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Subject:	FFTF Comments on Integrated Assessment
Date:	Wednesday, August 08, 2012 9:45:48 AM
Attachments:	Integrated Assessment, Draft a,FFTF comments.pdf Comments on IA - 08-07-12-FFTF.doc

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Chris, Ed;

Our comments on the integrated assessment ISG are contained in the attached files.

Do you have any comments on our dam failure white paper that you can share this morning?

Jim Riley

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JAPAN LESSONS-LEARNED PROJECT DIRECTORATE

JLD-ISG-2012-##

Guidance for Performing the Integrated Assessment for Flooding

DRAFT Interim Staff Guidance

Revision 0
(DRAFT for use in public meeting on August 8-9, 2012)

JAPAN LESSONS-LEARNED PROJECT DIRECTORATE

JLD-ISG-2012-##

Guidance for Performing the Integrated Assessment for Flooding

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Revision 0
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DRAFT
INTERIM STAFF GUIDANCE
JAPAN LESSONS-LEARNED PROJECT DIRECTORATE
GUIDANCE FOR PERFORMING THE INTEGRATED ASSESSMENT FOR EXTERNAL FLOODING
JLD-ISG-12-##

PURPOSE

This interim staff guidance (ISG) is being issued to describe to stakeholders methods acceptable to the staff of the U.S. Nuclear Regulatory Commission (NRC) for performing the Integrated Assessment for external flooding as described in NRC's March 12, 2012 request for information (Ref. (1)) issued pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) 50.54(f) regarding Recommendation 2.1 of 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* (Ref. (2)). Amongst other actions, the March 12, 2012 letter requests that respondents reevaluate flood hazards at each site and compare the reevaluated hazard to the current design basis at the site for each flood mechanism. Addressees are requested to perform an Integrated Assessment if the current design basis flood hazard does not bound the reevaluated flood hazard for all mechanisms. This ISG will assist operating power reactor respondents and holders of construction permits under 10 CFR Part 50 with performance of the Integrated Assessment. It should be noted that the guidance provided in this ISG is not intended to describe methods for use in regulatory activities beyond the scope of the March 12, 2012, 50.54(f) letter.

BACKGROUND

Following the events at the Fukushima Dai-ichi nuclear power plant, the NRC established a senior-level agency task force referred to as the Near-Term Task Force (NTTF). The NTTF conducted a systematic and methodical review of the NRC regulations and processes and determined if the agency should make additional improvements to these programs in light of the events at Fukushima Dai-ichi. As a result of this review, the NTTF developed a comprehensive set of recommendations, documented in SECY-11-0093(Ref.(2)). These recommendations were enhanced by the NRC staff following interactions with stakeholders. Documentation of the NRC staff's efforts is contained in SECY-11-0124, *Recommended Actions To Be Taken Without Delay From the Near Term Task Force Report*, dated September 9, 2011 (Ref.(3)), and SECY-11-0137, *Prioritization of Recommended Actions To Be Taken in Response to Fukushima Lessons Learned*, dated October 3, 2011(Ref. (4)).

As directed by the staff requirements memorandum for SECY-11-0093 (Ref.(2)), the NRC staff reviewed the NTTF recommendations within the context of the NRC's existing regulatory framework and considered the various regulatory vehicles available to the NRC to implement the recommendations. SECY-11-0124 and SECY-11-0137 established the staff's prioritization of the recommendations based upon the potential safety enhancements.

As part of the staff requirements memorandum for SECY-11-0124, dated October 18, 2011 (Ref.(5)), the Commission approved the staff's proposed actions, including the development of three information requests under 10 CFR 50.54(f). The information collected would be used to support the NRC staff's evaluation of whether further regulatory action should be pursued in the areas of seismic and flooding design, and emergency preparedness.

In addition to Commission direction, the Consolidated Appropriations Act, Public Law 112-074, was signed into law on December 23, 2011. Section 402 of the law requires a reevaluation of licensees' design basis for external hazards.

In response to the aforementioned Commission and Congressional direction, the NRC issued a request for information to all power reactor licensees and holders of construction permits under 10 CFR Part 50 on March 12, 2012 (Ref.(1)). The March 12, 2012 50.54(f) letter includes a request that respondents reevaluate flooding hazards at nuclear power plant sites using updated flooding hazard information and present-day regulatory guidance and methodologies. The letter also requests the comparison of the reevaluated hazard to the current design basis at the site for each potential flood mechanism. If the reevaluated flood hazard at a site is not bounded by the current design basis, respondents are requested to perform an Integrated Assessment. The Integrated Assessment will evaluate the total plant response to the flood hazard, considering multiple and diverse capabilities such as physical barriers, temporary protective measures, and operational procedures. The NRC staff will review the responses to this request for information and determine whether regulatory actions are necessary to provide additional protection against flooding.

RATIONALE

On March 12, 2012, NRC issued a request for information to all power reactor licensees and holders of construction permits under 10 CFR Part 50. The request was issued in accordance with the provisions of Sections 161.c, 103.b, and 182.a of the Atomic Energy Act of 1954, as amended (the Act), and NRC regulation in Title 10 of the *Code of Federal Regulations*, Part 50, Section 50.54(f). Pursuant to these provisions of the Act or this regulation, respondents were required to provide information to enable the staff to determine whether a nuclear plant license should be modified, suspended, or revoked.

The information request directed respondents to submit an approach for developing an Integrated Assessment Report including criteria for identifying vulnerabilities. This ISG describes an approach for developing the Integrated Assessment Report that is acceptable to the staff.

APPLICABILITY

This ISG shall be implemented on the day following its approval. It shall remain in effect until it has been superseded or withdrawn.

PROPOSED GUIDANCE

This ISG is applicable to holders of operating power reactor licensees and construction permits under 10 CFR Part 50 from whom an Integrated Assessment is requested (i.e., sites for which the current design basis flood hazard does not bound the reevaluated hazard for all potential flood mechanisms). For combined license holders under 10 CFR Part 52, the issues in NTTF Recommendation 2.1 and 2.3 regarding seismic and flooding reevaluations and walkdowns are resolved and thus this ISG is not applicable.

IMPLEMENTATION

Except in those cases in which a licensee or construction permit holder under 10 CFR Part 50 proposes an acceptable alternative method for performing the Integrated Assessment, the NRC staff will use the methods described in this ISG to evaluate responses to the portions of the March 12, 2012 request for information related to the Integrated Assessment.

BACKFITTING DISCUSSION

Licensees and construction permit holders under 10 CFR Part 50 may use the guidance in this document to meet the intent of the portions of the March 12, 2012 request for information related to the Integrated Assessment. Accordingly, the NRC staff issuance of this ISG is not considered backfitting, as defined in 10 CFR 50.109(a)(1), nor is it deemed to be in conflict with any of the issue finality provisions in 10 CFR Part 52.

FINAL RESOLUTION

The contents of this ISG, or a portion thereof, may subsequently be incorporated into other guidance documents, as appropriate.

ATTACHMENTS

1. Guidance for performance of Integrated Assessment

REFERENCES [#INCOMPLETE AND UNFORMATTED]

1. **USNRC.** *#INSERT Reference to NRC 50.54(f) letter.* ML #.

2. **U.S. Nuclear Regulatory Commission.** *Recommendations for Enhancing Reactor Safety in the 21st Century, The Near-Term Task Force Review of Insights from the Fukushima Dai-ichi Accident, SECY-11-0093.* July 12, 2011. ADAMS Accession No. ML111861807.

3. **USNRC.** *#INSERT Reference to SECY-11-0124, Recommended Actions To Be Taken Without Delay From the Near Term Task Force Report.* September 9, 2011.

4. —. *#INSERT Reference to SECY-11-0137, Prioritization of Recommended Actions To Be Taken in Response to Fukushima Lessons Learned.* October 3, 2011.

5. —. *#INSERT Reference to SRM for SECY-11-0124.* ADAMS Accession No. ML 112911571.

6. —. *#INSERT Reference to NRC endorsement letter of NEI 12-07.*

7. **ANS.** *#INSERT Reference to ANS PRA document.*

8. **NEI.** *#INSERT Reference to NEI 12-07.* ML12173A215.

9. **USNRC.** *#INSERT Reference to STAFF REQUIREMENTS – SECY-12-0025.*

10. —. *#INSERT Reference to NUREG/CR-7046 .*

11. —. *#INSERT Reference to NUREG 1852.*

12. **ANSI/ANS.** *#INSERT referene to ANS/ANSI 2.8-1992, Determining Design Basis Flooding...*

13. **USNRC.** *#INSERT Reference to Regulatory Guide 1.200, "AN APPROACH FOR DETERMINING THE TECHNICAL ADEQUACY OF PROBABILISTIC RISK ASSESSMENT RESULTS FOR RISK-INFORMED ACTIVITIES".*

GUIDANCE FOR PERFORMANCE OF INTEGRATED ASSESSMENT

1. Introduction

The Integrated Assessment evaluates the total plant response to external flood hazards, considering both the protection and mitigation capabilities of the plant. The purpose of the Integrated Assessment is to: (1) evaluate the effectiveness of the existing licensing basis, (2) identify plant-specific vulnerabilities, and (3) assess the effectiveness of existing or planned plant systems and procedures in protecting against flood conditions and mitigating consequences for the entire duration of a flooding event.

There are two fundamental aspects to the Integrated Assessment. The first aspect involves evaluation of the flood protection capabilities at a specific nuclear power plant site to meet their intended safety functions when considering multiple and diverse features such as physical flood protection barriers, temporary protective measures, and operational procedures, individually or in combination. In addition to evaluating the performance of individual flood protection features, the evaluation of flood protection effectiveness considers the site flood protection as a set of systems with interdependent components and subsystems (including dependence on procedures). The second aspect of the Integrated Assessment involves evaluation of the plant's ability to maintain key safety functions during a flood in the event that the flood protection systems are compromised and unable to perform their intended safety functions. Thus, ultimately, the Integrated Assessment should demonstrate the reliability of the flood protection system utilized at the plant by considering the ways in which the system can fail and the likelihood of various failure modes. Moreover, the Integrated Assessment evaluates the capability of the plant to respond to and mitigate the consequences of such a failure by maintaining key safety functions using all credited resources.

This sounds good but please define credited!

In general, the types and attributes of flood protection features (including procedures) utilized at nuclear power plants are diverse due to differences in factors such as:

- hazard characteristics (e.g., flood mechanisms, flood durations, and debris quantity)
- site topography and surrounding environment
- other site-specific considerations (e.g., available warning time)

As a result, this guidance must be capable of accommodating the unique environments and characteristics of nuclear power plant sites while ensuring that the information gathered as part of the NRC's March 12, 2012 information request provides a sufficient basis (including reliability insights) to determine if any additional regulatory actions are necessary to provide additional protection against flood hazards.[1]

[1] Recommendation 2.1 of the NTTF is being implemented in two phases. Phase 1 of Recommendation 2.1 implementation comprises the issuance of the 10 CFR 50.54(f) letters to addressees to request that they reevaluate the flooding hazard at their sites using updated hazard information and present-day regulatory guidance and methodologies. If necessary, respondents are also requested to perform an Integrated Assessment for flooding. Phase 2 uses the Phase 1 results to determine whether additional regulatory actions are necessary (e.g., update the design basis and SSCs important to safety).

The objective of this guidance is to provide a framework for the Integrated Assessment that helps facilitate consistent and informative responses to NRC's 50.54(f) letter, while being sufficiently flexible and adaptable to accommodate the site-specific characteristics of nuclear power plant sites.

1.1 Organization of guidance

This guidance document begins with an overview of the relationship between the Integrated Assessment and other activities requested under NRC's March 12, 2012 50.54(f), a summary of the information requested by the letter, and review of the Integrated Assessment scope (ISG Section 1). A list of terms and definitions is provided (ISG Section 2), Next, an overview of the framework and key assumptions of the Integrated Assessment is presented (ISG Section 3).

The guidance provided in this ISG for performing the Integrated Assessment is comprised of three distinct components:

1. information collection and compilation (ISG Section 4)
2. evaluation (ISG Section 5)
3. results (ISG Section 6)

Section 4 describes the information that should be collected and compiled to facilitate the performance of the Integrated Assessment, including:

- key plant elevations and protection of equipment
- applicable flood mechanisms

Section 5 (in conjunction with the Appendices to this ISG) provides guidance on the evaluations expected under the Integrated Assessment. The evaluations consist of:

- determination of controlling flood parameters
- evaluation of the effectiveness of flood protection systems
- evaluation of plant mitigation capability

Section 6 describes the documentation of the Integrated Assessment and provides guidance on the results that should be obtained based on the evaluations performed using this guidance. Results that should be documented include:

- description of available margin
- identification of vulnerabilities
- cliff-edge effects
- risk-insights and defense-in-depth considerations

1.2 Recommendation 2.3 Flood Walkdowns and Relationship to Integrated Assessment

As part of the 50.54(f) letter issued by the NRC on March 12, 2012, licensees were requested to perform flood protection walkdowns to verify that plant features credited in the current licensing basis for protection and mitigation from external flood events are available, functional, and properly maintained. These walkdowns are interim actions to be performed while the longer-term hazard reevaluations and integrated assessments actions are being performed. NRC and NEI worked collaboratively to develop guidelines for performing the walkdowns, resulting in the document NEI 12-07, "Guidelines for Performing Verification Walkdowns of Plant Flood Protection Features" (Ref. (7)), which NRC endorsed on May 31, 2012 (Ref. (6)).

As part of the walkdowns, respondents will verify that permanent structures, systems, and components (SSC) as well as temporary or portable flood protection and mitigation equipment will perform their intended safety functions as credited in the current licensing basis. Verification activities will ensure that changes to the plant (e.g., security barrier installations and topography changes) do not adversely affect flood protection and mitigation equipment. In addition, the walkdown will verify that procedures needed to install and operate equipment needed for flood protection or mitigation can be performed as credited in the current licensing basis. The walkdown will also verify that the execution of procedures will not be impeded by adverse weather conditions that could be reasonably expected to simultaneously occur with a flood event. Under the walkdowns, observations of potential deficiencies, as well as observations of flood protection features with small margin and potentially significant safety consequences if lost, were entered into the licensee's corrective action program.

It is anticipated that the walkdowns will be a valuable source of information that will be useful during the performance of the Integrated Assessment. In particular, the walkdowns will provide information on available physical margin (APM) under the existing design basis hazard, the condition of flood protection features, the feasibility of procedures, SSCs that are subjected to flooding, and the potential availability of systems to mitigate flood events. However, it is emphasized that the walkdowns are performed to the current licensing basis. The reevaluated flood hazards performed under Recommendation 2.1 (see Section 1.3) may be associated with a higher water surface elevations and different associated effects when compared to the current licensing basis. Therefore, some of the information from the walkdowns may not be directly applicable as part of the Integrated Assessment. It is expected that any additional information related to the impact of the flooding hazard reassessment will be considered as part of the Integrated Assessment, and that this information would be available to effectively consider the flood protection capabilities in light of potential additional flooding impacts to the site (i.e., higher elevations, accessibility issues) that may not have been fully considered during the implementation of Recommendation 2.3.

1.3 Recommendation 2.1 Flood Hazard Reevaluations and Relationship to Integrated Assessment

An integrated assessment is only required if the new hazard is greater than the CLB hazard. No margin is necessary.

NRC's March 12, 2012 50.54(f) letter requests that respondents reevaluate all appropriate external flooding sources, including the effects from local intense precipitation on the site, probable maximum flood (PMF) on stream and rivers, storm surges, seiche, tsunami, and dam failures. It is requested that the reevaluation apply present-day regulatory guidance and methodologies being used for early site permit (ESP) and combined license (COL) reviews including current techniques, software, and methods used in present-day standard engineering practice.

For the sites where the reevaluated flood is *not* bounded by the existing design basis hazard for all flood mechanisms applicable to the site, respondents are requested to submit an interim action plan with the hazard report that documents actions planned or taken to address the reevaluated hazard. Subsequently, respondents are also asked to perform an Integrated Assessment. In light of the reevaluated hazard, the Integrated Assessment will evaluate the capability of the existing licensing basis (i.e., flood protection and mitigation systems), identify plant-specific vulnerabilities, and assess the effectiveness of existing or planned systems and procedures for protecting against and mitigating the effects of the reevaluated hazard for the entire duration of the flood event.

1.4 Actions and Information Requested

For the sites where the reevaluated flood is not bounded by the existing design basis for all flood-causing mechanisms, the March 12, 2012 letter requests that respondents perform an Integrated Assessment of the plant to identify vulnerabilities and actions to address them.

Respondents are requested to provide the following as part of the Integrated Assessment report (Ref. (1), Encl. 2, p. 8-9):

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.

This ISG provides guidance on methods considered acceptable to NRC for performing the Integrated Assessment as requested by the March 12, 2012 50.54(f) letter.

Loss of UHS issue issue needs to be resolved

1.5 Scope of Integrated Assessment

In accordance with the 50.54(f) letter, the scope of the Integrated Assessment includes full-power operations and other plant configurations that could be susceptible to damage due to the status of the flood protection features. The scope also includes flood-induced loss of an ultimate heat sink (UHS) water source (e.g., due to failure of a downstream dam), that could be adversely affected by the flood conditions (The loss of UHS from causes other than flooding are not included.). The March 12, 2012 50.54(f) letter also requests that the Integrated Assessment address the entire duration of the flood conditions.

2. Terms and definitions

Available Physical Margin (APM): The term available physical margin 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, Ref. (6).).

Plant-specific vulnerability: As defined Ref. (1), 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.

Flood event duration: The length of time in which the flood event affects the site, beginning with notification of a flood (i.e., a flood forecast) and including preparation for the flood, period of inundation, and recession of water from the site [#figure to be generated]

Variety of site conditions: The site conditions considered in the Integrated Assessment should be all modes of operation (e.g., full power operations, startup, shutdown, and refueling) and adverse weather conditions that could reasonably be expected to simultaneously occur.

or

Flood protection feature: An individual incorporated, exterior and temporary structure, system, component (e.g., barrier) or associated procedure that protects against the effects of external floods.

This is fairly general. What level of redundancy and diversity is expected? Since this reevaluation is beyond design basis, FLEX guidance should be sufficient.

Flood protection system: In the context of the Integrated Assessment, a flood protection system is set of flood protection features that are intended to protect a specific SSC or group of SSCs (e.g., features used to protect the intake structure) or the entire plant (e.g., a levee around an entire site) and that are primarily separate and independent from flood protection features used to protect other SSCs. See Appendix A, Section # for additional discussion.

Total plant response: The total plant response is comprised of the capability of the plant to (1) protect against flood events (considering diverse flood protection features) and (2) mitigate consequences, if the flood protection system is compromised, by maintaining key safety functions using all credited resources.

Flood height and associated effects: Maximum stillwater surface elevation plus the following:

- wind waves and run-up effects
- hydrodynamic loading, including debris
- effects due to sediment deposition and erosion
- concurrent site conditions, including adverse weather conditions

Key safety functions: The minimum set of safety functions that must be maintained to prevent core damage and large early release. These include reactivity control, reactor pressure control, reactor coolant inventory control, decay heat removal, and containment integrity in appropriate combinations to prevent core damage and large early release. (Ref. (7))

Flood parameter scenario(s): A set(s) of flood parameters that should be considered as part of the Integrated Assessment. (see Section 5.3 for additional details).

Fault tree: A deductive logic diagram that depicts how a particular undesired event can occur as a logical combination of other undesired events (Ref. (7)).

not sure that a probability can be determined. Suggest "systematically evaluate the event"

Event tree: A logic diagram that begins with an initiating event or condition and progresses through a series of branches that represent expected system or operator performance that either succeeds or fails and arrives at either a successful or failed end state (Ref. (7)).

Human reliability analysis (HRA): A structured approach used to identify potential human failure events and to systematically estimate the probability of those events using data, models, or expert judgment (Ref. (7)).

Passive (flood) feature: [#definition under development] Incorporated, exterior, or temporary flood protection features that do *not* require the change of state of a component in order to perform as intended. Examples include dikes, berms, sumps, drains, basins, yard drainage systems, walls, removable wall and roof panels, floors, structures, penetration seals, temporary water tight barriers, barriers exterior to the immediate plant area that are under licensee control, and cork seals.

Active (flood) feature: [#definition under development] Incorporated, exterior, or temporary flood protection features that do require the change of state of a component in order to perform as intended. Examples include sump pumps, portable pumps, isolation and check valves, flood detection (e.g., level switches), and flood doors (e.g., watertight doors).

Incorporated (flood) feature: Engineered passive or active flood protection features that are permanently installed in the plant that protect safety related systems, structures and components from inundation and static/dynamic effects of external flooding. Examples include pumps, seals, valves, gates, etc. that are permanently incorporated into a plant structure (Ref. (8)).

Temporary (flood) feature: Passive or active flood protection features within the immediate plant area that protect safety-related systems, structures and components from inundation and static/dynamic effects of external flooding and are temporary in nature (i.e., they must be installed prior to the advent of the design basis external flood). Examples include portable pumps, sandbags, plastic sheeting, and portable panels (Ref. (8)).

Exterior (flood) feature: Engineered passive or active flood protection features external to the immediate plant area and credited to protect safety related systems, structures and components from inundation and static/dynamic effects of external floods. Examples include levees, dikes, floodwalls, flap gates, sluice gates, duckbill valves and pump stations (Ref. (8)).

Operator manual action (for flooding): Proceduralized activity carried out by plant personnel outside of the control room to prepare for or respond to an external flood event.

Failure modes and effects analysis (FMEA): A process for identifying failure modes of specific components and evaluating their effects on other components, subsystems, and systems (Ref. (7)).

Critical elevation: The elevation at which a piece or group of equipment will fail to function, or a transient will be induced, due to water inundation

Cliff-edge effect: The term cliff-edge effect is used to indicate that there may be an elevation at which safety consequences of a flood event increase sharply with a small increase in the flood level.

Mitigation capability: In the context of the Integrated Assessment, mitigation capability refers to the capability of the plant to prevent loss of key safety functions in the event that a flood protection system(s) is not capable of performing its intended function(s).

[#terms to be added or modified, as appropriate]

[#list of acronyms to be added]

3. Framework for Integrated Assessment

This Integrated Assessment guidance utilizes a graded approach so that the type of analysis performed for a plant is commensurate with the site characteristics. In particular, for a given plant, the types of assessments and methodologies considered appropriate for performing the Integrated Assessment vary based on two key factors:

1. the relationship between the re-evaluated flood hazard (including flood height and associated effects) and the existing flood protection at the plant,
2. the type(s) of flood protection utilized at the plant

risk insights?

Under the graded approach, it may be appropriate to perform conventional, engineering evaluations of individual flood protection features (using primarily deterministic approaches) at some plants while application of PRA techniques[2] (e.g., system logic models) may be appropriate for other sites. Figure 1 provides a conceptual illustration of the graded approach. The figure demonstrates that the type of evaluation appropriate for performing the Integrated Assessment depends jointly on the relationship between the revaluated hazard and the existing flood protection as well as the type of flood protection utilized at the site. The inherent reliability of flood protection features may differ substantially from plant-to-plant, and, as illustrated by the *x*-axis in Figure 1, the Integrated Assessment procedure described herein accounts for the differences in characteristics of flood protection. The *y*-axis in Figure 1 is a function of the reevaluated flood hazard in comparison to the existing flood protection. Moving upward on the *y*-axis in Figure 1 represents the increasing utility associated with use of system reliability techniques as the available margin under the reevaluated hazard becomes small or negative (i.e., the site flood protection is not able to accommodate the reevaluated flood elevation or associated effects for the flood event duration).

3.1 Key assumptions

The following subsections provide information on key assumptions applicable to the Integrated Assessment.

3.1.1 Protection and mitigation

The Integrated Assessment evaluates the current licensing basis protection and mitigation capability of plants in response to the reevaluated flood hazards as well as additional in-place or planned resources. In assessing the protection and mitigation capability of a plant, credit can be taken for all available resources (onsite and offsite) as well as the use of

[2] This guide describes the use of PRA-techniques, however the approaches described in this document are not intended to be compliant with guidance provided in Ref. (3).

RG 1.200?

systems, equipment, and personnel in nontraditional ways. Temporary protection and mitigation measures as well as non-safety related SSCs can also be credited with sufficient technical bases. In crediting use of systems, equipment, and personnel in non-traditional ways, non-safety related SSCs, temporary mitigation and protection features, or similar resources, the Integrated Assessment should account for the potentially reduced reliability of such resources relative to permanent, safety-related equipment (Ref.(9)). Moreover, if credit is taken for these resources, sufficient justification should be provided that they will be available and functional when required for the flood event duration. Justification should include consideration of the time required to acquire these resources and place them in service. Guidance on evaluation of flood protection and mitigation capability is available in Sections 5.4 and 5.5 and Appendices A and B.

3.1.2 Modes of operation and concurrent conditions

in

As described in Section 1.5, the scope of the Integrated Assessment includes full power operations and other plant configurations that could be susceptible due to the status of the flood protection features. The Integrated Assessment should provide a evaluation of the effectiveness of flood protection and mitigation capability of the plant for the mode(s) of operation that the plant will be ~~for~~ the entire flood event duration. In addition, the Integrated Assessment should include a description of the expected total plant response under other modes of operation, including a description of controls that are in place in the event that a flood occurs during any of these modes (e.g., during refueling). The assessment should consider whether specific vulnerabilities may arise during modes of operation other than full-power (e.g., conditions where flood protection features may be bypassed or defeated for maintenance or refueling activities).

The Integrated Assessment should consider concurrent plant conditions, including adverse weather that could reasonably be expected to simultaneously occur with a flood event[3] as well as equipment that may be directly affected by the flood event (e.g., loss of the switchyard due to inundation).

3.1.3 Flood frequencies

Due to the limitations of the current state of practice in hydrology, widely-accepted and well-established methodologies are not available for most flood mechanisms for assigning initiating event frequencies using probabilistic flood hazard assessment for floods as severe as those specified in the design basis hazards for nuclear power plants (Ref. (10)). Because of these limitations, the Integrated Assessment does not require the computation of hazard frequencies and guidance is not provided in this ISG to support this task. NRC staff will rigorously evaluate the use of probabilistic flood hazard assessment on a case-by-case basis.

Should plants identify in advance that they intend to pursue a probabilistic approach?

Need to define the criteria in advance so licensees can prepare the IA to the same standard that the NRC uses to review it

4. Information collection and compilation

4.1 Critical plant elevations and protection of equipment

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[3] Ref. (11) provides guidance on combined events that should be considered as part of the Integrated Assessment. As part of the Recommendation 2.1 hazard reevaluations (see Section 1.3), Ref. (8) should have been used in establishing the combined events applicable to a site.

need the final list of references

To facilitate the performance of the Integrated Assessment the following information should be collected or otherwise understood:

- the critical elevations[4] of plant equipment and the safety functions affected when the critical elevation of the equipment is reached
- the flood protection features or systems used to protect each piece or group of critical plant equipment (e.g., a site levee, a category 1 wall and flood doors, or a sandbag barrier) and any procedures required to install, construct, or otherwise implement the flood protection
- the manner by which the equipment could be subjected to flooding (e.g., site inundation, building leakage)

In lieu of a defining a discrete critical elevation associated with each piece of equipment, it may be appropriate to define the equipment failure probability as a function of flood elevation or other associated effect (i.e., a flood fragility). Justification for fragility parameters should be provided.

4.2 Applicable flood mechanisms and plant conditions

The hazard reevaluations performed under Recommendation 2.1 (see Section 1.3) identify the external flood mechanisms applicable to a site. Prior to performing the Integrated Assessment, the flood height and associated effects[5] for all applicable flood mechanisms from the hazard review should be collected or reviewed for use in the Integrated Assessment.

In addition, for each flood mechanism, the following information should also be collected for use in the Integrated Assessment:[6]

- the expected plant mode(s) during the flood event duration
- available instrumentation and communication mechanisms associated with each flood mechanism, if applicable (e.g. river forecasts, dam condition reports, river gauges)
- the availability of and access to onsite and offsite resources and consumables
- accessibility considerations to/from and around the site that may impact mitigating actions

5. Evaluation guidance

5.1 Overview of evaluation procedure

The Integrated Assessment is intended to identify site-specific vulnerabilities and provide other important insights, including evaluation of available margin, defense-in-depth, and cliff-edge effects. As described in Section 3, the Integrated Assessment is developed based on a graded approach to ensure the type of assessment performed is appropriate for the unique characteristics of a given site. Depending on site characteristics, the graded

[4] See Section 2 for definition.
[5] See Section 2 for definition.
[6] This information may be available, in part, from the Recommendation 2.3 walkdown report or licensee walkdown records (see Section 1.2)

approach supports assessments ranging from engineering evaluations of individual flood protection features to evaluations based on PRA-techniques (e.g., system logic models and risk-insights).

The evaluation performed as part of the Integrated Assessment consists of three steps:

1. assembly of peer review team
2. determination of controlling flood parameters
3. evaluation of the effectiveness of flood protection systems
4. evaluation of mitigation capability

peer review team?

These steps are illustrated in Figure 2 and briefly described below.

The first evaluation step involves assembling the peer review team as described in Section 5.1 and Appendix D. The next step involves determination of the flood parameter scenario(s) that should be considered as part of the evaluation. Additional guidance on determining the flood parameter scenario(s) that should be considered is provided in Section 5.3. Third, based on the controlling flood parameter scenario(s), an evaluation of the effectiveness of the flood protection system at the site is performed. Additional information on the appropriate type of flood protection evaluation to perform as part of the Integrated Assessment (e.g., engineering evaluation of individual flood protection features or evaluation using PRA-techniques) is provided in Section 5.4. The fourth step is evaluation of the capability of the plant to mitigate the loss of the flood protection system or individual flood protection features. While all sites should evaluate the effectiveness of their flood protection, it is not necessary for all sites to perform an evaluation of the mitigation capabilities of the plant. For example, an evaluation of mitigation capability is not necessary if the flood protection at a site can be shown to have high reliability and margin under the reevaluated hazard. In addition, if a site is not affected by flood mechanisms other than local intense precipitation (including safety-related structures if located below site grade) and the drainage system is capable of handling the event, it is not necessary to perform an evaluation of plant mitigation capability. Instead, at sites meeting these conditions, a limited evaluation and documentation of available margin and cliff-edge effects is sufficient (see Section 6.1). At all other sites a more detailed evaluation of mitigation capability is appropriate, as described in Section 5.5.

Why are app B controls not sufficent? This could get resource intensive if a number of plants have to perform this at the same time.

5.2 Peer review

The technical adequacy of the Integrated Assessment is measured in terms of the appropriateness with respect to scope, level of detail, methodologies employed, and plant representation, which should be consistent with this guidance and commensurate with the site-specific hazard and inherent flood protection reliability. An independent peer review is an important element of ensuring technical adequacy. The licensee's Integrated Assessment submittal should include a discussion of measures used to ensure technical adequacy, including documentation of peer review. Additional details on peer review for the Integrated Assessment are provided in Appendix D.

5.3 Controlling flood parameters

The flood parameters considered as part of the Integrated Assessment for a plant are based on the Recommendation 2.1 hazard reevaluations (see Section 1.3). Flood hazards do not need to be considered individually as part of the Integrated Assessment. Instead, the

Integrated Assessment should be performed for a set(s) of flood parameters defined based on the results of the Recommendation 2.1 hazard reevaluations (which are summarized in Section 4.2). This set of parameters is referred to as a flood parameter scenario(s) in this ISG.

The flood parameters that should be defined in a flood parameter scenario and considered as part of the Integrated Assessment include:

Can the any conservatisms associated with the reevaluated flood height be credited in the IA?

- flood height and associated effects
- flood event duration, including warning time and intermediate water surface elevations that trigger actions by plant personnel
- plant mode(S) of operation during the flood event duration

Generally, there is one controlling flood hazard for a site. In this case, the flood parameter scenario should be defined based on this controlling flood hazard. However, at some sites, due the diversity of flood hazards to which the site is exposed, it may be necessary to define multiple flood parameter scenarios to capture the different plant effects from the diverse flood parameters associated with applicable hazards. In addition, sites may utilize different flood protection systems to protect against or mitigate different flood hazards. In such instances, the Integrated Assessment should define multiple flood parameter scenarios.

If appropriate, instead of considering multiple flood parameter scenarios as part of the Integrated Assessment, it is acceptable to develop an enveloping scenario (e.g., the maximum water surface elevation, inundation duration, and minimum warning time generated from different hazard scenarios). For simplicity, these flood parameters may be combined to generate a single bounding scenario of flood parameters for use in the Integrated Assessment.

5.4 Effectiveness of flood protection

5.4.1 Overview

There are vast differences from plant to plant with regard to the flood protection measures utilized. Site flood protection may include incorporated, exterior, and temporary features credited to protect against the effects of external floods. In addition to physical barriers, flood protection at nuclear power plants may involve a variety of procedures. These procedures may be associated with installation of features (e.g., floodgates, portable panels, placement of portable pumps in service), construction of barriers (e.g., sandbag barriers), and may be directly related to maintenance of reactor safety functions (e.g. connection of a portable pump to deliver water for cooling functions).

As part of the Integrated Assessment, an evaluation should be performed of the capability of the site flood protection to prevent loss of key safety functions due to flood height and associated effects for each flood parameter scenario. In addition to performing evaluations of individual flood protection features, the Integrated Assessment should include evaluation of the reliability of flood protection systems as a whole, if applicable. The evaluation should account for dependent components and sub-systems (e.g., the protection of a room may be dependent on a sump pump to remove water leaking through a barrier) and any associated procedures (e.g., the performance of a temporary barrier is dependent on the construction of the barrier based on procedures). The flood protection evaluation should provide an understanding of potential failure modes of a flood protection system as well as estimates of failure probabilities, if applicable. Quantitative evaluation of the reliability of active components of the flood protection system is appropriate. The reliability of operator manual actions may be evaluated using human reliability analysis (HRA) concepts and approaches.[7] The capability of the flood protection system should be evaluated for a variety of site conditions, including all susceptible plant configurations.

5.4.2 Evaluation of flood protection

Conventional, component-level engineering evaluations (i.e., deterministic evaluation of an individual flood protection feature) of flood protection are appropriate if a site is not affected by flood mechanisms other than local intense precipitation (including safety-related structures if located below site grade) and the drainage system is capable of handling the event.

Conventional, component-level engineering evaluations of flood protection are also appropriate if a site relies on a permanent exterior barrier (e.g., a levee around the site). Demonstration of the soundness of the flood protection barrier under the loads associated with a flood parameter scenario(s) should include a demonstration that the barrier is in satisfactory condition and structurally adequate based on engineering evaluations. Appendix A provides guidance on evaluating exterior barriers.

If a site relies upon permanent incorporated barriers, a conventional engineering evaluation (as described above) may provide appropriate justification of barrier integrity. However, if an incorporated barrier requires operator manual actions (e.g., installation of a flood gate or closure of a flood door), the flood protection evaluation should account for considerations such as the communication mechanisms that trigger operator action, the feasibility of credited operator actions (e.g., barrier installation), time required to initiate and carry out procedures, availability of resources, and other relevant factors. The flood protection evaluation should be performed for the flood height and associated effects defined by a flood parameter scenario. The evaluation should consider intermediate water surface elevations that trigger emergency action levels and associated actions. In addition, if an incorporated barrier relies on active components (e.g., sump pumps required to handle leakage through seals or other barriers), the flood protection evaluation should account for equipment reliability. PRA techniques provide an appropriate framework for performing these evaluations (e.g., through use of event trees and fault trees). Additional guidance is provided in the Appendices to this ISG.

If a site relies on temporary protective measures or operator manual actions, it is appropriate to evaluate the reliability of the temporary barriers and utilize HRA concepts and approaches to evaluate the feasibility and reliability of the operator manual actions. The flood protection evaluation should be performed for the flood height and associated effects for a flood parameter scenario. The evaluation should consider intermediate water surface elevations that trigger emergency action levels or that are associated with discontinuities in the flood protection system (e.g., the elevation at which protection changes from protection by a flood gate to protection by sandbags). PRA techniques (e.g., system reliability

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[7] [#text under development] At the time of publication of this ISG, HRA methodologies have not been extensively used specifically for evaluation of procedures associated human actions during the flood event duration. However, HRA approaches and concepts can be used to evaluate the reasonableness of specific actions that may be relied upon during a severe flood event.

current HRA methodologies may be adaptable for feasibility, not reliability (for the complex scenarios required for flooding) which is typically a numerical value methods) provide a means for evaluating temporary flood protection and associated operator manual actions (including actions associated with installation or construction of temporary barriers). Additional guidance is provided in the Appendices to this ISG.

definition?

If, based on the flood protection evaluation, a flood protection system is deemed capable of withstanding the flood height and associated effects for a flood parameter scenario, the Integrated Assessment should provide sufficient justification to support this conclusion. The Integrated Assessment should demonstrate that the flood protection integrity is maintained with sufficiently high reliability under the flood parameter scenario(s). In addition, the limiting margin associated with the flood protection system as well as the margin associated with individual flood protection features should be identified. Demonstration of the aforementioned items requires an understanding of the capability of flood protection systems for a range of flood levels. Margin can be demonstrated by incrementally increasing the flood elevation (while accounting for associated effects) and showing the elevation beyond which the system is no longer capable of reliably performing its intended function.

Clarify that this applies to the new hazard and crediting protection greater than the CLB

What is "small"?

If the flood protection evaluation indicates the flood protection system is able to accommodate the flood parameter scenario, but only by a small margin, uncertainties and sensitivities are important. If margin is small for any flood protection feature or system, a sensitivity study should be performed and the Integrated Assessment should determine the sensitivity of the flood protection evaluation to reasonable variation in parameters and other modeling assumptions.

The Integrated Assessment should identify any flood protection systems that are unable to accommodate the flood height and associated effects for a flood parameter scenario(s). Any flood protection component or system determined not to be capable of performing its intended function under the reevaluated hazard should be documented as a vulnerability (see Section 6.1.2). Vulnerabilities should be documented for all susceptible plant configurations. In addition, if the flood protection system is not able to accommodate the reevaluated hazard, the flood protection evaluation should determine at what elevation the flood protection system is able to accommodate a flood with sufficiently high reliability.

5.5 Plant mitigation capability

For all sites, the Integrated Assessment requires an understanding of available margin, the flood elevation beyond which significant safety consequences may be caused by a small increase in flood level (i.e., cliff-edge effects) and other insights. This information should be documented as described in Section 6.1. In addition, for all sites, the Integrated Assessment should provide an understanding of the overall site conditions that will be realized during a flood parameter scenario, including identification of any safety-related SSCs or SSCs that are important to safety that are affected by the flood event.

A more extensive evaluation of plant mitigation capability is appropriate for sites that have not demonstrated that flood protection features or procedures have high reliability and margin (e.g., sites using temporary barriers with significant reliance on operator manual action). Plant mitigation capability should be evaluated for credible flood protection failure modes identified based on the evaluation described in Section 5.4 and Appendix A. For each scenario involving the compromise of flood protection under a flood parameter scenario, the mitigation capability of the plant should be evaluated considering all available resources for the flood event duration. Appendix B provides guidance evaluating of mitigation capability in the event that the flood protection system is compromised.

6. Report Documentation

As indicated in the March 12, 2012 50.54(f) letter, the Integrated Assessment report should provide the following (Ref. (1), Encl. 2, p. 8-9):

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.

Thus, using the guidance provided in this document, the Integrated Assessment report should provide a description of the procedure and methodologies used to perform the Integrated Assessment. The report should document the applicable flood mechanisms and the flood parameter scenario(s) considered as part of the Integrated Assessment. The report should provide an evaluation of the effectiveness of the current licensing basis flood protection and mitigation capability. In addition, the report should document the effectiveness of additional in-place and planned protective and mitigation measures, if applicable. The report should document identified vulnerabilities, available margin, cliff-edge effects, and additional risk-insights. This section provides additional guidance on documenting the assumptions, evaluations, and results of the Integrated Assessment.

[#additional text under development]

6.1 Results

6.1.1 Evaluation of available margin

The Integrated Assessment report should include a description of available margin under the reevaluated hazards (i.e., flood parameter scenario(s), see Section 5.3) for all flood protection systems at the site. The report should also include a discussion of the significance of this margin in terms of the additional severity in flood hazard that would be required to eliminate the margin. In addition, the Integrated Assessment report should include a discussion of the effects of exceeding the available margin on maintenance of key safety functions.

6.1.2 Identification of vulnerabilities

The licensee should provide a description of identified vulnerabilities.[8] The licensee should also provide a description of all safety functions that may be affected by identified

[8] See Section 2 for definition.

vulnerabilities. The description should indicate the combined effect of vulnerabilities on key safety functions. In addition, the description should identify the flood elevation at which each SSC has been compromised.

The Integrated Assessment report should also include a description of all deficiencies identified during the Recommendation 2.3 walkdowns (see Section 1.2) that have not yet been resolved (i.e., closed) by the licensee's corrective action program.

6.1.3 Cliff-edge effects

Cliff-edge effects are particularly important if a site flood protection system(s) demonstrates small margin under the reevaluated hazard. The Integrated Assessment should evaluate if, and at what elevation, a cliff-edge effect may occur. The Integrated Assessment report should document the elevation at which cliff-edge effects are expected and the potential safety consequences of exceeding that elevation. The report should also document the effect of all available resources on reducing the safety consequences associated with rising water surface elevations.

6.1.4 Risk insights and defense-in-depth

[#text under development] Risk-significant insights should be documented as part of the Integrated Assessment. Examples of risk-insights include:

- Specific flood protection features that, if unavailable or degraded, would result in a significant increase in the overall risk to the plant during a reassessed flood hazard. This should include specific actions, procedures, systems and components that are relied on to maintain the plant in a safe condition.

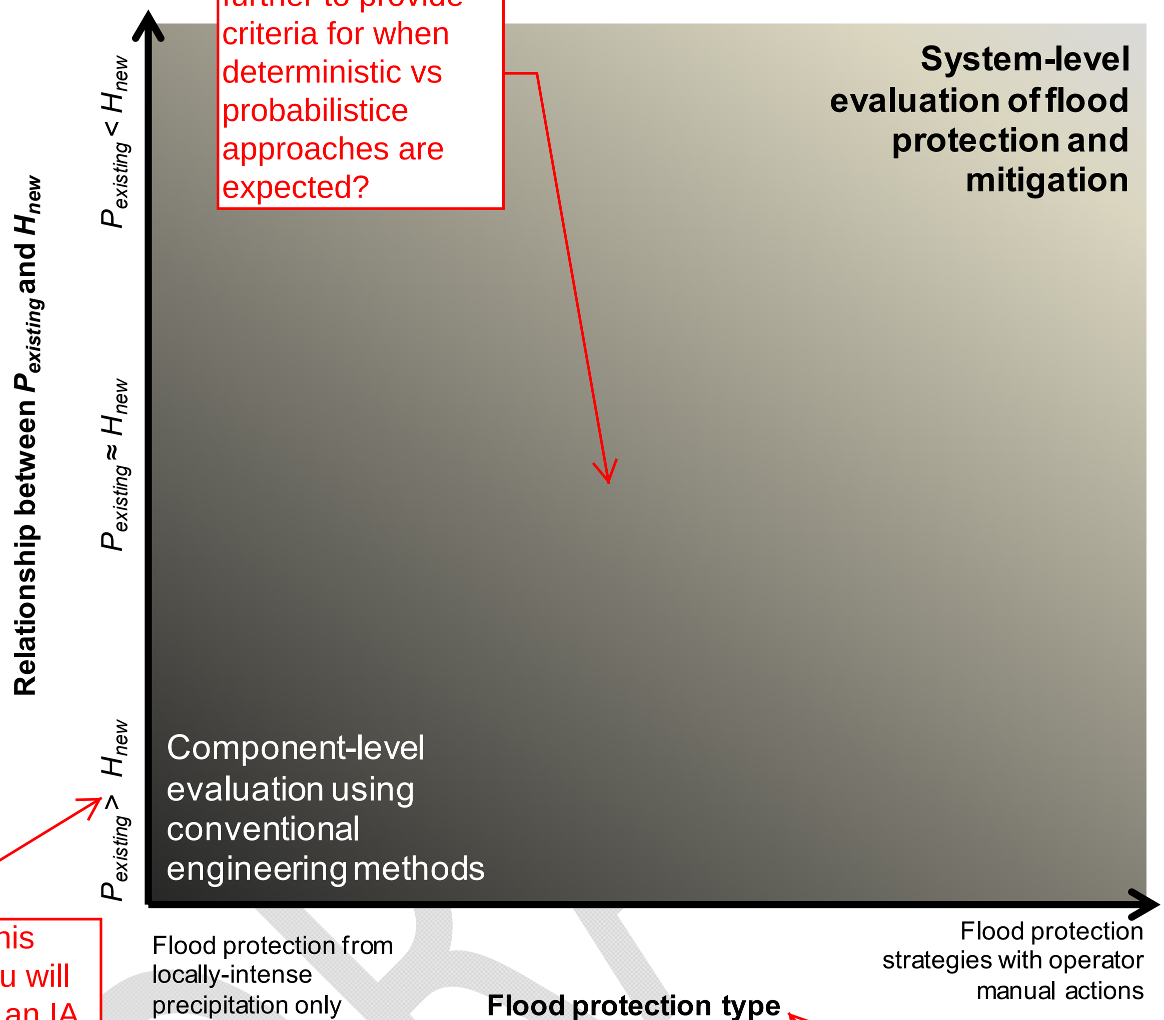
definition?

- Observations of plant safety consequences or substantial increases in risk associated with flood elevations below the maximum water surface elevation for a flood parameter scenario
- SSCs important to safety that are affected by the reevaluated flood but previously were not (i.e., SSCs that were "dry" under the design basis hazard but are "wet" under the reevaluated hazard)

[#text under development] The defense-in-depth philosophy is applied in reactor design and operation to provide multiple means to accomplish safety functions and prevent the release of radioactive material. It is an effective way to account for uncertainties in equipment and human performance and, in particular, to account for the potential for unknown and unforeseen failure mechanisms or phenomena, which (because they are unknown or unforeseen) are not reflected in evaluation based either on PRA-techniques or traditional engineering analyses. Therefore, to address these unknown and unforeseen failure mechanisms and phenomena, the Integrated Assessment report should document if and how defense-in-depth considerations are used and maintained for flood events at the site.

[#additional text under development]

Will this be defined further to provide criteria for when deterministic vs probabilistice approaches are expected?



If you have this condition, you will not be doing an IA

It would be clearer if the x-axis was labeled "inherent reliability of existing flood protection features

$P_{existing}$ = existing flood protection

H_{new} = reevaluated hazard

Figure 1: Illustration of graded approach

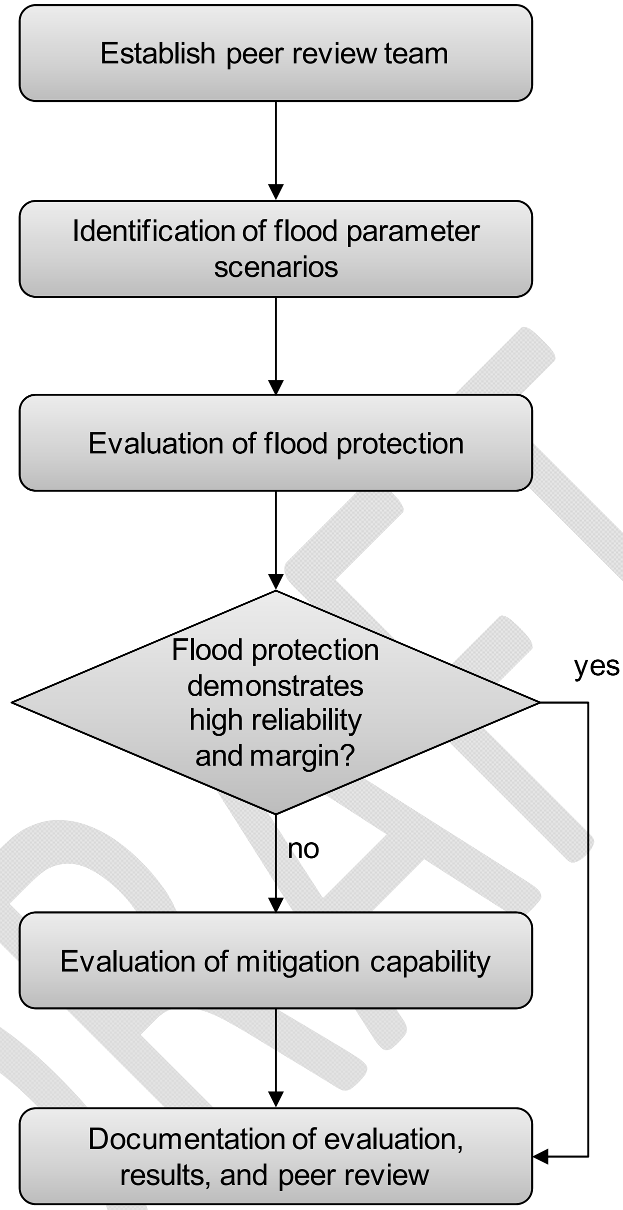


Figure 2: Evaluation flowchart

APPENDIX A: Evaluation of flood protection

[#text under development]

APPENDIX B: Evaluation of plant mitigation capability

[#text under development]

APPENDIX C: Human reliability analysis

[#text under development]

APPENDIX D: Peer Review

An independent peer review is an important element of the Integrated Assessment. The peer review increases confidence and assurance that the results of the Integrated Assessment are reliable and provide a sound basis for regulatory decisions. Additional details about the peer review attributes, team composition, and documentation are provided below.

D.1 Peer review attributes

Peer review should include the following attributes:

- The peer review should be a participatory peer review, as opposed to a late-stage review.
- Peer reviewers on various technical elements should have the opportunity to interact with each other when performing the reviews. The peer review should be conducted as a team for critical items, including evaluation of the reliability of: (1) operator manual actions, (2) temporary protective measures, and (3) non-safety-related equipment used for event mitigation.
- In conducting the peer review, particular attention should be paid to justifications for use of models or methods that are not consistent with current practice.

D.2 Peer review team

Why is this necessary?

Watch out for all inclusive "all"

The peer review team should be assembled based on the following considerations:

- Peer reviewers should be independent of those who are performing the Integrated Assessment. At least one reviewer should be external to the licensee's organization.
- The peer review team should cover all areas of expertise important to the Integrated Assessment. The peer review team members should have combined experience in the areas of systems engineering, flood hazard assessment, flood protection engineering (e.g., structural and geotechnical engineering), human reliability analysis, and application of PRA methodologies.

Why is this expertise necessary?

If used

- Reviewers focusing on the evaluation of flood protection features should have demonstrated experience consistent with the types of flood protection utilized at the site.
  - At sites utilizing permanent flood protection barriers, the peer reviewer(s) should have demonstrated experience in flood walkdowns as well as structural and geotechnical engineering.
  - At sites utilizing temporary protective measures, reviewers should have demonstrated experience constructing or inspecting temporary barriers.
  - At sites relying significantly on operator manual actions, reviewers should have experience in human reliability analysis for the assessment of operator manual actions. Individuals with experience assessing operator manual actions for fire (e.g., as described in Ref. (11)) should be considered when assembling the peer review team at sites relying on operator manual actions to protect against or mitigate a flood event.

NUREG 1852 was developed for fire manual actions, not flood and its use is still evolving with issues that are still being addresed.

D.3 Peer review documentation

The peer review process should be clearly documented in the Integrated Assessment report. Documentation in the Integrated Assessment report should include the following:

- a description of the peer review process
- the names and qualifications of the peer review team members, including the areas reviewed by each participant.
- a discussion of the key findings and a discussion as to how the findings were addressed
- information regarding the disposition of comments made by peer reviewers
- a review of the final Integrated Assessment report
- the conclusions of the peer review

APPENDIX E: Examples

[#text under development]

Integrated Assessment Comments

- General
  - The goal for ISG completion is November 30. If there are issues that are still being developed at that time, would it be possible to issue supplementary guidance after November 30, but before the IAs are expected to start, to further clarify the guidance? Propose that NEI could develop supplemental guidance for NRC endorsement during this period.
  - HHA evaluation approach may result in reevaluation results that are close to, although less than, the CLB. Confirm that an integrated assessment is only required if the new hazard is greater than the CLB hazard. No margin is required.
  - The document uses both terms: "licensing basis" and "design basis". The term "licensing basis" should apply and should be used consistently.
  - If conditions are analyzed as part of the reevaluated hazard that were never considered by the CLB (like dynamic loading or local precipitation), is an integrated assessment required even if the overall flood level of the reevaluated hazard is less than the CLB flood level? Another way to ask this: The 50.54(f) letter talks about verifying that the CLB bounds the reevaluated hazard, but is a hazard the main event, or must all parts of the event (such as dynamic loading, wave runup, etc) have been considered and bounded by the CLB? Does this consideration only apply to the most limiting event evaluated in the CLB? (Other less limiting events may not have been completely evaluated.) The guidance must be clear on this question.

- Acceptance Criteria:
  - In general, the analysis seems to be very loose on criteria. As an example, is the defense-in-depth and reliability criteria applied to FLEX acceptable, or are there other expectations? Guidance on appropriate countermeasures is needed. As another example, the decision point in the flowchart on Page 22 is very subjective if no criteria are defined. The guidance talks about identification of small margins, but without a definition.

- Methodology
  - Cliff-edge effect is addressed in this document. What is an acceptable margin? Once we have determined the maximum flood level using the latest methods and criteria, and protected or mitigated it, why is additional margin required? Margin over the requirements should be at the discretion of the licensee.

- Use of risk insights
  - Can flood hazard event frequency information be established/agreed on to help understand the context of flood hazard protection strategies?
  - Related to use of probabilistic flood hazard assessments the document says that the "staff will rigorously evaluate the use of probabilistic hazard assessment on a case-by-case basis" (page 13). This seems to imply that the Staff is not ruling this out but will challenge the content. What is meant by "rigorous" or what criteria will be applied?
  - The document is inconsistent in the acceptability of how PRA techniques or risk insights might be used. The document appears to be hesitant to use PRA techniques to address event frequency, but does imply that the techniques can be used to evaluate the plant response - clarification would be useful. We are not aware of established methods for quantifying plant response for external flooding. How does the Staff perceive the difference?

Integrated Assessment Comments

- Definitions
  - The definition of key safety functions needs to be clearer. It discusses maintaining the minimum set of safety functions, but does not define what level of redundancy (e.g., number of trains) or diversity (AFW and/or RHR for decay heat removal) are expected. Since this event is beyond design basis, we should not have to protect all safety related equipment. FLEX guidance should be applicable.
  - Why is RCS pressure control defined as an independent safety function in the definition of key safety function? This would have to be addressed in supporting the other safety functions.

- Peer Review
  - Why is the peer team review process being required, as opposed to implementing our Appendix B requirements for using qualified personnel and performing independent verifications? The peer review team should be comprised of in-house or contracted personnel using existing procedures and processes.
    - Peer reviews in the PRA process (for example) were dependent upon a set of previously developed standards and prior knowledge of the process. This is not the case for IAs.
    - If the intent is to ensure a consistent and "mature" approach, wouldn't a pilot approach work better? Subsequent plants would complete their IAs after the pilot plant was finished and the IA guidance was revised as appropriate.
  - The expectations for the peer review process as described in the appendix would require specific expertise that would be limited in availability. It may not be practical to conduct a number of these at the same times. This would affect completion schedules.
  - The concept of peer reviews as it relates to this ISG has not been discussed before. Often peer reviews are conducted after-the-fact as independent reviews, conducting it ahead-of-the-fact tends to bring it into the process. If a peer review is necessary, the peer review process would need to be defined much more completely. Similarly, peer review of PRA related issues with respect to the IA would need to be defined as there may be both PRA model review, Hazard Frequency review and IA process application. More clarity would be needed for these more complex assessments.

- NRC requested information
  - Documents for assessing the condition and capability of flood protection features (either qualitatively or quantitatively) or for use in designing flood protection systems
  - Documents describing efforts related to testing of flood protection features (e.g., seals) to assess their performance (e.g., rate of leakage) or reliability (e.g., probability of failure)
  - Documents describing application of HRA approaches and concepts for assessing the feasibility or reliability of procedures associated with flooding (either qualitatively or quantitatively)