Seismic Walkdown Guidance

For Resolution of Fukushima Near-Term Task Force Recommendation 2.3: Seismic

This document does **NOT** meet the requirements of 10CFR50 Appendix B, 10CFR Part 21, ANSI N45.2-1977 and/or the intent of ISO-9001 (1994).

EPRI Project Manager
R. Kassawara

ELECTRIC POWER RESEARCH INSTITUTE

3420 Hillview Avenue
Palo Alto, CA 94304-1338
USA

PO Box 10412
Palo Alto, CA 94303-0813
USA

800.313.3774
650.855.2121

askepri@epri.com

www.epri.com

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THE FOLLOWING ORGANIZATION(S), UNDER CONTRACT TO EPRI, PREPARED THIS REPORT:

MPR Associates, Inc.

NOTE

For further information about EPRI, call the EPRI Customer Assistance Center at 800.313.3774 or e-mail askepri@epri.com.

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The following organization, under contract to the Electric Power Research Institute (EPRI), prepared this report:

MPR Associates, Inc.

Principal Investigators:
Richard G. Starck and Caroline S. Schlaseman

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Product Description

[Later]

Abstract

[Later]

Table of Contents

List of Figures

List of Tables

Section 1: Purpose and Approach

[This section is still under development. Changes shown in this section should NOT be considered final at this time.]

Purpose

Enclosure 3 to the NRC 50.54(f) Letter [1] states the following purposes of the NRC request:

- To gather information with respect to Near-Term Task Force (NTTF) Recommendation 2.3, as amended by staff requirements memorandum (SRM) associated with SECY-11-0124 and SECY-11-0137,
- To request licensees to develop a methodology and acceptance criteria for seismic walkdowns to be endorsed by the NRC staff,
- To request licensees to perform seismic walkdowns using the NRC-endorsed walkdown methodology, as defined herein,
- To identify and address degraded, nonconforming, or unanalyzed conditions through the corrective action program, and
- To verify the adequacy of licensee monitoring and maintenance procedures.

Additionally, the NRC 50.54(f) Letter includes under "Requested Actions" the request that the walkdown "verify current plant configuration with the current license basis."

The 50.54(f) Letter also requests that the procedures used by licensees to conduct the walkdown include the following characteristics:

a. Determination of the seismic walkdown scope and any combined effects

b. Consideration of NUREG-1742, EPRI Report NP-6041, GIP, and common issues and findings discussed in the responses to TI 2515/183

c. Pre-walkdown actions (e.g., data collection, review of drawings and procedures, identification of the plant licensing basis, identification of current seismic protection levels)

d. Identification of SSCs requiring seismic protection and used in the protection of the reactor and spent fuel pool, including the ultimate heatsink (UHS)

e. Description of the walkdown team composition and qualifications

f. Details of the information to be collected during the walkdown including equipment access considerations

g. Documentation and peer review requirements

The guidance contained in this document is intended to meet the above objectives. The remainder of this Section 1 provides an overview of the guidance; details for implementing this guidance are included in the remaining sections of this document.

Overview of Approach

The overall approach for addressing the actions and information requested in the 50.54(f) Letter includes the following activities, as shown in Figure 1-1 through Figure 1-4:

Selection of a Seismic Walkdown Equipment List (SWEL)

Three groups of items are identified for the Seismic Walkdown Equipment List:

1. Equipment or Systems Sample needed to bring the reactor to a safe shutdown condition and maintain containment function. In Figure 1-1, the items from this sample are labeled as SWEL 1.
2. Spent Fuel Pool equipment sample and features that could potentially cause rapid drain-down of the pool. In Figure 1-2, these items are labeled as SWEL 2.
3. IPEEE Seismic Vulnerabilities identified and dispositioned during the IPEEE. In Figure 1-3, these items are labeled as SWEL 3.

Seismic Walkdowns and Area Walk-Bys

Seismic walkdowns of the three groups of items on the SWEL described above and walk-bys of the areas containing the SWEL items are illustrated as Screen #1 in Figure 1-4.

Licensing Basis Evaluation

Detailed evaluations of the items identified as having potential adverse seismic conditions are performed to determine whether the plant seismic licensing basis is met, as illustrated as Screen #2 in Figure 1-4

The key activities for implementing the overall approach in addressing the 50.54(f) Letter are summarized below and described in more detail in the remaining sections of this document.

Section 2: Personnel Qualifications

The qualifications of personnel who will perform the key activities required to fulfill the requirements and expectations of the 50.54(f) Letter are described in Section 2: Personnel Qualifications. These personnel are responsible for:

- Identification of the items to be walked down,
- Performance of the seismic walkdowns and walk-bys, and
- Performance of the licensing basis evaluations.

The reviews conducted during each of these activities satisfy the Peer Review activities requested in the 50.54(f) Letter. Additionally, a Peer Review will be performed of the overall report to ensure that the objectives are met.

Section 3: Selection of SSCs

The process used to select the items that will be included in the overall Seismic Walkdown Equipment List (SWEL) is described in detail in Section 3: Selection of SSCs. In general, the SWEL is comprised of three groups of items, which are described at a high level in the following subsections.

Sample of Required Items – SWEL 1

As shown in Figure 1-1, Screen #1 is used to select Seismic Category (SC) I structures, systems, and components (SSCs) (because they have a seismic licensing basis).

Some SC I SSCs already have existing evaluations and regularly undergo inspections. Those items covered by other such programs are not evaluated further as shown by Screen #2 and described below:

- Seismic Category I structures are typically confirmed to meet their seismic licensing bases through analyses. Periodic inspections of SC I structures for degradation (e.g., concrete spalling) that might undermine their licensing basis are conducted in accordance with plant Maintenance Rule structural inspections.

- Primary Containment penetrations are typically confirmed to meet their seismic licensing bases through analyses. Periodic inspections and/or testing to ensure penetrations are not degraded are required by ASME Section XI.
- Seismic Category I piping systems have been confirmed to meet their licensing bases through several NRC programs, e.g., IE Bulletin 79-14. Periodic walkdowns by plant system engineers and ASME Section XI In-service Inspections ensure SC I piping systems are maintained in accordance with their licensing bases.

Cable/conduit raceways and HVAC ductwork, although not included as "equipment" in the SWEL, are reviewed during area walk-bys of the spaces containing items on the SWEL.

In Figure 1-1, Screen #3 identifies equipment from systems required for safe shutdown. The four safe shutdown functions (reactor reactivity control, reactor coolant pressure control, reactor coolant inventory control, and decay heat removal, which includes the Ultimate Heat Sink), plus containment functions, must be maintained by frontline and supporting system equipment.

In Figure 1-1, Screen #4 represents the sample selections made to ensure that SWEL 1 includes:

- Equipment in various frontline and supporting systems
- Major new or replacement equipment installed within the past 15 years (i.e., from the approximate completion of seismic IPEEE evaluations)
- Diverse types of equipment, e.g., the 21 classes of equipment considered in seismic IPEEE and USI A-46 programs
- Equipment located in different environments, e.g., dry/cool vs. hot/damp

Spent Fuel Pool Related Items – SWEL 2

As shown in Figure 1-2, the first screen is to determine whether the Spent Fuel Pool (SFP) SSCs are Seismic Category I and therefore have a seismic licensing basis against which to evaluate their adequacy. All plants are expected to have a SC I spent fuel pool because it is integral to the SC I Reactor Building (BWR) or Auxiliary Building (PWR). However, as noted above, SC I structures are not included in the SWEL scope because they are addressed by other existing programs. The additional input to SWEL 2 would be features of the SFP that could potentially cause a rapid drain-down of the pool, even if such features are not Seismic Category I items.

Improvements to Address IPEEE Seismic Vulnerabilities – SWEL 3

Figure 1-3 outlines the approach for responding to the 50.54(f) request that "improvements made as part of the licensees' response to the individual plant examination of external events (IPEEE) program for seismic issues should be reported." As shown in Figure 1-3, if review of the IPEEE documentation and licensing correspondence determines that physical modifications were made to plant equipment, such equipment would be added to the scope of the walkdowns through SWEL 3.

Section 4: Seismic Walkdowns and Area Walk-Bys

Details of the process for conducting the seismic walkdowns of items of equipment and systems on the SWEL (which includes all items in SWELs 1, 2 and 3) are described in Section 4: Seismic Walkdowns and Area Walk-Bys. Additionally, the process for conducting walk-bys of each area of the plant that includes an item on the SWEL is included in Section 4: Seismic Walkdowns and Area Walk-Bys. Overviews of these two key activities are discussed in the following two subsections.

Seismic Walkdowns

Seismic walkdowns are examinations to identify potential adverse seismic conditions for items of equipment and systems included in the SWEL. If a potential adverse condition is identified during the equipment walkdown, the potential adverse condition is evaluated with respect to the current licensing basis (CLB), as described in Section 5: Seismic Licensing Basis Evaluations. As discussed in detail in Section 4: Seismic Walkdowns and Area Walk-Bys, the equipment walkdowns should:

- Examine anchorage conditions and evaluate compliance with the CLB,
- Look for adverse seismic spatial interactions that could directly affect the ability of the equipment to perform its safety functions, and
- Look for other degradation that may affect the ability of the SWEL item to perform its safety function or raise questions regarding compliance with the CLB.

Area Walk-Bys

The area walk-bys are to be conducted in each area of the plant that contains an item on the SWEL. The area walk-by will consider the overall condition of the area with respect to seismic concerns that are not captured during the seismic walkdown of the SWEL item. If a potential adverse condition is identified during the walk-bys, the potential adverse condition is evaluated with respect to the current licensing basis (CLB), as described in Section 5: Seismic Licensing Basis Evaluations. As discussed

in detail in Section 4: Seismic Walkdowns and Area Walk-Bys, the key examination factors that should be considered in walk-bys include:

- Anchorage conditions (if visible without opening equipment),
- Significantly degraded equipment in the area,
- A visual assessment (from the floor) of cable/conduit raceways and HVAC ducting (e.g., condition of supports or fill conditions of a cable tray),
- Potential adverse seismic spatial interactions.
- Potential adverse interactions that could cause flooding/spray and fire in the area, and
- Other seismic housekeeping items, including temporary installations.

Section 5: Licensing Basis Evaluations

Items of concern from both the equipment seismic walkdowns and area walk-bys are evaluated with respect to their seismic licensing basis, as described in detail in Section 5: Seismic Licensing Basis Evaluations. If the equipment or item of concern cannot be readily shown to meet its seismic licensing basis, then the issue will be evaluated further under the plant's Corrective Action Program (CAP). Under the CAP, if the item is found not to meet its seismic licensing basis, it is expected that an assessment of the extent of condition would be performed.

Section 6:Peer Review

[Under development]

Section 7: IPEEE Vulnerabiliities

[Under development]

Section 8: Submittal Report

Requirements of the submittal report are described in detail in Section 8: Submittal Report. In accordance with the 50.54(f) Letter, the final submittal report will include the following:

a. Information on the plant-specific hazard licensing bases and a description of the protection and mitigation features considered in the licensing basis evaluation

b. Information related to the implementation of the walkdown process

c. A list of plant-specific vulnerabilities (including any seismic anomalies, outliers, or other findings) identified by the IPEEE

and a description of the actions taken to eliminate or reduce them (including their completion dates)

d. Results of the walkdown including key findings and identified degraded, nonconforming, 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, Revision, 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

e. Any planned or newly installed protection and mitigation features

f. Results and any subsequent actions taken in response to the peer review

Clarifications

Peer Review

The reviews conducted during each of the three key activities (SWEL preparation, seismic walkdowns and walk-bys, and licensing basis evaluation) satisfy the Peer Review activities requested in the 50.54(f) Letter. Additionally, a Peer Review will be performed of the overall report to ensure that the objectives are met.

Seismic Protection

The term “seismic protection” is used in several places in the 50.54(f) Letter, including Requested Information Item 1.d “Identification of SSCs requiring seismic protection . . .” SSCs that must function during and/or following an earthquake are designed for the displacements, velocities, or accelerations associated with the seismic event; therefore the term “protection” is more appropriate when used with respect to flooding or high wind events.

Licensee Monitoring and Maintenance Procedures

The 50.54(f) Letter requires the seismic walkdown activity to “verify the adequacy of licensee monitoring and maintenance procedures.” This will not be done directly by the walkdown, but it will be indirectly verified based on the findings from the walkdown, e.g., if degraded conditions are found, the issue, along with the underlying cause, will be evaluated under the plant’s CAP.

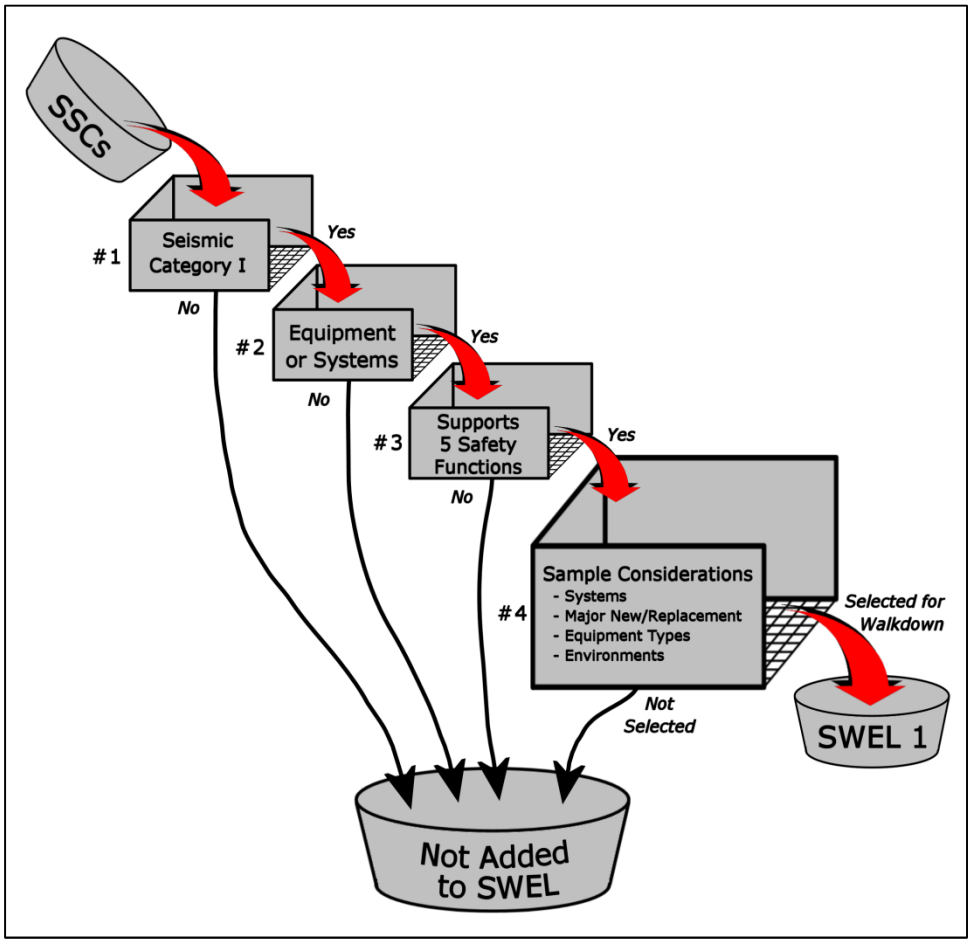


Figure 1-1
Sample of Required Items – SWEL 1

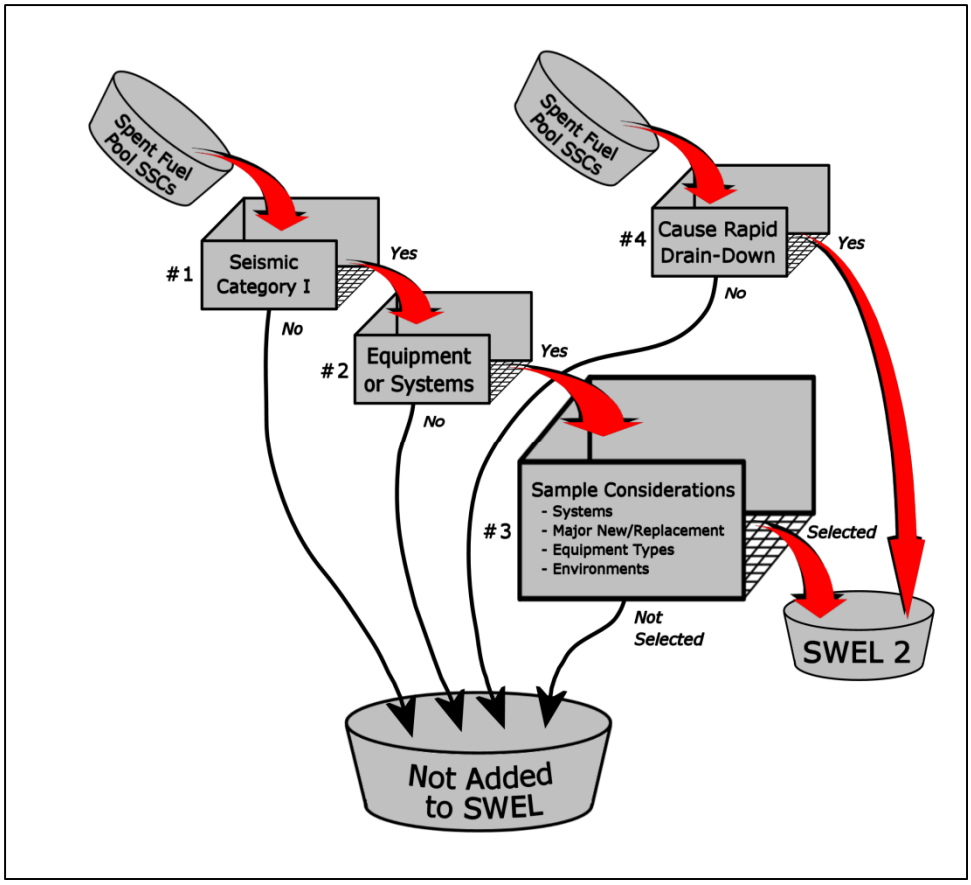


Figure 1-2
Spent Fuel Pool Related Items – SWEL 2

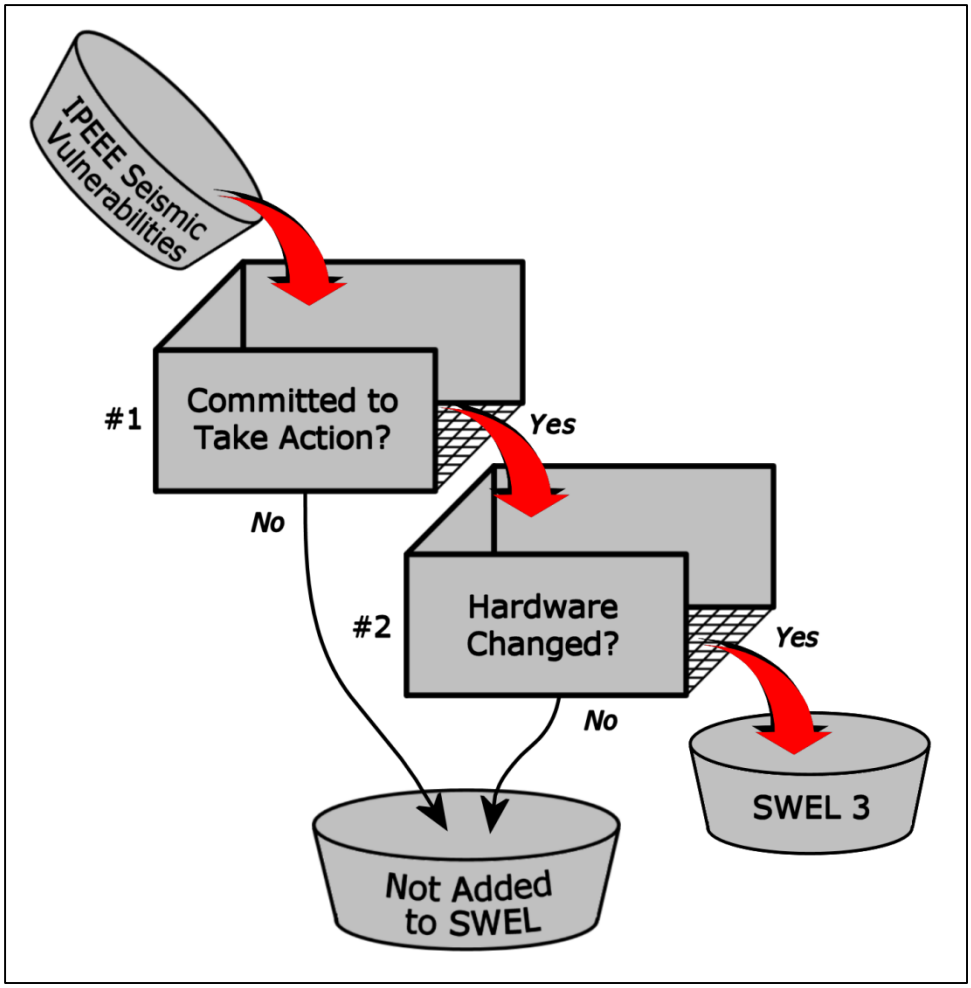
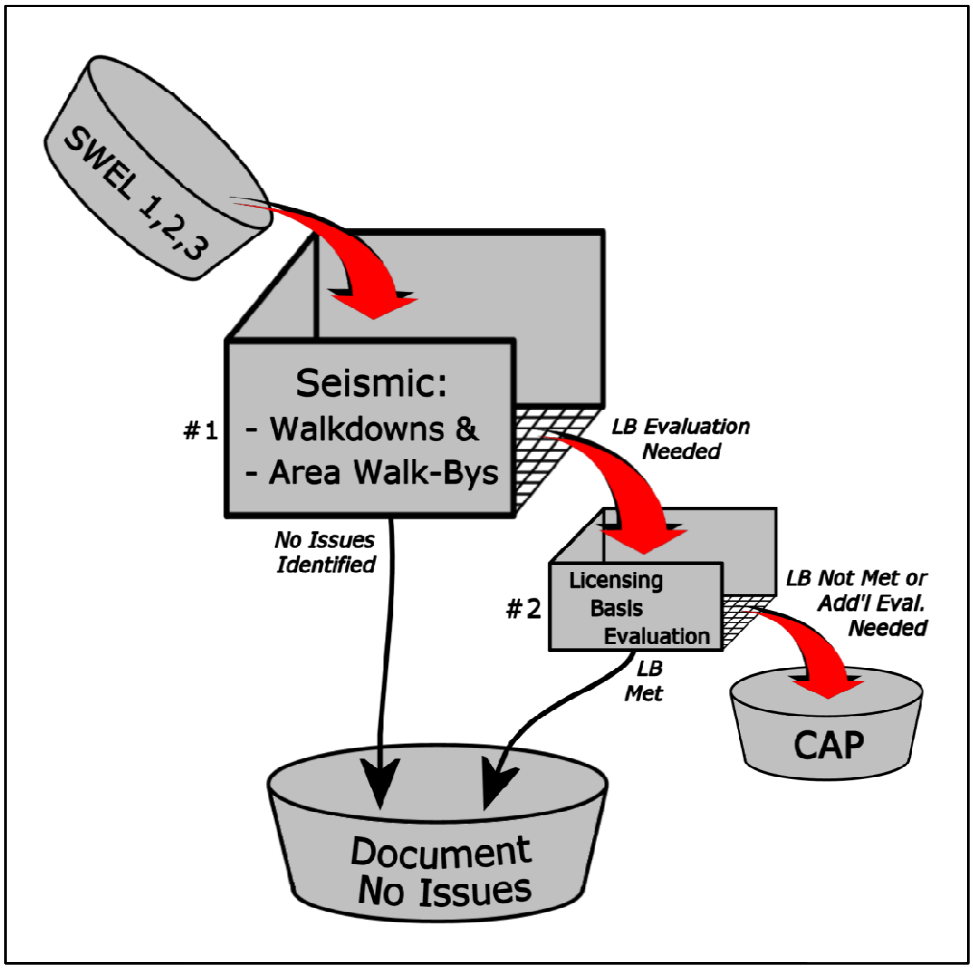


Figure 1-3
Improvements to Address IPEEE Seismic Vulnerabilities – SWEL 3


SWEL 1,2,3
Seismic:
#1 - Walkdowns &
- Area Walk-Bys
LB Evaluation Needed
No Issues Identified
#2 Licensing Basis Evaluation
LB Not Met or Add'l Eval. Needed
LB Met
CAP
Document No Issues

Section 2: Personnel Qualifications

[This section is still under development. Changes shown in this section should NOT be considered final at this time.]

This section defines the qualifications for personnel who will be involved in performing the evaluations described in this Seismic Walkdown Procedure. These personnel are responsible for:

- Identifying the scope of SCs to review, as described in Section 3: Selection of SSCs,
- Performing the seismic walkdowns and evaluations, as described in Section 4: Seismic Walkdowns and Area Walk-Bys, and
- Performing the seismic licensing basis evaluations, as described in Section 5: Seismic Licensing Basis Evaluations.

Guidance is also provided for how personnel should interact with each other while performing the above scope of work.

Equipment Selection Personnel

The equipment selection personnel are responsible for identifying the sample of SSCs to be walked down. This list of SSCs is called the Seismic Walkdown Equipment List (SWEL). Guidelines for developing the SWEL are included in Section 3: Selection of SSCs. The Equipment Selection Personnel should have knowledge of plant operations, plant documentation, and associated SSCs. They should also have the capability to select a broad distribution of SSCs for the SWEL. It would also be beneficial for the Equipment Selection Personnel to also have knowledge of the SSCs identified during the IPEEE program (and the USI A-46 program, if applicable).

The Equipment Selection Personnel may request support from others to help them develop the SWEL. In particular, input from Plant Operations Personnel may be useful for identifying (1) major equipment and systems that may have been added or changed, (2) equipment and systems located in different environments, and (3) equipment and systems that may be accessible for inspection during the plant walkdown.

A second person should review and sign off on the adequacy of the SWEL, based on the requirements in Section 3: Selection of SSCs. This reviewer should have the same type of knowledge and experience as the Equipment Selection Personnel, as described above.

Plant Operations Personnel

Plant operations personnel have two types of responsibilities during implementation of this Seismic Walkdown Procedure.

First, they are responsible, on an as-needed basis, for providing information to the Equipment Selection Personnel as they develop the SWEL, as described in Section 3: Selection of SSCs. For example, plant operations personnel may be able to point to major changes or additions to the plant since the IPEEE program had been completed (as illustrated by Screen #3 in Figure 1-1). Their input may also be useful in identifying SSCs that are in different environments and that are accessible for inspection during the plant walkdown.

Second, plant operations personnel are responsible, on an as-needed basis, for providing information and support to the Seismic Walkdown Engineers (SWEs) during the seismic walkdowns and evaluations (as illustrated by Screen #4 in Figure 1-1). In particular, the plant operations personnel should be available to answer questions on the function and operation of SSCs so the SWEs can decide whether malfunction of certain features of an item of SSC will affect its safety-related function. In addition, the plant operations personnel should be available to give the SWEs access to and facilitate inspection of SSCs, including their anchorage.

To fulfill these responsibilities, the plant operations personnel should have knowledge and experience in the specific plant systems being seismically evaluated. This knowledge should cover both steady state and transient operations of various systems and the associated plant-specific operating procedures. They should also be able to supply information on the consequences of, and operator recovery from, functional anomalies.

Seismic Walkdown Engineers

The Seismic Walkdown Engineers (SWEs) are responsible for performing the seismic walkdowns and evaluations, as described in Section 4: Seismic Walkdowns and Area Walk-Bys. The SWEs shall have:

- A degree, or equivalent, in mechanical or civil/structural engineering
- Experience in seismic engineering, as it applies to nuclear power plants
- Completed one of the following two training courses:

- NTTF 2.3 Seismic Walkdown Training Course[1]
- SQUG Walkdown Training Course[2]

The seismic walkdowns and evaluations may be conducted by one or more Seismic Review Teams (SRTs), each of which must include at least two SWEs. The SWEs are expected to conduct the walkdowns together. During these walkdowns, the SWEs are expected to actively discuss their observations and judgments with each other. Additionally, the SWEs are expected to come to agreement on the results of their walkdowns and evaluations before reporting the results of their review.

The Seismic Walkdown Engineers may be assisted in conducting the seismic walkdowns by other individuals. For example, systems engineers or Plant Operations Personnel may accompany the SWEs during the walkdown to facilitate access to and inspection of equipment and systems. They may also provide understanding of the safety-related functions of the equipment and systems as well as nearby equipment and systems that may cause an adverse seismic interaction condition.

Nevertheless, regardless of what help the Seismic Walkdown Engineers receive from others, they are responsible for the seismic evaluations, engineering judgments, and documentation of the walkdowns.

The qualifications and experience of the SWEs should be documented as described in Section 8: Submittal Report.

Licensing Basis Reviewer

The Licensing Basis Reviewer is responsible for determining whether the SSCs, identified by the SWEs as potentially having adverse conditions to malfunction or failure during an earthquake, meet the plant seismic licensing basis for those items, as described in Section 5: Seismic Licensing Basis Evaluations.

The Licensing Basis Reviewer should have knowledge and experience in the following areas:

- Seismic licensing basis for the SSCs in the plant
- Seismic qualification methods and documentation for the plant
- Requirements and procedures for entering the Corrective Action Program (CAP) for the plant

The Licensing Basis Reviewer is expected to interface with the SWEs to understand the bases for the SWEs' concerns regarding the identified

[1] The NTTF 2.3 Seismic Walkdown Training Course is a 2-day course sponsored by EPRI. This course is based on this Seismic Walkdown Procedure.

[2] The SQUG Walkdown Training Course is a 5-day course sponsored by EPRI based on the Generic Implementation Procedure (GIP) [10].

potential seismic vulnerabilities. The SWE and the Licensing Basis Reviewer may be the same person.

More than one Licensing Basis Reviewer may be used to evaluate whether the SSCs identified by the SWEs meet the plant seismic licensing basis.

A second person should review and sign off on the results of the seismic licensing basis evaluation, based on the requirements in Section 5: Seismic Licensing Basis Evaluations. This reviewer should have the same type of knowledge and experience as the Licensing Basis Reviewer, as described above.

Section 3: Selection of SSCs

This section provides guidance for selecting the structures, systems, and components (SSCs) that should be placed on the Seismic Walkdown Equipment List (SWEL) so that they can be walked down by the Seismic Walkdown Engineers (SWE), as described in Section 4: Seismic Walkdowns and Area Walk-Bys.

Guidance is provided in this section for selecting SSCs in each of the following three groups:

- The process for selecting a Sample of Required Items to safely shut down the reactor and maintain containment integrity is illustrated in Figure 1-1. This process produces the first Seismic Walkdown Equipment List (SWEL 1).
- The process for selecting Spent Fuel Pool Related Items is illustrated in Figure 1-2. This process produces the second Seismic Walkdown Equipment List (SWEL 2).

The SWELs from these two groups are combined into a single SWEL. Details for selecting the SSCs in each of these three groups are provided below.

The equipment selection process described in this section is to be performed by an Equipment Selection Person, as described in Section 2: Personnel Qualifications. A second Equipment Selection Person should review this work as a peer reviewer to confirm that the SWELs are consistent with guidelines described in this section. The peer reviewer should document his review by interviewing the primary Equipment Selection Person and complete the checklist shown in Appendix The Equipment Selection Person and the reviewer should be identified in and sign off on the documentation of the SWELs, as described in Section 8: Submittal Report.

Sample of Required Items

The process for selecting a sample the SSCs for shutting down the reactor and maintain containment integrity includes the following four screens, as shown in Figure 1-1:

- Screen #1 – Seismic Category I
- Screen #2 – Equipment or Systems

- Screen #3 – Support for the 5 Safety Functions
- Screen #4 – Sample Considerations

The process for selecting SSCs using each of these four screens is described below. This will result in the first Seismic Walkdown Equipment List (SWEL 1).

Screen #1 – Seismic Category I

Screen #1 in Figure 1-1 narrows the scope of SSCs in the plant to those that are classified as Seismic Category (SC) I. This is done because only such items have a defined seismic licensing basis against which to evaluate the as-installed configuration. Selecting these items is intended to comply with the request in the NRC 50.54(f) Letter, under the "Requested Actions" section, to "verify current plant configuration with the current license basis." Typically, the plants have equipment lists that define the SSCs are Seismic Category I.

Screen #2 – Equipment or Systems

Screen #2 in Figure 1-1 narrows the scope of SSCs by selecting only those that do not regularly undergo inspections to confirm that their configuration continues to be consistent with the plant licensing basis. The types of SSCs not selected for addition to the SWEL 1 are those described below.

- Seismic Category I Structures are typically confirmed to meet their seismic licensing bases through analyses. Periodic inspections of SC I structures are routinely performed to confirm that degradation (e.g., concrete spalling) has not occurred, which could cause the structures to fall outside their licensing basis. Inspections to identify structural degradation are included in plant programs designed to address the Maintenance Rule. Therefore, SC I structures are not included on SWEL 1.
- Primary Containment Penetrations are typically confirmed to meet their seismic licensing bases through analyses. Periodic inspections and/or testing are performed, as required by ASME Section XI, to verify that these penetrations have not degraded. Therefore, primary containment penetrations are not included on the SWEL. Other containment integrity systems, such as the containment spray system and the containment isolation valves, may be considered for inclusion on SWEL 1.
- Seismic Category I Piping Systems have been confirmed to meet their licensing bases through several generic NRC programs, e.g., IE Bulletin 79-14. Periodic walkdowns by plant system engineers and ASME Section XI In-service Inspections

ensure that SC I piping systems are maintained in accordance with their licensing bases. Therefore, SC I piping systems are not included on SWEL 1.

The potential for distribution system seismic interaction (i.e., cable/conduit raceways and HVAC ductwork) on SWEL items are evaluated during the equipment walkdowns. A general review of distribution systems is performed during the Area Walk-Bys as described in Section 4: Seismic Walkdowns and Area Walk-Bys.

After applying the above selection criteria, it is expected that the SWEL will basically include mechanical and electrical equipment plus tanks and heat exchangers. Examples of these types of equipment are listed in Appendix B: Classes of Equipment. Note that Equipment Class 0 (Other) is included in this list. This catchall category includes other types of equipment not in any of the other 21 classes on that list.

Screen #3 – Support for the 5 Safety Functions

Screen #3 in Figure 1-1 narrows the scope of SSCs to be included on SWEL 1 to those associated with maintaining the following five safety functions.

- Reactor reactivity control
- Reactor coolant pressure control
- Reactor coolant inventory control
- Decay heat removal
- Containment function

The first four functions are associated with bringing the reactor to a safe shutdown condition. The fifth function is associated with maintaining primary containment integrity.

The recommended approach for selecting SSCs associated with these five safety functions is to develop a list of equipment in various systems associated with these five safety function. Details for implementing this approach are provided in the following subsections.

Previous Equipment List

Previous programs that could be used to define a base list of SSCs include the IPEEE program and, for some plants, the USI A-46 program. The IPEEE program was intended to address the seismic margin of SSCs associated with all of the above five safety functions. For plants that used the Seismic Probability Risk Assessment (SPRA) method, SSCs from the dominant functional/systemic sequences can be used for the base list. For plants that used the NRC Seismic Margins Assessment (NRC SMA) method, SSCs from the important sequences and cut sets could be used

for the base list. For plants that used the EPRI Seismic Margins Assessment (EPRI SMA) method, SSCs from the success paths could be used for the base list.

The USI A-46 program was intended to address the seismic adequacy of mechanical and electrical equipment in about 60 of the older nuclear power reactors in the U.S. SSCs from the walkdown Safe Shutdown Equipment List (SSEL) developed in this program address the first four safe shutdown functions listed above.

Systems Typically Used for Safety Functions

The frontline and support systems that are typically used to accomplish the five safety functions are listed in Appendix B of EPRI NP-6041 [13]. The frontline systems for Pressurized Water Reactors (PWRs) are shown in Table B-1 of this reference. The frontline systems for Boiling Water Reactors (BWRs) are shown in Table B-2 of this reference. The support systems for both PWRs and BWRs are shown in Table B-3 of this reference. Copies of these tables are included in Appendix E: Systems to Support Safety Functions.

Note that in some cases, more than one type of system can be used to accomplish a safety function. Also, some systems can be used to accomplish more than one safety function.

The major pieces of equipment in the Nuclear Steam Supply System (NSSS) that are located inside the containment are excluded from the scope of this program. Also excluded are the supports for this equipment along with all the components mounted in or on this equipment. The technical basis for excluding such equipment from the scope of this program is summarized below:

- Primary reactor components such as reactor vessels, reactor fuel and internals, pressurizers, steam generators and reactor coolant pumps in domestic nuclear plant are designed for seismic loadings. The requirements for seismic design of these components and their supports are specified in the Safety Analysis Reports for each plant and in the ASME codes.
- The primary reactor components and supports are subject to formal, periodic in-service inspection under Section XI of the ASME Boiler and Pressure Vessel Code. As a result, any deficiencies in the installation, support, and anchorage of this equipment would have been detected and corrected many years ago and are not current concerns.
- The adequacy of the seismic design of primary reactor components and supports has been reviewed and verified for a number of older operating plants in the NRC's Systematic Evaluation Program (SEP) and for all operating nuclear plants under USI A-2, Asymmetric Loads. These program reviews

confirmed that seismic design and installation of NSSS equipment is not a significant safety issue.

Screen #4 – Sample Considerations

Screen #4 in Figure 1-1 narrows the scope of SSCs to be included on SWEL 1 a sample that considers the following five attributes:

- Various types of systems
- Major new and replacement equipment
- Various types of equipment
- Various environments
- Equipment enhanced from IPEEE

The size of the sample should be sufficiently large to include a variety of items that collectively include all of the above five attributes. It is anticipated that SWEL 1 will typically include from about 90 to 120 items.

It is not expected that the sample will include every permutation from every variation within the above attributes. For example, some of the systems in the plant will not have had installation of major new and replacement equipment.

Further, some systems and may have only a limited number of different types of equipment. For example, certain fluid systems may not have batteries on racks.

Similarly, not all plants have all of the various types of equipment classes within the plant. For example, some plants generate DC power using inverters and therefore do not have motor generators.

Instead, it is expected that the SWEL, taken as a whole, will include representative items from some of the variations within each of the above five attributes.

In the process of selecting equipment for the sample, it is recommended that the Equipment Selection Person consult with and obtain advice from plant operators and others (e.g., systems engineers, maintenance personnel, etc.). For example, operators may be able to identify equipment with operational issues or that have been exposed to repeated maintenance activities. Such activity may have left the equipment in a state that no longer conforms to its seismic licensing basis.

Each of the above listed attributes is discussed below in more detail.

Various types of systems

Equipment from various types of systems should be selected for the sample. The types of systems to be considered include frontline and support systems listed in Appendix B of EPRI NP-6041 [13] (copies of these lists are included in Appendix E: Systems to Support Safety Functions).

Major new and replacement equipment

Some of the major new or replacement equipment installed within the past 15 years (i.e., from the approximate completion of the seismic IPEEE evaluations) should be selected for the sample.

In addition, it is recommended that the Equipment Selection Person consult with and obtain advice from plant operators and others (e.g., systems engineers, maintenance personnel, etc.) to identify equipment that has recently (e.g., within the past 6 months) been modified or upgraded. Such equipment may be more susceptible to potential housekeeping issues such having portable equipment stored nearby within a zone of influence where earthquake motions could cause adverse seismic interactions.

Various types of equipment

Various types of equipment should be selected for the sample. This may be accomplished by including an item from each of the classes of equipment listed in Appendix B: Classes of Equipment.

Various environments

The equipment to be selected for the sample should be from different locations in the plant that have different operating environments. For example, this could include equipment in environments that are dry and hot, wet and cold, mild and harsh, and inside and outside buildings.

Equipment Enhanced from IPEEE

During the IPEEE program, plant-specific seismic vulnerabilities (including anomalies, outliers, or other findings) were identified. Some of this equipment should be included in SWEL 1.

Note the status of all IPEEE vulnerabilities will be identified as described in Section 7: IPEEE Vulnerabiliities.

Spent Fuel Pool Related Items

The process for selecting a sample of the SSCs associated with the Spent Fuel Pool (SFP) includes the following four screens, as shown in Figure

1-2: The following four screens are used in this process resulting in the second Seismic Walkdown Equipment List (SWEL-2):

- Screen #1 – Seismic Category I
- Screen #2 – Equipment or Systems
- Screen #3 – Sample Considerations
- Screen #4 – Rapid Drain-Down

The process for selecting SSCs using these screens is similar to the approach described above for SWEL 1, with the following exceptions.

Screen #2, Equipment or Systems, considers only those items associated with the spent fuel pool.

Screen #3, Sample Considerations, is expected to produce a much smaller sample of equipment than for SWEL 1.

Screen #4, Rapid Drain-Down, identified equipment that could allow the spent fuel pool (SFP) to drain rapidly. Based on performance of SSCs during past earthquakes and typical designs of spent fuel pools at nuclear power plants, the scope of SSCs is limited to hydraulic lines connected to the SFP and the equipment connected to those lines. The structures supporting the spent fuel pool walls and bottom are assumed to be seismically adequate and not likely fail during an earthquake since they are typically classified as seismic Category I.

The SSCs that should be identified may be limited to those that could allow rapid drainage of the SFP. Rapid drainage is defined as lowering the water level to the top of the fuel assemblies within 72 hours after the earthquake. It is only necessary to consider drainage caused by gravity loading; it is not necessary to consider mechanisms in which the water is pumped out of the SFP.

Since gravity is the driving force, the minimum size of the leak path can be estimated for each elevation in SSCs below the top of the spent fuel assemblies.

Any items identified as having the potential for rapidly draining the SFP should be added to SWEL 2.

Equipment Access

[Under development]

Section 4: Seismic Walkdowns and Area Walk-Bys

[This section is still under development. Changes shown in this section should NOT be considered final at this time.]

This section provides guidance for conducting Seismic Walkdowns and Area Walk-Bys. These are represented as Screen #1 in Figure 1-4.

The seismic walkdowns described in this section are to be conducted by at least two Seismic Walkdown Engineers (SWEs), as described in Section 2: Personnel Qualifications. It is expected that the SWEs will be using their engineering judgment, based on their experience and training, to identify potential adverse seismic conditions. These engineers may also rely upon new or existing analyses, where needed, to inform their judgment.

Seismic Walkdowns

Seismic Walkdowns focus on the seismic adequacy of the items on the SWEL and those nearby SSCs that could cause potential adverse seismic interactions for those SWEL items. The Seismic Walkdown focuses on the following adverse seismic conditions associated with the subject item of equipment:

- Adverse anchorage conditions
- Adverse seismic spatial interactions

If items on the SWEL or those nearby SSCs are judged not to have potential adverse seismic conditions, then it is not necessary to conduct a licensing basis evaluation of those SSCs.

However, if potential adverse seismic conditions are identified, then further evaluations should be performed, as described in Section 5: Seismic Licensing Basis Evaluations.

The results of the Seismic Walkdowns should be documented on the Seismic Walkdown Checklist (SWC) shown in Appendix C: Checklists.

Details for identifying potential adverse anchorage conditions and adverse seismic interactions during the Seismic Walkdowns are described in the following subsections. Preparations for conducting the Seismic Walkdowns are also described.

Adverse Anchorage Conditions

Guidance for identifying anchorage that could be degraded, non-conforming, or unanalyzed is based on visual inspections of the anchorage and verification of anchorage configuration. Details for these two types of evaluations are provided in the following two subsections.

The evaluation of potential adverse anchorage conditions described in this subsection applies to the anchorage connections that attach the identified item of equipment to the civil structure on which it is mounted. For example, the anchor bolts that secure the base of a Motor Control Center to the concrete floor are evaluated in this subsection. Evaluation of the connections that secure components within the MCC is covered in the subsection: **Other Adverse Seismic Conditions**.

Visual Inspections

The purpose of the visual inspections is to identify whether any of the following potential adverse anchorage conditions are present:

- Bent, broken, missing, or loose hardware,
- Corrosion that is more than mild surface oxidation,
- Visible cracks in the concrete near the anchors, and
- Other potential adverse seismic conditions.

Based on the results of the visual inspection, the SWEs should judge whether the anchorage is degraded, non-conforming, or unanalyzed. The results of this visual inspection should be documented on the Seismic Walkdown Checklist (SWC), shown in Appendix C: Checklists.

However, if it is not possible to judge whether the anchorage is degraded, non-conforming, or unanalyzed, then further evaluations of the anchorage should be performed, as described in Section 5: Seismic Licensing Basis Evaluations.

Configuration Verifications

In addition to the visual inspections of the anchorage as described above, the configuration of the installed anchorage should be verified to be consistent with existing plant documentation.

The anchorage configuration verification should be performed on at least 50% of the items on the SWEL that have anchorage; line-mounted

equipment (e.g., valves) need not be evaluated for anchorage adequacy and need not be counted in establishing the 50% sample size.

Examples of documentation that can be used for verifying that the anchorage installation configurations are consistent with the plant documentation include:

- Design drawings
- Seismic qualification reports of analyses or shake table tests
- IPEEE or USI A-46 documentation

If plant documentation showing the characteristics of the anchorage for a particular item of equipment cannot be located, then that item should be evaluated further, as described in Section 5: Seismic Licensing Basis Evaluations.

Adverse Seismic Spatial Interactions

An adverse seismic spatial interaction is the physical interaction between a nearby SSC and the item on the SWEL caused by relative motions between the two during an earthquake. An inspection should be performed in the area adjacent to and surrounding the equipment on the SWEL to identify any seismic interaction condition that could adversely affect the capability of that SWEL item to perform any of its intended safety-related functions.

The three types of seismic spatial interaction effects that should be considered are:

- Proximity
- Structural failure and falling
- Flexibility of attached lines and cables

Guidance for evaluating each of these types of seismic spatial interactions is described in Appendix D: Seismic Spatial Interaction.

The Seismic Walkdown Engineers should exercise judgment to identify credible seismic interaction hazards.

Other Adverse Seismic Conditions

In addition to adverse anchorage conditions and adverse seismic interactions, described above, there may be other potential adverse seismic conditions that could challenge the seismic adequacy of SSCs. Examples of the types of conditions that could pose potential adverse seismic conditions include the following:

- Loose or missing fasteners that secure internal or external components to equipment

- Large, heavy items, not typically included by the original equipment manufacturer, mounted on a cabinet
- Cabinet doors or panels that are not latched or fastened
- Other adverse conditions

Any identified other adverse conditions should be documented on the Seismic Walkdown Checklist (SWC), shown in Appendix C: Checklists.

Preparations for Seismic Walkdowns

The following pre-walkdown activities are recommended:

- Obtain the Seismic Walkdown Seismic List (SWEL)
- Enter available data for each item of equipment onto the Seismic Walkdown Checklist (SWC) including:
  - Tag number or equipment ID
  - Equipment/System description
  - Location in the plant
  - Floor elevation
  - Whether a configuration verification of the anchorage for that item is needed
- Obtain drawings showing area layouts and equipment locations
- Obtain in-structure response spectra for applicable equipment locations
- Obtain the plant documentation showing the anchorage for 50% of the items on the SWEL
- Obtain available documents from prior seismic walkdowns, e.g., IPEEE and USI A-46 checklists and data sheets
- Obtain plant documentation for IE Bulletin 80-11 masonry block walls
- Arrange for badging and dosimetry
- Arrange for plant operations and/or maintenance personnel to open cabinets and other equipment for anchorage inspection
- Arrange for plant operations/systems personnel to provide answers to operations/systems questions than may arise during the Seismic Walkdowns and Area Walk-Bys

Area Walk-Bys

The purpose of the Area Walk-Bys is to identify potential adverse seismic conditions associated with other SSCs located in the vicinity of the items on the SWEL.

The Area Walk-Bys are to be conducted in the "vicinity" of items on the SWEL. "Vicinity" is defined as the same room and elevation containing the SWEL item. If the room is very large (e.g., Turbine Hall), then the "vicinity" can be defined as extending about 20 feet in each horizontal direction from the SWEL item location.

The key examination factors that should be considered during Area Walk-Bys include the following:

- Anchorage conditions (if visible without opening equipment)
- Significantly degraded equipment in the area
- A visual assessment (from the floor) of cable/conduit raceways and HVAC ducting (e.g., condition of supports or fill conditions of cable trays)
- Potential adverse seismic interactions including those that could cause flood/spray and fire in the area
- Other seismic housekeeping items, including temporary installations

The Area Walk-Bys are intended to identify adverse seismic conditions that can be visually identified during a slow walk past the SSCs without stopping to open cabinets or taking an extended look. Therefore, it is expected that the Area Walk-By will take significantly less time than it takes to conduct the Seismic Walkdowns described above for an item of equipment on the SWEL. If a potential adverse seismic condition is identified during the Area Walk-By, then additional time will likely be needed to adequately evaluate that adverse condition and document that finding.

The results of the Area Walk-Bys should be documented on the Area Walk-By Checklist (AWC) shown in Appendix C: Checklists. A separate AWC should be filled out for each area inspected. It is necessary to only identify those adverse seismic conditions found during the Area Walk-By; it is not necessary to identify or document the observations of the other SSCs inspected during the Area Walk-By that were not found to have adverse seismic conditions.

Additional details for evaluating the potential for adverse seismic interactions that could cause flood/spray or fire in the area are provided in the following two subsections.

Seismically Induced Flooding/Spray Interactions[3]

Seismically induced flooding/spray interactions are the effect of possible ruptures of vessels or piping systems that could spray, flood or cascade

[3] Guidance for seismically induced flooding/spray interactions adapted from Appendix F of [13].

water into the area where SWEL items are located. This type of seismic interaction was considered during the IPEEE program. Documentation of those evaluations should be considered if a potential seismically induced flooding/spray interaction is identified during the Area Walk-Bys.

One area of particular concern is threaded fire protection piping with long unsupported spans. If adequate seismic supports are present or there are isolation valves near the tanks or charging sources, flooding may not be a credible concern. Numerous failures have been observed in past earthquakes resulting from sprinkler head impact. Less frequent but commonly observed failures have occurred due to flexible headers and stiff branch pipes, non-ductile mechanical couplings, seismic anchor motion and failed supports.

Examples where seismically induced flooding/spray interactions could occur include the following:

- Fire protection piping with inadequate clearance around fusible-link sprinkler heads
- Non-ductile mechanical and threaded piping couplings can fail and lead to flooding or spray of equipment
- Long, unsupported spans of threaded fire protection piping
- Flexible headers with stiffly supported branch lines
- Non-Seismic Category I tanks

The Seismic Walkdown Engineers should exercise judgment to identify credible seismically induced interactions that could lead to flooding or spray.

Seismically Induced Fire Interactions

Seismically induced fire interactions can occur when equipment or systems containing hazardous/flammable material fail or rupture. This type of seismic interaction was considered during the IPEEE program. Documentation of those evaluations should be considered if a potential seismically induced fire interaction is identified during the Area Walk-By.

Examples where seismically induced fire interactions could occur include the following:

- Hazardous/flammable material stored in unanchored drums, unanchored shelves, or unlocked cabinets
- Natural gas lines and their attachment to equipment or buildings
- Acetylene bottles
- Hydrogen lines and bottles

The Seismic Walkdown Engineers should exercise judgment to identify credible seismically induced interacts that could lead to fires.

Section 5: Seismic Licensing Basis Evaluations

[This section is still under development. Changes shown in this section should NOT be considered final at this time.]

This section provides guidance and criteria for performing seismic licensing basis evaluations of the SSCs identified with potential adverse seismic conditions during the seismic walkdowns and evaluations, as described in Section 4: Seismic Walkdowns and Area Walk-Bys. This activity is illustrated as Screen #2 in Figure 1-4.

For the SSCs found to meet the plant seismic licensing basis, no further action is warranted, except to document that result, as described in Section 8: Submittal Report.

For the SSCs that do not appear to meet the plant seismic licensing basis or for which additional licensing basis evaluations are necessary, the identified potential adverse seismic condition should be entered into the plant Corrective Action Program (CAP). This activity is illustrated as the CAP bucket in Figure 1-4.

The seismic licensing basis evaluations described in this section are to be conducted by Licensing Basis Reviewers, as described in Section 2: Personnel Qualifications.

Approach

When an item of SSC is identified as having a potential adverse seismic condition, it should be evaluated against its seismic licensing basis. This is done by:

- Determining the Current Licensing Basis (CLB) for the plant as it relates to the seismic adequacy of the SSC,
- Identifying what seismic qualification documentation may exist for the SSC, and

- Evaluating whether the as-installed condition of the SSC is consistent with the seismic documentation.

The terms “Current Licensing Basis (CLB)” and “Seismic Qualification Documentation” are defined below.

Current Licensing Basis

The Current Licensing Basis (CLB) 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 licensing basis, including all modifications and additions to such commitments over the life of the facility operating license[4].

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

Seismic Qualification Documentation

Depending upon the requirements defined in the CLB, several different methods may have been used to demonstrate that Seismic Category I SSCs will perform their intended safety-related functions during and/or after an earthquake. These typically include seismic analyses, shake table testing, and for some plants use of earthquake experience data based on the GIP [10] for new and replacement equipment.

Seismic Licensing Basis Evaluations

It may be possible to easily show that the installation of a particular item of SSC either meets or violates the seismic licensing basis using previous evaluations. For example, the results from the IPEEE and USI A-46 programs addressed the seismic adequacy of equipment anchorage and

[4] Current Licensing Basis is defined in NRC Inspection Manual Part 9900.

adverse seismic interactions for each item of equipment on their safe shutdown equipment lists. The documentation from these programs can be useful in assessing those potential adverse seismic conditions identified in Section 4: Seismic Walkdowns and Area Walk-Bys.

An example where it is easy to show that the licensing basis is met is a motor control center (MCC) that is found not to have an anchor bolt in one of the six locations in its base where anchor bolts could be installed. However, if the shake table test report used to seismically qualify that MCC showed that the test was conducted with only the five bolts installed, then that item is seismically adequate and meets the seismic licensing basis, provided there is no statement in the UFSAR requiring all six bolts to be installed (this is an unlikely requirement).

An example where it is easy to show that the seismic licensing basis is not likely to be met is a tall, narrow MCC, located on an upper elevation in the plant. If the seismic walkdown found this MCC without any anchors securing it to the floor or to a wall, the MCC would likely tip over, become damaged, and render the MCC unable to fulfill its safety-related function. Such an MCC would not likely meet its seismic licensing basis. If such a situation exists, then this potential adverse seismic condition should be submitted to the plant CAP for further review and disposition.

Similarly, if it cannot be easily determined that an item of SSC with a potential adverse seismic condition meets the plant seismic licensing basis, then that should also be submitted to the plant CAP for further review and disposition.

The principal purpose for entering the plant CAP is to determine whether the SSC, identified during the seismic walkdown with a potential adverse seismic condition, meets the plant seismic licensing basis. In addition, if the seismic licensing basis is not met for that one item of SSC, then it is expected that the CAP will initiate an extent of condition evaluation to identify instances where such a violation could occur in other similar SSC.

Documentation

The results of the seismic licensing basis evaluations for those items of SSC that had been identified as not meeting the plant seismic licensing basis should be documented, as described in Section 8: Submittal Report. This should include:

1. Description of the adverse seismic condition and what seismic licensing basis was not met, and
2. Status and schedule for completion of the resolution of the items that were entered into the CAP.

Note that the licensing basis evaluations and the results of the CAP may be completed after the licensee submits the 180-day report to the NRC.

Section 6: Peer Review

This section describes Peer Review requirements for the activities performed to meet the 50.54(f) Letter [1].

Selection of SSCs

The process for selecting the items included on the Seismic Walkdown Equipment List (SWEL) is described in detail in Section 3: Selection of SSCs. As noted in that section, the work of the preparer should be reviewed by a Peer Reviewer, who is qualified in accordance with the requirements in Section 2: Personnel Qualifications.

The Peer Reviewer should review the SWEL to ensure the items on the SWEL adequately represent a diverse sample of the equipment required to perform the five safety functions discussed in Section 3: Selection of SSCs, including diversity of normal operating environment. The Peer Reviewer should document his review of the SWEL on the checklist shown in Appendix F: Checklist for Peer Review of SSC Selection.

Seismic Walkdowns and Area Walk-bys

Section 4: Seismic Walkdowns and Area Walk-Bys describes the process for both the Seismic Walkdown of items on the SWEL and Area Walk-Bys of the locations of the SWEL items. As part of this process, the two Seismic Walkdown Engineers should discuss their observations while in the plant and document their consensus decision about the seismic adequacy of conditions they find on the checklists shown in Appendix C: Checklists. If a consensus is not reached, the more conservative judgment is documented on the checklist, thus ensuring a conservative decision about whether an additional evaluation is required to confirm the observed condition meets the seismic licensing basis.

This in-process review of the work of each other's work by the Seismic Walkdown Engineers meets Peer Review requirements for the Seismic Walkdown and Area Walk-Bys.

Seismic Licensing Basis Evaluations

If the Seismic Walkdown Engineers identify a condition in the plant that potentially would inhibit the equipment or system from performing its safety-related function during and/or following a seismic event, and thus

not meet its seismic licensing basis, the condition is identified as requiring a licensing basis evaluation.

If the potentially adverse condition can be shown to be acceptable with respect to its seismic licensing basis with limited effort, then this evaluation should be documented by the person performing the evaluation, and independently reviewed by a Peer Reviewer. For example, if the SWEs identified a potential for seismic-induced flooding from a tank in the area on their Area Walk-By Checklist, and the person performing the licensing basis evaluation identifies a seismic qualification calculation of the tank, then the result of this evaluation would be documented by the preparer and reviewed by the Peer Reviewer, who would also sign the evaluation document.

If more than a limited effort is needed to evaluate a potentially adverse seismic condition, then the issue should be entered into the plant's Corrective Action Program (CAP), which includes accepted review processes.

Final Submittal Report

A review of the final submittal report by a Peer Reviewer should be preformed to ensure that all the objectives and requirements of the 50.54(f) Letter are met. Specific reviews should include:

- Qualifications of personnel, as defined in Section 2: Personnel Qualifications`
- SWEL preparation checklist, as shown in Appendix F: Checklist for Peer Review of SSC Selection
- SWC and AWC checklists, as shown in Appendix C: Checklists
- Licensing basis evaluation documentation, or records of entry into CAP, of potentially adverse seismic conditions identified during the Seismic Walkdowns and Area Walk-Bys
- Overall report, including the status of IPEEE enhancements

The signature of the Peer Reviewer who reviewed the report should be included on the final report.

Section 7: IPEEE Vulnerabiliities

[This section will include guidance for identifying plant-specific seismic vulnerabilities that had been identified during the IPEEE program and the actions taken to eliminate or reduce them.]

Section 8: Submittal Report

[This section will include guidance for preparing the report to be submitted to the NRC. It will include a suggested outline for the submittal report.]

Section 9: References

1. NRC (E Leeds and M Johnson) Letter to All Power Reactor Licensees et al., "Request for Information Pursuant to Title 10 of the Code of Federal Regulations 50.54(f) Regarding Recommendation 2.1, 2.3, and 9.3, of the Near-Term Task Force Review of Insights from the Fukushima Dai-ichi Accident."
2. Summary of Observations; Temporary Instruction 2515/183, "Followup to the Fukushima Daiichi Nuclear Station Fuel Damage Event."
3. Resolution of Generic Safety Issues: Issue 156: Systematic Evaluation Program (Rev. 8) (NUREG-0933, Main Report with Supplements 1–34). [http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr0933/sec3/156r8.html]
4. IE Bulletin No. 79-02, Pipe Support Base Plate Designs Using Concrete Expansion Anchor Bolts. [http://www.nrc.gov/reading-rm/doc-collections/gen-comm/bulletins/1979/bl79002.html]
5. IE Bulletin No. 79-07, Seismic Analysis of As-Built Safety-Related Piping Systems. [http://pbadupws.nrc.gov/docs/ML0312/ML031220050.pdf]
6. IE Bulletin No. 79-14, Seismic Analyses for As-Built Safety-Related Piping Systems. [http://www.nrc.gov/reading-rm/doc-collections/gen-comm/bulletins/1979/bl79014.html]
7. IE Bulletin No. 80-11, Masonry Wall Design. [http://www.nrc.gov/reading-rm/doc-collections/gen-comm/bulletins/1980/bl80011.html]
8. Generic Letter 87-02, Verification of Seismic Adequacy of Mechanical and Electrical Equipment in Operating Reactors, Unresolved Safety Issue (USI) A-46. [http://www.nrc.gov/reading-rm/doc-collections/gen-comm/gen-letters/1987/gl87002.html]
9. Generic Letter No. 88-20, Supplement 4, Individual Plant Examination of External Events (IPEEE) For Severe Accident Vulnerabilities - 10CFR 50.54(f). [http://www.nrc.gov/reading-rm/doc-collections/gen-comm/gen-letters/1988/gl88020s4.html]
10. Generic Implementation Procedure (GIP) for Seismic Verification of Nuclear Plant Equipment, Revision 3A, December 2001, Seismic Qualification Utility Group (SQUG). [http://pbadupws.nrc.gov/docs/ML0405/ML040560253.html]

11. EPRI NP-7149-D, Summary of the Seismic Adequacy of Twenty Classes of Equipment Required for the Safe Shutdown of Nuclear Plants, Electric Power Research Institute, March 1991.

12. NUREG-1407, “Procedure and Submittal Guidance for the Individual Plant Examination of External Events (IPEEE) for Severe Accident Vulnerabilities,” U.S. Nuclear Regulatory Commission, June 1991.

13. EPRI NP-6041-SL, Revision 1, “A Methodology for Assessment of Nuclear Power Plant Seismic Margin (Revision 1),” Electric Power Research Institute, August 1991.

Appendix A: Initializations and Acronyms

The initializations and acronyms used in this report are defined in this appendix.

AWC	-	Area Walkdown Checklist
BWR	-	Boiling Water Reactor
CAP	-	Corrective Action Program
EPRI	-	Electric Power Research Institute
GIP	-	Generic Implementation Procedure (GIP) for Seismic Verification of Nuclear Plant Equipment
HCLPF	-	High Confidence, Low Probability of Failure
IPEEE	-	Individual Plant Examination for External Events
LB	-	Licensing Basis
MEL	-	Master Equipment List
NRC	-	Nuclear Regulatory Commission
NTTF	-	Near-Term Task Force
PRA	-	Probabilistic Risk Assessment
PWR	-	Pressurized Water Reactor
SC	-	Seismic Category
SFP	-	Spent Fuel Pool
SMA	-	Seismic Margin Assessment
SPEL	-	Success Path Equipment List (used in IPEEE SMA)
SPRA	-	Seismic Probabilistic Risk Assessment

SQUG	-	Seismic Qualification Utility Group
SRT	-	Seismic Review Team
SSC	-	Structure, System, and Component
SSEL	-	Safe Shutdown Equipment List (used in USI A-46)
SWC	-	Seismic Walkdown Checklist
SWE	-	Seismic Walkdown Engineer
SWEL	-	Seismic Walkdown Equipment List
USI A-46	-	Unresolved Safety Issue A-46, Seismic Qualification of Equipment in Operating Plants

Appendix B: Classes of Equipment

The following list of classes of mechanical and electrical equipment is adapted from Table A-1 of EPRI NP-6041 [13]. This list of equipment classes is based on the GIP [10].

Table B-1
Classes of Equipment

0. Other	11. Chillers
1. Motor Control Centers and Wall-Mounted Contactors	12. Air Compressors
2. Low Voltage Switchgear and Breaker Panels	13. Motor Generators
3. Medium Voltage, Metal-Clad Switchgear	14. Distribution Panels and Automatic Transfer Switches
4. Transformers	15. Battery Racks
5. Horizontal Pumps	16. Battery Chargers and Inverters
6. Vertical Pumps	17. Engine Generators
7. Pneumatic-Operated Valves	18. Instrument Racks
8. Motor-Operated and Solenoid-Operated Valves	19 Temperature Sensors
9. Fans	20. Instrument and Control Panels
10. Air Handlers	21. Tanks and Heat Exchangers

Appendix C: Checklists

[This section is still under development. Changes shown in this section should NOT be considered final at this time.]

This appendix included the following two types of checklists:

- Seismic Walkdown Checklist (SWC)
- Area Walk-By Checklist (AWC)

Seismic Walkdown Checklist (SWC)

Equipment ID No. _____ Equip. Class _____

Equipment Description _____

Location: Bldg. _____ Floor El. _____ Room, Area _____

Manufacturer, Model, Etc. (optional but recommended) _____

Anchorage

1. Is anchorage configuration verification required for this item of equipment? Y☐ N☐
2. Is the anchorage free of bent, broken, missing or loose hardware Y☐ N☐ U☐ N/A☐
3. Is the anchorage free of corrosion that is more than mild surface oxidation Y☐ N☐ U☐ N/A☐
4. Is the anchorage free of visible cracks in the concrete near the anchors Y☐ N☐ U☐ N/A☐
5. Is the anchorage configuration consistent with plant documentation? Y☐ N☐ U☐ N/A☐

Is the anchorage free of potential adverse seismic conditions? Y☐ N☐ U☐

Interaction Effects

1. Are soft targets free from impact by nearby equipment or structures? Y☐ N☐ U☐ N/A☐

Seismic Walkdown Checklist (SWC)

Equipment ID No. _____ Equip. Class _____

Equipment Description _____

2. Are overhead equipment, distribution systems, and masonry block walls not likely to collapse onto the equipment? Y☐ N☐ U☐ N/A☐

3. Do attached lines have adequate flexibility? Y☐ N☐ U☐ N/A☐

Is equipment free of adverse seismic interaction effects? Y☐ N☐ U☐

Have you looked for and found no adverse seismic conditions that could affect the safety functions of the equipment? Y☐ N☐ U☐

Comments

Evaluated by: _____ Date: _____

Area Walk-By Checklist (AWC)

Location: Bldg. _____ Floor El. _____ Room, Area _____

1. Does anchorage of equipment in the area appear to be free of potential adverse seismic conditions (if visible without opening equipment)? Y☐ N☐ U☐ N/A☐

2. Does anchorage of equipment in the area appear to be free of significant degraded conditions? Y☐ N☐ U☐ N/A☐

3. Based on a visual inspection from the floor, do the cable/conduit raceways and HVAC ducting appear to be free of adverse seismic conditions (e.g., condition of supports and fill conditions of cable trays)? Y☐ N☐ U☐ N/A☐

4. Does it appear that the area is free of adverse seismic spatial interactions with other equipment in the area? Y☐ N☐ U☐ N/A☐

5. Does it appear that the area is free of potential adverse seismic interactions that could cause flooding or spray in the area? Y☐ N☐ U☐ N/A☐

Area Walk-By Checklist (AWC)

6. Does it appear that the area is free of potential adverse seismic interactions that could cause a fire in the area? Y☐ N☐ U☐ N/A☐

7. Does it appear that the area is free of adverse seismic interactions associated with seismic housekeeping practices and temporary installations? Y☐ N☐ U☐ N/A☐

Have you looked for and found no adverse seismic conditions that could affect the safety functions of the equipment in the area? Y☐ N☐ U☐

Comments

Evaluated by: _____ Date: _____

_____ _____

Appendix D: Seismic Spatial Interaction

[This section is still under development. Changes shown in this section should NOT be considered final at this time.]

An adverse seismic spatial interaction is the physical interaction of any nearby SSC with the subject item of equipment caused by relative motions between the two during an earthquake. An inspection should be performed in the area adjacent to and surrounding the equipment on the SWEL to identify any seismic interaction condition that could adversely affect the capability of that SWEL item to perform any of its intended safety-related functions.

The three types of seismic spatial interaction effects that should be considered are:

- Proximity
- Structural failure and falling
- Flexibility of attached lines

Guidance for evaluating each of these types of seismic spatial interactions is described in below.[5]

Proximity

Seismic proximity interaction is the impact of adjacent equipment or structures on SWEL items due to their relative motion during seismic excitation. This relative motion can be the result of the vibration and movement of the SWEL item itself or any adjacent SSCs. When sufficient anchorage, bracing, or other means are provided to preclude large deflections, seismic proximity effects are not typically a concern.

Even if there is impact between adjacent equipment or structures, there may not be any significant damage to the SWEL item. In such cases, this

[5] Seismic spatial interaction guidance is adapted from Appendix D of [8].

seismic interaction would not be considered a reason for concern, provided the equipment can still accomplish its safety-related functions.

Guidance for evaluating proximity effects for distributed systems and for mechanical and electrical equipment are provided below

Proximity Effects for Distributed Systems

The motion of piping, conduit, cable raceways, and other distribution lines may result in impact interactions with SWEL items. Non-safety-related piping is commonly supported with rod hangers or other forms of flexible dead load support, with little or no lateral restraint. Where adequate clearance with SWEL items is not provided, potential impact interaction may result. The integrity of the piping is typically not a concern. (Threaded fittings, cast iron pipes and fittings, and Victaulic couplings may be exceptions where large anchor movement is possible.) In general, impacts between distribution systems (piping, conduit, ducts, raceways) and SWEL items of comparable size are not a cause for concern; the potential for large relative motions between dissimilar size systems should be carefully evaluated to assure that a large system cannot carry away a smaller one.

Engineering judgment should be exercised by the Seismic Walkdown Engineers in estimating potential motions of distribution systems in proximity to the SWEL item under evaluation. For screening purposes, a clearance of 2 inches for relatively rigid cable tray and conduit raceway systems and 6 inches for relatively flexible systems would normally be adequate to prevent impacts, subject to the judgment of the Seismic Walkdown Engineers.

Where potential interaction may involve systems with significant thermal movements during plant normal operating conditions, the thermal displacements should be evaluated along with those resulting from seismic deflections. Inter-equipment displacement limits may be developed from the applicable floor response spectra to assist in this effort.

Proximity Effects for Mechanical and Electrical Equipment

Inadequately anchored or inadequately braced mechanical and electrical equipment such as pumps, valves, vessels, cabinets, and switchgear may deflect or overturn during seismic loadings resulting in impact with nearby SWEL items. Certain items, such as tanks with high height-to-diameter aspect ratios, can deflect and impact nearby equipment. Electrical cabinets in proximity to each other may pound against each other.

The Seismic Walkdown Engineers should use judgment in such cases to evaluate the potential displacements and their potential effect on nearby SWEL items.

Structural Failure and Falling

SEL items can be damaged and unable to accomplish their safe-related function due to impact caused by failure of overhead or adjacent SSCs. (This interaction hazard is commonly referred to as a Category II over Category I concern.) This seismic interaction effect can occur from nearby or overhead:

- Mechanical and electrical equipment;
- Piping, raceways, and HVAC systems;
- Architectural features; and
- Operations, maintenance, and safety equipment.

The seismic interaction effects that are of concern for these types of SSCs are described below. It is the intent of this evaluation that realistic hazards be identified; failure of non-seismically supported equipment and systems located over a SWEL item should not be arbitrarily assumed. The judgment of the Seismic Walkdown Engineers should be used to differentiate between likely and unlikely interaction hazards.

Mechanical and Electrical Equipment

Equipment such as tanks, heat exchangers, and electrical cabinets that are inadequately anchored or inadequately braced have historically overturned and/or slid due to earthquake excitation. In some cases this has resulted in damage to nearby equipment or systems.

Piping, Raceways, and HVAC Systems

Falling of non-seismically designed piping, raceways, and HVAC systems have been observed in very limited numbers during earthquakes due to unique circumstances. Most commonly reported are falling of inadequately secured louvers and diffusers on lightweight HVAC ducting. Damage from piping systems is less common and usually is limited to component failures that have rarely compromised system structural integrity. Typical damage is attributed to differential motions of systems resulting from movement of unanchored equipment, attachment of systems between buildings, or extremely flexible long runs of unrestrained piping. Very long runs of raceway systems pose a potential falling hazard when the runs are resting on, but not attached to, cantilever supports.

Architectural Features

Architectural features include such items as ceilings, light fixtures, platform grating, unreinforced masonry walls, and non-seismic Category I structures. The seismic interaction effects for these are described below:

- Ceilings. T-bar suspended tiles, recessed fixtures, and sheet rock are used in some plant areas (such as the control room). Seismic capabilities of these ceilings may be low. The Seismic Walkdown Engineers should check for details that are known to lead to failure such as open hooks, no lateral wire bracing, etc.
- Light Fixtures. Normal and emergency light fixtures are used throughout the plant. Fixture designs and anchorage details vary widely. Light fixtures may possess a wide range of seismic capabilities. Pendant-hung fluorescent fixtures and tubes pose the highest risk of failure and damage to sensitive equipment. The Seismic Walkdown Engineers should check for positive anchorage, such as closed hooks and properly twisted wires. Typically this problem is not caused by lack of strength; it is usually due to poor connections. Emergency lighting units and batteries can fall and damage SWEL equipment due to impact or spillage of acid.
- Platform Gratings. Unrestrained platform gratings and similar personnel access provisions may pose hazards to impact-sensitive SWEL items or components mounted on these items. Some reasonable positive attachment is necessary, if the grating can fall.
- Unreinforced Masonry Walls. Unreinforced, masonry block walls should be evaluated for possible failure and potential seismic interaction with nearby SWEL items unless the wall has been seismically shown to be adequate as part of the IE Bulletin 80-11 program. The Seismic Walkdown Engineers should review the plant documentation for IE Bulletin 80-11 masonry walls to determine which walls have and which walls have not been shown to be seismically adequate during that program.
- Non-Seismic Category I Structures. If any SWEL item is located in a non-Seismic Category I structure, then potential structural vulnerabilities of the building should be identified; however, nuclear plant structures (including non-seismic structures) are typically seismically adequate.

Operations, Maintenance, and Safety Equipment

Nuclear plant operations and maintenance require specialized equipment, some of which may be permanently located or stored in locations near SWEL items.

Some operations, maintenance, and safety equipment is designed so that it may be easily relocated by plant personnel. Where equipment design or plant operating procedures do not consider anchorage for permanently located equipment, this equipment may slide, fall, overturn, or cause impact with SWEL items. Typically such equipment includes the following:

- Cabinets and Lockers. Inadequately restrained floor and wall-mounted filing cabinets and equipment storage lockers may result in overturning or falling and impact.
- Gas Storage Bottles. Unrestrained or inadequately restrained gas bottles may result in overturning and rolling and cause impact.
- Refueling Equipment. Refueling equipment such as lifting equipment and servicing and refueling tools may be stored in proximity to SWEL items. Inadequately restrained equipment may pose hazards.
- Monorails, Hoists, and Cranes. Monorails and service cranes are permanently located over heavy equipment requiring movement for service. Falling of service crane appurtenances such as tools and equipment boxes may result from inadequate component anchorage. They should be restrained from falling. Judgment by the Seismic Walkdown Engineers should be used to assess the potential for and consequences of such equipment falling.
- Radiation Shields, Fire Protection, and Miscellaneous Equipment. Temporary and permanent radiation shielding may pose hazards. Miscellaneous maintenance tools, such as chains and dollies, test equipment, and fire protection equipment such as fire extinguishers and hose reels may fall if inadequately restrained. Equipment carts may roll into SWEL items.

Flexibility of Attached Lines

Distribution lines, such as small bore piping, tubing, conduit, or cable, which are connected to SWEL items, can potentially fail if there is insufficient flexibility to accommodate relative motion between the SWEL item and the adjacent equipment or structures. Straight, in-line connections in particular are prone to failure. The scope of review for flexibility of these lines extends from the item of equipment being evaluated to the first support on the building or nearby structure.

Evaluation of Seismic Spatial Interaction Effects

The Seismic Walkdown Engineers should identify and evaluate all credible and significant interactions in the immediate vicinity of the

SWEL item. This includes consideration of seismic interactions on the equipment itself and on any connected distribution lines (e.g., instrument air lines, electrical cable, and instrumentation cabling) that are in the vicinity of the item of equipment. Evaluation of interaction effects should consider detrimental effects on the capability of equipment and systems to function, taking into account equipment attributes such as mass, size, support configuration, and material hardness in conjunction with the physical relationships of interacting equipment, systems, and structures. In the evaluation of proximity effects and overhead or adjacent equipment failure and interactions, the effects of intervening structures and equipment that would preclude impact should be considered.

Damage from interaction in earthquakes is from unusual circumstances or from generic, simple details such as open hooks on suspended lights. The Seismic Walkdown Engineers should spend most of their time looking for:

- Unusual impact situations and
- Lack of proper anchorage or bracing.

There should not be much concern with piping and other system or structural component failures.

Summary of Seismic Spatial Interaction Effects Examples

This section briefly summarizes examples of possible seismic spatial interaction effects that may adversely affect an item of equipment on the SWEL.

- Unreinforced masonry walls adjacent to equipment may spall or fall and impact equipment or cause loss of support of equipment. The wall does not have to be evaluated if it has already been addressed as part of an IE Bulletin 80-11 program.
- Emergency lighting units and batteries used for emergency lighting can fall or overturn and damage equipment by impact or spilling of acid.
- Fire extinguishers may fall and impact or roll into equipment.
- Intercom speakers can fall and impact equipment.
- Equipment carts, dollies, chains, air bottles, welding equipment, etc., may roll into, slide, overturn, or otherwise impact equipment.
- Piping, cable trays, conduit, and HVAC may deflect and impact equipment.

- Cable trays, conduit systems, and HVAC systems, including HVAC louvers and diffusers, may fall and impact equipment.
- Structures or structural elements may deform or fall and impact equipment.
- Anchor movement may cause breaks in piping, cable trays, conduit, HVAC, etc., which may fall or deflect and impact adjacent equipment.
- Mechanical piping couplings can fail and lead to pipe deflection or falling and impact on equipment.
- Electrical cabinets that deflect and impact walls, structural members, another cabinet, etc., may damage devices in the cabinet or cause devices to trip or chatter.
- Storage cabinets, office cabinets, files, bookcases, wall lockers, and medicine cabinets may fall or tip into equipment.
- The doors on electrical cabinets may swing and impact devices or cause relays to chatter.
- Inadequately anchored or braced equipment such as pumps, vessels, tanks, heat exchangers, cabinets, and switchgear may deflect or overturn and impact equipment.
- Architectural features such as suspended ceilings, ceiling components such as T-bars and acoustical panels, light fixtures, fluorescent tubes, partition walls, and plate glass may deflect, overturn or break and fall and impact equipment.
- Grating may slide or fall and impact equipment.
- Sheetrock may fall and impact equipment if it was previously water-damaged or if there is severe distortion of the building.
- Unanchored room heaters, air conditioning units, sinks, and water fountains may fall or slide into equipment.

Appendix E: Systems to Support Safety Functions

EPRI Report NP-6041 [13], Appendix B includes lists of systems typically used to support PWR and BWR frontline safety functions and the associated support functions. Copies of the following tables from this report are reproduced in this appendix.

- Table B-1, Safety Function-System Matrix for PWRs
- Table B-2, Safety Function-System Matrix for BWRs
- Table b-3, Major Component in Support Systems

Table B-1

SAFETY FUNCTION-SYSTEM MATRIX FOR PWRs

Safety Functions	Frontline Systems That Perform a Safety Function	Important Components in Frontline System
A. Reactivity Control	Reactor Trip System	• Reactor Trip Switchgear • Manual Actuation Circuit • Control Rod Drive Assemblies
	Chemical and Volume Control System (emergency boration)	• Charging Pumps • Boron Injection Tanks (BIT) • Heaters; Heat Tracing • Motor-Operated Valves for Suction and Injection Alignment
B. RCS Pressure Control	Turbine Trip	• Turbine Stops Valves • Turbine Control Valves • Electric Trip Solenoid Valves • Electric Trip Valves • Mechanical Trip Pilot Valves
	Main Steam Isolation Valves	
	Auxiliary Feedwater System	• Turbine-Driven Feedwater Pumps (including turbine auxiliaries and steam supply) • Motor-Driven Feedwater Pumps • Motor-Operated Valves for Suction and Injection Alignment • Condensate Storage Tank
	Steam Generator Power-Operated Atmospheric Relief Valves	
	Pressurizer Power-Operated Relief Valves	
C. RCS Inventory Control	High Pressure Injection System	• High Pressure Safety Injection Pumps • Motor-Operated Valves for Suction and Injection Alignment • Refueling Water Storage Tank (i.e., borated water)

NOTE: This matrix was developed assuming that offsite power is unavailable.

Table B-1 (Continued)

SAFETY FUNCTION-SYSTEM MATRIX FOR PWRs

Safety Functions	Frontline Systems That Perform a Safety Function	Important Components in Frontline System
	Chemical and Volume Control System (operating in the ECCS mode)	• Charging Pumps • Motor-Operated Valves for Suction and Injection Alignment • RWST
	High Pressure Recirculation System	• High Pressure Safety Injection Pumps • Charging Pumps • Motor-Operated Valves for Suction and Injection Alignment • Sump Recirculation Valves • RHR Pumps
	Low Pressure Injection System	• RHR Pumps • Motor-Operated Valves for Suction and Injection Alignment • RWST
	Low Pressure Recirculation System	• RHR Pumps • Motor-Operated Valves for Suction and Injection Alignment • Sump Recirculation Vent
D. RCS Heat Removal	Auxiliary Feedwater	• See Above
	Steam Generator Power-Operated Atmospheric Relief Valves	
	Pressurizer Power-Operated Relief Valves	
	High Pressure Injection or Recirculation System	• See Above
	Residual Heat Removal System	• RHR Pumps • RHR Heat Exchangers • Motor-Operated Valves for Suction and Injection Alignment

NOTE: This matrix was developed assuming that offsite power is unavailable.

Table B-2

SAFETY FUNCTION-SYSTEM MATRIX FOR BWRs

Safety Functions	Frontline Systems That Perform a Safety Function	Important Components in Frontline System
A. Reactivity Control	Reactor Scram System	• Scram Valves • Control Rod Drive Assemblies • Control Rod Drive Pumps • Condensate Storage Tank • Strainers and Filters • Manual Valves • Check Valves
	Standby Liquid Control System (SLCS) (liquid poison)	• SLCS Pumps • Liquid Poison Tanks • Heaters and Heat Tracing • Explosive Actuated Valves
B. RCS Pressure Control	Steam Line SRVs and Automatic De-pressurization System	• Dual Action Safety and Relief Valves
	Main Steam Line Isolation Valves	
C. RCS Inventory Control	High Pressure Coolant Injection System	• Turbine-Driven Pump and Auxiliaries • Motor-Operated Valves for Suction and Injection Alignment • Condensate Storage Tank • Suppression Pool
	High Pressure Core Spray System	• Turbine-Driven Pump and Auxiliaries • Motor-Operated Valves for Suction and Injection Alignment • Condensate Storage Tank • Suppression Pool

NOTE: This matrix was developed assuming that offsite power is unavailable.

Table B-2 (Continued)

SAFETY FUNCTION-SYSTEM MATRIX FOR BWRs

Safety Functions	Frontline Systems That Perform a Safety Function	Important Components in Frontline System
	Control Rod Drive (CRD) Injection	• CRD Hydraulic Pump • Scram Valves
	Feedwater Coolant Injection (FWCI)	(information not available on FWCI)
	Automatic De-pressurization	• See Above
	Low Pressure Coolant Injection	• Electric Driven RHR Pumps • Motor-Operated Valves for Suction and Injection Alignment • Suppression Pool
	Low Pressure Core Spray (LPCS)	• Electric Driven LPCS Pumps • Motor-Operated Valves for Suction and Injection Alignment • Suppression Pool
D. RCS Suppression Pool Heat Removal	Isolation (emergency) Condenser	(information not available on isolation condenser)
	Suppression Pool Cooling Mode of RHR	• Electric Driven RHR Pumps • Motor-Operated Valves for Suction and Injection Alignment • Suppression Pool • RHR Heat Exchangers
	Shutdown Cooling Mode of RHR	• Electric Driven RHR Pumps • RHR Heat Exchangers • Motor-Operated Valves for Suction and Injection Alignment
	Steam Condensing Mode of RHR	• RHR Heat Exchangers • RCICS

NOTE: This matrix was developed assuming that offsite power is unavailable.

Table B-3

MAJOR COMPONENTS IN SUPPORT SYSTEMS

	Support System	Major Components
1.	AC Power	4-kV Buses Diesel Generators Diesel Generator Auxiliaries, Fuel Oil Supply, and Air-Start Systems Transformers Automatic Fast Transfer Switchgear Emergency Power Sequencer Other Switchgear (including relays and breakers) Power Cables Cable Trays 480V Unit Substations 480V Buses Motor Control Centers Load Centers Distribution Panels 120V Instrument Buses Inverters Fuses
2.	DC Power	125V Buses Batteries Battery Racks Battery Chargers Distribution Panels DC Power Cables Cable Trays Ground Detection Equipment
3.	Engineered Safety Features Actuation System	Sensors Cabling from the Sensors to the Signal Processing Equipment Signal Processing Equipment Actuation Subsystems Cabinets (and associated HVAC) Control Boards Relays Bistables Breakers

Table B-3 (Continued)

MAJOR COMPONENTS IN SUPPORT SYSTEMS

	Support System	Major Components
4.	Service Water and Component Cooling Water Systems	Horizontal Pumps Vertical Pumps Motor-Operated Valves Air-Operated Valves Check Valves Manual Valves Relief Valves Piping Heat Exchangers Surge Tanks Makeup Pumps HVAC Systems Traveling Screens and Screen Wash Pumps Strainers Intake Bay Gates Cooling Towers Cooling Tower Pumps Cooling Tower Fans
5.	Compressed Air System	Compressors Receivers Solenoid-Operated Valves Check Valves Dryers Filters
6.	HVAC Systems	Fans Dampers Chillers and Refrigeration Units Heaters Ductwork

Appendix F: Checklist for Peer Review of SSC Selection

Appendix G: Definition of Terms

Area Walk-By – A visual examination that considers the overall condition of areas that contain items on the Seismic Walkdown Equipment List.

Area Walk-By Checklist – A generic checklist that can be used to document the results of the Area Walk-Bys.

Current Licensing Basis (CLB) – As defined in NRC Inspection Manual Part 9900, the Current Licensing Basis (CLB) 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. Design basis information, defined by 10 CFR 50.2, is documented in the UFSAR as required by 10 CFR 50.71. The design basis of safety related SSCs is established initially during the original plant licensing and relates primarily to the accident prevention and mitigation functions of safety - related SSCs. The design basis of a safety related SSC is a subset of the CLB.

Five Safety Functions – The Seismic Walkdown Equipment List selection process is designed to ensure that the walkdowns include a sample of equipment needed for five safety functions, which include four safe shutdown functions (reactor reactivity control, reactor coolant pressure control, reactor coolant inventory control, and decay heat removal, which includes the ultimate heat sink) and containment functions.

Equipment Selection Personnel – Personnel responsible for identifying the sample of equipment to be examined during a Seismic Walkdown.

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).

Licensing Basis Evaluations – Licensing Basis Evaluations are more detailed reviews performed to determine whether an SSC is consistent with the seismic licensing basis if potential adverse seismic conditions are identified during the Seismic Walkdowns or Area Walk-Bys.

Licensing Basis Reviewer – Person responsible for performing the Licensing Basis Evaluations.

Near-Term Task Force (NTTF) – The NRC Near-Term Task Force was established in response to Commission direction to conduct a systematic and methodical review of NRC processes and regulations to determine whether the agency should make additional improvements to its regulatory system and to make recommendations to the Commission for its policy direction, in light of the accident at the Fukushima Dai-ichi Nuclear Power Plant.

NTTF 2.3 Seismic Walkdown Training Course – A 2-day course sponsored by EPRI to prepare plant personnel to perform Seismic Walkdowns and Area Walk-Bys needed to support responding to the March 12, 2012 50.54(f) letter.

Rapid Drain Down – In this document, a Rapid Drain Down refers to seismically-induced failure(s) that result in spent fuel pool water inventory loss at a rate that could uncover the fuel within 72 hours.

Seismically Induced Fire Interactions – The potential for fires to occur when equipment or systems containing flammable material fails or ruptures.

Seismically Induced Flooding/Spray Interactions – The effect of possible ruptures of vessels or piping systems that could spray, flood, or cascade water into the area where items on the Seismic Walkdown Equipment List are located.

Seismic Review Team – A team consisting of at least two Seismic Walkdown Engineers that perform the Seismic Walkdowns and Area Walk-Bys.

Seismic Spatial Interaction – The physical interaction between a nearby SSC and the item on the Seismic Walkdown List caused by relative motions between the two during an earthquake.

Seismic Walkdown – A visual examination of equipment to identify potential adverse seismic conditions.

Seismic Walkdown Checklist – A generic checklist that can be used to document the results of the Seismic Walkdown.

Seismic Walkdown Engineers – Personnel responsible for performing the Seismic Walkdowns and Area Walk-Bys as described in Section 4.

Seismic Walkdown Equipment List (SWEL) – The items to be examined during the Seismic Walkdown.

SQUG Walkdown Training Course – A 5-day training course sponsored by EPRI based on the Generic Implementation Program (GIP).

Vicinity – "Vicinity" is defined as the same room and elevation containing the Seismic Walkdown Equipment List item. If the room housing the item is very large, then "vicinity" can be defined as extending about 20 feet in each horizontal direction from the item location.