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Subject: Documents for Discussion at our June 13 and 14 meetings
Date: Wednesday, June 06, 2012 5:45:04 PM
Attachments: [Integrated Assessment Concept_rev a4.doc](#)
[Inq 001 Gap Analysis_rev 0.doc](#)

Chris, Ed;

Our meetings next week will start to address the evaluation process and integrated assessment. In preparation for this meeting I previously sent you a draft process for addressing inquiries (FAQs) on our guidance. This message forwards a draft version of the integrated assessment guidance I have been working on and one of the "FAQs" we have developed (on gap analysis).

We are working on three more "FAQs: dam failures, hazard screening, and available physical margin significant consequence. I will send you a draft of these as soon as we develop them more completely.

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NEI 12-09: Guidance for Integrated Assessments and Interim Evaluation Reports

1.0 Purpose

An integrated assessment is an evaluation of the effectiveness of the existing design basis and any other planned or installed features for the protection and mitigation of flood conditions during the entire duration of a flood. The flood being considered is determined through the use of the methodologies in place for new plant license applications and early site permits and it considers the most severe of the natural phenomena that have been historically reported for the site and surrounding area. In the context of the flooding response to the Fukushima short term lessons learned 50.54(f) letter, an Integrated Assessment is completed when the results of the flood hazard reevaluation exceed the design basis flood hazard for the site.

The purpose of this document is to describe an NRC endorsed approach to completing an Integrated Assessment. This guidance also addresses the interim action plan that might be required at the time the flooding evaluation is submitted.

1.0 Introduction

There are three times within the flooding reevaluation effort performed in response to Enclosure 2 of Reference 1 when an Integrated Assessment or a similar evaluation must be submitted.

1. All sites must submit plans for completing an Integrated Assessment within 60 days of the NRC endorsement of this guidance. This submittal will describe the approach that the licensee intends to take should the flood hazard reevaluation for a site exceed the site's flooding design basis.
2. If a site's reevaluated flood hazard exceeds its design basis, the affected site will submit an interim action plan that documents actions planned or taken to address the reevaluated hazard. This interim action plan is submitted at the same time as the flooding hazard reevaluation results.
3. If a site's reevaluated flood hazard exceeds its design basis, the affected site will also need to complete an integrated assessment in accordance with this guidance. This Integrated Assessment must be submitted within 2 years of the date that the flood hazard reevaluations are submitted.

This guideline addresses all three submittals.

NEI 12-09: Guidance for Integrated Assessments and Interim Evaluation Reports

3.0 Scope

The Integrated Assessment must consider the effects of an external flood caused by natural phenomena (such as local intense precipitation, dam failure, storm surge, tsunami, and seiche) on the following systems, structures, and components (SSCs):

- SSCs that are important to safety
- Features of the ultimate heat sink (UHS) that could be adversely affected by the flood conditions and lead to degradation of the flood protection (the loss of UHS from non-flood associated causes are not included)

The Integrated Assessment must also take into account:

- Full power operations and other plant configurations that could be susceptible due to the status of the flood protection features.
- Entire duration of the flood conditions.

4.0 Definitions

4.1 Cliff Edge Effects

Cliff-edge effects were defined by the NRC's Near Term Task Force (NTTF) Report, which noted that "the safety consequences of a flooding event may increase sharply with a small increase in the flooding level" (see NTTF Report pages 29, 36, 37). To clarify, the staff differentiates between cliff-edge effects (which are dealt with in Recommendation 2.1) and the term, available physical margin (APM). The APMs were determined by the Recommendation 2.3 walkdowns. During the integrated assessment, the cliff-edge effects and the associated safety risks will be determined using the APMs as well as other information, such as the specific SSCs that are subjected to flooding and the potential availability of other systems to mitigate the risk

4.2 Plant-Specific Vulnerability

As defined in the referenced 50.54(f) letter, plant-specific vulnerabilities are those features important to safety that when subject to an increased demand due to the newly calculated hazard evaluation have not been shown to be capable of performing their intended safety functions.

NEI 12-09: Guidance for Integrated Assessments and Interim Evaluation Reports

4.3 Integrated Assessment

An integrated assessment is an evaluation of the effectiveness of the existing design basis and any other planned or installed features for the protection and mitigation of flood conditions for the entire duration of the flood considering the most severe of the natural phenomena that have been historically reported for the site and surrounding area. The Integrated Assessment also determines options for additional protection and mitigation features or other actions taken or planned to address plant specific vulnerabilities, and informs the NRC's regulatory decision making process for subsequent licensee actions

4.4 Available Physical Margin

The term available physical margin (APM) describes the flood margin available for applicable flood protection features at a site (not all flood protection features have APMs). The APM for each applicable flood protection feature is the difference between licensing basis flood height and the flood height at which water could affect an SSC important to safety. Determination of APM for local intense precipitation may not be possible (additional details are provided in section 3.13 of the flooding design basis walkdown guidance, NEI 12-07)

The APM determined by the Recommendation 2.3 walkdowns (NEI 12-07) can be used to identify straightforward and economical flood-protection enhancements while the Recommendation 2.1 assessments are being completed.

4.5 Susceptible Plant Configurations

The potential effect of flooding on the plant must consider the normal plant configurations that might exist when a postulated flood could occur. The plant conditions considered should include full power operations, startup, shutdown, and refueling. These different plant conditions will not only affect the status of flood protection features, they might also affect what equipment must be protected. The licensee should consider:

- the range of flood protection feature configurations that may exist during all plant conditions including maintenance periods and

NEI 12-09: Guidance for Integrated Assessments and

Interim Evaluation Reports

- the time available from the point at which a flood warning is received until flooding conditions exist that could affect the credited function of the flood protection feature.

4.6 Flood Duration

The potential effect of flooding on the plant must consider the effects that could occur over the full duration of the flood. The flood duration is the length of time in which flood conditions exist at the site. For some hazards, flood conditions could persist for a significant amount of time. Extended inundation on or near the site could present concerns such as:

- Site and building access,
- Travel around the site,
- Equipment operating times, and
- Supplies of consumables

Flood protection feature limitations based on flood duration should be evaluated. For example, if the duration of the design basis flood is 72 hours and a diesel driven pump is credited with removing water from an area, the total amount of fuel available for the pump and the operating time it represents should be determined and included in the assessment.

5.0 Assumptions

The flowing assumptions are acceptable for performance of Integrated Assessments;

- The results of the flooding reevaluations for existing plants that use methodologies applicable to new plants are “beyond design basis”; the evaluations do not define a new licensing basis for the existing plant (see Reference 1, pg. 2, 4). Therefore the flowing applies:
 - Evaluation results do not create immediate operability concerns for affected SSCs.
 - The strategies used by licensees to address the results do not need to adhere to 10CFR50 Appendix B standards for safety related changes to plant design or procedures.

Note however, the NRC may decide to order a licensee to change its licensing or design basis subsequent to submittal of the reevaluation results or Integrated Assessment Report.

NEI 12-09: Guidance for Integrated Assessments and

Interim Evaluation Reports

- Credit can be taken for all available resources, both on-site and off-site (ref. 1, pg. 2), including the use of systems, equipment, and personnel in non-traditional ways. For example, replenishing the spent fuel pool from the potable water or fire protection systems can be assumed as long as these systems would not be rendered non-function by the flood at the time they are needed.
- The integrated assessment analysis can use a combination of mitigation and protection to address the flooding results (ref. 1, pg. 2).
- Temporary mitigation and protection measures can be credited (ref. 1, pg. 2).
- FLEX equipment can be used to mitigate the flood if FLEX is in place and available.
- Combined events do not need to be assumed unless they can be reasonably be expected to occur at the same time. For example, high winds and lightening should be assumed to occur at the same time as a flood due to local intense precipitation, but a seismic event need not be assumed (unless the seismic event caused the flood). ANSI/ANS 2.8-1992 "Determining Design Basis Flooding at Power Reactor Sites" provides additional guidance on combined events that should be considered.
- Credit can be taken for non-safety related SSCs as long as the SSCs can be shown to not be rendered non-functional by the flood.
- Risk informed concepts can be used to estimate the feasibility of the flood hazard.
- Flood timing effects can be used to determine how much time is available before the flood affects the site and how long flooding conditions persist.

6.0 Requested Actions

Enclosure 2 of Reference 1 includes the following requested actions pertinent to the content of this guideline.

- For the sites where the reevaluated flood exceeds the design basis, addressees are requested to submit an interim action plan that documents actions planned or taken to address the reevaluated hazard with the hazard evaluation.
- Subsequently addressees should perform an integrated assessment of the plant to identify vulnerabilities and actions to address them.

NEI 12-09: Guidance for Integrated Assessments and Interim Evaluation Reports

7.0 Requested Information

Enclosure 2 of Reference 1 requests the following information pertinent to the content of this guideline.

7.1 All Addresses

- REQUIRED RESPONSE item 1 requires all licensees to submit an approach for developing an Integrated Assessment report, including criteria for identifying vulnerabilities, within 60 days of NRC endorsement of this guideline:
- REQUESTED INFORMATION item 1.d requires all addressees to address any flooding hazards higher than their design basis by providing an interim evaluation and actions taken or planned prior to completion of the Integrated Assessment.

7.2 As Requested by NRC

In accordance with REQUESTED INFORMATION item 2, sites whose current design basis flood evaluation does not bound the reevaluated hazard for all flood causing mechanisms and who have been requested by the NRC to submit an Integrated Assessment, must provide written responses to the items below within 2 years of submittal of the flood hazard reevaluation results.

- (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 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.

8.0 Criteria for Identifying Vulnerabilities

NEI 12-09: Guidance for Integrated Assessments and Interim Evaluation Reports

9.0 Methodology

9.1 Approach to an Integrated Assessment

In accordance with Enclosure 2 of Reference 1, every licensee is expected to submit its approach to an Integrated Assessment within 60 days of NRC endorsement of this guideline. This section describes the expected content of this submittal.

Licensees should state that they will follow this guidance if they are asked to prepare an Integrated Assessment. Since the flooding design basis walkdowns will likely have been completed at the time this submittal is due, the following information should be included in the submittal:

- General observations on the results of the walkdowns, including ;
 - Minimum Available Physical Margins observed on the site
 - Expected applicability of Integrated Assessment

9.2 Interim Evaluation

Licensees whose reevaluated flood hazard exceeds their design basis flood hazard are to submit an interim evaluation and actions taken or planned to address any higher flooding hazards relative to the design basis. This submittal must be made at the same time as the flood reevaluation results submittal. This section provides guidance on the content of this submittal.

- Describe the flood protection features that were exceeded by the results of the reevaluation and the flooding hazard(s) that affected them
- Describe the probability of occurrence of the associated hazard at the severity assumed in the reevaluation
- Describe the interim changes completed or planned to address the reevaluated flood hazard result.
- Propose a schedule for completing the planned changes
- If any reevaluated flood hazards exceed the existing flood protection features and no changes are planned address them, explain the basis for this decision. A possible

NEI 12-09: Guidance for Integrated Assessments and

Interim Evaluation Reports

approach might be based on the probability of occurrence combined with the cost of the protection modifications needed and the existence of FLEX.

- Describe why it is acceptable to continue to operate as the proposed changes are implemented

9.3 Integrated Assessment Report

Licensees who are requested by the NRC to submit an Integrated Assessment must do so within 2 years of submittal of their flood reevaluation results. The Integrated Assessment must identify vulnerabilities and actions to address them. The items below provide guidance on the content of the Integrated Assessment Report items contained in REQUESTED INFORMATION item 2.

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

- This should be an update of the approach described in section 9.1 above.

(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.

- Include a brief summary of the flood causing mechanisms
- Describe the effects of the flood mechanisms
- Describe the associated parameters that were used in the assessment
- Describe vulnerabilities, if any, that were identified by the assessment.
- Discuss any available margins beyond the postulated hazard results.
- Determine the limiting margin on site
- Explain the significance of this margin in terms of the additional severity and probability of occurrence of the hazard that would be required to eliminate the margin.
- Discuss the effects on safe plant operation of exceeding the available margins

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

- Describe additional protection features planned or installed. If planned, provide the schedule for installation.
- Describe additional mitigation features planned or installed. If planned, provide the schedule for installation.

NEI 12-09: Guidance for Integrated Assessments and Interim Evaluation Reports

- Describe the FLEX equipment and implementation design at your site, including the flood hazard it was designed to address
 - Discuss the resulting available margins, including the limiting margin on site
 - Explain the significance of this resulting margin in terms of the hazard that would be necessary to exceed it and the probability of occurrence of such a hazard
- (d.) Identify other actions that have been taken or are planned to address plant-specific vulnerabilities.
- Describe procedure changes that have been made to address more severe flooding hazards
 - Describe personnel resource changes that have been implemented to improve the site's capability to respond to a flooding event
 - Describe the feasibility of the operator actions that would be necessary to implement the existing and additional procedures
 - Describe the criteria you used to determine what additional protection and mitigation features to adopt.

Outline of Content/Approach

- Assemble the information on Available Physical Margin that was collected during the flooding design basis walkdowns. Determine limiting margins for the site and the equipment affected.
- Compare new flood evaluation results with licensing basis for floods
- Identify vulnerabilities (flood protection features that are not capable of performing their intended functions when subjected to the flood results calculated by new plant flood evaluation methods) based on the flood reevaluation results and the limiting margins
- Identify safety related SSCs that may be affected by the vulnerabilities.
- Evaluate the effect of flooding on the affected SSCs. This evaluation should take into account:
 - the elevation of the SSC,
 - the effect of water at the height expected on the function of the SSC,
 - the availability of redundant SSCs or other SSCs that could be used in place of the SSCs that were affected
- Determine the effect on safe plant operation of mitigation measures that could be taken

NEI 12-09: Guidance for Integrated Assessments and

Interim Evaluation Reports

- Determine the overall effect on safe plant operation
- Propose changes in flood protection features and mitigation measures that would alleviate the effect of the flood. Protection features and mitigation measures that might be considered include:
 - FLEX
 - Manual actions
 - Temporary barriers
 - Portable pumps
- Propose a schedule for completing the proposed changes
- Describe why it is acceptable to continue to operate as the proposed changes are implemented. Considerations that might be applied include:
 - Probability of event
 - Use of FLEX equipment
 - Interim actions taken

10.0 References

1. NRC Letter to Licensees, dated March 12, 2012, "Request for Information Pursuant to Title 10 of the Code of Federal Regulations 50.54(f) Regarding Recommendations 2.1, 2.3, and 9.3 of the Near Term Task Force Review of Insights from the Fukushima Dai-ichi Accident"
 2. NRC Letter to Licensees, dated November 30, 2012, Endorsement of Integrated Assessment Guidance
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Flooding Guidance Inquiry Form

A. TOPIC: Gap Analysis	Inq. No.: <u>001</u>
Source document: <u>NRC 50.54(f) letter on Fukushima near term activities</u>	Section: _____
B. DESCRIPTION: External flooding evaluations submitted to the NRC for ESP/COL plants may be used as the basis for reevaluations for operating plants co-located on the same sites as ESP/COL plants. Guidance on how this should be done consistently is necessary.	
C. Initiator: Name: <u>Ken Huffman</u> Phone: <u>(770) 485-2067</u> Date: <u>05-31-12</u> E-Mail: <u>khuffman@epri.com</u>	
D. RESOLUTION: (Include additional pages if necessary. Total pages: <u>1</u>) Discussion: With respect to external flooding reevaluation the NRC 50-54(f) letter issued March 12, 2012 “requested that the reevaluation apply present-day regulatory guidance and methodologies being used for ESP and COL reviews”. The NRC letter establishing response due dates for external flooding reevaluations recognized the use of existing ESP/COL plant evaluations as the basis for operating plant reevaluations in establishing Category 1 plants. “Category 1: Licensees in this category are expected to report the results of reevaluations within one year. This category includes most sites that are co-located with an ESP or COL site. Except for the site-specific drainage analysis of the operating units; flooding hazards at these sites have already been analyzed using present-day methodologies and guidance.” Follow-up Actions: External flooding reevaluations of operating plants co-located with ESP/COL plants that are based on the co-located ESP/COL plant’s flooding evaluation will consider and include, as appropriate, supplemental evaluations addressing local specific physical characteristics or structures that affect the applicability of the ESP/COL plant evaluation to the operating plant. These considerations are site specific and include physical characteristics or structures that affect flooding mechanisms, such as drainage associated with local intense precipitation, wind-wave combined events at safety cooling water intake structures located on the coast or streamside, tsunami runup, dynamic loading conditions, etc. Revision: <u>0</u> Date: <u>5/31/12</u>	
E. NRC Review: Not Necessary _____ Interpretation <u>X</u> Agency Position _____ Explanation: _____	
F. Industry Approval: Documentation Method: _____ Date: _____	
G. NRC Approval: Documentation Method: _____ Date: _____	