3.10 Seismic and Dynamic Qualification of Mechanical and Electrical Equipment

This section addresses the seismic and dynamic qualification of mechanical, electrical, and instrumentation and controls (I&C) equipment. The equipment covered by this section includes equipment associated with systems that are essential to emergency reactor shutdown, containment isolation, reactor core cooling, and containment and reactor heat removal, or otherwise are essential in preventing significant release of radioactive material to the environment. Instrumentation needed to assess plant and environmental conditions during and after an accident, as described in RG 1.97, is addressed in Chapter 7 and Section 3.11. This includes the equipment that performs the above functions automatically, that operators use to perform the above functions manually, and for which failure can prevent satisfactory accomplishment of one or more of the above safety functions. This includes equipment in the reactor protection system (RPS), engineered safety features (ESF) Class 1E equipment, the emergency power system, and auxiliary safety-related systems and supports.

Examples of mechanical equipment included in these systems are pumps, valves, fans, and control rod drive mechanisms (CRDM). Examples of electrical and I&C equipment included are fan motors, valve operators, solenoid valves, pressure switches and electrical penetrations. This equipment is included in three different categories:

- Active mechanical equipment that is required to perform a mechanical operation during and after a seismic event, while accomplishing its safety-related functions.
- Passive mechanical equipment that is only required to maintain its structural and pressure boundary integrity during and after a seismic event.
- Instrumentation that is needed to assess plant and environs conditions during and after an accident.

As stated in NUREG-1030 (Reference 1) the simultaneous occurrence of a loss-of-coolant accident (LOCA) and a seismic event do not have to be considered. This is consistent with the European Utility Requirements (Reference 2) for light water reactor nuclear power plants. These requirements establish that a design earthquake "…is not considered as an initiating event for limiting accidents… such as a steam system piping break downstream of isolation valves, small break LOCAs, and a steam generator tube rupture."

Therefore, the following assumptions are applied to define the scope of the equipment requiring seismic qualification, and to confirm that the four essential safe shutdown functions (reactor reactivity control, reactor coolant pressure control, reactor coolant inventory control, and decay heat removal) can be accomplished following a safe shutdown earthquake (SSE):

- Offsite power may not be available for up to 72 hours following the earthquake.

- No other extraordinary events or accidents (e.g., LOCAs, high-energy line breaks, fires, floods extreme winds, and sabotage) are postulated to occur, other than the SSE and loss of offsite power (except that service loading combinations specified in SRP 3.9.3, Table I are considered in the pipe stress analysis and pipe support design process when required by the ASME Code required design specification.).

- The equipment to be seismically qualified includes:

  – Active mechanical equipment which operates or changes state to accomplish safe shutdown as defined in the Technical Specifications.

  – Active equipment in systems which support the operation of identified safe shutdown equipment (e.g., power supplies, control systems, cooling systems, lubrication systems).

  – Instrumentation needed to confirm that the safe shutdown functions have been achieved and are being maintained.

  – Instrumentation needed to operate the safe shutdown equipment.

  – Tanks and heat exchangers used to reach and maintain safe shutdown.

  – Cable and conduit raceways which support electrical cable for the selected safe shutdown equipment (see Section 3.7.3 and Appendix 3A).

  – Instrumentation described in RG 1.97 (see Section 3.11 for additional information regarding conformance with RG 1.97).

- The following equipment types are not identified for seismic qualification:

  – Passive equipment such as piping and filters (see Section 3.9.2, Appendix 3A, and U.S. EPR Piping Analysis and Pipe Support Design (Reference 3).

  – Major items of equipment in the nuclear steam supply system, their supports, and components mounted on or within this equipment, such as the reactor pressure vessel, reactor fuel assemblies, reactor internals, control rods, reactor coolant pumps, steam generators, pressurizer, and reactor coolant piping (see Section 3.7.2 and Appendix 3C).

  – Radioactive waste management systems designed in accordance with RG 1.143 (see Section 3.2.1).

The information presented in this section includes:

- The seismic qualification criteria and methods employed for each category of equipment.

- The documentation of the qualification process used to demonstrate the required seismic capability.

The following GDC apply to this section:

- GDC 1 and GDC 30 as they relate to qualifying equipment to appropriate quality standards commensurate with the importance of the safety functions to be performed.
- GDC 2 and 10 CFR 50, Appendix S as they relate to designing equipment to withstand the effects of natural phenomena, such as earthquakes.
- GDC 4 as it relates to qualifying equipment as capable of withstanding the dynamic effects associated with external missiles and internally generated missiles, pipe whip, and jet impingement forces.
- GDC 14 as it relates to qualifying equipment associated with the reactor coolant boundary so that there is an extremely low probability of abnormal leakage, of rapidly propagating failure, and of gross rupture.

Compliance with the above GDC is demonstrated through the methodology described in Sections 3.10.1, 3.10.2, and 3.10.3.

Other sections that interface with this section are listed below.

- Section 3.2 defines the seismic classification of those structures, systems, and components (SSC), including their foundations and supports, that are safety-related and designated as Seismic Category I.
- Section 3.6.2 addresses the determination of rupture locations and the dynamic effects associated with postulated pipe ruptures.
- Section 3.7.3 defines the seismic and dynamic input motions for floor-, wall-, and pipe-mounted equipment.
- Section 3.9.2 defines the dynamic testing and analysis of systems, components, and equipment.
- Section 3.9.3 defines the design and service-loading combinations for Seismic Category I pressure retaining mechanical equipment, including the Class 1, 2, and 3 components, component supports, and core support structures identified in the ASME Boiler and Pressure Vessel Code, Section III (Reference 4). The applicable design and service loading combinations are also for seismic qualification of Seismic Category I electrical, I&C, and non-pressure retaining mechanical equipment.
- Section 3.9.6 defines the functional design, qualification, and inservice testing programs for pumps, valves, and dynamic restraints.
- Section 3.13 defines the adequacy of programs for assuring the integrity of bolting and threaded fasteners, including provisions for installation and maintenance of mounting and bolting details.

3.10.1 Seismic Qualification Criteria

3.10.1.1 Qualification Standards

The methods employed for seismic and dynamic qualification of mechanical and electrical equipment are described or referenced in Section 3.10.2. These methods comply with the requirements of GDC 1, GDC 2, GDC 4, GDC 14, GDC 30, and 10 CFR 50, Appendix S. The methods used to implement the requirements of 10 CFR 50, Appendix B are described in Chapter 17.

An acceptable method for complying with the NRC regulations on the seismic qualification of electrical and mechanical equipment is described in RG 1.100, Revision 3. This Regulatory Guide states that the procedures described in IEEE Std 344-2004 are acceptable to the NRC staff for satisfying the NRC regulations pertaining to seismic qualification of electrical and mechanical equipment. [*AREVA NP uses IEEE Std 344-2004*[1] *(Reference 5) to provide the technical requirements for seismic qualification of components that are included in the environmental qualification (EQ) program, along with other components that are not addressed in the EQ program. Seismic qualification based on experience, per Section 10 of IEEE Std 344-2004, is not utilized by AREVA NP.*

The methods and guidance in ASME QME-1-2007 (Reference 7), as endorsed in RG 1.100, Rev. 3 are also used for seismic qualification of active mechanical equipment.]* See Section 3.10.2 for further discussion on QME-1-2007.

The U.S. EPR design utilizes the following procedures in IEEE Std 344 for seismic qualification of electrical and mechanical equipment:

- Predicting equipment performance by analysis.
- Testing the equipment under simulated seismic conditions.
- Qualifying the equipment by a combination of analysis and testing.
- Use of applicable test data from previous qualification of similar equipment.

Electrical and mechanical equipment for the U.S. EPR is qualified only for the case of the SSE defined in Section 3.7.1. As described in Section 3.7, consideration of design cases for an operating basis earthquake (OBE) is not a design requirement for the U.S. EPR. Therefore, low-level seismic effects (fatigue) required by IEEE Std 344 to qualify electrical and mechanical equipment are considered using the equivalent of five OBE

1. Section 3.11 provides the justification for the use of the latest version of the IEEE standards referenced in this section that have not been endorsed by existing Regulatory Guides. AREVA NP maintains the option to use current NRC-endorsed versions of the IEEE standards.

events followed by one SSE event (with 10 maximum stress cycles per event). This is included in the seismic qualification process based on the approach outlined in Section 3.7.3.2.

Seismic qualification testing will be done once for an envelope of the in-structure response spectra resulting from the entire set of certified seismic design response spectra (CSDRS), including ground motions for the COL sites with high frequency content.

The U.S. EPR electrical and I&C equipment are covered by an EQ program in compliance with 10 CFR 50.49. A list of electrical and I&C equipment that are located in a harsh environment, and are being seismically qualified in accordance with IEEE Std 344, is provided in Table 3.11-1—List of Environmentally Qualified Electrical/I&C Equipment. Electrical and I&C equipment that are not located in a harsh environment, but are being seismically qualified in accordance with IEEE Std 344, are included in Table 3.10-1—List of Seismically and Dynamically Qualified Mechanical and Electrical Equipment. This table is comprehensive, in that it includes all Seismic Category I and II components in the systems screened for seismic qualification. Table 3.10-1 currently does not include the assumptions previously identified for defining the scope of equipment requiring seismic qualification. The list of equipment in Table 3.10-1 also includes postaccident monitoring (PAM) components based on the variables in RG 1.97, Revision 4. As noted in Section 7.5, the list of PAM equipment will be evaluated as the emergency operating procedures for the U.S. EPR are developed. Table 3.10-1 provides a more extensive list of PAM equipment than the minimum PAM list provided in Section 7.5. This is a result of the EQ and Seismic qualification systems screening process that identified additional components as potentially supporting PAM instrumentation. These lists will be reconciled when the complete PAM list is developed, as explained in Section 7.5, and subsequently incorporated into the COL applicant's FSAR. This will also necessitate an evaluation of the equipment listed in Table 3.10-1, including the assumptions previously identified for defining the scope of equipment requiring seismic qualification. Mechanical equipment is covered by the engineering design process and is in compliance with 10 CFR 50, Appendix A and GDC 4. A list of mechanical equipment that is being seismically qualified in accordance with IEEE Std 344 is provided in Table 3.10-1.

A COL applicant that references the U.S. EPR design certification will identify any additional site-specific components that need to be added to the equipment list in Table 3.10-1. A list of systems screened for seismic qualification is provided in Table 3.10-2—List of U.S. EPR Important-to-Safety Systems Screened for the Seismic Qualification Program.

The EQ program for electrical equipment is described in Section 3.11. The seismic qualification procedures for mechanical and electrical equipment are described in more detail in Attachment E to Appendix 3D. A list of safety-related active valves, in accordance with the guidance of RG 1.148, is in Section 3.9.6.

3.10.1.2 Performance Requirements for Seismic Qualification

A seismic qualification data package (SQDP) is developed for each equipment (or equipment class) on the list to document the qualification results that establish the seismic capability of the equipment. A sample SQDP format is included in Attachment F to Appendix 3D. The SQDP includes a specification of performance requirements that establish the safety-related functions of the equipment that must be performed during and after a seismic event.

3.10.1.3 Acceptance Criteria

The seismic qualification of electrical, instrumentation, and mechanical components demonstrates that the equipment is capable of performing its safety-related functions while subjected to normal operating loads, accident load conditions, and the maximum expected seismic loads (e.g., the SSE loads) at the location of the equipment. Non-active mechanical components are required to maintain their structural and pressure boundary integrity during and after the required seismic event.

3.10.1.4 Input Motion

The basis for the required response spectra (RRS) is provided by an envelope of the in-structure response spectra (ISRS) developed from soil conditions at the location of the equipment from the building or subsystem analysis, as described in Section 3.7. The RRS reflects the additional amplification of the ISRS due to the flexibility of the equipment supporting structure. Damping values to be used in the qualification of systems are also discussed in Section 3.7. The ISRS, at the specified damping value, provide the basis to derive a corresponding RRS at the location of the equipment. The RRS defines the minimum seismic input motion for the qualification process for the component. The seismic loads are then added to other applicable loads, such as normal and transient operating and accident loads.

The equipment RRS and other applicable loads are used to verify the qualification of the equipment and are identified and listed in the SQDP.

3.10.2 Methods and Procedures for Qualifying Mechanical, Electrical and I&C Equipment

The seismic qualification of mechanical, electrical, and I&C equipment is performed in accordance with the requirements of IEEE Std 344. The qualification can be demonstrated by testing, analysis, or a combination of both. The method of qualification selected is based on the applicability of the method for the size, type, complexity, and functional requirements of the equipment.

Testing is the preferred method for seismic equipment qualification. The type of test used to establish qualification depends on many factors, such as the type of equipment, its safety function, its location, and its flexibility.

Qualification by analysis only, can be used under the following conditions:

- Maintaining the structural and pressure boundary integrity is sufficient to perform its safety-related functions.
- The equipment is structurally simple and its behavior can be predicted by a conservative analytical approach.
- The equipment is too large or heavy to obtain a representative test input at existing test facilities. As required, the essential control devices and electrical parts of the equipment are tested separately.
- The interfaces, such as interconnecting cables to a cabinet, cannot be conservatively considered in the testing.

The loads to be considered in the analysis and the methods of combining responses are described in Section 3.9 and Attachment E to Appendix 3D.

Active valves and dampers can be qualified by a combination of analysis and testing to demonstrate operability and structural integrity. Attached appurtenances, such as operators, limit switches, and solenoid valves, can be qualified separately by testing, as recommended in IEEE Std 382 (Reference 6) and IEEE Std 344.

Mechanical and electrical equipment may also be seismically qualified using previous seismic qualification testing, subject to suitable similarity analyses, where such previous testing has been determined to meet the specified performance requirements and acceptance criteria. This qualification is based on the guidelines in IEEE Std 344-2004, supplemented with analysis as required.

In endorsing the use of ASME QME-1-2007, the NRC in RG 1.100 Rev. 3 acknowledged that several appendices are designated as either non-mandatory or mandatory (e.g., Non-mandatory Appendix QR-A; Nonmandatory Appendix QR-B; Non-mandatory Appendices QDR-A, QDR-B, and QDR-C; Nonmandatory Appendices QP-A, QP-B, QP-C, QP-D, and QP-E; and Mandatory Appendix QV-I and Non-mandatory Appendix QV-A). RG 1.100 Rev. 3 states that if a licensee commits to the use of non-mandatory appendices in ASME QME-1-2007 for its qualification of active mechanical equipment, then the criteria and procedures delineated in those nonmandatory appendices become part of the requirements for its qualification program, unless specific deviations are requested and justified. Section 3.9.6 defines the functional design, qualification, and inservice testing programs for pumps, valves, and dynamic restraints.

As noted in Section 3.10.1.1, [*QME-1-2007 is used for the seismic qualification of active mechanical equipment with the following clarifications:*

Non-mandatory Appendix QR-A, "Seismic Qualification of Active Mechanical Equipment."
Non-mandatory Appendix QR-A is not utilized]* because seismic qualification is in accordance with IEEE 344-2004, which is consistent with QME-1-2007, Sections QV-7450(b), QR-A7100, QR-A7200, and QR-A7300. Additionally, Section 10.2, Earthquake Experience Data, QR-A7400 and QR-A7500, is not utilized by AREVA NP.

[*Non-mandatory Appendix QR-B, "Guide for Qualification of Nonmetallic Parts" is utilized for the qualification of non-metallic parts.*]*

Non-mandatory Appendices to Section QDR, "Qualification of Dynamic Restraints."
The provisions for the design and qualification of snubbers, regarding Section Appendix QDR and non-mandatory Appendices QDR-A, QDR-B, and QDR-C, are provided in Section 3.9.3, Section 3.9.6.4, and Reference 3, Section 6.6. As noted in Section 3.9.6.4, snubbers in safety-related systems include provisions to allow access for IST program activities.

[*Non-mandatory Appendices to Section QP, "Qualification of Active Pump Assemblies."*
AREVA NP is not utilizing non-mandatory Appendices QP-A through QP-E.]*
Pump and motor assemblies are designed and qualified in accordance with applicable standards (e.g., ASME B&PV Code, QME-1, ASME B16, IEEE 323, IEEE 334, IEEE 344, RG 1.84, ASME NQA-1).

[*Appendices to Section QV, "Functional Qualification Requirements for Active Valve Assemblies for Nuclear Power Plants."*

- *Mandatory Appendix QV-I, "Qualification Specification for Active Valves," was used in the development of valve specifications.*

- *Non-mandatory Appendix QV-A, "Functional Specification for Active Valves for Nuclear Power Plants," is used as guidance in the development of valve specifications*]* to demonstrate that lessons learned from industry experience are included in the specifications.

- The definition of "valve assembly" in Section QV-4000, "Definitions," refers to power operated valves. NRC considers the power actuators for valve assemblies to include all types of power actuators, such as motor, pneumatic, hydraulic, solenoid, and other drivers. The guidance in ASME QME-1-2007 may also be used, where applicable, in the qualification of manually operated valves.

- Section QV-6000, "Qualification Specification," states that the owner or owner's designee is responsible for identifying the functional requirements for a valve assembly, and that these requirements be provided in a qualification specification prepared in accordance with Mandatory Appendix QV-I. NRC considers Mandatory Appendix QV-I to be a necessary part of the implementation of Section QV of ASME QME-1-2007. For example, Mandatory Appendix QV-I provides the definitions of QV Category A and B valve assemblies used in Section QV of ASME QME-1-2007. As previously noted, Mandatory Appendix QV-I is used by AREVA NP in the development of valve specifications. [*Valves listed as active valves on the valve data sheets shall be functionally qualified in accordance with Section QV of ASME QME-1-2007, including mandatory Appendix QV-1 and Section QV-G,*]* while being subjected to mechanical operating and mechanical loads (e.g., connected pipe loads), design pressure as specified in the valve data sheet, and the specified seismic accelerations. Functional testing includes mounted appurtenances.

3.10.2.1 Seismic Qualification of Electrical Equipment and Instrumentation

3.10.2.1.1 Seismic Qualification by Type Test

Seismic qualification by testing is performed in accordance with IEEE Std 344. Multi-frequency and multi-axis testing are the preferred method of qualification, though the standard allows alternative testing methods, such as single-frequency and single-axis testing. Regardless of which testing method is used, the test will conservatively simulate and envelop the required seismic motion at the location of the equipment.

Recommended testing methods for different types and locations of equipment are detailed in Appendix 3D, Attachment E.

3.10.2.1.2 Seismic Qualification by Analysis and Test

Qualification by analysis only when justified, or by analysis and testing when required, is permitted per IEEE Std 344. Operability and structural integrity of some components can be demonstrated by calculating critical component deflections and stresses under various combinations of operational and seismic loads. Resulting values are then compared to allowable levels, per applicable codes and equipment specification.

The methods of qualification by analysis are described in Appendix 3D, Attachment E.

3.10.2.2 Seismic Qualification of Active Mechanical Equipment

Active mechanical equipment is equipment that is required to perform a mechanical operation during or after a seismic event, while accomplishing its safety-related functions. The equipment in this category includes, but is not limited to, active valves and pumps. A list of all active valves and pumps is included in Section 3.9.6.

Active mechanical equipment is seismically qualified either by testing, using the methodology stated in IEEE Std 344 and detailed in Appendix 3D, Attachment E, or by a combination of testing and analysis. In addition to qualification by testing, active pump operability and structural integrity can be demonstrated by analysis. Stresses and deflections of critical components can be evaluated for different loading conditions and shown to be acceptable.

Check valves with a compact configuration are characteristically simple in design. The valve may be qualified by analysis to accelerations representative of its installed location. Functionality of the check valve is to be demonstrated by hydrostatic or pneumatic seat leakage, and periodic inservice inspections and tests as referenced in Section 3.9.6.3.3.

Pressurizer safety relief valves are seismically qualified by a combination of testing and analysis. Stresses and deformations of critical components are evaluated. In addition, a static load equivalent to the maximum applicable design basis loads is applied at the top of the bonnet. The pressure is then increased until the valve mechanism actuates. A successful actuation within the design setpoint requirements demonstrates its operational overpressurization capabilities during an SSE.

Active valves with extended structures also can be qualified by a combination of testing and analysis. Attached appurtenances, such as operators, limit switches, and solenoid valves, are qualified by seismic testing as recommended in IEEE Std 382 and IEEE Std 344. The valve itself, with the extended structure, can be qualified by a "static pull test." The equivalent static loads are calculated using the higher of the seismic accelerations per IEEE Std 382 or the actual seismic accelerations obtained from the piping analysis at the valve extended structure. During the test, equivalent static loads are applied at the valve in the direction that would cause the highest stresses or deflections at the base of the extended structures. The design pressure in the valve is simultaneously applied to the valve during the static pull test. The valve then performs its safety-related function, while in the deflected position, within the specified operating time limits.

Motor operators are seismically qualified by testing as recommended in IEEE Std 382 and IEEE Std 344.

3.10.2.3 Seismic Qualification of Non-Active Mechanical Equipment

Non-active mechanical equipment is only required to maintain its structural and pressure boundary integrity during and after the seismic event. Seismic qualification by analysis, as described in Section 3.7, Section 3.9, and Appendix 3D, Attachment E, is preferred for this equipment.

The following are typical analyses that are used for qualification:

- An analysis to determine the vibratory input to a valve or pump.

- An analysis to determine the system natural frequencies and the movement of the pump or valve during the dynamic events.
- An analysis to determine the pressure differential and the impact energy on a valve disc during a LOCA or main steam line break and to verify the design adequacy of the disc.
- An analysis to verify the design adequacy of the wall thickness of valve and pump pressure-retaining components.
- An analysis to determine the natural frequencies of a pump shaft and rotor assembly to determine whether they are within the frequency range of the vibratory excitations. If the minimum natural frequency of the assembly is beyond the excitation frequencies, a static deflection analysis of the shaft is acceptable to account for dynamic effects. If the assembly natural frequencies are close to the excitation frequencies, an acceptable dynamic analysis is performed to determine the structural response of the assembly to the excitation frequencies.

These analyses are acceptable for simple and passive elements, such as valves and pump bodies, to confirm structural integrity under postulated event loadings.

3.10.3 Methods and Procedures for Qualifying Supports of Mechanical and Electrical Equipment and Instrumentation

Adequacy of equipment supports will be established by analysis or test in accordance with the guidance provided in SRP 3.10, Acceptance Criteria, (II) (1) (B).

Supports will be tested with equipment installed or with a dummy weight simulating the equivalent equipment inertial mass effects and dynamic coupling to the support in accordance with the guidance provided in SRP 3.10, Acceptance Criteria (II) (1) (B) (iii). When performing analysis, the combined stresses of equipment supports are in accordance with SRP 3.9.3. The critical support component stresses, and deflections if applicable, are determined and are compared to allowable levels per applicable codes and regulations (e.g., ASME Boiler and Pressure Vessel Code). When complete testing is not practicable, simple and passive equipment may be analyzed to confirm their structural integrity under postulated event loadings. However, complex active devices which are vital to the operation of equipment should be additionally monitored and/or tested for functionality.

Input motions are represented by ISRS curves at the equipment support mounting locations. The detailed methodology for derivation of ISRS is addressed in Section 3.7.2.5.

The Required Response Spectra (RRS), which are based on the ISRS, shall include a 1.4 performance-based factor for the critical equipment during severe accident scenarios in accordance with ASCE/SEI 43-05, Section 8.3.2. The 10 percent margin for uncertainties required by IEEE Standard 323 in the RRS is included in the 1.4 factor described above. The Test Response Spectra (TRS) closely resembles and envelops the RRS.

Equipment functionality adequacy will be demonstrated by testing. The equipment support will be included in the test using the representative ISRS input motion at the equipment support mounting location. If the equipment is installed in a non-operational mode for the support testing, the response in the test at the equipment mounting locations should be monitored and characterized in a manner consistent with SRP 3.10, Acceptance Criteria (II) (1) (A) (iii). In such a case, equipment should be tested separately for functionality, and the actual input motion to the equipment in this test should be more conservative in amplitude and frequency content than the monitored response from the support test.

The seismic qualification of equipment requires consideration of actual or installed equipment mounting. The mounting conditions and methods for the tested or analyzed equipment simulate the expected or installed conditions. The equipment mounting considered in the analysis or testing is identified in the SQDP.

3.10.4 Test and Analysis Results and Experience Database

The results of seismic qualification testing and analysis, per the criteria in Section 3.10.1, Section 3.10.2, Section 3.10.3, are included in the corresponding SQDP (see Appendix 3D, Attachment F). A COL applicant that references the U.S. EPR design certification will create and maintain the SQDP file during the equipment selection and procurement phase. If the seismic and dynamic qualification testing is incomplete at the time of the COL application, a COL applicant that references the U.S. EPR design certification will submit an implementation program, including milestones and completion dates, for NRC review and approval prior to installation of the applicable equipment.

Complete and auditable plant-specific records and reports are available and are maintained at a central location for the life of the plant. The reports describe the qualification methods used for the equipment in sufficient detail to document compliance with the specified criteria. These records are updated and maintained current as equipment is replaced, modified, further tested, or requalified.

The equipment seismic qualification file contains a list of the systems' equipment and the equipment support structures. The equipment list identifies which equipment is NSSS supplied and which equipment is balance-of-plant supplied. The equipment qualification file includes qualification summary data sheets for each mechanical and electrical component of each system which summarizes the component's qualification. See Appendix 3D, Attachment F for a sample SQDP and Appendix 3D, Attachment A for a sample equipment qualification data package.

3.10.5 References

1. NUREG-1030, "Seismic Qualification of Equipment in Operating Nuclear Power Plants," U.S. Nuclear Regulatory Commission, February 1987.

2. European Utility Requirement for LWR Nuclear Power Plants, Volume 3, EPR Subset, December 1999.

3. ANP-10264NP-A, Revision 0, "U.S. EPR Piping Analysis and Pipe Support Design Topical Report," AREVA NP Inc., November 2008.

4. ASME Boiler and Pressure Vessel Code, Section III, "Rules for Construction of Nuclear Facility Components," The American Society of Mechanical Engineers, 2004.

5. IEEE Standard 344-2004, "IEEE Recommended Practice for Seismic Qualification of Class 1E Equipment for Nuclear Power Generating Stations," Institute of Electrical and Electronics Engineers, June 2005.

6. IEEE Standard 382-2006, "IEEE Standard for Qualification of Safety-Related Actuators for Nuclear Power Generating Stations," Institute of Electrical and Electronics Engineers, March 2007.

7. ASME QME-1-2007 Edition, "Qualification of Active Mechanical Equipment Used in Nuclear Power Plants," 2007 edition.

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