the PMP flood event as it is located at the site plant grade – assumed to be 219.6 feet msl.

Access roads to the power block structures will be flooded during the PMP event, as they are located below 219.3 feet msl. However, the power block structures are not flooded from the PMP event due to an available 0.3 feet margin. The assumed local intense precipitation has not historically endured at its maximum rate (19.2 inches/hour) for a duration which would require transporting equipment and/or relief from new staffing personnel at the safety-related structures during a PMP flood event.

Units 1 & 2 can remain in all operational plant modes independent of postulated flood heights and durations at the site, and, therefore, changes in operational mode do not affect the plant’s ability to remain dry and keep safety-related SSCs protected.

5.2 Dam Failures

The Units 1 & 2 FHRR revealed that, in addition to PMP, the dam failure reevaluation yielded a flood elevation higher than the current design basis. Dam breach flooding resulting from dam failure with coincident wave run-up yielded a maximum flood elevation at the site of 178.1 feet msl. The current design basis provides a flood elevation resulting from dam failure of 168 feet msl. See Table 3-3 for the reevaluated flood elevations related to each flood causing mechanism.

Despite the reevaluated flood height of 178.1 feet msl from dam failures including coincident wave run-up, the floor elevation of 219.6 feet msl of safety-related structures and openings at the site provides 41.5 feet of available margin above the resultant flood water from the dam failure flood causing mechanism.

The heightened flood elevation from the reevaluated dam failure at the Units 1 & 2 site provides a basis for performing this IA in accordance with the March 12, 2012 10 CFR 50.54(f) letter. However, the flood scenario demonstrated by the reevaluated PMP at Units 1 & 2 remains the controlling flood parameters to evaluate at this site. The PMP flood elevation exceeds the dam failure flood elevation by 41.2 feet, and PMP flooding parameters will be used to evaluate the protection capability of flood protection features in this IA.

Units 1 & 2 can remain in all operational modes during a worst-case dam failure scenario with all safety-related structures, systems, and components being protected from flooding.

6.0 Critical Plant Elevations and Equipment Protection

6.1 Settlement of Units 1 & 2 Power Block Structures

Section 2.5.4 of the Units 1 & 2 UFSAR addresses the predicted heave and settlement of the Units 1 & 2 power block area during the initial excavation through the construction of the facility. A heave-and-settlement monitoring program existed during the entire construction and has been maintained during the operational period as described in Section 2.5.4.1 of the Units 1 & 2 UFSAR. Currently, the settlement monitoring program data are collected and reported to the NRC at a reduced frequency (annually) because settlement of the structures has essentially ceased. During the excavation period, the heave at selected depths below the excavation resulting from the removal of the overburden was recorded. From the obvious measured heave data, corrected for depth and loading effects, an average heave of approximately 1.8 inches was determined for the excavation floor in the power block area.

Measured settlements attributed to backfilling of the excavations are not reported in the UFSAR. Units 1 & 2 UFSAR Figure 2.5.4-1 presents estimated settlements for power block structures with a maximum settlement of 4.2 inches (0.35 feet). The maximum measured total settlement at the power block structures reported in the Plant Report on Settlement, August 1986, was 3.6 inches (0.3 feet). These values, along with the calculated differential settlements, are within the allowable limits.

The soil column between the bedrock and the Blue Bluff Marl (BBM) clay, the competent foundation layer, is approximately 1,000 feet deep. The power block excavation extends down, about 90 feet, to the BBM. The BBM is typically from 60 feet to 70 feet thick. Some of the power block structures are founded on and in the BBM, and some are founded in the backfill. Depending on the foundation loading and other factors, the measured settlements vary within the expected range.

As a result of the settlement, the nominal design elevations (NDE) are not the actual elevations of the structures. As part of the preparation of the Flooding Hazard Re-evaluation Report (FHRR), a survey was performed to confirm the actual elevations of floors at NDE 220 feet msl. The minimum elevation reported in the recent survey was elevation 219.6 feet msl, which is located on the Unit 1 Auxiliary Building floor at the base of the north wall. For the purposes of this IA, the NDE of 220 feet msl, the elevation of the grade level structures, is established as elevation 219.6 feet msl, which is the lowest of any of the settlements in the UFSAR and the results of the recent survey.

JLD-ISG-2012-05, Section 5.3 provides for consideration of certain critical plant elevations and the manner by which plant equipment could be subjected to flooding. The relevant Units 1 & 2 plant nominal design elevations and the assumed, actual power block floor elevation are in Table 6-1 below:

Table 6-1 Critical Plant Design Elevations

Units 1 & 2 Power Block Plant Level	Nominal Design Elevation (feet msl)	Measured Elevation (feet msl)
Power Block Unfinished Plant Grade	219.0	-
Power Block Finished Plant Grade	219.5	-
Power Block SSCs Finished Floor/Entry Ways	220.0	219.6

The power block floors are elevated from finished plant grade by horizontal concrete slabs separating the levels of each building. From the field surveys conducted at the plant in preparation of the Units 1 & 2 FHRR, the lowest power block floor elevation reported was actually 219.6 feet msl. All critical elevations of safety-related SSCs and associated equipment is at or above the re-evaluated minimum Units 1 & 2 power block floor elevation of 219.6 feet msl, which is above the bounding flood elevation of 219.3 feet msl. Therefore, flood protection features or systems used to protect each piece of equipment, the manner by which the equipment could be subjected to flooding, and potential pathways for ingress of water are non-existent at Units 1 & 2.

6.2 Current Design Basis Flood Elevations

The current design basis flood elevations from various flood causing mechanisms (except the local intense precipitation flooding) are listed in Table 6-2 below and are taken from Section 2.4 of the Units 1 & 2 UFSAR. For Flooding in Streams and Rivers and Dam Failure analyses, the Units 1 & 2 current licensing basis considers all pertinent associated effects such as wind speeds and wave run-up with the Probable Maximum Flood (PMF). The FHRR re-evaluated dam breach flooding with coincident wave run-up, which yielded a maximum flood elevation of 178.1 feet msl – 41.5 feet below the lowest SSC floor elevation of 219.6 feet msl Additionally, the groundwater level at the site has historically been measured to be less than 162.0 feet msl, and the maximum potential groundwater level is estimated to be 165.0 feet msl – 54.6 feet below the floor elevation of safety-related structures at the site. A comparison of elevation values between the Units 1 & 2 current design basis flood mechanisms and the re-evaluated flood elevations from the Units 1&2 FHRR are shown in Table 6-3 below.

Table 6-2 Current Design Basis Flood Elevations

Flood Causing Mechanism	Flood Elevation (msl)	Flood Elevation coincident with Wind Wave (msl)	Source
Local Intense Precipitation (PMP)	(1)	N/A	(1)
Flooding in Streams and Rivers	138 feet	165 feet	Units 1 & 2 UFSAR Sections 2.4.3.4 and 2.4.3.6
Upstream Dam Failures	141 feet	168 feet	Units 1 & 2 UFSAR Sections 2.4.4.2 and 2.4.4.3
Storm Surge and Seiche	N/A	N/A	Units 1 & 2 UFSAR Section 2.4.5
Tsunami	N/A	N/A	Units 1 & 2 UFSAR Section 2.4.6
Ice Induced Flooding	N/A	N/A	Units 1 & 2 UFSAR Section 2.4.7
Channel Diversion	N/A	N/A	Units 1 & 2 UFSAR Section 2.4.9

(1) The Units 1 & 2 UFSAR provides the simplified methodology for determining the PMP flood height but it does not report the value. Section 1.2.1 of the Units 1 & 2 FHRR provides the current PMP analysis methodology and results.

Table 6-3 Current Design Basis and Re-evaluation Flood Elevations

Flood Causing Mechanism	Current Design Basis Flood Elevation	Re-evaluation Flood Elevation	Re-evaluation Flood Delta From Design Basis	Re-evaluation Flood Delta from SSC (219.6 ft msl)
Local Intense Precipitation (PMP)	219.1 ft msl	219.3 ft msl	+0.2 ft	-0.3 ft
Flooding in Streams and Rivers	165 ft msl	151 ft msl	-14 ft	-68.6 ft
Dam Failures	168 ft msl	178.1 ft msl	+10.1 ft	-41.5 ft
Storm Surge and Seiche	N/A	N/A	N/A	N/A
Tsunami	N/A	N/A	N/A	N/A
Ice Induced Flooding	N/A	N/A	N/A	N/A
Channel Diversion	N/A	N/A	N/A	N/A

7.0 Evaluation of Flood Protection

Units 1 & 2 SSCs important to safety cannot reach a flooded state as indicated by the FHRR for both the design basis and re-evaluated flood-causing mechanisms, but there are site characteristics engineered into the design of the plant to facilitate drainage and divert water away from Units 1 & 2. The Units 1 & 2 FWR also credited certain sub-grade flood protection features to protect against groundwater seepage into below-ground, safety-related SSCs. For those groundwater flood protection features mentioned below, the IA requirements are not applicable if not challenged by external flooding mechanisms. None of the flood protection features described with applicable flood protection evaluation methodology in JLD-ISG-2012-05, Appendix A are utilized as external flood protection features for Units 1 & 2 safety-related SSCs.

7.1 Site Topography

The Units 1 & 2 power block area is on a high plateau and is not in the path of any adjacent watershed. The topography is such that the runoff is directed away from the power block by a combined system of culverts and open ditches to natural drainage channels. The system has been evaluated to ensure that flooding of safety-related equipment would not occur as a result of the local intense PMP. The highest flood level from the local intense PMP is 219.3 feet msl, which is 0.3 feet below the lowest floor elevation in the Units 1 & 2 power block area.

7.1.1 Performance Criteria

The performance criteria listed in Section 6.2 and evaluation information in Section 8.2.2 of JLD-ISG-2012-05 as well as related methodology of Appendix A are not applicable for a site topography evaluation as the natural elements composing site elevation protect safety-related SSCs at the site grade elevation when APM exists above the controlling site flood elevation. No failure modes exist for site topography at the plant site. Heave and settlement monitoring of Units 1 & 2 will continue for the life of the plant.

7.1.2 Flood Protection Evaluation

The lowest measured safety-related structure floor and opening to a safety-related structure at Units 1 & 2 is located 219.6 feet msl. This potential external water ingress point remains 0.3 feet above the controlling PMP flood water elevation, which provides inherent protection to the safety-related structures, systems, and components from external flooding.

7.1.3 Flood Protection Performance Justification

Units 1 & 2 site topography, as a flood protection feature, provides a minimum safety-related SSC floor elevation of 219.6 feet msl, which yields 0.3 feet reliable, available margin above the bounding PMP water elevation of 219.3 feet msl. JLD-ISG-2012-05, Section 6.3 provides required information that is not applicable to evaluating the site topography of Units1 & 2.

7.2 Site Drainage Features

While the site yard drainage system is designed and constructed to effectively divert surface water away from the Units 1 & 2 power block, the site drainage features of the Units 1 & 2 site were assumed to be 100 percent blocked in the Units 1 & 2 FHRR. Blocking the site drainage features to prevent their functionality helps generate the peak local intense PMP flood elevation of 219.3 feet

msl. Therefore, an evaluation of the site yard drainage system as a flood protection feature is not required.

7.2.1 Performance Criteria

Because the site yard drainage system is not intended to be credited as a reliable flood protection system, the criteria of JLD-ISG-2012-05, Section 6.2 and related methodology of Appendix A are not applicable.

7.2.2 Flood Protection Evaluation

This section is not applicable as an evaluation of a protection feature credited for 100% failing during a PMP flood event is not required.

7.2.3 Flood Protection Performance Justification

Because the Units 1 & 2 site drainage system is not credited as a reliable flood protection feature, justification of its performance is not applicable in this IA. JLD-ISG-2012-05, Section 6.3 requires evaluation information that is not applicable to a flood protection feature not credited to function in a flood scenario.

7.3 Incorporated Flood Protection Features

Incorporated flood protection features are permanent, passive barriers and include walls, wall penetration seals, and waterstops at Units 1 & 2. These credited flood protection features in the Units 1 & 2 licensing basis are located well below 219.6 feet msl and protect against groundwater seepage into the buildings with safety-related SSCs. There are no incorporated flood protection features to protect safety-related SSCs against above-grade, external flood water and associated effects in the Units 1 & 2 licensing basis.

No surface ingress points at the plant site exist to allow the PMP water to flood sub-grade, safety-related SSCs, such as below-ground cables and safety-related equipment areas.

Underground, safety-related tunnels connecting rooms in separated safety-related structures exist as a conduit for cabling and system piping. The tunnels are covered by compacted, load-bearing competent site soil, and no interim entry points into the tunnel system exist between buildings. The entry points into those tunnels exist within safety-related structures at or above the floor elevation of, at least, 219.6 feet msl – which is protected from the controlling flood elevation with available margin. There are no other entry points or penetrations outside of the safety-related structures into safety-related tunneling at the site.

7.3.1 Concrete Walls

Certain exterior concrete walls were credited in the Units 1 & 2 FWR as a flood protection feature. Every wall inspected as a flood protection feature is located in a power block building room located at a sub-grade elevation at or below historical groundwater elevations (162.0 feet msl) at the site. No concrete walls are challenged by external flooding from the bounding local intense

PMP flood water elevation. All credited concrete walls are, at least, 57.6 feet below the floors and access points into safety-related structures.

7.3.1.1 Performance Criteria

Because there are no above-grade concrete walls credited for the protection of safety-related SSCs against external flooding, the criteria of JLD-ISG-2012-05, Section 6.2 and related methodology of Appendix A are not applicable.

7.3.1.2 Flood Protection Evaluation

Evaluation of the below-grade concrete walls is not applicable due to those walls being located at least 57.6 feet below safety-related structure floors and entry points.

7.3.1.3 Flood Protection Performance Justification

No concrete walls located at or above site grade are credited to protect safety-related SSCs at Units 1 & 2 from external flooding. As a result, performance justification for these non-credited features, as described in JLD-ISG-2012-05, Section 6.3, is not applicable.

7.3.2 Penetration Seals

Certain sub-grade floor and wall penetration seals were credited in the Units 1 & 2 FWR as flood protection features. Every wall or floor penetration seal inspected as a flood protection feature is located in a power block building room located on a sub-grade floor at or below historical groundwater elevations at the site (162.0 feet msl). No penetration seals are challenged by external flooding from the bounding local intense PMP flood water elevation.

7.3.2.1 Performance Criteria

Because there are no above-grade penetration seals credited for the protection of safety-related SSCs against external flooding, the criteria of JLD-ISG-2012-05, Section 6.2 and related methodology of Appendix A are not applicable.

7.3.2.2 Flood Protection Evaluation

Evaluation of the below-grade penetration seals is not applicable due to those seals being located at elevations at least 57.6 feet below safety-related structure flooring and entry points.

7.3.2.3 Flood Protection Performance Justification

No penetration seals located within buildings at or above site grade are credited to protect safety-related SSCs at Units 1 & 2 from external flooding. As a result, performance justification for these non-credited features, as described in JLD-ISG-2012-05, Section 6.3, is not applicable.

7.3.3 Waterstops

Waterstops embedded in exterior wall or floor construction joints of the Units 1 & 2 power block buildings, or in seismic gaps below the groundwater table elevation, are credited flood protection features in the Units 1 & 2 licensing basis. The FWR considered the waterstops in inspections of the incorporated concrete wall barriers.

The waterstops are in place below 219.6 feet msl to protect against groundwater seepage into sub-grade SSCs. One waterstop is provided at each construction joint below 170 feet msl, except in the nuclear service cooling water towers where two waterstops are provided at each construction joint below 220 feet msl. Two waterstops are provided at each seismic separation gap below 170 feet msl, and one waterstop is provided at each seismic gap located between 170 feet msl and 220 feet msl. No waterstops are challenged by external flooding from the bounding local intense PMP flood water elevation.

7.3.3.1 Performance Criteria

Because there are no above-grade waterstops credited for the protection of safety-related SSCs against external flooding through seismic gaps or construction joints, the criteria of JLD-ISG-2012-05, Section 6.2 and related methodology of Appendix A are not applicable.

7.3.3.2 Flood Protection Evaluation

Evaluation of the below-grade waterstops is not applicable for protection against external flooding due to those waterstops not being impacted external flood water – only groundwater.

7.3.3.3 Flood Protection Performance Justification

There are no waterstops embedded within seismic gaps or construction joints at or above site grade. There is varying margin between each waterstop and site grade, but no external flooding challenges the waterstops because they are below-ground. Therefore, no waterstops are credited to protect safety-related SSCs at Units 1 & 2 from external flooding. As a result, performance justification for these non-credited features, as described in JLD-ISG-2012-05, Section 6.3, is not applicable.

8.0 Units 1 & 2 Evaluation Results

The current Units 1 & 2 design basis high flood water elevation of 219.1 feet msl was exceeded by 0.2 feet in the Units 1 & 2 FHRR local intense PMP analysis, which prompted the development of this IA as required in NTTF Recommendation 2.1 (Enclosure 2 to the March 12, 2012 10 CFR 50.54(f) letter).

As indicated above, the Units 1 & 2 controlling flood scenario parameters derived from the FHRR are generated from the local intense PMP with a maximum flood elevation of 219.3 feet msl. For these controlling flood parameters at the Units 1 & 2 site, the re-evaluated flood height is 0.3 feet below the lowest safety-related SSC floor elevation of 219.6 feet msl. Given the FHRR indicates 0.3 feet APM, the Units 1 & 2 site can continue to be classified as a dry site, and it can be concluded that the site is not susceptible to flooding from any postulated flood hazard mechanism. Therefore, Units 1 & 2 is protected from external flooding by site topography and design, and not reliance upon flood protection features or mitigation measures.

The site FWR performed in accordance with NTTF Recommendation 2.3 verified the effectiveness of the Units 1 & 2 flood protection features and determined that no additional or enhanced flood protection features are necessary to be implemented at Units 1 & 2. The flood walkdown inspections confirm that the plant is protected from revaluated flood hazard mechanisms.

As a dry site, Units 1 & 2 is built above the maximum estimated flood stage, and therefore safety-related SSCs, including rooms important to safety, do not require in-room water detection systems specific for external flooding. Thus, water detection and warning systems are not relied upon in the licensing basis for protection against external floods. The Units 1 & 2 FHRR does not identify any severe weather conditions that would impair support functions necessary to achieve safe shutdown of the units.

APM exists for all flood hazard mechanisms between the Units 1 & 2 safety-related SSC floor elevations and flood water peak elevations. Units 1 & 2 can operate in all plant modes throughout site flooding durations without safety-related SSCs being challenged, so that changes in operational mode do not affect the plant's ability to remain dry and keep safety-related SSCs protected

9.0 Mitigation Capability

Units 1 & 2 is not in a flooded state from the controlling flood parameters determined by the FHRR performed in accordance with NTTF Recommendation 2.1 of the 10 CFR 50.54(f) March 12, 2012 letter. Units 1 & 2 has reliable margin between the lowest safety-related SSC floor elevation and the maximum external flood elevation generated by the local intense PMP. JLD-ISG-2012-05, Section 7 does not apply to this IA because an evaluation of mitigation capability is not required for sites that have demonstrated that flood protection is reliably provided with margin to safety-related SSCs.

Additionally, no temporary active measures or manual actions are required to protect Units 1 & 2 safety-related SSCs from external flooding by any potential flooding mechanism. JLD-ISG-2012-05, Appendix C is not applicable to this IA because no evaluation of manual actions to protect against flooding is needed. The instructed documentation of JLD-ISG-2012-05, Sections 8.2.3, 8.3, and 8.4 also do not apply to this Units 1 & 2 IA.

Electric Generating Plant Units 1 & 2

Attachment 1

Integrated Assessment for External Flooding

Peer Review

A.1 Peer Review

A.1.1 Peer Review Process

Preparer's Note

Pursuant to JLD-ISG-2012-05, "Guidance for Performing the Integrated Assessment for External Flooding," Revision 0, Section 4 and Appendix B.3, "Peer Review Documentation," state how this Peer Review Attachment meets the objectives of a successful peer review by first describing the peer review process utilized to meet the requirements of JLD-ISG-2012-05, Appendix B.

A.1.2 Peer Reviewer/Peer Review Team

Preparer's Note

The name and credentials (e.g. training, experience, expertise, capabilities and background information) of the peer reviewer or members of the peer review team would be provided in this section – consistent with the requirements of Appendix B.3 of JLD-ISG-2012-05.

Additionally, describe how the peer review team member(s) met the reviewer attributes and were independent from the preparation, review, and supervision of the IA report development in this section of the Attachment, in accordance with JLD-ISG-2012-05, Appendix B.1 and B.3.

A.1.3. Findings and Comments

Preparer's Note

Consistent with JLD-ISG-2012-05, Appendix B.3, provide the key findings, observations, and/or comments made by the peer review team member(s) in this section of the Peer Review Attachment along with the how the comments were dispositioned for inclusion in the final IA report.

A.1.4. Conclusions

Preparer's Note

In this section of the Peer Review Attachment, state the peer review team's overall conclusions of its review with regard to the completeness, accuracy of input information and reported results, technical bases, and the alignment of the IA report with the guidance of JLD-ISG-2012-05.