## Enclosure 2 – Coordination and Clarification

Licensees are currently evaluating flooding hazards using present-day standards and guidance and submitting reports to the U.S. Nuclear Regulatory Commission (NRC) in accordance with Phase 1 of the activities associated with the Near-Term Task Force's (NTTF's) Recommendation 2.1. In addition to the hazard reevaluation, each licensee who determines that the hazard for its plant exceeds the current design-basis flood level was requested to describe interim actions taken or planned that address the specific flooding issues identified by the reevaluation. The request for information and related guidance also call for affected licensees to perform an integrated assessment of the effects of higher flood levels on the nuclear power plant site. The integrated assessment was initially intended to evaluate the total plant response to the flood hazard and identify vulnerabilities and actions to address them. The integrated assessment could consider multiple and diverse capabilities such as physical barriers, temporary protective measures, and operational procedures. The capabilities being developed and implemented as part of the mitigating strategies required by Order EA-12-049, "Requirements for Mitigation Strategies for Beyond-Design-Basis External Events," could also be considered as part of an integrated assessment.

As licensees were performing their reevaluations of seismic and flooding hazards, guestions arose regarding the regulatory treatment of flood levels that were potentially higher than those established as design- or licensing-basis events for specific facilities. These questions translate to how the NRC staff would determine if regulatory actions are necessary under Phase 2 of the program and how those decisions are integrated with other Fukushima-related activities. A challenge in answering such questions is that the NRC response to the Fukushima accident involves the concurrent imposition and implementation of new requirements and the collection and assessment of information, such as the reevaluations of external hazards. The NRC staff has provided some guidance and plans regarding the decision-making process and integration of Fukushima-related activities to address specific questions during the reevaluation of external events and the implementation of mitigating strategies. The collection and assessment of information related to flooding hazards as part of the NRC's resolution of the NTTF's Recommendation 2.1 would (if Commission affirms staff's recommendations) help establish functional requirements and reference bounds for design to address external event scenarios in accordance with the generic mitigating strategies requirements. Focusing the flooding reevaluations on the SSCs serving key safety functions within the mitigating strategies could, in many cases, improve the efficiency of the NRC's regulatory process by eliminating the need for a broader assessment of the plant response as described in current plans and staff guidance for integrated assessments.

In keeping with the established policies that reevaluated hazards are not automatically incorporated into the licensing basis for operating reactors, but instead would be assessed in accordance with the NRC's regulation for considering new regulatory requirements (i.e., 10 CFR 50.109, "Backfitting"), the Director of the NRC's Office of Nuclear Reactor Regulation provided supplemental information in letters dated March 1, 2013, regarding flooding reevaluations and February 20, 2014, for seismic reevaluations. The letter, dated March 1, 2013, stated:

The staff considers the flood hazard re-evaluations being performed pursuant to the 50.54(f) letter to be beyond the current design/licensing basis of operating plants. Consequently, the results of the analysis performed using present-day regulatory guidance, methodologies, and information would not generally be expected to call into question the operability or functionality of SSCs. Therefore, the results are not expected to be reportable pursuant to 10 CFR 50.72, "Immediate notification requirements for operating nuclear power reactors," and 10 CFR 50.73, "Licensee event report system." However, as with any new information that may arise at a plant, licensees are responsible for evaluating and making determinations related to operability and any associated reportability on a case-by-case basis.

## and:

Notwithstanding the preceding discussion, and as noted in the 50.54(f) letter, based upon the results of the review of the responses and other available information, the staff may impose additional requirements to protect against the re-evaluated flood hazard. As always, the safety of the operating plants is of paramount importance. The NRC staff will follow established regulatory processes, including the backfit rule, in determining whether additional requirements are warranted. Further, as with any submittal to the NRC, licensees should evaluate the content to determine if it requires special treatment (e.g., security-related, proprietary, etc.) and request the information be withheld from public disclosure, as appropriate.

As licensees and the NRC staff were assessing the reevaluations of external hazards, they were also working on implementing the order that required the development and implementation of mitigating strategies for beyond-design-basis external events. The initial plans for the mitigating strategies allowed the use of the most recent site flood analysis (e.g., the design-basis flood) because the licensees had not yet completed the Recommendation 2.1 hazard reevaluations. However, the need for the mitigating strategies to address external hazards (especially flooding) exceeding the original design-basis levels for some facilities had been recognized during discussions on implementation of Order EA-12-049 and this point was incorporated into staff and industry guidance documents. The incorporation of the beyond-design-basis external hazards into measures being taken to control risks via implementation of improved mitigating capabilities and strategies is reflected in the regulatory basis document published for the mitigation of beyond-design-basis events (MBDBE) rulemaking activity. The NRC staff described the linkage between the reevaluation of hazards and the planned requirements for mitigating strategies as follows in the published regulatory basis document:

Since the purpose of the SBOMS [Station Blackout Mitigating Strategies (SBOMS) now referred to as MBDBE] rulemaking would be to provide mitigation capability for extreme external events, information from NTTF Recommendation 2.1 regulatory activities or other re-evaluations of site-specific hazards would be relevant and need to be addressed and could result in changes to the facility. These changes could include changes to: installed equipment; portable equipment connections; and/or guidance and strategies.

Consistent with Order EA-12-049 and related regulatory guidance, it is expected that the SBOMS rule would contain requirements to maintain the SBOMS capabilities, including the protection afforded the equipment consistent with any updated hazard analyses. The supporting SOC and regulatory guide would indicate that the meaning and intent of this provision would be to ensure that new information or operating experience feedback (e.g., new information about a re-evaluated hazard) that impacts the SBOMS equipment and strategies would need to be addressed, and the SBOMS strategies and equipment protection would be updated accordingly.

The relevant hazard information would be taken into account in showing that adequate time for use of portable equipment can reasonably be met as described in [Nuclear Energy Institute] NEI 12-06, Section 3.2.1.7, Principle 6, and clarified in JLD-ISG-2012-01's Staff Position of Section 2.1.<sup>1</sup> The establishment of an appropriate hazard is, therefore, an important element of the strategies that requires maintenance of mitigation capability for changes in the facility that could impact the identified time constraints. As such, the staff expects that NTTF Recommendation 2.1 activities, for licensees having re-evaluated hazards that exceed their current design basis, could have a significant impact on their SBOMS equipment and strategies. For example, the industry and the NRC are currently considering an expedited approach for the treatment of seismic issues to address NTTF Recommendation 2.1, and the result of that effort could impact the SBOMS equipment and strategies related to this rulemaking. The SBOMS rule could serve to codify the requirement for establishing and addressing re-evaluated hazards and their impact on mitigation equipment and strategies.

The completion and submittal of flooding reevaluations and the development and implementation of mitigating strategies for beyond-design-basis external events are bringing to the forefront the issue of the regulatory treatment of hazards that exceed existing design-basis flood levels. Licensees have developed interim actions and are undertaking additional analyses and plant changes to address the potential effects of beyond-design-basis natural events on equipment important to safety, and in particular on equipment used as part of the mitigating strategies associated with Order EA-12-049 and the MBDBE rulemaking. The reevaluation of flooding hazards will likely raise guestions from both internal and external stakeholders regarding the mitigation of risks from water levels significantly above the original design bases for individual facilities. The NRC staff has, therefore, engaged the nuclear industry and developed a general approach for Phase 2 of Recommendation 2.1 on flooding and the process by which the flooding reevaluations will be incorporated into the overall response to lessons learned from the Fukushima Daiichi accident. As discussed above, the flooding reevaluation activities are supporting (1) the establishment of design basis functions and reference bounds for design for mitigating strategies and, if warranted, (2) support for plant-specific evaluations of other possible regulatory actions (i.e., potential plant-specific backfits). The use of the flooding reevaluations from Recommendation 2.1 primarily to define functional requirements and

<sup>&</sup>lt;sup>1</sup> NEI 12-06, "Diverse and Flexible Coping Strategies (FLEX) Implementation Guide," is the industry guidance document for implementing NRC Order EA-12-049 and was endorsed in NRC interim staff guidance (ISG) JLD-ISG-2012-01, "Compliance with Order EA-12-049, Order Modifying Licenses with Regard to Requirements for Mitigating Strategies for Beyond-Design-Basis External Events."

reference bounds for mitigating strategies is a change from existing guidance and descriptions provided in briefings and reports to the Commission and the preliminary draft proposed rule does not require action in this regard. This integration of activities is an appropriate way to provide reasonable confidence that key safety functions are maintained during flooding scenarios while improving the efficiency and effectiveness of addressing lessons learned from the Fukushima accident.

The NRC staff finds that the integration of the activities will provide the desired outcome in terms of meaningful and assured safety improvements. The recommended approach also provides benefits in terms of establishing regulatory clarity and stability, reducing demands on schedules and resources, and ensuring timely responses to the lessons learned from the Fukushima accident. Primarily, the NRC staff proposes that the Commission require that licensees' mitigating strategies address the reevaluated flooding hazards as part of the MBDBE rulemaking. The reevaluation of the flooding hazard will help define important attributes of the equipment and actions used for the mitigating strategies for beyond-design-basis external events. Focusing the flooding reevaluations on the SSCs serving key safety functions within the mitigating strategies requirements could reduce the need for a broader assessment of the plant response as described in the current flooding-related guidance documents. There may be circumstances where the staff concludes that the flooding reevaluations warrant investigating the need for additional protection or mitigation beyond that provided by mitigating strategies. The current efforts to coordinate activities related to mitigating strategies and flooding reevaluations would improve the efficiency of implementing ongoing safety improvements. The NRC staff is requesting that the Commission approve the revised focus of Phase 1 flooding assessments and integration of Phase 2 decision-making into the development and implementation of mitigating strategies in accordance with Order EA-12-049 and the related MBDBE rulemaking.

## Establishing Design-Basis Functions and Values for Mitigating Strategies SSCs

A major part of addressing the lessons learned from the Fukushima accident for nuclear power plants in the United States is the development and implementation of mitigating strategies for beyond-design-basis external events. Figure 2.1 provides a simplified representation of the issue and resultant mitigating strategies. The figure shows how a beyond-design-basis event, such as a flooding scenario exceeding the values used to protect safety-related SSCs, can initiate a plant upset (Point 1). Nuclear power plants are designed with multiple safety systems to ensure that important safety functions, such as core cooling, are provided and protected against design-basis events (Point 2). However, postulated beyond-design-basis events can not only initiate a plant upset but can also challenge the availability of equipment performing key safety functions (Point 3). The Fukushima accident is an example of such an event where a tsunami exceeded the established flood protection features, caused the loss of electrical power and other safety systems, and ultimately a loss of safety functions needed to maintain the integrity of the reactor core and containment structures. The mitigating strategies put in place to address such external events therefore include measures (primarily location and separation) to protect some equipment from beyond-design-basis external events and thereby provide capabilities to prevent fuel damage in the reactor core or spent fuel pool and a significant release of radioactive material from the affected plant should the site be faced with external events more severe than previously analyzed (Point 4).

Simplified Representation Mitigating Strategies for Beyond Design Basis External Events





The following Figure 2-2 expands on this simple representation and includes the primary path related to ensuring mitigating strategies are developed for beyond-design-basis external events (Point 3), as well as the conditional path if consideration of additional plant-specific backfits might be warranted (Point 6). The availability of reevaluated flooding hazard information and the possible differences between reference bounds for design assumed for compliance with Order EA-12-049 and the MBDBE rulemaking are reflected in the letter "a" and "b" designations. Finally, Point 7 simply reflects that any evaluation of a potential backfit would need to consider the requirements imposed for improved mitigating strategies and the possibility that a plant-specific backfit might be addressed by enhancements to the established mitigating strategies.





The industry and NRC staff were faced with challenges related to the schedules for implementing Order EA-12-049 and the re-evaluation of flooding hazards using present day standards and guidance. The need to develop and implement plans for mitigating strategies for beyond-design-basis external events prior to completing the reevaluation of seismic and flooding hazards led the NRC staff to accept for the purpose of Order EA-12-049 that the functional requirements for installed and portable equipment could, if other information was not

available, be established at conditions associated with the most recent site flood analysis.<sup>2</sup> There is, however, a general consensus that the desired end state following completion of the hazard reevaluations and implementation of the MBDBE rulemaking is that licensees have mitigating strategies to address the scenarios identified from the Recommendation 2.1 assessments. Guidance documents and the regulatory basis for the MBDBE rulemaking have included statements that the mitigating strategies are expected to address beyond-design-basis events, including the flooding reevaluations resulting from the Recommendation 2.1 requests for information. However, incorporating the flooding reevaluations and integrated assessments into the process to define functional requirements for mitigating strategies equipment may require licensees to perform additional evaluations of installed equipment, structures, and the placement of portable equipment to reconcile the mitigating strategies plans and the results from the flooding assessments.

Although the focus for the reevaluated flooding hazards is related to assessing the capabilities for mitigating strategies, the activities related to the flooding reevaluations may result in the NRC staff identifying safety concerns and the need to consider regulatory actions beyond those being implemented in accordance with Order EA-12-049 and the related MBDBE rulemaking. The NRC staff will use established processes such as those defined in Management Directive (MD) 8.4, "Management of Facility-specific Backfitting and Information Collection" to initiate, review, and disposition any such safety concerns. MD 6.4, "Generic Issues Program," defines the process for raising and resolving generic safety concerns.

The planned increased integration of the re-evaluation of flooding into the mitigating strategies activities will serve to enhance the plant improvements being implemented in response to the lessons learned from the Fukushima Daiichi accident. The NRC staff described in the § 50.54(f) letter and related guidance an approach where Phase 1 of the flooding assessments (hazard reevaluation, interim actions, and integrated assessment) would support a subsequent NRC decision on appropriate regulatory actions. Those regulatory actions could include requiring licensees to prevent flooding of safety-related SSCs by improving flooding protection (akin to redefining the design-basis flood), requiring mitigating capabilities for cases where the availability of safety-related SSCs are challenged by flood waters, or some combination of actions to prevent or mitigate the risks from the reevaluated flooding hazards. As discussed above, the relationship between the external hazard re-evaluations and the development of mitigating strategies for such events has become clearer as both activities have developed over time, and the planned integration of the activities will support a more efficient and effective resolution of the issues. The NRC staff undertook improved coordination of the activities given that both centered on providing key safety functions during challenging external events. This paper responds to the staff requirements memorandum related to SECY-11-0124, "Recommended Actions to be Taken Without Delay from the Near-Term Task Force Report," in which the staff was directed to provide the Commission with information about the technical bases and acceptance criteria for implementing Recommendation 2.1.

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NEI 12-06 includes guidance for screening and considering external events, including flooding scenarios that states "The equipment should be stored in one or more of the following configurations: (a) Stored above the flood elevation from the most recent site flood analysis. The evaluation to determine the elevation for storage should be informed by flood analysis applicable to the site from early site permits, combined license applications, and/or contiguous licensed sites...."

The integrated assessments envisioned by the original guidance provided an opportunity for licensees and the NRC staff to gain insights into plant responses to flooding beyond testing capabilities to mitigate the event. Although the assessment of flooding hazards would now be focused primarily on the mitigating strategies capabilities (including necessary installed SSCs), the revised approach does not rule out the possibility that some licensees may perform the more detailed integrated flooding assessment as described in the current guidance documents (i.e., assessing plant impacts beyond maintaining mitigating strategy capabilities). These assessments could support licensees' consideration of asset protection measures (Figure 2.2; Point 5) or identify possible cost savings associated with traditional flood protection versus revised mitigating strategies. The staff may also undertake detailed assessments of flood protection and mitigation capabilities beyond Order EA-12-049 and the MBDBE rulemaking if needed to support evaluating the possible pursuit of plant-specific requirements in accordance with NRC's backfit regulation. The NRC staff will, on a case-specific basis, consider information about the reevaluated hazards; available response times for identified scenarios; plant-specific configurations and licensing histories; and other factors when defining an appropriate assessment of flooding scenarios to support evaluating a potential plant-specific backfit.

The assessments of mitigating strategies equipment and actions would ensure protection against various flooding mechanisms and conditions identified from the flooding reevaluations. Mitigating strategies would therefore need to address scenarios that could range from slightly above the design-basis flood to significantly above the design-basis flood and depending on the site, scenarios involving different warning times, debris loads, and event durations. The NRC staff has had several public meetings with the nuclear industry regarding the need to consider the reevaluated flooding hazard and possibly modify equipment or strategies to address conditions different than those considered in the implementation of Order EA-12-049. The industry provided a framework generally consistent with that proposed by the NRC staff in terms of assessing new hazard information and evaluating mitigating strategies and related equipment to either confirm the various flooding scenarios are adequately addressed or to identify possible revisions to the strategy to address the reevaluated flooding hazard. Changes to the mitigating strategies could involve modifications to the existing equipment or the locations and structures in which they are stored and plans developed for a variety of external hazards or could involve developing a targeted strategy for specific flooding scenarios.

An example of revising the existing equipment and plans developed for multiple external hazards would be to raise the elevation of a connection or storage location to accommodate higher flood levels that might be calculated when using present day standards and guidance. The assessment of new hazard information would consider not only the flooding conditions but also the timing of the event in terms of the ability of a licensee to be warned of an impending flood and ability to prepare. Licensees may be able to address some flooding scenarios by taking advantage of the available warning time to shut down the plant and optimize the use of the mitigating strategies developed to address all external hazards.

It is clear that for some flooding scenarios, licensees may need to develop targeted or scenario-specific mitigating strategies to deal with events that far exceed their original design-basis flood and the approaches developed for other external hazards. For example, some low-probability, but conceivable flooding scenarios could challenge a licensee's access to many plant SSCs, including those used to mitigate most beyond-design-basis external events. A possible scenario that would warrant a targeted mitigating strategy is the failure of one or more major dams upstream of a nuclear plant.

In addition to the expected damage to the nuclear power station, such a flooding scenario would – in and of itself - have major adverse impacts on public health and safety, regional economic activities, and other socio-economic conditions. However, measures would still be needed to ensure that the damage to the nuclear facility would not adversely impact the scope of the damage to the local community resulting from the disaster by introducing additional complexities resulting from a large release of radioactive materials. In the event of such an unlikely, but very large flood, the goal of protecting public health and safety by providing additional capabilities to prevent damage to fuel assemblies in the reactor core and the spent fuel pool is considered acceptable.

Licensees may develop a scenario-specific plan for some postulated flooding events that would identify the necessary actions, including the orderly shutdown of the reactor, to support the unit(s) achieving and maintaining a manageable shutdown condition. The targeted strategy would address the time from initial notification throughout the period of degrading conditions, loss of access to important plant areas and equipment, and receding water levels. As appropriate, the scenario-specific mitigating strategy would include provisions to address the following:

- Facility structures (containments, reactor and fuel buildings, etc.) and key systems (e.g., reactor vessel and spent fuel pool). The targeted strategy should address possible actions to help maintain overall structural and system configurations and integrity to support achieving and maintaining a manageable shutdown condition. Configuration control can, as appropriate, rely on the ability of structures and systems to withstand the static and dynamic forces associated with an overwhelming flood or include administrative actions, such as opening flowpaths for the flood waters to travel through a building. If flood waters are expected to enter buildings, the targeted strategy should address the ability of key systems to maintain a configuration that supports a manageable shutdown condition (i.e., prevents loss of cooling to fuel assemblies in the core and spent fuel pool).
- Cooling functions. The mitigating strategies should address those measures (design characteristics, installed equipment, portable equipment, etc.) providing cooling functions for the reactor core and spent fuel beginning with the notification of the initiating event (e.g., dam failure), throughout the plant shutdown, and ultimately achieving and maintaining a manageable shutdown condition.
- The targeted or scenario-specific mitigating strategy would identify key steps (including equipment and personnel) for the following:
  - Preparing for the arrival of the flood waters (e.g., reaching cold shutdown or refueling mode).
  - Providing cooling for the reactor core and spent fuel for the range of possible flooding levels—addressing the various potential stages of losing access to plant structures and equipment.

 Maintaining a manageable shutdown condition for the range of possible flooding levels—addressing equipment (including needed fuel supplies and supporting functions), access and movement to staging areas, and personnel support and safety (including food and water). As with other aspects of mitigating strategies, the plan should address maintaining the manageable shutdown condition using onsite portable equipment until such time as support can reasonably be expected from offsite resources.

The NRC staff is implementing the above approach as part of its activities related to Recommendation 2.1 on flooding reevaluations and Recommendation 4 on improving plant capabilities to deal with SBO events and mitigating strategies for beyond-design-basis external events. These approaches are consistent with longstanding policies on the treatment of design-basis events and safety enhancements to address beyond-design-basis events. The integration of the reevaluated flooding hazards with the ongoing mitigating strategies activities and the related rulemaking effort provide the most effective and efficient path for the timely resolution of Fukushima-related issues and implementation of safety enhancements at nuclear power plants.