

**From:** [Miller, Ed](#)  
**To:** ["RILEY, Jim"](#)  
**Subject:** FW:  
**Date:** Thursday, May 17, 2012 1:17:00 PM  
**Attachments:** [Copy of Flooding Walkdown Guidance End of meeting May 10 - Response to comments, Rev P May 17.docx](#)

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**From:** Miller, Ed  
**Sent:** Thursday, May 17, 2012 12:48 PM  
**To:** Miller, Ed  
**Subject:**

NEI 12-xx (Rev. PL)  
January-May 2012

NEI 12-~~xx~~-07 [Revision-J P]

# Guidelines for Performing Verification Walkdowns of Plant Flood Protection Features

May 2012

Last Updated: 5/24/2012 12:21 PM

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NEI 12-xx (Rev. ~~PL~~)  
~~January-May~~2012

NEI 12-~~xx~~07 [Revision ~~IP~~]

Nuclear Energy Institute

# Guidelines for Performing Verification Walkdowns of Plant Flood Protection Features

May 2012

*Nuclear Energy Institute, 1776 I Street N.W., Suite 400, Washington D.C. (202.739.8000)*

Last Updated: 5/24/2012 12:21 PM

## **ACKNOWLEDGEMENTS**

NEI appreciates the invaluable assistance of the Fukushima Flooding Task Force toward development of this guideline.

DRAFT

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*Nuclear Energy Institute, 1776 I Street N.W., Suite 400, Washington D.C. (202.739.8000)*

Last Updated: 5/24/2012 12:21 PM

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## 1 INTRODUCTION

In response to the nuclear fuel damage at Fukushima Daiichi due to earthquake and subsequent tsunami, the United States Nuclear Regulatory Commission (NRC) is requesting information pursuant to Title 10 of the Code of Federal Regulations, Section 50.54 (f) (Reference 8.1). As part of this request, licensees will be required to perform walkdowns to verify that plant features credited in the current licensing basis (CLB) for protection and mitigation from external flood events are available, functional, and properly maintained.

## 2 PURPOSE

This document provides guidance for assessing External Flood Protection and Mitigation Capabilities in accordance with the NRC recommendation in item 2.3 of SECY 11-0137 and enclosure 4 of the March 12, 2012 Fukushima accident near term activities 10CFR50.54(f) letter (Reference 8.1). It is intended that this approach be applied with any appropriate adjustments required to address plant specific differences. If any substantive plant specific differences from this guidance were used that were not described in the utility's 90 day response to Reference 8.1, describe the differences in item e. of the Appendix D Walkdown Report.

The walkdowns will verify that permanent structures, systems, components (SSCs), portable flood mitigation equipment, and the procedures needed to install and or operate them during a flood are acceptable and capable of performing their design function as credited in the current licensing basis (CLB). The walkdowns will also verify that plant modifications implemented since original construction, such as security barrier installations and changes to topography, do not adversely affect plant flooding protection.

The specific request from SECY 11-0137 Item 2.3 is provided below. The SECY text is for information only. This Guideline provides the details for completing the actions pertaining to external floods:

- 1. Engage stakeholders to inform development of a methodology and acceptance criteria for seismic and flooding walkdowns; and*
- 2. Develop and issue a request for information to licensees pursuant to 10CFR50.54(f) to (1) perform seismic and flood protection walkdowns to identify and address plant specific issues (through corrective action program) and verify the adequacy of monitoring and maintenance for protection features and (2) inform the NRC of the results of the walkdowns and corrective actions taken or planned.*



In order for the walkdown effort to be as efficient as possible, it is recommended that the walkdown team be familiar with the information required to respond to SECY 11-0137 item 2.1 (new plant flooding evaluations) as well as item 2.3 as well as Reference 8.1 enclosures 2 and 4.

### 3 DEFINITIONS

The following definitions are provided to clarify requirements of the flood protection verification walkdowns.

#### 3.1 **Incorporated Barrier/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

#### 3.2 **Temporary Barrier/Feature**

Passive or active flood protection features within the immediate plant area such as portable pumps, sandbags, plastic sheeting, portable panels, etc. 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.

#### 3.3 **Exterior Barrier/Feature**

Engineered passive or active flood protection features external to the immediate plant area and credited as part of the current licensing basis that 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.

#### 3.4 **Current Licensing Basis (CLB)**

The Current Licensing Basis (CLB) is, as defined by 10 CFR 54.3, is the set of Nuclear Regulatory Commission (NRC) requirements applicable to a specific plant, plus a licensee's docketed and currently effective written commitments for ensuring compliance with, and operation within, applicable NRC requirements and the plant-specific design basis, including all modifications and additions to such commitments over the life of the facility operating license. It also includes the plant-specific design basis information, defined by 10 CFR 50.2, as documented in the most recent UFSAR as required by 10 CFR 50.71.

The set of NRC requirements applicable to a specified plant CLB includes:

- NRC regulations in 10 CFR Parts 2, 19, 20, 21, 26, 30, 40, 50, 51, 54, 55, 70, 72, 73 and 100 and appendices there-to
- Commission Orders
- License Conditions
- Exemptions
- Technical Specifications
- Plant-Specific design basis information defined in 10 CFR 50.2 and documented in the most recent UFSAR (as required by 10 CFR 50.71).
- Licensee Commitments remaining in effect that were made in docketed licensing correspondence (such as licensee responses to NRC bulletins, License Event Reports, Generic Letters and Enforcement Actions).
- Licensee Commitments documented in NRC safety evaluations

### 3.4a Design Bases

Design bases, as defined by 10 CFR 50.2, means that information which identifies the specific functions to be performed by a structure, system, or component of a facility, and the specific values or ranges of values chosen for controlling parameters as reference bounds for design. These values may be (1) restraints derived from generally accepted "state of the art" practices for achieving functional goals, or (2) requirements derived from analysis (based on calculation and/or experiments) of the effects of a postulated accident for which a structure, system, or component must meet its functional goals.

### 3.5 Inaccessible

Inaccessible areas are areas that cannot reasonably be inspected due to significant personnel safety hazard, Very High Radiation Areas, major equipment disassembly, or no reasonable means of access (e.g., buried).

NOTE: The potential use of the "inaccessible" classification should be carefully evaluated before it is applied to any of the flood protection features. Not performing the direct visual inspection may prevent obtaining the measurement of critical SSC dimensions in accordance with Section 5.5.2.4; or, delay collecting data necessary for the Flooding Hazard Evaluation. In addition, as outlined in Section 5.1, items classified as "inaccessible" will require the utility to justify that there is reasonable assurance that the feature is available and will perform the external flood protection or mitigation function for the full duration of the flood condition.

### 3.6 Restricted Access

Areas that are normally not accessible for direct visual inspection are classified as "Restricted Access". It is expected that flood protection features in these areas will be inspected when conditions allow. The following represent

considerations that may make an area “Restricted Access” during the walkdowns:

1. Hazard to personnel, such as
  - i. Entry into high radiation areas
  - ii. Locations with environmental concerns such as high heat, inadequate ventilation, or the possibility of toxic gas
  - iii. *Opening doors* of panels or cabinets containing energized equipment
2. Risk to plant operation, such as:
  - i. Opening junction boxes
  - ii. Disturbing trip sensitive equipment by opening panels
3. Difficulty of access, such as
  - i. Locations that are not accessible from normal personnel access areas due to height or distance (walkways, floors, platforms, etc.). Generally these items will require a supporting activity such as erection of scaffolding.
  - ii. Flood protection features that are normally under water
  - iii. Requiring heavy machinery and coordinated efforts to gain access (yard manholes, valve pits, etc.)

NOTE: The potential use of the “Restricted Access” classification should be carefully evaluated before it is applied to any of the flood protection features. Not performing the direct visual inspection may prevent obtaining the measurement of critical SSC dimensions in accordance with Section 5.5.2.4; or, delay collecting data necessary for the Flooding Hazard Evaluation. In addition, as outlined in Section 5.1, items classified as “Restricted Access” will require the utility to identify when the direct visual inspection can be accomplished.

### 3.7 **Deficiency**

For the purpose of this guidance, a deficiency exists when a flood protection feature is unable to perform its intended flood protection function when subject to a design basis flooding hazard. This condition may also lead to compromising the overall ability to provide protection or mitigation. This concept includes non-conforming conditions as defined in NRC Inspection Manual Part 9900.

Observations that may be potential deficiencies will be evaluated in accordance with station processes and entered into the Corrective Action Program. Only observations that are determined by the CAP to be deficiencies are reported to the NRC in the Walkdown Report.

Examples:

- During the walkdown of an external flooding penetration seal, the visual inspection determines that the sealing material is missing and the

evaluation of the condition determines that the seal **cannot meet** its required function. – This **should** be reported as a Deficiency.

- During the procedure walk-through, an identified “flood protection feature” procedure step requires connection of a temporary pump to a piping connection that has been removed by a modification 2 years earlier. The step **cannot** be performed as written. – This **should** be reported as a Deficiency.
- During the walkdown of an active “flood protection feature” it is identified that the feature does not have an active preventive maintenance task assigned to it. Through evaluation it is determined the feature **can meet** its required function. This observation should be placed in the CAP, but **should not** be reported as a Deficiency unless it is required by the CLB.

### 3.8 **Flood Protection Features**

For the purposes of this walkdown guidance, flood protection features include incorporated, exterior and temporary structures, systems, and components and applicable procedures that are credited to protect against or mitigate the effects of CLB external floods. The features that protect against or mitigate the effects of external floods are defined in the station’s CLB. These features can have either an active or passive flood protection function. Some examples follow:

- Passive incorporated, exterior, or temporary items. These include (but are not limited to) 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 incorporated, exterior, or temporary equipment or components. These include (but are not limited to) credited sump pumps, portable pumps, isolation and check valves, flood detection (e.g., level switches), and flood doors (e.g., watertight doors).
- Procedures and/or guidelines intended to prevent or mitigate the effects of an external flooding event.

### 3.9 **Reasonable Simulation**

Reasonable simulation is a walk-through of a procedure or activity to verify the procedure or activity can be executed as specified/written. This simulation would require verification that:

- all resources needed to complete the actions will be available. (Note that staffing assumptions must be consistent with site access assumptions in emergency planning procedures.)

- any credited time dependent activities can be complete in the time required considering the time required for detection, recognition and communication to initiate action for the applicable flood hazard,
- specified equipment/tools are properly staged and in good working condition,
- connection/installation points are accessible,
- the execution of the activity will not be impeded by the event it is intended to mitigate or prevent (for example, access to the site and movement around it can be accomplished during the flood)
- the execution of the activity will not be impeded by other adverse conditions that could reasonably be expected to simultaneously occur (for example, winds and lightning).

Reasonable simulation does not require for example; the building of temporary barriers, the actual installation of stop logs, connection of temporary equipment to permanent plant equipment, pumping of water, etc. Reasonable simulation may require the actual performance of these activities if there has never been a demonstration that the activity can be completed in the credited time.

### 3.10 Visual Inspection

A visual inspection is a visual comparison of the physical condition of a structure, system, or component (SSC) to acceptance criteria. In the limited situations where a protection feature cannot be visually inspected, it should be categorized as restricted access or inaccessible and the guidance in sections 3.5, 3.6, and 5.1 should be followed.

### 3.11 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 Reference 8.2, pages 29, 36, 37).

While the NRC used the same term as the NTTF Report in its 50.54(f) information request related to Flooding Recommendation 2.3 (Reference 8.1), the information that the NRC expects utilities to obtain during the Recommendation 2.3 walkdowns is different. To clarify, the NRC is now differentiating between cliff-edge effects (which are dealt with in Recommendation 2.1) and a new term, Available Physical Margin (APM). APM information will be collected during the walkdowns, but will not be reported in the response to Reference 8.1.

### 3.12 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

**Comment [g1]:** Check for reported vs recorded

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 the examples below.

- 1) The top of the lowest flood barrier is a flood gate in the auxiliary building (a Category 1 structure). The top of the flood gate is at an elevation of 1014 ft. If the river rises above this elevation, water will enter the building. The current licensing basis states that the maximum predicted flood level is elevation 1014 ft. Therefore the APM = 0 ft.
- 2) Cables from the switchyard enter the structure at site grade where the site grade is at elevation 400 ft. These cable penetrations are protected with seals guaranteed for a 40-foot static head. Therefore this structure is protected to elevation 440 ft (400 ft + 40 ft). Other flood protection features on the structure, such as door seals and sandbags, provide flood protection to elevation 445 ft. The current licensing basis states that the maximum predicted flood level at the site is elevation 430 ft. Therefore, the APM = 10 ft.
- 3) Site Drainage Conditions During Local intense Precipitation: If the site design basis flood elevation is controlled by local-intense precipitation (site drainage) and ponding, the APM should be computed relative to this elevation (i.e., the difference between the water height and the height of building entrances through which water could flow). If information is not available about estimated water heights, APM for this particular flood hazard mechanism should be recorded as unknown and the protection height should also be recorded.

**Comment [g2]:** Square with Appendix B

-Local to the feature, penetrations entering safety-related buildings below ground and sealed and provide protection from ponded water to 5 ft above site grade. If local site ponding results in a water surface elevation of 4 ft above site grade, then the APM is 1 ft. If information is not available about water surface elevation, then the APM should be recorded as unknown and these penetrations should be recorded as being protected to 5 ft.

-Local to the feature, if all exterior door entrances contain a sill approximately 6-inches above the local site-grade elevation and local ponding is 4 inches, the APM is 2 inches. If information is not available about the height of local ponded water, then the APM should be recorded as unknown and these doors should be recorded as being protected to 6 in.

### 3.15 Variety of Site Conditions

Enclosure 4 (Flooding Recommendation 2.3) of Reference 1 requests that the walkdown procedure verify that flood protection systems for the plant are available, functional, and implementable under a variety of site conditions. The site conditions considered should be those configurations included in the CLB (modes of operation; for example, full power operations, startup, shutdown, and refueling) and adverse weather conditions that could reasonably be expected to simultaneously occur. The Walkdown Report (Appendix D, items b and d) should clearly describe the flood protection licensing basis, including what plant configurations were assumed concurrent with a flood event, and what plant structures, systems, components, and procedures are credited to mitigate an external flood if it occurred at any time. (Note that the Walkdown Report should include a description of the existing plant capability, not an assessment of plant vulnerabilities to flooding that might exist under all susceptible plant configurations. The assessment of plant vulnerabilities to all susceptible plant configurations will be completed, if applicable, as part of an Integrated Assessment performed in response to Enclosure 2 of Reference 1).

The Appendix D report should clearly describe the variety of site conditions that were considered as part of the flooding CLB. Note that site conditions that are not part of the flooding CLB are not within the scope of the walkdowns as described in section 5.

### 3.16 Flood Duration

Potential effects of flooding on the plant should 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

For the purposes of these walkdowns, the duration of the flood should be the time assumed in the CLB. The walkdown report should document the flood duration assumed as part of the licensing basis.

## 4 SCOPE

The following section establishes the flood protection features that require walkdown in accordance with this document.

### 4.1 Basis for Establishing Walkdown Scope

The following criteria are used to establish the bases for the scope of the external flood protection feature walkdowns:

1. Plant configuration and procedures will be compared to the flood protection features credited in the current licensing basis documents for flooding events (e.g., UFSAR, current drawings, and procedures). Include the flood protection features designed to protect the spent fuel pool. Any apparent contradictions in flood protection level that are part of the current licensing basis must be addressed and an appropriate value used for the walkdown procedure. Document the basis for the value in the walkdown report.
2. Only flooding events originating from external sources are to be considered.
3. Procedures necessary to ensure function of external flood protection features are within the walkdown scope.
4. Procedures and processes to monitor onsite above grade reservoirs that are under the control of the licensee are within the walkdown scope.
5. This guidance does not require inspecting the initiators that may cause the floods (e.g., inspection or verification of inspection reports of upstream dams are not within the scope of this walkdown process), but verifying adequate communication with the appropriate organizations is expected (see section 5.8).

#### 4.2 **Identify Flood Protection Features (Walkdown List)**

Each licensee shall review existing (current) design and licensing documents including flood response procedures to identify site-specific features credited for protection and mitigation against external flooding events.

For each plant site:

1. Determine current site topography and any changes that may have affected the topography assumed by the licensing basis flood evaluation. Topographical changes will affect water flow on site and should have been evaluated for their effect on flooding. The need for a land survey for elevations will depend upon the accuracy of the applicable drawings and site topographical documents- (see example A.1.4 in Appendix A). Note that the review of changes should address both the potential for increased flood levels and the potential for extended flood conditions, if the identified changes have the potential to alter site drainage characteristics (e.g., a new building that channelizes flow or impedes the recession of flood water). No specific analysis is required; this review should be based on field observations.
2. Determine changes to site building elevations and site configurations including buildings that have been added or modified or significant changes to land use (e.g., additional paved areas) since the current licensing basis flood evaluation was completed. Note that in some



designs certain buildings are expected to be inundated during a flooding event. These buildings must also be included in the walkdown scope and the walkdown must ensure that the flood protection features within such buildings will perform their credited function if the building is flooded.

3. Determine the barriers important to resisting the effects of external flooding (e.g., structures, walls, floors, doors, etc.).
4. Identify penetrations through barriers, such as trenches and cable openings, that could provide a path for flood water to enter buildings and the means to seal these penetrations. Temporary penetrations / equipment hatches that could provide a path for floodwater to enter buildings should also be identified. (These are typically opened only during outages to move large equipment.) The means and process to isolate these penetrations, if they are open, within the required time should be identified
5. Identify instrumentation relied upon to detect water in rooms and the associated warning system
6. Identify any features or pathways credited for flood water relief (e.g., surface drainage swales, subsurface drainage system, culverts, floor/yard drains, etc.). Include these features in the verification walkdown to ensure pathways are clear and capable of performing their function, i.e. passage of water along the path assumed or described in the documents.
7. Review plant response procedures for external floods and identify any incorporated or exterior equipment that is credited for flood protection or mitigation. Include this equipment in the verification walkdowns.
8. Identify any situations for which temporary plant equipment (e.g., portable pumps, sandbags, temporary barriers, etc.) is credited to protect or mitigate the effects of the external flooding event. Include this equipment in the verification walkdowns.
9. Include the flood response procedures assessed in items 7 and 8 above among the documents that will be reviewed to evaluate the practicality of the associated actions performed by site personnel (see definition of Reasonable Simulation).
10. Review the training provided to support implementation of plant flood procedures to determine if it is adequate (content, frequency, and participants) and reflects any time sensitive actions.
11. Establish critical attributes that will be used and reported in the Appendix B Walkdown Record Form, Part A, "Description".

Generic lessons learned from IER 11-1 walkdowns, NRC TI 2515-183 inspection results and IPEEE conclusions have been incorporated into this guidance. Each site should review its site specific results of these items to identify lessons learned that should be incorporated into the plant specific walkdown procedure.

## 5 METHODOLOGY

The following methodology is provided as guidance for performing the walkdowns.

### 5.1 **Develop Walkdown Scope**

Using the guidance provided in Section 4, develop a list of flood protection features and related operating or flood mitigation procedures credited in CLB documents for protection and mitigation against external flooding events. These items constitute the scope of the walkdowns and it is the expectation that all of these items will be subject to visual inspection, reasonable simulation, or, if necessary, functional tests.

This guidance does not require testing of any active component. For active components it is only necessary to confirm that no concerns are identified during the walkdown inspection, that they are included in a maintenance program that periodically checks their function and that the testing performed under the program is acceptable (see sections 5.7 and 6).

For temporary flood protection features and incorporated or exterior features that require operator action, the walkdown shall also include verification through Reasonable Simulation that the procedures that cover implementation of the protection strategy can be implemented as written. Verifications completed since March 2011 are acceptable provided they meet the guidance in this document and appropriate documentation can be obtained to support the conclusion.

Justification for delaying walkdown of a flood protection SSC that has "Restricted Access" shall be provided in the response to the 10CFR50.54(f) letter, with a schedule for when walkdown of the flood protection item will be accomplished and any special procedures necessary to complete the inspection that change this guidance.

Under very rare circumstances, an item will be "inaccessible" and cannot be visually inspected (for example, flood protection features in very high radiation areas or buried items, see example A.1.2 in Appendix A). Any items classified as "inaccessible" shall be identified in the response to the NRC 10CFR50.54(f) letter. These items shall be evaluated and justification shall be provided that there is reasonable assurance that the feature is available and will perform the external flood protection or mitigation function for the full duration of the flood condition. This could be accomplished by a review of items such as construction records, plant documentation, inspection of justifiably similar installations that are accessible and materials of construction / fabrication records. If reasonable assurance cannot be provided, then an evaluation of the potential impact of the loss of function of the flood protection feature will be provided. If more than one

“inaccessible” flood protection feature with potential loss of function is reported, then an evaluation of the aggregate effect flood protection features must be provided.

The walkdown process should also include an assessment of any manual actions that are credited for external flood protection to ensure the actions can be performed as required considering the conditions expected during a licensing basis external flood (see Section 5.8). For multi-unit sites this includes an assessment of whether all the manual actions that are credited for external flood protection at all units on the site can be performed simultaneously in response to a single flood event with the available staff and within the timeframe required.

Utilities should also consider collecting information that will contribute to completion of the flooding reevaluations that will be performed in response to Enclosure 2 of Reference 8.1 and understanding their results. Appendix E and Part F of Appendix B provide guidance.

## 5.2 **Prepare Walkdown Packages**

The following list of elements that should be considered in preparing a walkdown package:

1. Pre-Job Brief
2. Walkdown Guidance and Acceptance Criteria
3. Walkdown Record
4. Design Drawings (for Reference)
5. General Arrangement Drawings (for Reference)
6. Flood Protection Strategy Implementation Procedures

Guidance and documentation for the conduct of the walkdowns should be developed to incorporate both generic and site-specific information. Each licensee should review design and licensing documents and site procedures to establish the flood protection CLB for each items identified in Section 5.1 (Develop Walkdown Scope). Part A of the Walkdown Record Form (Appendix B) should be prepared for all flood protection features that fall within the scope of this guidance. Parts A and B should be completed in order and prior to the rest of the form.

If an existing site procedure is available for inspection of an item and the inspection acceptance criteria is sufficient to establish that the item is capable of meeting its flood protection and mitigation requirements, the site procedure can be used to perform the walkdown.

Note that this guideline has been endorsed by the NRC; if a site procedure is used in lieu of this guideline, it should meet the attributes provided in this guideline and the utility should be prepared to justify any substantive differences

as compared to this document. The use of site specific walkdown guidance must be reported to the NRC in the utility's 90 day response to Reference 8.1.

### 5.3 **Walkdown Team Selection and Training**

Personnel selected to perform the walkdown inspection activities should be experienced and knowledgeable as follows before starting walkdown activities:

- Personnel completing parts A, B, and E of Appendix B, Walkdown Record Form, should be knowledgeable of the site current licensing basis.
- Personnel performing visual inspections (Part C of Appendix B) should be experienced or trained to perform visual inspections of plant structures, systems, and components.
- In cases where specific knowledge is necessary to inspect a flood protection feature/procedure (e.g., an earthen berm, structural concrete wall, etc), at least one member of the walkdown team must have the ability to determine if the condition of the feature/procedure needs to be entered into the CAP. (e.g., geotechnical engineer, structural engineer, etc)
- Personnel should meet the guidance outlined in Table 1 of Appendix C (Sample Training Content) for the walkdown activities they perform (refer to Part A, B, C, D, E, or F of the Appendix B, Walkdown Record Form).

It is the responsibility of each site / utility to document how assigned individuals meet experience or knowledge requirements; specific expectations are at the discretion of the utility.

Utilities are expected to use the training developed by the NEI Fukushima Flooding Task Force and available on INPO's NANTEL website to familiarize the personnel performing the activities in this guideline (see Appendix C).

Walkdown Personnel may be supported by craft personnel who do not need to meet the above requirements.

Walkdown teams performing visual inspections of features not subject to a regular surveillance program should consist of a minimum of two people with a complementary set of skills (such as previous walkdown experience, operations, knowledge of flooding design basis, knowledge of design, construction and performance of flood protection features). The number of personnel on the walkdown team is at the discretion of the utility and will depend on what items are being reviewed (e.g., procedure and PM reviews may only require one person).

Flooding walkdowns should not be performed simultaneously with routine activities.

#### 5.4 **Perform Pre-Job Briefs**

It is recommended that a pre-job brief be performed prior to conducting the walkdowns. A pre-job brief using existing plant human performance procedures and tailored to the walkdown task may be utilized.

The following items should be included in the pre-job brief:

1. Positive Component Verification
2. Inspection Methodology
3. Acceptance Criteria
4. Field Documentation Requirements
5. Reporting Degraded Conditions

#### 5.5 **Inspection of Flood Protection and Mitigation Features**

For each item on the walkdown list, perform the specified inspection to assess the capability of the item to perform its required function. Conduct of the inspection should conform to the following generic guidance. If another approach is used, the utility should be prepared to justify any substantive differences between it and this document. The performance of these activities should be reported on the Walkdown Record Form (Appendix B).

The results of the walkdowns conducted in response to INPO IER 11-1, "Fukushima Daiichi Nuclear Station Fuel Damage caused by Earthquake and Tsunami", or other comprehensive walkdowns conducted to validate flood protection features in 2011 may be used to satisfy the walkdown requirement for a flood protection feature if the previously performed walkdown performance and documentation meets the expectations in this guideline (see Section 4, Scope) and any changes are addressed that may have affected the feature since the time of the previously performed walkdowns. This determination is at the discretion of the utility. If the previously performed results are used for any feature, the walkdown record form (Appendix B) for the associated flood protection feature should state that the previously performed inspection was the source of the information and the documentation from the previously performed walkdown is either attached to or referenced on the record form.

##### 5.5.1 General

Sections 5.5.2 through 5.5.6 describe the general approach for inspecting in-scope features. These four sections are organized as follows to describe the applicable expected inspection activities.

- Incorporated or Exterior Passive Flood Protection Features
- Incorporated or Exterior Active Flood Protection Features
- Temporary Passive Flood Protection Features
- Temporary Active Flood Protection Features

Appendix A provides some examples of each of these flood protection feature types for illustrative purposes.

**Note that any walkdown observation that cannot be immediately judged as acceptable must be entered into the Corrective Action Program for disposition.**

#### 5.5.2 Incorporated or Exterior Passive Flood Protection Features

1. Prior to conducting the walkdown, determine if visual inspection of the flood protection feature is relevant. For example, visual inspection of instrumentation and controls may be of no value.
2. If visual inspection of the flood protection feature is relevant, perform an external visual inspection for indications of degradation that would prevent its credited function from being performed. Conditions that should be recorded include (but are not limited to) missing flood protection feature, severe corrosion, missing fittings, missing fasteners or structural anchors, water leakage pathways through barriers (for example, conduit that is below the licensing basis flood level), degraded/missing penetration seals, degraded/missing door seals, etc. [see examples A.1.2 (concrete and steel structures) and A.1.3 (seals) in Appendix A]
3. If visual inspection is not relevant, determine if some other form of inspection (such as a functional check or verification that the function of the component is determined by a preventive maintenance program) should be performed.
4. Perform measurements of critical SSC dimensions [see examples A.1.1 (site elevations) and A.1.4 (passive flood barriers) in Appendix A].
5. Determine the Available Physical Margin where applicable. The APM determined will provide insights that can later be used in the flooding reevaluations required by Recommendation 2.1 of Reference 8.1. The APMs can also be used to identify straightforward and economical flood-protection enhancements while the Recommendation 2.1 assessments are being completed. (see definition of Available Physical Margin for examples)
6. Verify by observation or by review of other documentation that the feature is functional.

7. Determine whether the feature is included in a controlled preventive maintenance (PM) program, testing program, or technical specification surveillance procedure.
8. If the feature is subject to controlled PM programs providing reasonable assurance of continuing functionality, document this observation and the relevant program in the walkdown records. Use section 5.7 to guide the assessment of the flood protection feature testing done in accordance with this program.
9. If a passive feature is not subject to a controlled PM program that provides reasonable assurance of continuing functionality, evaluate whether this is acceptable. Enter any concerns in the Corrective Action Program.
10. Ensure any equipment that is designed to operate, or not fail, when submerged is capable of performing its intended function under those conditions.

#### 5.5.3 Incorporated or Exterior Active Flood Protection Features

In addition to the activities described in 5.5.2:

1. Assess the manual actions required to operate the feature to ensure they can be performed within the required time considering the conditions expected during a design basis flood. Reasonable simulation can be used for this purpose.
2. Ensure that adequate consumables exist to support the flood protection feature during the entire time its function is credited by the current licensing basis.
3. Assess the associated training to ensure its adequacy.
4. Identify the procedures used to operate this equipment in the records used to document the walkdown results.

NOTE: It is not necessary to verify function of active components by operating the system or individual component. Components with an active function can be assumed to function properly if included in a routine PM or surveillance program and the testing performed under the program is acceptable (see sections 5.6 and 6). If credit is being taken for such activities, identify the credited program in the walkdown records. If there are open issues with the feature that could preclude its function during an external flood event, enter the observation into the Corrective Action Program.

#### 5.5.4 Temporary Passive Flood Protection Features

In addition to the activities described in 5.5.2:

1. Verify that the equipment is properly staged and in a condition that would allow its use should it be needed for its intended purpose, or that sufficient time is available after a flood warning to move the equipment to an appropriate location. (See example A.3.1 in Appendix A)

2. Confirm that all connections necessary to hook up the temporary equipment to allow performance of its flood protection function will work in their intended application and that any supplies, seals, fasteners, etc. are of sufficient quantity, in good condition, properly staged, inventoried regularly and subject to periodic condition assessment. Reasonable simulation can be used for this purpose.
3. Assess the equipment/tools (forklifts, cranes, carts, slings, wrenches etc.) necessary to transport and install the flood protection feature. Verify that the equipment is identified and available.
4. Assess transportability and accessibility of any credited temporary equipment to ensure that it is possible, considering the conditions expected during a licensing basis flood, to access the equipment and to readily transport the equipment to the desired location (e.g., nothing blocks or prohibits access) within the time required by the design basis flood event. For example, if movement of a temporary barrier to its installed location includes transporting it across an unpaved area, the effect of mud / soft ground that may be present during the event should be assessed.
5. Determine whether plant lay down requirements contain provisions to assure that equipment transport pathways remain free of obstructions
6. Assess the manual actions required to install the feature to ensure they can be completed within the required time considering the conditions expected during a licensing basis flood (i.e., concurrent adverse weather conditions).
7. Identify the procedures used to install this equipment in the the Walkdown Record Form.

#### 5.5.5 Temporary Active Flood Protection Features

In addition to the activities described in 5.5.2, 5.5.3, and 5.5.4:

1. Verify that any needed support equipment is staged, available, and appropriate for completing the function.

#### 5.5.6 Procedure Walk-through and Reasonable Simulation

Procedures that have been identified as implementing procedures for flood protection features will require a procedure walk-through. Reasonable simulation can be used for this purpose. This activity includes the following:

1. Walk-through of a procedure or activity to verify the procedure or activity can be executed as specified/written.
2. Verify that any credited time dependent activities can be completed in the time required. Time-dependent activities include detection (some signal that the event will occur, has occurred, or is occurring), recognition (by someone who will notify the plant), communication (to the control room), and action (by plant staff).



3. Verify that specified equipment/tools are properly staged and in good working condition, verification that connection/installation points are accessible.
4. Verify that the execution of the activity will not be impeded by the event it is intended to mitigate or prevent. For example, movement of equipment across unpaved areas on the site could be impeded by soft soil conditions created by excessive water.
5. Review the reliance on the station staff to execute required flood protection features. If during the review several activities are identified to rely on station staff, then perform and document an evaluation of the aggregate effect on the station staff to assure all actions can be completed as required.

To ensure that logistics associated with implementation of the procedures are properly considered, personnel/departments that have responsibility for supporting or implementing the procedure should participate in the simulation effort. The simulation should also ensure that the personnel assigned to the procedure do not have other duties that could keep them from completing their flood protection activities during an actual event. Actions that would be performed in parallel during an event should be simulated in parallel; not checked individually and the results combined.

Reasonable simulation need not require the actual performance of the necessary activities if they have been previously performed and documented or it is periodically demonstrated and documented that the activities can be completed in the credited time.

## **5.6 Review of the Maintenance and Monitoring of Flood Protection Features**

Flood protection features, whether permanent or temporary, must be checked to ensure that their flood protection function is adequately maintained. The review performed in accordance with this guidance should:

- Ensure that the feature is included in a periodic test, monitoring, or inspection program,
- Verify that the testing, monitoring, or inspection is being performed, and
- Determine if the scope of the test, monitoring, or inspection is adequate to confirm the credited flood protection function of the feature. (This is not intended to be a design review of the component or a review of the adequacy of all aspects of the testing/inspection/monitoring performed. For flood protection features such as seals, it is sufficient that the test, monitoring, or inspection confirm that the seal is appropriate, installed as designed, and not damaged; it is not necessary to test the pressure rating of the seal.)

Any questionable observations should be entered into the Corrective Action Program for disposition.

## 5.7 **Review of Operating Procedures**

Equipment operating and flood mitigation procedures should be reviewed to ensure that strategies will work as planned considering the conditions expected during a licensing basis flood combined with other adverse natural conditions (such as lightning, hail, high winds, etc.) that could reasonably be expected to simultaneously occur. The following guidance should be used.

- Ensure that appropriate procedures exist for the operation, positioning, or installation (if necessary) of flood protection features, that the procedures will work under the conditions expected during a licensing basis flood (including other concurrent adverse weather events, such as high winds) and that the procedure steps can be completed within the time allotted. Reasonable Simulation can be used for this review.
- Ensure that flood protection procedures include a process for obtaining the credited warnings with sufficient time to perform the necessary actions should a flooding event be possible. The notification process should be captured in a memorandum of understanding, procedure, or other durable document that will ensure that critical items such as points of contact, actions, and time requirements are clearly understood.
- The instructions in the procedure should be verified for adequacy and reviewed to ensure that any needed support equipment is staged, available, inventoried, periodically assessed for functionality, and appropriate for completing the function.
- Ensure that training on the procedures is appropriate to assure continuing proficiency in their implementation.
- Verify that any procedures governing site preparation for an expected flood event are adequate and can be completed within the warning time expected for a licensing basis flood event.
- Verify that processes are in place to revise the procedures when changes occur to the associated flood protection features, plant staffing requirements, or flood hazard assessments.
- Verify that operator staff is trained to the procedures.

## 5.8 **Documentation of Available Physical Margins**

Available Physical Margin data is collected in Part C of the Walkdown Record Form (Appendix B). If the physical margin of a flood protection feature appears to be small (a plant specific judgment) and the consequences of

flooding at that location appear to be significant (loss of a safety function), the condition should be entered into the CAP. CAP disposition should consider:

- The size of the margin (based on issues such as complexity and uncertainty of the existing licensing basis flood evaluation), and
- The consequences of flooding the area affected by the flood protection feature (significant consequences are those that result in a loss of system level safety function, i.e., loss of all trains of a safety related system).

If the CAP disposition determines that a loss of safety function is possible if the flood protection margin is exceeded, interim protection or mitigation should be implemented while the flooding reevaluations and integrated assessment required by Enclosure 2 of Reference 8.1 are completed. Neither the observation nor its CAP disposition needs to be reported as part of the walkdown report since these are preliminary conclusions. Furthermore, the CAP determination need not be completed prior to submittal of the walkdown report.

### **5.9 Documenting Possible Deficiencies**

All observations should be documented in the Walkdown record forms, and when the observation cannot be immediately judged as acceptable, also entered in the licensee Corrective Action Program in accordance with site procedures. All flooding walkdown observations identified as deficiencies by the Corrective Action Program (CAP) and other items identified during the walkdowns, but awaiting final disposition by the CAP, must be reported to the NRC in the walkdown report (Appendix D).

### **5.10 Restricted Access, or Inaccessible**

If access to a flood protection feature is not available to walkdown personnel, it will be identified as such on the record form and the reason documented. Subsequent actions will be taken to either gain access for inspection of the item, or (if the item is "inaccessible") an evaluation will be performed addressing the ability of the feature to perform its credited function during the duration of the flood assumed in the licensing basis (see guidance in section 5.1). Any inspections that cannot be completed will be reported in the flooding walkdown report (Appendix D).

## **6 ACCEPTANCE CRITERIA**

All observations that cannot be immediately judged as acceptable should be entered into the licensee Corrective Action Program (CAP) where an evaluation

of the observation can be made. CAP disposition should use the following acceptance criteria to guide the assessment of implications.

**Flood protection features are considered acceptable if no conditions adverse to quality were identified during walkdowns, verification activities, or program reviews as determined by the licensee's Corrective Action Program. Conditions adverse to quality are those that prevent the flood protection feature from performing its credited function during a design basis external flooding event and are "deficiencies". Deficiencies must be reported to the NRC in the response to the 50.54(f) letter.**

Note that the use of site-specific acceptance criteria (procedural, design documents, etc.) for flood protection features in lieu of the above generic guidance is at the discretion of the licensee.

These general criteria were chosen because it is not practical or desirable for this guidance to contain specific acceptance criteria for flood protection features. The large variety of protection features and functions make it impossible to capture all the possibilities. For example, some of the considerations that should be taken into account when flood protection features are reviewed include the following:

- Flood protection configuration is in accordance with as-built drawings, as-built installation records, inspection records, vendor documents, etc.
- Visual inspection does not identify any material degradation
- Instructions contained within the implementation procedures can be implemented as written and within the allowed time considering the warning time available for the applicable flood hazard and expected conditions during the event
- When applicable, PMs or periodic inspections are in place, within their required periodicity, and of adequate scope.
- There are not unresolved adverse PM or periodic inspection implementation results.
- No topography changes, including security barrier installations, adversely affect the site drainage plan.

Rather than attempting to list all the considerations that might apply, this guidance uses the general criteria and CAP process as explained above.

## 7. EVALUATION AND REPORTING RESULTS OF THE WALKDOWN

The guidance for performance and review signatures contained within this section and Appendix B is a recommendation. Signatures are included on the Walkdown Record Form for the following reasons:

- The completion signatures facilitate tracking which individuals have performed each activity.
- The review signatures also facilitate tracking of performance, but they also indicate the activities that should receive more attention because the associated information forms the basis for subsequent efforts or because the activity is evaluative in nature and provides summary information that might be used in the response to Reference 8.1.

Ultimately, the controls applied to the walkdown effort should be governed by the utility process used for responding to NRC requests for information “under oath and affirmation”.

Walkdown results shall be documented as follows:

1. Documentation of field observations shall be recorded on a form provided in the walkdown package. The recommended record form is provided in Appendix B. The form includes separate sections for each of the different kinds of reviews that can be done under this guidance. Only the applicable sections need to be completed for each flood protection feature.
2. Section 5.3 recommends that two people should participate in walkdown inspections while only one person may be used for procedure and maintenance/testing reviews. The signatures in Appendix B are consistent with these recommendations.
3. The individual who prepares the Walkdown Record Form or who performs the visual inspection or other review documented by the form should sign the “Prepared By”, “Performed By” or “Evaluated By” space in the applicable section of the form.
4. The second individual performing the visual inspection should sign in the “Performed By” space of section C of the sheet. If a second person is not used for the walkdowns, enter “N/A” in the space and document the reason for only one participant in the visual inspection.
5. The individuals reviewing the information in the form should sign in the “Reviewed By” space in sections B or E as applicable. The purpose of the review is to ensure:
  - No errors in the paperwork
  - Work is technically accurate
  - Comments, conclusions, and explanations are clearly stated
  - Answers to questions do not result in conflicting information
  - Conclusions are technically justified and supported by sound reasoning.
6. It is recommended that all of the Walkdown Record Sheets be packaged together with a cover page that documents Management review of the entire package.

6.—Perform an overall evaluation of the walkdown results including station staff and the aggregate effect to assure all actions can be completed as required.

7. The reviews described above satisfy the “peer review” activities requested in Reference 8.1, enclosure 4.
8. Photographs of visual inspection observations are recommended to create a permanent record
9. All failures to meet acceptance criteria will be entered into the CAP.
10. All flood protection features that could not be inspected because of access limitations (inaccessible or restricted access) will be evaluated using the guidance in section 5.1 and reported in the response to the 50.54(f) letter.
11. The 10CFR50.54(f) letter enclosure entitled “Recommendation 2.3: Flooding” contains a “Requested Information” section that lists all the information that must be included in licensee responses. Appendix D contains a guidance for completing the walkdown report.
12. Part F of the Walkdown Record Form is optional, but recommended because the information will be useful in the flooding reevaluations requested by Enclosure 2 of Reference 8.1.

At the conclusion of the walkdown, the record forms should be processed in accordance with plant procedures and retained for NRC inspection

## 8 RELATED INFORMATION SOURCES

- 8.1 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”
- 8.2 Recommendations for Enhancing Reactor Safety in the 21<sup>st</sup> Century, The Near Term Task Force Review of Insights from the Fukushima Dai-ichi Accident, July 12, 2011
- 8.3 INPO Event Report Level 1 11-1, *Fukushima Daiichi Nuclear Station Fuel Damage Caused by Earthquake and Tsunami*
- 8.4 NRC Inspection Manual, Temporary Instruction 2515/183, *Follow-up to the Fukushima Daiichi Nuclear Station Fuel Damage Event*, November 2011, ML113220407.
- 8.5 NRC Inspection Manual, Inspection Procedure 62002, *Inspection of Structures, Passive Components, and Civil Engineering Features at Nuclear Power Plants*, Section 03.01(h), *Dams, Embankments and Canals*

- 8.6 NRC Inspection Procedures, Attachment 71111.01, *Adverse Weather Protection*, Section 02.04, *Evaluate Readiness to Cope with External Flooding*
- 8.7 NUREG/BR-0326, Rev. 1 (August 2009), *NRC Inspector Field Observation Best Practices*
- 8.8 Regulatory Guide 1.102, *Flood Protection for Nuclear Power Plants*

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**APPENDIX A**

Examples

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## A. Examples

The following examples of inspection considerations are provided for illustration only. The list of characteristics included and the attributes inspected for each should not be considered all inclusive. This section is organized in a manner similar to section 5.6 (permanent passive, permanent active, temporary passive, temporary active).

### A.1 Incorporated or Exterior Passive Features

#### A.1.1 Site Elevations and Topography

- Compare the current site topography with the topography assumed in the current licensing basis flood evaluation.
- Assess differences to determine if they could affect water flow or flood levels and create vulnerabilities in existing flood protection features.
- The need for a land survey for elevations will depend upon the accuracy of the applicable drawings and site topographical documents.

##### A.1.1.1 Earthen Features (i.e., flood protection berm)

- Verify that earthen features are in place as designed to the correct height (with no allowance for dimensional tolerances that reduce its protection function) and width. Verify that rip-rap or other erosion protection features are installed and in place if included.
- No signs of leakage

#### A.1.2 Concrete and Steel Structures

The exterior surfaces of Category I (Safety-Related) structures are generally credited to prevent flooding of the interior spaces and to withstand the hydrostatic forces during a flood event. Adjoining non safety related structures must be included if those structures are connected to safety related buildings and structures through access openings or penetrations.

- Verify that the structure is in place and in accordance with its design configuration. Perform physical measurement to confirm the required height. The minimum required height must be met with no allowance for dimensional tolerance.
- Visually inspect all exterior exposed surfaces of the building below the analyzed maximum flood height for significant indications of structural degradation or any openings that might permit flooding of the interior spaces.
- Visible penetrations are sealed.
- Required relief paths are in place and unobstructed

- No signs of leakage on interior surfaces
- If conditions will not allow close examination, use of binoculars is permitted if 100% of the surface area below the maximum flood height can be inspected in a manner sufficient to meet the intent of this section.
- No apparent degradation in structural members that challenges their ability to withstand forces from flooding, i.e. reinforced concrete, concrete block or steel barriers, such as surface cracks greater than 0.04 inches in width.
- Interior surfaces of the structure should be inspected for signs of leakage that may be occurring as a result of non-detectible leakage thru external surfaces. Refer to the note below.
- Concrete structures should not show water stains/stalactites emanating from their surfaces.
- Surfaces of the structure/building that are buried are considered inaccessible and not subject to inspection. A visual inspection of interior surface is acceptable if the exterior surface is inaccessible. In addition, the base of structures should be inspected for evidence of scouring or undermining that may have occurred during previous high water events.
- If a PM/surveillance exists that inspects the structure, then it is not necessary to specifically inspect individual barriers for this review (although the surface (e.g., wall), in accessible areas, must still be visually scanned for any unexpected conditions). If credit is being taken for a PM, then identify the PM number in the walkdown records.

#### A.1.3 Wall, Ceiling, and Floor Seals (e.g., Penetration Seals, Cork Seals)

- Perform a visual inspection of credited wall, ceiling, and floor penetration seals for indications of degradation that would allow flood waters to penetrate into the flood protected area. Conditions that should be recorded include (but are not limited to) damage, undocumented openings or holes (such as those due to abandoned equipment), etc.
- The credited side(s) (surface) of a seal must be inspected. For example, if the side of a wall penetration seal that is credited for flood protection is examined and found to be acceptable, the other side of the seal does not need to be examined.
- Visible penetrations are sealed and there are no visible through wall holes.
- Penetration sleeves, link seals, piping, and conduit should have an absence of corrosion on the exposed steel surface.
  1. Conduit seal material should have an absence of water stains below the penetrations.

#### A.1.4 Passive Flood Barriers or Water Diversion Structures

- Perform an external visual inspection of passive structural barriers and water diversion structures for any condition that would prevent function of the flood protection feature. Conditions that should be recorded include (but are not limited to) severe corrosion, erosion, indications of significant structural damage, missing fasteners and anchors, undocumented holes or openings, etc.
- Critical dimensions of the barrier or structure (e.g., minimum height of a flood wall) shall be measured.
- The need for a land survey for elevations will depend upon the accuracy of the applicable drawings and site topographical documents.

#### A.1.5 Drains and Catch Basins

- Verify by visual inspection that there are no obstructions or obvious blockage to drains and catch basins credited for protection against licensing basis external flood events.
- Verify that the drains and catch basins are in the location shown on design drawings.
- Verify that any back flow prevention features (such as check valves) are functional as required.
- Verify that controls are in place to assure drains will not be unintentionally obstructed during plant laydown activities or vehicle parking.
- Drain systems can be assumed to function properly if they are tested as part of a routine Preventative Maintenance (PM) program. If there are open issues with the drainage system that could prevent function during an external flood event, enter that condition into the CAP.

#### A.1.6 Plugs and Manhole Covers

- Verify Material Condition. Specifically, visually inspect the material condition of the plug and seal materials to determine if there is any damage that would prevent the device from performing the flood protection function.
- Caulking should not have any apparent cracks or gaps.
- Only one side (surface) of a plug need be inspected. For example, if the exterior side of a concrete plug is examined and found to be acceptable, the interior side does not need to be examined.

#### A.1.7 Drainage Pathways (Swales, Subsurface Drainage System, Etc.)

- Verify the feature is in place and configured as designed
- Visually inspect the material condition to determine if there is any damage that might prevent the feature from performing its flood protection function.

- Verify that the plant swales are free of obstructions which could prevent the feature from performing the flood protection function and controls are in place to assure they remain obstruction free.
- Verify that back flow prevention devices are functional

#### A.1.8 Piping and Cable Vaults and Tunnels, Electrical Cable Conduit

Water ingress into tunnels, vaults, and cable conduit is not a concern in the short term unless there are components in these structures with an active flood protection function that might be damaged by submergence. The concern that must be addressed during the walkdown is the possibility that these features might provide a flooding pathway into buildings and other structures that are protected from flooding.

- Visually inspect all seals or other devices that are credited to prevent water intrusion into a space that contains safety related equipment or equipment credited for flood protection during a flooding event.
- Determine if there is any damage that would prevent the seals or other devices from performing their flood protection function. See item A.1.3 above for more guidance on seal inspection.

#### A.1.9 Floor Hatches

- Visually inspect floor hatches that are below the analyzed maximum flood height for indications of structural degradation or any openings that might permit flooding of the interior spaces.
- Confirm any hatches in the floor of a flood barrier are capable of limiting the passage of water either above or below the barrier to an acceptable level. The basis for acceptance must be an actual test or an evaluation that includes a review of the design and walkdown of the material condition..
- Only one side (surface) of a hatch need be inspected. For example, if the exterior side of a concrete hatch is examined and found to be acceptable, the interior side does not need to be examined.

### A.2 Incorporated or Exterior Active Features

#### A.2.1 Doors

- Perform an external visual inspection of doors for indications of degradation that would prevent satisfactory performance of the flood protection function of the door. Conditions that should be recorded include (but are not limited to) severe corrosion, missing fittings, missing fasteners, undocumented holes or openings, damaged jams or seals, obstructions, etc.

- Confirm that the doors are closed (or can be closed) and have the proper door swing (i.e., swing in the direction shown on design drawings).

#### A.2.1.1 Credited Water Tight Doors

- Verify that the door appears to be water tight (constructed in a consistent manner) and
- Door jams, fittings and fasteners are in place and functional
- Door are seals in place and with no degradation that would affect function

#### A.2.1.2 Credited Non-Watertight Doors

- Verify presence with acceptable gaps
- No degradation that would prevent function
- Door jams, fittings and fasteners in place and functional

#### A.2.2 Pumps

- Perform an external visual inspection for indications of degradation that would prevent function of the pump. Conditions that should be recorded include (but are not limited to) severe corrosion, missing fittings, etc.
- Verify by means of Reasonable Simulation that plant staff can operate the pump in the manner credited for its function
- Verify that the pump is included in a plant maintenance/testing program that periodically assesses its function

#### A.2.3 Water Level Indication

Certain rooms may have instrumentation or switches that are credited to indicate the presence of water during an external flood event. For those instruments:

- Verify Material Condition. Specifically, visually inspect the material condition of the instrument to determine if there is any damage that would prevent the device from performing its flood protection function or any obstructions to the sensing element that would prevent accurate readings.
- Verify that the instrument is included in a plant maintenance/testing program that periodically assesses its function

### **A.3 Temporary Passive Features**

#### A.3.1 Portable Flood Barriers

- Verify that credited temporary barriers are stored as expected and in sufficient quantity, and are subject to periodic inventory and condition assessment
- Visually inspect a representative sample to ensure no physical damage or degradation that would impede their function
- Verify that the barriers can be accessed and transported to the location where they will be needed, considering the conditions that might be expected at the time of their use
- Determine if controls are in place to prevent obstruction of transport routes and whether the capability exists to clear flood induced obstructions.
- Verify that the barriers can be installed and if necessary, inflated, in the manner credited for their function
- If the barriers are subject to age related degradation, verify that they are included in a plant maintenance program that periodically assesses their condition

### **A.4 Temporary Active Features**

#### A.4.1 Pumps

- Perform an external visual inspection for indications of degradation that would prevent function of the pump. Conditions that should be recorded include (but are not limited to) severe corrosion, missing fittings, missing connections, etc.
- Verify that the pumps can be accessed and transported to the location where they will be needed, considering the conditions that might be expected at the time of its use
- Determine if controls are in place to prevent obstruction of transport routes and whether the capability exists to clear flood induced obstructions.
- Verify by means of Reasonable Simulation that plant staff can install and operate the pump in the manner credited for its function
  - Verify that the pump is included in a plant maintenance program that periodically assesses its condition

### **A.5 Available Physical Margin**

#### A.5.1 Temporary Barriers

- Determine the flood height / elevation at the location where temporary barriers will be built and compare this value with the height of the barrier required by the procedure that governs its erection. The temporary barrier need not be erected unless required by Reasonable Simulation.



**APPENDIX B**  
  
WALKDOWN  
RECORD FORM

### Walkdown Record Form

Plant Name: \_\_\_\_\_ Unit: \_\_\_\_\_

#### **PART A. IDENTIFICATION:**

List the flood protection feature credited in CLB documents for protection and mitigation against external flooding events.

Flood Protection Feature ID or Procedure Number: \_\_\_\_\_

Description or Procedure Title: \_\_\_\_\_

Location: Bldg. or Area \_\_\_\_\_  
Elevation \_\_\_\_\_  
Room \_\_\_\_\_ Column \_\_\_\_\_

Indicate below the type of the feature (check all that are applicable):

- Incorporated or Exterior Passive       Temporary Passive  
 Incorporated or Exterior Active       Temporary Active

Enter the flood height at the location of the feature: \_\_\_\_\_

If the feature is a procedure, enter N/A

If the flooding design basis is determined by local-intense precipitation and the flood height is unknown, enter unknown

References: 1. \_\_\_\_\_  
2. \_\_\_\_\_  
3. \_\_\_\_\_

Evaluated By: \_\_\_\_\_ Date: \_\_\_\_\_  
Print / Sign

#### **PART B. PRELIMINARY ANALYSIS:**

##### Part B.1 - Visual Inspection:

Q1. Is a visual inspection required? Y N

If No, Explain why not \_\_\_\_\_

If Yes:

- annotate (below) that Part C must be completed, and

- list any Licensing Basis / Acceptance Criteria that require verification during visual inspection (identify any critical characteristics / parameters applicable to the flood protection feature that are verifiable by inspection such as flood height or elevation, expected operation (e.g., door must close), and equipment name plate data (for example, pump capacity, seal rating, etc.)):

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Part B.1 Evaluated By: \_\_\_\_\_ Date: \_\_\_\_\_  
Print / Sign

Part B.2 - Functional Testing or Periodic Monitoring:

- Q2. Is the component included in a preventive maintenance (PM) program? Y N
- Q3. Is the component included in a periodic test (e.g. surveillance test)? Y N

- If either, or both, the answers to question Q2 and Q3 is "Yes", document the identified PM(s) or test(s) \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

- If the answers to questions Q2 and Q3 are both "No", describe any other existing test(s) that periodically verify the ability of the component to perform its credited CLB flood protection function. If there are no such tests, annotate with "none".  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

- If there are no identified PMs or tests, should monitoring or testing be considered to periodically verify the component is able to perform its credited CLB flood protection function? Y N

If "Yes", enter this observation in the CAP (include references to CAP in "Comments" below).

For all identified PMs or tests described above, evaluate whether the existing PM or test(s) are appropriate to verify the credited CLB flood protection function. Document findings in "Comments" below. If the existing test(s) are not, or may not be, sufficient to verify the credited CLB flood protection function, enter this observation in the CAP (include reference to CAP in "Comments" below).

Comments: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Part B.2 Evaluated By : \_\_\_\_\_ Date: \_\_\_\_\_  
Print / Sign

Part B.3 - Procedure Walk-Through / Reasonable Simulation (see section 5.7):

Q4. Does an appropriate procedure exist for the operation, positioning, or installation of the flood protection feature? Y N

If Yes, document the procedure number \_\_\_\_\_

If No and a procedure should govern the operation, positioning, or installation, enter the observation into the CAP and reference the CAP entry here: \_\_\_\_\_

\_\_\_\_\_

Q5. Is a procedure or activity walk-through (reasonable simulation) applicable?  
Y N

If No, Explain why not and ensure that all information in part D is documented \_\_\_\_\_

Q6. Is a separate walkdown record form for another flood protection feature being credited for completion of this reasonable simulation? Y N

If yes, indicate which Walkdown Record Form is being credited and ensure that all information in part D is documented: \_\_\_\_\_

If a reasonable simulation IS applicable, and a separate walkdown record form IS NOT being credited:

- annotate (below) that Part D must be completed, and
- list the applicable procedure(s)
- list any credited time dependent activities
- list critical characteristics for any Available Physical Margins that should be measured (e.g., height of temporary barrier)

Applicable Procedures / time dependent activities / applicable critical characteristics:

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Part B.3 Evaluated By : \_\_\_\_\_ Date: \_\_\_\_\_  
Print / Sign

Summary of Findings:

Suggested parts of the Walkdown Record Sheet to complete are as follows (Check those that apply, Part E always applies, Part F is recommended any time Part C is applicable):

- C ( ) Visual Inspections
- D ( ) Activity or Procedure Walk-Through (Reasonable Simulation)
- E (X) Conclusions
- F ( ) Preparations for Flooding Reevaluations (Optional)

Comments:

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Part B.1 to B.3 Reviewed By: \_\_\_\_\_ Date: \_\_\_\_\_  
Print / Sign

**PART C. VISUAL INSPECTION:**

Q7. Is the feature accessible? Y N

If No, Explain (See section 5.1 and 5.11) \_\_\_\_\_  
\_\_\_\_\_

Q8. Is the Material Condition Acceptable? Y N

Q9. Are the Critical Characteristics Per Design (refer to Q1 for list of critical characteristics)?  
Y N N/A

Comments: \_\_\_\_\_  
\_\_\_\_\_

Q10. Can the equipment be operated as expected in order to achieve its flood protection function (see Q1)? Y N

Q11. Determine the available physical margin (the difference between licensing basis value of the critical characteristic (question Q.1) and the as found value – see definitions)

Actual height or name plate data:

Available Physical Margin: \_\_\_\_\_

Q12: If the flood height is unknown, record the height of the barrier: \_\_\_\_\_

Comments:

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Part C Performed By: \_\_\_\_\_ Date: \_\_\_\_\_  
Print / Sign

Part C Performed By: \_\_\_\_\_ Date: \_\_\_\_\_  
Print / Sign

**PART D. ACTIVITY OR PROCEDURE WALK-THROUGH (REASONABLE SIMULATION):**

Refer to Part B.3 for procedures or activities that require walk-through (reasonable simulation). Refer to sections 3.9, 5.5.3, 5.5.6, and 5.7 for details on requirements for walk-through and reasonable simulation.

Q12. Can credit be taken for previous performance of the activity or procedure?  
Y N

If yes, indicate which questions below were answered by the previous performance, and provide the information obtained and the date of the last performance if any were not answered, enter the information below. \_\_\_\_\_  
\_\_\_\_\_

Q13. Does the procedure or activity include an expectation to obtain flood warnings?  
Y N

If Yes:

- list the applicable document or memorandum of understanding that describes the warning process. If the process is not documented or if the documentation does not meet the guidance in section 5.7, enter the observation into the CAP.
- list any credited time dependent activities

Applicable Documents / time dependent activities::  
\_\_\_\_\_  
\_\_\_\_\_

Q14. Will the personnel resources necessary to perform the activity or procedure be available during an actual flooding event? Y N

Q15. Can credited time-dependent activities be completed in the time required, including the detection, recognition, communication, and manual actions necessary for operation and, if applicable, installation?                    Y    N    N/A

Q16. Are specified equipment, tools, and necessary supplies/consumables properly staged and in good working condition?                    Y    N    N/A

Q17. Are connection/installation points usable and accessible?                    Y    N  
N/A

Q18. Can the activity be executed such that it will not be impeded by the event it is intended to mitigate or impeded by other adverse conditions that could reasonably be expected to simultaneously occur?                    Y    N    N/A

Provide reasoning for answer to Q18: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Q19. If equipment is necessary to move materials or install the flood protection feature, is this equipment identified in the procedure, available, and the transport pathway is clear?                    Y    N    N/A

Q20. Is training provided for this activity or procedure?                    Y    N

Q21. Is the associated training adequate (content and evidence of completion, see section 5.5.3)?                    Y    N    NA

Document the basis for the conclusions in Q20 and Q21: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Q22. Are available physical margin measurements applicable?                    Y    N

If applicable, document the APM obtained: \_\_\_\_\_

Q23: If the flood height is unknown, record the height of the barrier: \_\_\_\_\_

Q24. Was the Reasonable Simulation performed successfully?                    Y    N

Q25: Estimate the time required to perform this activity, the number of staff required, and any specialized skill sets needed during an actual flood event  
\_\_\_\_\_

*Comments:*  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Part D Evaluated By: \_\_\_\_\_  
Print / Sign

Date: \_\_\_\_\_

**PART E. CONCLUSION:**

Q 24. Identify if small margin and significant consequence appears to exist

Available Physical Margin (Q11 and Q22): \_\_\_\_\_

**Comment [g3]:** Check final Q#s

Observations on Available Physical Margin:  
\_\_\_\_\_  
\_\_\_\_\_

Equipment Affected:  
\_\_\_\_\_  
\_\_\_\_\_

If small margin and significant consequences appear to exist, enter the observation into the CAP and provide a reference to the CAP entry  
\_\_\_\_\_  
\_\_\_\_\_

Q25. Are all aspects of the flood protection feature evaluated under Parts B through D acceptable? Y N

If YES, no further action is required

If NO, DESCRIBE POTENTIAL PROBLEMS THAT REQUIRE FURTHER EVALUATION. These items are to be entered into the Corrective Action Program for disposition. Provide Corrective Action Program entry information as applicable.

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Part E Evaluated By: \_\_\_\_\_  
Print / Sign

Date: \_\_\_\_\_

Part E Reviewed By: \_\_\_\_\_  
Print / Sign

Date: \_\_\_\_\_

\_\_\_\_\_



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~~February~~ May 2012

Last Updated: 5/24/2012 12:21 PM

## **APPENDIX C**

# SAMPLE TRAINING CONTENT

## Scope and Purpose of Training

### Content

The purpose of this appendix is to provide an outline of knowledge requirements (content) for persons assigned to perform the various parts / sections of the Appendix B, Walkdown Record Sheet. The knowledge requirements selected are intended to:

- Provide persons with the information necessary to complete their assigned parts / sections of the Appendix B, Walkdown Record Sheet a proficient manner.
- Familiarize persons with relevant overview and background information contained in reference 8.1.
- Familiarize persons with relevant terms and definitions contained in NEI 12-07, Guidelines for Performing Verification Walkdowns of Plant Flood Protection Features.
- Provide technical information necessary to perform inspections, draw conclusions, and identify discrepant conditions when performing visual inspections, review of preventive maintenance and testing records of external flood features, and review of walkdown record sheets.

The scope of this appendix is limited to persons assigned to complete parts / sections of the Appendix B, Walkdown Record Sheet.

The scope and purpose of the outlined content is not to:

- Provide persons with complete familiarization of materials and content in NEI 12-07, Guidelines for Performing Verification Walkdowns of Plant Flood Protection Features.
- Provide persons with complete familiarization of requirements and content, or ability to assemble response materials as described in reference 8.1.

### Requirements:

- Individuals assigned to complete Part A, B, C, D, E, or F of the Appendix B, Walkdown Record Sheet, should be knowledgeable of the applicable content as indicated in Table 1.
- The information outlined in Table 1 assumes persons assigned to perform Part A through F of Appendix B, Walkdown Record Sheet, meet the experience or knowledge requirements described in section 5.3, Walkdown Team Selection and Training. If individuals do not meet these requirements, then requirements may be adjusted accordingly by the utility.
- It is the responsibility of each site / utility to document how individuals meet the outlined knowledge requirements.

**Table 1**

<b>Activity</b>	<b>Knowledge Required for the Respective Activity</b>	<b>Applicable to</b>
Familiarization with basis for walkdown scope and items to be inspected	• Purpose and intent of NEI 12-07 document *	Persons completing Part A through F of Appendix B, Walkdown Record Sheet
	• Relationship between the NEI 12-07 document and the March 12, 2012 50.54(f) letter (reference 8.1) *	
	• Key definitions and terms in the NEI 12-07 document *	
	• Overview of activities contained in NEI 12-07 Appendix B, Walkdown Record Sheet *	
	• Prerequisites and requirements for personnel assigned to perform activities contained in Appendix B, Walkdown Record Sheet	
	• When a procedure walk-through or reasonable simulation is required *	
	• Definitions and content in Appendix E, Preparations for Flooding Reevaluations and Integrated Assessment *	
	• High level understanding of the site current design and licensing basis for external flooding (e.g. flood heights, protected SSCs, sources of flooding)	
Preliminary Analysis Activities	• Information required to locate existing preventive maintenance (PM) for SSCs credited in the CLB for flood protection	Persons completing Part B of Appendix B, Walkdown Record Sheet
	• Information required to locate existing periodic tests that may include a SSCs credited in the CLB for flood protection	
	• Expectations for the review of PMs and periodic tests to ensure flood protections features are adequately tested	
Field Walkdown Activities / Observations	• Overview of the approach and purpose for visual inspections *	Persons completing Part C of Appendix B, Walkdown Record Sheet
	• Characteristics and considerations for SSCs to be visually inspected *	
	• Expectations and methods to be followed when recording observations and findings during visual inspections	
	• Required activities when performing procedure walk-throughs or reasonable simulations *	Persons completing Part D of Appendix B, Walkdown Record Sheet
Documentation and Conclusions	• Record keeping requirements for Appendix B, Walkdown Record Sheets	Persons completing Part A through F of Appendix B, Walkdown Record Sheet
	• Quality expectations for documentation associated with Appendix B, Walkdown Record Sheets	

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~~February~~ May 2012

\*- Covered in the NANTEL training module

**APPENDIX D**

Walkdown Report

DRAFT

### **Introduction**

Enclosure 4 of the NRC's March 12, 2012 50.54(f) letter on Near Term Task Force recommendations from the Fukushima Dai-ichi Accident contains a request for information related to the results of the flooding design basis walkdowns performed in accordance with this guideline. The purpose of this appendix is to provide additional information on the specific items in the request as an aid to preparing the report consistently across the industry and in a manner that will minimize subsequent NRC questions. The guidance in this appendix was developed during meetings with the NRC and has been endorsed by them as documented in their endorsement of this guideline.

### **Walkdown Report Content**

The specific information requests from the NRC letter are repeated in the sections below followed by an explanation of intent.

#### **a. Describe the design basis flood hazard level(s) for all flood-causing mechanisms, including groundwater ingress.**

- Identify all flood hazards that were evaluated in the site's design basis and the flood level resulting from each. Identify hazards that were screened out.
  - i. Note that some flood hazards may be limiting for flood level and some for other considerations such as warning time and dynamic loading.
- Describe any key assumptions (e.g., all culverts were assumed blocked)
- Include information on the methodology used in developing the design basis flooding hazard.
- If differences or contradictions in flood hazard levels were found in design or licensing basis documentation, include a description of the basis for flood level used

#### **b. Describe protection and mitigation features that are considered in the licensing basis evaluation to protect against external ingress of water into SSCs important to safety.**

- Describe the flooding licensing basis including what plant configurations (modes of operation; for example, full power operations, startup, shutdown, and refueling) were considered. This description should be consistent with the scope of the flooding walkdowns.
- Document the flood duration assumed in the CLB. If the CLB does not provide information on the flood duration, this lack of information should be documented in the walkdown report.
- Describe the flood protection features that are credited in the CLB, such as incorporated, exterior and temporary barriers, time required for credited

actions under flood conditions, active flood protection features, procedures, warnings credited for external floods, site drainage plan, etc.

- Describe weather conditions or flood levels that trigger procedures and associated actions for providing flood protection and mitigation.
- Describe the adverse weather conditions that were assumed concurrent with flood protection features and associated actions.

**c. Describe any warning systems to detect the presence of water in rooms important to safety.**

- Describe the room water level warning systems (e.g., alarms) credited for their flood protection function in the plant's external flooding licensing basis
- Note that systems that detect internal flooding sources are not part of the scope of the walkdown

**d. Discuss the effectiveness of flood protection systems and exterior, incorporated, and temporary flood barriers. Discuss how these systems and barriers were evaluated using the acceptance criteria developed as part of Requested Information Item 1.h.**

- The purpose of the 2.3 walkdowns is to verify the conformance with the CLB; the adequacy of the CLB will be addressed as part of the 2.1 flood reevaluations if an integrated assessment is required
- The acceptance criteria for the walkdowns are described in section 6 of the guideline. This approach is consistent with requested information item 1.h of the 50.54(f) letter. Discuss how the plant implemented this approach.

• This discussion should include an evaluation of the overall effectiveness of the plant's flood protection features to perform their credited functions during a variety of site conditions (as defined previously), as determined by the results of the walkdowns (the features are available, functional, and implementable). The CAP process will determine which of the walkdown observations are deficiencies and what actions were taken or planned to address them. Questions such as the following should be evaluated for a variety of site conditions:

- i. Is the barrier system functional?
  - ii. Are operator actions feasible?
- Describe how other existing plant equipment, structures, and procedures might mitigate the effects of an external flood under a variety of plant configurations.
    - i. Clearly describe what additional existing, if any, plant structures, systems, components, and procedures that are not part of the flooding CLB and that could be used to mitigate an external flood.



Note that the Walkdown Report should include a description of existing plant capability, not an assessment of plant vulnerabilities to flooding that might exist under all susceptible plant configurations. The assessment of plant vulnerabilities to all susceptible plant configurations will be completed, if applicable, as part of an Integrated Assessment performed in response to Enclosure 2 of Reference 1

- ii. Note: NUMARC 93-01, Rev 4A provides guidance on implementation of the maintenance rule. Section 11.3.4.2 of this document recommends an assessment of maintenance activities that expose SSCs to flood hazards in a manner that degrades their capability to perform key safety functions. Credit for this activity could be included in this discussion.

**e. Present information related to the implementation of the walkdown process (e.g., details of selection of the walkdown team and procedures,) using the documentation template discussed in Requested Information Item 1.j, including actions taken in response to the peer review.**

- Confirm that guidance was followed (and options selected when available within the guidance) and any exceptions taken to the guidance. See sections 5.3, 7, Appendix B
- Describe how the walkdown teams were organized (e.g., number of members, general background, etc.). See sections 5.3 and 7.
- Describe the approach used to comply with section 5.3 guidance on walkdown team selection and training.

**f. Results of the walkdown including key findings and identified degraded, non-conforming, or unanalyzed conditions. Include a detailed description of the actions taken or planned to address these conditions using the guidance in Regulatory Issues Summary 2005-20, Rev 1, Revision to NRC Inspection Manual Part 9900 Technical Guidance, "Operability Conditions Adverse to Quality or Safety," including entering the condition in the corrective action program.**

- Include the following items
  - Description of all deficiencies as determined by the CAP. Observations that are entered into the CAP and not dispositioned as deficiencies do not need to be reported.
  - Description of any observations reported in the CAP that were not dispositioned at the time of the report

- Describe actions that were taken or are planned to address the deficiencies using the guidance in Regulatory Issues Summary 2005-20 Revision 1.
- Flood protection features that could not be inspected, including
  - Features affected by restricted access (see section 5.1):
    - Justification for delay
    - Schedule
    - Any necessary special procedures
  - Inaccessible features (see section 5.1):
    - Basis for reasonable assurance that the feature is available and will perform its credited function or an assessment of the impact of non-performance of the function
    - If more than one “inaccessible” flood protection feature with potential loss of function is reported, then an evaluation of the aggregate effect flood protection features must be provided.
- Walkdown record forms are not submitted to the NRC, but as discussed in Section 7 are retained onsite for NRC inspection

**g. Document any cliff-edge effects identified and the associated basis.**

**Indicate those that were entered into the corrective action program. Also include a detailed description of the actions taken or planned to address these effects.**

- Cliff edge effects and physical margins do not need to be reported to the NRC as part of the Walkdown Report. However, the Appendix B walkdown records, which include the collected APM information, need to be retained and available for NRC audits and inspections.
- -While the NRC used the same term as the NTTF Report in its 50.54(f) information request (Reference 8.1) related to Flooding Recommendation 2.3, the information that the NRC expects utilities to obtain during the Recommendation 2.3 walkdowns is different. To clarify, the NRC is now differentiating between cliff-edge effects (which are dealt with in Recommendation 2.1) and a new term, Available Physical Margin (APM). APM information will be collected during the walkdowns, but will not be reported in the response to Reference 8.1, Enclosure 4. The APMs determined by the Recommendation 2.3 walkdowns do not involve calculating the cliff-edge effects (i.e., the safety consequences). During the Recommendation 2.1 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
- Instead of submitting cliff-edge effects report that Available Physical Margins have been collected and documented in the Walkdown Record form (Appendix B). This information will be used in the flood hazard

reevaluations performed in response to Item 2.1: Flooding in the 50.54(f) letter (Reference 8.1).

**h. Describe any other planned or newly installed flood protection systems or flood mitigation measures including flood barriers that further enhance the flood protection. Identify results and any subsequent actions taken in response to the peer review.**

- Describe changes determined to be necessary by the flood walkdowns and whether they have been completed or their schedule for completion
- For the purposes of the flooding design basis walkdown verification, the peer review is the process described in section 7. The only actions and results that should be reported are those that resulted in a change to the walkdown process or methodology. Corrections and resolution of differences resulting from the normal process of performer / reviewer interaction are not reported.

DRAFT

## **APPENDIX E**

### **Recommendations for Preparing for Flooding Reevaluations**

DRAFT

## Flood Protection Feature Walkdown Enhancements

Comment [g4]: Remove for submission

### Introduction

The walkdowns required to respond to Enclosure 4 of Reference 1 (NRC's March 12, 2012 50.54(f) letter, *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*) compare a plant's existing flood protection features to the plant's current licensing basis for flooding.

Enclosure 2 of the same letter requires utilities to complete a flood hazards evaluation for all their sites using the methodologies and guidance applicable to new plant applications. The results of these evaluations are to be compared to the current licensing basis for flooding to determine if the design basis flood evaluation bounds the re-evaluated flood hazard. This comparison is to be performed for all susceptible plant configurations and for the entire duration of the flood conditions. If a licensee's current design basis does not bound the reevaluated flood hazard, the licensee will need to perform an integrated assessment to identify vulnerabilities and actions to address them.

In order to provide the information required by enclosure 2 to the 50.54(f) letter without re-performing the walkdowns required by enclosure 4, it is recommended that utilities capture additional information beyond that necessary to verify conformance with the existing licensing basis. The recommended additional information is described in this document. This information need not be reported to the NRC as part of the Design Basis Walkdowns results requested by Enclosure 4.

### Definitions

The following additional definitions apply to this appendix.

#### Integrated Assessment

An Integrated Assessment is the evaluation required for plants whose the current flooding design basis does not bound the reevaluated hazard performed in response to Enclosure 2 of Reference 8.1 for all flood causing mechanisms. The purpose of the integrated assessment is to determine 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.

#### Cliff Edge

The definition of cliff edge that is provided in the main body of the guideline is applicable to this appendix.

#### 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 functions.

Since the flooding hazard reevaluations will not be completed at the time the flooding walkdowns are performed, within the context of this appendix this definition is expanded to include the following concept:

*Plant vulnerability also refers to the point at which a flood protection feature is impacted by rising flood levels, making its ability to protect against a flood questionable.*

The following is an example of this concept: An unsealed penetration exists in a flood barrier. If the water level during a flood were to reach the level of this penetration, leakage through the barrier would occur, thereby impacting the flood protection function of the barrier. The position of the unsealed penetration defines the level at which a plant specific vulnerability exists.

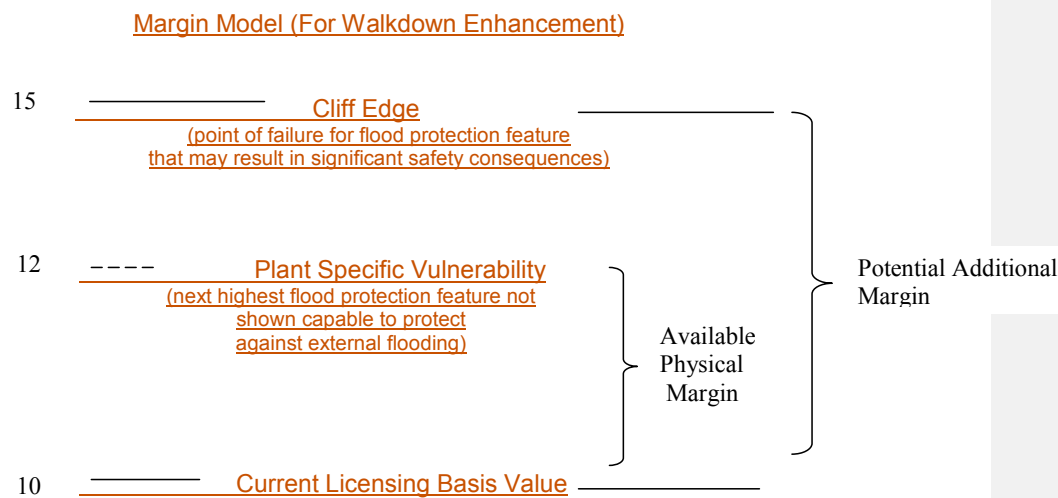
#### Available Physical Margin

The Available Physical Margin for a flood protection feature defined in the Definitions section of the Guideline. The Available Physical Margin indicates how much a new plant flood evaluation result can increase beyond the current licensing basis without raising a concern about the ability of the flood protection feature to perform its credited function. For example, if the credited height of a flood barrier in the current licensing basis is 10 feet and an unsealed penetration through the barrier exists at 12 feet, the

Available Physical Margin is 2 feet.

### Potential Additional Margin

The Potential Additional Margin is the additional amount by which a flood protection feature can be easily improved to accommodate more challenging flood evaluation results. To continue the example above, if the credited height of a flood barrier in the current licensing basis is 10 feet, an unsealed penetration through the barrier exists at 12 feet, and the total height of the barrier is 15 feet, then the Potential Additional Margin is 5 feet (assuming that the unsealed penetration can be sealed and qualified as a flood protection feature readily sealed). See illustration below.



### Recommendations

In addition to the information required to respond to Enclosure 4 of Reference 1, the flooding design basis walkdowns should also capture the following information on margins, susceptible plant conditions, and flood duration as described below in order to prepare for plant flooding reevaluations and Integrated Assessments (response to Enclosure 2 of Reference 1).

### Margin Information

The margin information does not need to be reported to the NRC in the flood walkdown report, but the Available Physical Margin information must be collected and evaluated in accordance with the guidance in the main body of this document. The walkdowns should collect the following information in order to allow margin assessment.

- The current licensing basis value for flood protection features,

- The value at which the as-built flood protection feature parameter (such as barrier height, seal pressure rating, sump pump capacity, etc.) becomes a plant specific vulnerability. The difference between this value and its associated licensing basis value defines the Available Physical Margin.
- The value at which the as-built flood protection feature can no longer perform its credited function. The difference between this value and its associated licensing basis value defines the Potential Additional Margin.

As an example, if the licensing basis of a flood barrier is 10 feet, the lowest unsealed penetration in the barrier is at 12 feet, and the total height of the barrier is 15 feet, both the Available Physical Margin (in this case, 2 feet) and the Potential Additional Margin (in this case, 5 feet) should be captured. This information will be useful in assessing the implications of the new plant flood evaluation results that will be performed in response to item 2.1 of Reference 1; specifically:

It is recommended that utilities assess Potential Additional Margin information to determine if pre-emptive plant modifications may be advisable in order to avoid a situation where the new plant flood evaluation results challenge existing flood protection features.

Available Physical Margin and Potential Additional margin information need not be reported to the NRC as part of the walkdown results report ~~required by the response to Enclosure 4 of Reference 1.~~

#### Susceptible Plant Configurations

Enclosure 2 of Referenced 1 requires that the potential effect of flooding on the plant must consider all plant configurations that might exist when a postulated flood could occur. ~~The plant conditions configurations considered should include those that could occur during full power operations, startup, shutdown, and refueling all modes of operation.~~ These different plant conditions will not only affect the status of flood protection features, they might also affect what equipment must be protected. The walkdowns are a good opportunity to identify the ~~potential~~ impact of susceptible plant configurations. ~~In doing so~~

If the CLB does not consider all modes of operation and associated plant configurations, the licensee should consider the following during the plant walkdowns:

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

This information does not need to be reported to the NRC in the walkdown report unless it is part of the CLB for a plant.

Last Updated: 5/24/2012 12:21 PM

**Comment [g5]:** Enclosure 4 or the 50.54(f) included this as well

**Comment [g6]:** This part shouldn't be in the optional appendix.

FFTF: The concept described in this appendix is different from that required to respond to the 50.54(f) letter. See the discussion of Variety of Plant Conditions in the main body of the document.



### Flood duration

Enclosure 2 of the Referenced letter requires that the potential effect of flooding on the plant must consider the effects that could occur over the full duration of the flood. For some hazards flood conditions could persist for a significant amount of time. Extended flood duration could present concerns such as:

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

In order to facilitate assessing the effect of the duration of the floods determined by the new plant flood evaluations, it is recommended that the review and walk through of plant procedures performed as part of the design basis walkdowns consider the implications of a longer flood that may be identified by new plant flood hazard evaluation methods. Flood protection feature limitations based on flood duration should be evaluated as part of the design basis walkdown records. For example, if the duration of the design basis flood is 2 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 recorded.

This information does not need to be reported to the NRC in the walkdown report unless it is part of the CLB for a plant.

### References.

NRC 10 CFR 50.54(f) letter, *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*, dated March 12, 2012