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U.S. NUCLEAR REGULATORY COMMISSION

STANDARD REVIEW PLAN

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3.10 SEISMIC AND DYNAMIC QUALIFICATION OF MECHANICAL AND ELECTRICAL EQUIPMENT

REVIEW RESPONSIBILITIES

Primary - Organization responsible for mechanical engineering reviews

Secondary- Organization responsible for reviews of electrical engineering and instrumentation and controls

I. AREAS OF REVIEW

The applicant's safety analysis report (SAR) should contain information concerning the methods of tests and analyses employed to ensure the functionality of mechanical and electrical equipment (includes instrumentation and controls) under the full range of normal and accident loadings (including seismic). The SAR is reviewed to ensure conformance with the requirements of Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, "Domestic Licensing of Production and Utilization Facilities," Appendix A, General Design Criteria for Nuclear Power Plants," General Design Criteria (GDC) 1, 2, 4, 14, and 30; 10 CFR Part 50, Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants"; and 10 CFR Part 50, Appendix S, "Earthquake Engineering Criteria for Nuclear Power

Plants." Mechanical and electrical equipment must be designed to withstand the effects of earthquakes (i.e., seismic Category I requirements and other accident-related loadings).

Mechanical and electrical equipment (including instrumentation and control (I&C) components) covered by this Standard Review Plan (SRP) section includes equipment associated with systems that are essential to emergency reactor shutdown, containment isolation, reactor core cooling, and containment and reactor heat removal functions or are otherwise essential in preventing significant release of radioactive material to the environment. Also covered by this SRP section is equipment (1) that performs the above functions automatically, (2) that is used by the operators to perform these above functions manually, and (3) whose failure can prevent the satisfactory accomplishment of one or more of the above safety functions. This SRP section also covers instrumentation that is needed to assess plant and environs conditions during and after an accident, as described in Regulatory Guide (RG) 1.97, "Criteria for Accident Monitoring Instrumentation for Nuclear Power Plants." Examples of mechanical equipment included in these systems are pumps, valves, fans, valve operators, and snubbers. Examples of electrical equipment are battery and battery racks, instrument and instrument racks, control consoles, electrical cabinets, electrical panels, valve operator motors, solenoid valves, pressure switches, relays, level transmitters, electrical penetrations, and pump and fan motors.

The ~~primary~~ review organization for SRP Sections 3.7.2, "Seismic System Analysis," and 3.7.3, "Seismic Subsystem Analysis," has the responsibility, in accordance with SRP Sections 3.7.2 and 3.7.3, for reviewing the licensee's ~~analysis~~derivation of seismic and dynamic input motion for all pipe-mounted equipment. The seismic and dynamic input motion will be used as input for the seismic and dynamic qualification of equipment. In addition, the primary review organization is responsible, in accordance with SRP Section 3.2.1, "Seismic Classification," for reviewing the seismic classification of systems that perform the functions delineated in the previous paragraph.

The secondary review organizations, in fulfilling their secondary review responsibility, verify that electrical equipment and instrumentation and controls for the equipment described in the previous paragraphs, as well as for Category 1 accident monitoring instrumentation as defined in Revision 2 and 3 of RG 1.97 and Type A, B, C, and D accident monitoring instrumentation as defined in Revision 4 of RG 1.97, are included in the seismic and dynamic qualification program and that the performance aspects of these items are included in the seismic and dynamic qualification testing.

The specific areas of review are as follows:

1. Qualification Criteria. ~~Qualification criteria are the~~The criteria for qualification, such as the deciding factors for choosing between tests, analyses, or a combination of test and analysis, the considerations in defining the seismic and other relevant dynamic load input motions, and the demonstration of adequacy of the qualification program.

2. Structural Integrity and Functionality of Mechanical and Electrical Equipment. This area of review addresses the methods and procedures, including tests and analyses, used to ensure structural integrity and the functionality of mechanical and electrical equipment in the event of a safe~~-~~ shutdown earthquake (SSE), after a number of postulated occurrences of the operating~~-~~ basis earthquake (OBE), and in combination with other relevant dynamic and static loads.

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3. Supports. This area of review addresses methods and procedures of analysis or testing of the supports for mechanical and electrical equipment and the procedures used to account for possible amplification of vibratory motion (amplitude and frequency content) under seismic and dynamic conditions.

4. Experience Database. If qualification by an experience-based approach is proposed, the staff reviews ~~both the applicant's justification to use an experience-based approach, and~~ the details of the experience database, including applicable implementation procedures, to ensure structural integrity and functionality of the in-scope mechanical and electrical equipment. Supporting documentation for equipment identified in the database should confirm that such equipment would remain functional during and after an SSE in addition to the equivalent effect of five postulated occurrences of OBE in combination with other relevant static and dynamic loads.

5. Inspections, Tests, Analyses, and Acceptance Criteria (ITAAC). For design certification (DC) and combined license (COL) reviews, the staff reviews the applicant's proposed ITAAC associated with the structures, systems, and components (SSCs) related to this SRP section in accordance with SRP Section 14.3, "Inspections, Tests, Analyses, and Acceptance Criteria." The staff recognizes that the review of ITAAC cannot be completed until after the rest of the application has been reviewed against acceptance criteria contained in this SRP section. Furthermore, the staff reviews the ITAAC to ensure that all SSCs in this area of review are identified and addressed as appropriate in accordance with SRP Section 14.3.

6. COL Action Items and Certification Requirements and Restrictions. For a DC application, the review will also address COL action items and requirements and restrictions (e.g., interface requirements and site parameters).

   For a COL application referencing a DC, a COL applicant must address COL action items (referred to as COL license information in certain DCs) included in the referenced DC. Additionally, a COL applicant must address requirements and restrictions (e.g., interface requirements and site parameters) included in the referenced DC.

Review Interfaces

Other SRP sections interface with this section as follows:

1. SRP Section 3.2.1 addresses the seismic classification of those SSCs (including their foundations and supports) that are important to safety and are designated as seismic Category I.

2. SRP Section 3.2.2, "System Quality Group Classification," addresses the systems that perform the functions delineated in paragraph 2 of Subsection of this SRP section.

3. SRP Section 3.6.2, "Determination of Rupture Locations and Dynamic Effects Associated with the Postulated Rupture of Piping," addresses the determination of rupture locations and dynamic effects associated with the postulated pipe ruptures.

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4. SRP Sections and 3.7.2 and 3.7.3 address the seismic and dynamic input motions for all seismic Category I seismic system analysis and seismic subsystem analysis, e.g., all floor-, wall-, and pipe-mounted equipment.

5. SRP Section 3.9.2, "Dynamic Testing and Analysis of Systems, Structures, and Components," addresses the dynamic testing and analysis of systems, components, and equipment.

6. SRP Section 3.9.3, "ASME Code Class 1, 2, and 3 Components, and Component, Supports, and Core Support Structures," addresses the design and service-loading combinations for mechanical and electrical equipment including American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (Code) Class 1, 2, and 3 components, component supports, and core support structures.

7. SRP Section 3.9.6, "Functional Design, Qualification, and Inservice Testing Programs for Pumps, Valves, and Dynamic Restraints," addresses the functional design, qualification, and inservice testing programs for pumps, valves, and dynamic restraints.

8. Review of the adequacy of the design, installation, inspection, and testing of I&C components, including the functional design and qualification of digital I&C equipment located in a mild environment and the post-accident monitoring (PAM) equipment identified in 10 CFR 50.49(b)(3), is described in SRP Chapter 7~~.~~, "Instrumentation and Controls."

9. SRP Section 3.11, "Environmental Qualification of Mechanical and Electrical Equipment," addresses the environmental qualification of safety-related mechanical and electrical equipment.

10. Review of the adequacy of the design, installation, inspection, and testing of electric power systems is performed ~~under~~based on SRP Chapter 8~~.~~, "Electric Power."

11. SRP Section 3.13, "Threaded Fasteners - ASME Code Class 1, 2, and 3," addresses the adequacy of programs for assuring the integrity of bolting and threaded fasteners, including provisions for installation and maintenance of mounting and bolting details equivalent to those used for equipment qualification.

The specific acceptance criteria and review procedures are contained in the referenced SRP sections.

II. ACCEPTANCE CRITERIA

Requirements

Acceptance criteria are based on meeting the relevant requirements of the following Commission regulations:

1. GDC 1, "Quality Standards and Records," and GDC 30, "Quality of Reactor Coolant Pressure Boundary," as they relate to qualifying equipment to appropriate quality standards commensurate with the importance of the safety functions to be performed.

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2. GDC 2, “Design Bases for Protection against Natural Phenomena,” and Appendix S to 10 CFR Part 50, as they relate to designing equipment to withstand the effects of natural phenomena such as earthquakes.

3. GDC 4, “Environmental and Dynamic Effects Design Bases,” as it relates to qualifying equipment as capable of withstanding the ~~environmental conditions~~dynamic effects associated with normal operation, maintenance, testing, and postulated accidents, including loss-of-coolant accidents (LOCA~~), as well as~~). This qualification should consider the dynamic effects~~, including the effects of missiles, pipe whipping, and jet impingement forces,~~ that may result from equipment failures and from events and conditions outside the plant, including the effects of missiles, pipe whipping, and jet impingement forces.

4. GDC 14, “Reactor Coolant Pressure Boundary,” 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.

5. 10 CFR Part 50, Appendix B, “Quality Assurance Criteria for Nuclear Power Plants and Nuclear Reprocessing Facilities,” as it relates to qualifying equipment using the quality assurance criteria provided.

~~6. 10 CFR Part 50.49, “Environmental Qualification of Electric Equipment Important to Safety for Nuclear Power Plants,” as it relates to the environmental qualifications required for the electric equipment.~~

~~7.~~6. 10 CFR 50.55a, “Codes and Standards,” as it defines requirements for application of codes and standards for component construction.

~~8.~~7. 10 CFR ~~part~~Part 50, Appendix B, Criterion III, “Design Control,” as it relates to verifying and checking the adequacy of design, such as by the performance of a suitable test program, among other things, and which specifically requires that a test program used to verify the adequacy of a specific design feature shall include suitable qualifications testing of a prototype unit under the most adverse design conditions.

~~9.~~8. 10 CFR 52.47(b)(1), which requires that a DC application contain the proposed ITAAC that are necessary and sufficient to provide reasonable assurance that, if the inspections, tests, and analyses are performed and the acceptance criteria met, a plant that incorporates the design certification is built and will operate in accordance with the design certification, the provisions of the Atomic Energy Act (AEA), and the NRC’s regulations;

~~10.~~9. 10 CFR 52.80(a), which requires that a COL application contain the proposed inspections, tests, and analyses, including those applicable to emergency planning, that the licensee shall perform, and the acceptance criteria that are necessary and sufficient to provide reasonable assurance that, if the inspections, tests, and analyses are performed and the acceptance criteria met, the facility has been constructed and will operate in conformity with the combined license, the provisions of the ~~Atomic Energy Act~~AEA, and the NRC’s regulations.

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SRP Acceptance Criteria

Specific SRP acceptance criteria acceptable to meet the relevant requirements of the NRC's regulations identified above are as follows for the review described in this SRP section. The SRP is not a substitute for the NRC's regulations, and compliance with it is not required. However, an applicant is required to identify differences between the design features, analytical techniques, and procedural measures proposed for its facility and the SRP acceptance criteria and evaluate how the proposed alternatives to the SRP acceptance criteria provide acceptable methods of compliance with the NRC regulations.

To implement the requirements of the regulations identified above, the staff may use specific criteria, regulatory guides, and industry standards that provide information, recommendations, and guidance and in general describe an acceptable basis. SRP Section 3.9.3 defines acceptable load combinations and methods for combining dynamic responses for mechanical equipment. The same criteria are acceptable for electrical equipment.

Paragraphs 1 and 2 below describe acceptable testing and analysis procedures for confirming the functionality of equipment for the defined load condition. These criteria, when satisfied, will fulfill the requirements of GDC 2 and 4, as discussed above, 10 CFR Part 50, Appendix B, Criterion XI, "Test Control", and 10 CFR Part 50, Appendix S as they relate to the qualification of equipment.

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1. The qualification of electrical equipment and its supports should meet the requirements and recommendations of American National Standards Institute/Institute of Electrical and Electronics Engineers (IEEE) Std. 344-2004, "IEEE Recommended Practice for Seismic Qualification of Class 1E Equipment for Nuclear Power Generating Stations," as endorsed by the NRC in RG 1.100, "Seismic Qualification of Electric and Mechanical Equipment for Nuclear Power Plants." Revision 3[1]. (This revision of RG 1.100 provides guidance with exceptions for use of Appendix QR-A of ASME QME-1-2007 for seismic qualification of active mechanical equipment and other qualifications of mechanical components, and IEEE Std. 344-2004 for seismic qualification of Class 1E equipment.) The IEEE Std. C37.98-2013 is, in general, acceptable to the NRC staff for the seismic qualification testing of protective relays and auxiliaries, such as test and control switches, terminal blocks and indicating lamps. IEEE C37.98-2013 establishes test methods and conditions for determining the seismic capability and to demonstrate seismic qualification of protective relays and auxiliaries. These documents are generally applicable to all types of equipment and should be used to the extent practicable for the qualification of mechanical equipment. Specifically, conformance to the following criteria should be demonstrated.

   A. Qualification for Equipment Functionality

      i. Tests, analyses, or a combination of tests and analysis are required to confirm the functionality of all mechanical and electrical equipment during and after an earthquake of magnitude up to and including the OBE and SSE and for all static and dynamic loads from normal, anticipated

1 The NRC staff is completing a revision to Regulatory Guide 1.100 to accept the 2013 edition of IEEE Std. 344 and the 2012 edition of QME-1 for use by applicants and licensees, and this Revision 4 of the guide should be used when final. Conforming updates to this SRP section will be made in a future revision.

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operational occurrence, and accident conditions. Before SSE qualification, the applicant should demonstrate that the equipment can withstand the equivalent effect of five OBE excitations without loss of structural integrity. Analyses alone, without testing, are acceptable as a basis for qualification only if the necessary function of the equipment is ensured by its structural integrity alone. When complete testing is impractical due to factors such as limitations in vibration test equipment to accommodate large equipment, a combination of tests and analyses is acceptable.

Equipment that has been previously qualified by means of tests and analyses equivalent to those described herein is acceptable provided that the applicant submits proper documentation of such tests and analyses.

ii. Equipment should be tested in the operational condition. Functionality should be verified during and/or after the testing, as applicable to the equipment being tested. Loadings simulating those of plant normal operation, such as thermal and flow-induced loading, if any, should be concurrently superimposed upon the seismic and other pertinent dynamic loading to the extent practicable.

iii. Response spectrum or time history methods should specify the characteristics of the required seismic and dynamic input motions. These characteristics, derived from the seismic and dynamic analyses of the structures or systems, should be representative of the input motions at the equipment mounting locations, except as noted in paragraph 3 below, which addresses the case where the applicant proposes qualification by an experience-based approach.

iv. For seismic and dynamic loads, the actual test input motion should be characterized in the same manner as the required input motion, and the conservatism in amplitude and frequency content should be demonstrated (i.e., the test response spectrum (TRS) should closely resemble and envelop the required response spectrum (RRS) over the critical frequency range).

v. Since seismic load excitation and dynamic load excitation generally have a broad frequency content, multi-frequency vibration input motion should be used. However, single frequency input motion, such as sine beats, is acceptable provided the characteristics of the required input motion indicate that the motion is dominated by one frequency (e.g., by structural filtering effects), or the anticipated response of the equipment is adequately represented by one mode, or in the case of structural integrity assurance, the input has enough intensity and duration to produce sufficiently high levels of stress for such assurance. Components that have been previously tested to IEEE Std. 344-1971 should be reevaluated to justify the appropriateness of the input motion used and requalified if necessary.

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vi. For the seismic and dynamic portion of the loads, the test input motion should be applied to one vertical axis and one principal horizontal axis (or two orthogonal horizontal axes) simultaneously, unless it can be demonstrated that the equipment response in the vertical direction is not sensitive to the vibratory motion in the horizontal direction, and vice versa. The time phasing of the inputs in the vertical and horizontal directions must be such that a purely rectilinear resultant input is avoided. An acceptable alternative is to test with vertical and horizontal inputs in phase, and then repeat the test with inputs 180 degrees out of phase. In addition, the test must be repeated with the equipment rotated 90 degrees horizontally if this alternative is selected.

Components that have been previously tested to IEEE Std. 344-1971 should be requalified using biaxial test input motions unless the applicant provides justification for using a single-axis test input motion.

vii. Dynamic coupling between the equipment and related systems, if any, such as connected piping and other mechanical components, should be considered.

viii. The test fixture design should simulate the actual service mounting and should not cause any extraneous dynamic coupling to the test item.

ix. For pumps and valves, the loads imposed by the attached piping should be considered. To ensure functionality under combined loadings, the stresses resulting from the applied test loads should envelop the specified service stress limit for the intended function of the component. Stresses in valve bodies and pump casings should be limited to the particular material's elastic limit when the pump or valve is subject to the combination of normal operating loads, SSE, and other applicable dynamic loads.

x. If the dynamic testing of a pump or valve assembly proves to be impracticable, static testing of the assembly is acceptable provided that the end loadings are conservatively applied and are equal to or greater than postulated event loads, all dynamic amplification effects are accounted for, the component is in the operating mode during and after the application of loads, and an adequate analysis is made to show the validity of the static application of loads.

xi. The in situ application of vibratory devices to simulate the seismic and dynamic vibratory motions on a complex active device is acceptable to confirm the functionality of the device when the applicant shows that a meaningful test can be made in this way.

xii. The test program may be based on selective testing of a representative number of components according to type, load level, size, and the like on a prototype basis.

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xiii. Selection of damping values for equipment to be qualified by analysis should be made in accordance with RG 1.61, "Damping Values for Seismic Design of Nuclear Power Plants~~."~~," and that for equipment to be qualified by testing should be made in accordance with IEEE Std. 344-2004. Higher damping values may be used if justified by documented test data with proper identification of the source and mechanism.

xiv. When complete testing is not practical, the features listed below should be incorporated into a test and analysis functionality assurance program for pumps and valves. Similar programs can be developed for other types of equipment.

(1) Simple and passive elements, such as valve and pump bodies and their related piping and supports, may be analyzed to confirm structural integrity under postulated event loadings. However, complex active devices such as pump motors, valve operators and gate or disk assemblies, and other electrical, mechanical, pneumatic, or hydraulic appurtenances which are vital to the pump or valve operation should be tested for functionality.

(2) The following analyses are acceptable provided they are correlated to classical problems, elementary laboratory tests, or in situ tests:

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

b. An analysis is performed to determine the system's natural frequencies and the movement of the pump or valve during the dynamic events.

c. An analysis is performed to determine the pressure differential and the impact energy on a valve disc during a LOCA and to verify the design adequacy of the disc.

d. An analysis is performed to determine the forcing functions of the axial and radial loads imposed on a pump rotor because of a LOCA, such that combined LOCA and vibratory effects on the shaft and rotor assembly can be evaluated.

e. An analysis is performed to determine the speed of the pump shaft as a result of postulated events and to compare that speed with the design critical speed.

f. An analysis is performed to verify the design adequacy of the wall thickness of valve and pump pressure retaining bodies.

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g. An analysis is performed to determine the natural frequencies of a pump shaft and rotor assembly to ascertain 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's natural frequencies are close to the excitation frequencies, an acceptable dynamic analysis must be performed to determine the structural response of the assembly to the excitation frequencies.

h. When analyses are used for qualification, the combination of multimodal and multidirectional responses should be made in accordance with RG 1.92, "Combining Modal Responses and Spatial Components in Seismic Response Analysis."

B. Design Adequacy of Supports

i. Analyses or tests should be performed for all supports of mechanical and electrical equipment to ensure their structural capability.

ii. The analytical results should include the required input motions to the mounted equipment as obtained and characterized in the manner stated in Subsection I.1.A.iii above, and the combined stresses of the support structures should be in accordance with the criteria specified in SRP Section 3.9.3.

iii. Supports, if qualified by test, should be tested with equipment installed or with a dummy simulating the equivalent equipment inertial mass effects and dynamic coupling to the support. If the equipment is installed in a nonoperational mode for the support test, the response in the test at the equipment mounting location should be monitored and characterized in the manner stated in Subsection ~~I~~II.1.A.iii above. In such a case, equipment should be tested separately for functionality, and the actual input motion to the equipment in this test should be higher in amplitude and frequency content than the monitored response from the support test. If the support structure or dummy is too large and/or too heavy for test shake table then only the equipment may be seismic tested based on simulated seismic input response at the equipment/support interface mounting location. The support structure may then be seismically analyzed.

iv. The criteria of Subsections II.1.A.iii thru II.1.A.xiii above apply when tests are conducted on the equipment supports.

C. Verification of Seismic and Dynamic Qualification.

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The seismic and dynamic qualification testing performed in accordance with IEEE Std. 344-2004, as endorsed by the NRC in RG 1.100, Revision 3, as part of an overall qualification program should be performed in the sequence indicated in Section 6 of IEEE Std. 323-1974 (endorsed with exceptions by the NRC in RG 1.89, "Environmental Qualification of Certain Electric Equipment Important to Safety for Nuclear Power Plants"). The IEEE Std. C37.98-2013 is, in general, acceptable to the NRC staff for the seismic qualification testing of protective relays and auxiliaries.

2. Instrumentation described in RG 1.97, including associated mountings, should be tested under appropriate seismic and dynamic loadings as described in the regulatory guide, thereby ensuring that the instruments will continue to monitor plant variables and systems after a seismic event and/or accident.

3. If the applicant proposes qualification by an experience-based approach, ~~and the staff reviews the applicant's justification,~~ the details of the experience database, including applicable implementation methods and procedures to ensure structural integrity and functionality of the in-scope mechanical and electrical equipment, ~~should still~~must meet the functionality of equipment for the defined load condition as presented in paragraphs 1 and 2 above. Supporting documentation for equipment identified in the database should confirm that such equipment remained functional during and after an SSE and the equivalent effect of five postulated occurrences of OBE in combination with other relevant static and dynamic loads. Additional guidelines to determine the adequacy of an applicant's proposal to qualify equipment by earthquake and/or test experience approaches are detailed in RG 1.100.

~~The qualification of equipment by earthquake and/or test experience approach should not be used without adequate justification. Use of this approach is subjected to more detailed review by the NRC staff. Large uncertainties exist in the seismic qualification of equipment, as a class, on the basis of earthquake experience data, because (1) it is difficult to compile a credible earthquake experience database (e.g., estimation of ground and floor earthquake excitations used in the earthquake experience database), (2) the inclusion and exclusion rules (termed "prohibited features" in IEEE Std. 344-2004) of equipment in the database may not be complete, (3) the similarity between equipment in fossil or petrochemical plants in the database and the equipment in NPPs is difficult to establish; and, most importantly, (4) generally, there is not sufficient credible information from the earthquake experience database to provide assurance that certain active mechanical and electrical equipment will function properly during earthquakes.~~

~~5.~~4. GDC 1 and 10 CFR Part 50, Appendix B, Criteria XVII, "Quality Assurance Records," establish requirements for records concerning the qualification of equipment. To satisfy these requirements, complete and auditable records must be available, and the applicant must maintain them, for the life of the plant. These files should describe the qualification method used for all equipment in sufficient detail to document the degree of compliance with the criteria of this SRP section. These records should be updated and kept current as equipment is replaced, further tested, or otherwise further qualified.

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The equipment qualification file should contain a list of all systems, equipment, and the equipment support structures, as defined in the second paragraph of subsection I of this SRP Section. The equipment list should identify which equipment is supplied by the nuclear steam supply system (NSSS) and which equipment is supplied by the balance of plant (BOP). The equipment qualification file should also include qualification summary data sheets for each piece of equipment (i.e., each mechanical and electrical component of each system) which summarize the component's qualification. These data sheets should include the following information:

A. Identification of equipment, including vendor, model number, and location within each building. Valves that are part of the reactor coolant pressure boundary (RCPB) should be so identified. In addition to the information listed before, for electrical equipment provide functional designation and components associated with (e.g., logic equipment).

B. Physical description, including dimensions, weight, and field mounting condition, and identification of whether the equipment is pipe-, floor-, or wall-supported.

C. A description of the equipment's function within the system.

D. Identification of all design (functional) specifications and qualification reports and their locations. Functional specifications for active valve assemblies should conform to RG 1.148, "Functional Specification for Active Valve Assemblies in Systems Important to Safety in Nuclear Power Plants."

E. Description of the required loads and their intensities for which the equipment must be qualified.

F. If qualification by test, identification of the test methods and procedures, important test parameters, and a summary of the test results.

G. If qualification by analysis, identification of the analysis methods and assumptions and comparisons between the calculated and allowable stresses and deflections for critical elements.

H. If qualification by an experience-based approach, identification of the type of experience and the source of experience database.

I. The natural frequency (or frequencies) of the equipment.

J. Identification of whether the equipment may be affected by vibration fatigue cycle effects and a description of the methods and criteria used to qualify the equipment for such loading conditions.

K. Indication of whether the equipment has met the seismic qualification requirements.

L. Availability for inspection (i.e., statement of whether the equipment is already installed).

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M. A compilation of the required response spectra (or time history) and corresponding damping for each seismic and dynamic load specified for the equipment together with all other loads considered in the qualification and the method of combining all loads.

~~6.~~5. GDC 14 requires, in part, that the RCPB shall be designed, fabricated, erected, and tested so as to have an extremely low probability of abnormal leakage. Regulations in 10 CFR 50, Appendix A, GDC 30, "Quality of Reactor Coolant Pressure Boundary," further require, in part, that components that are part of the RCPB shall be designed, fabricated, erected, and tested to the highest quality standards practical. As discussed under acceptance criteria in SRP Section 3.9.6, to satisfy these requirements, the qualification program for valves that are part of the RCPB should include testing or testing and analyses demonstrating that these valves will not experience any leakage, or increase in leakage, as a result of any loading or combination of loadings for which the valves must be qualified.

~~7.~~6. The implementation of the qualification program described above should be documented in the following ways:

A. The preliminary safety analyses report (PSAR) or DC application should contain the following:

i. A detailed description of NSSS and architect/engineer (A/E) practice followed in qualification, including criteria, methods, and procedures used in conducting testing and analysis, which demonstrate the extent of compliance with the criteria set forth in Subsections II.1 thru II.5 above.

If equipment qualification by using earthquake experience data and/or test experience data is proposed, a detailed description of the experience database, including applicable implementation methods and procedures to ensure structural integrity and functionality of the in-scope mechanical and electrical equipment subject to the defined load condition as presented in paragraphs 1 and 2 above. Supporting documentation for equipment identified in the database should confirm that such equipment remained functional during and after an SSE and the equivalent effect of five postulated occurrences of OBE in combination with other relevant static and dynamic loads.

~~Note: Earthquake~~Additional guidelines to determine the adequacy of an applicant's proposal to qualify equipment by earthquake and/or test experience ~~data should not be used without adequate justification, and use of this seismic qualification of mechanical and electrical equipment is subject to more~~approaches are detailed ~~review by the NRC staff~~in RG 1.100.

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~~iii.~~ii. Information regarding administrative control of component qualification, especially a description of the equipment qualification file, the handling of documentation, internal acceptance review procedures, identification of the scope of NSSS and A/E suppliers, and the procedures for interchange of information between NSSS, A/E, equipment vendors, and testing laboratories.

B. In addition to the information contained in the PSAR, as revised, the final safety analysis report (FSAR) should contain the following:

i. A list of all systems required to perform the functions defined in the second paragraph of subsection I of this SRP section.

ii. A description of the results of any in-plant tests, such as in situ impedance tests, and any plans for operational tests which will be used to confirm the qualification of any item of equipment.

C. The seismic qualification report (SQR) should contain the following:

i. The list of systems required to perform the functions defined in the second paragraph of subsection I of this SRP section.

ii. The list of equipment, and its supports, associated with each system and any other equipment required in accordance with the second paragraph of subsection I of this SRP section.

iii. The summary data sheets for each piece of equipment (i.e., each component) listed.

iv. A detailed description of the experience database similar to ~~item~~Subsection II.6.A.ii above for in-scope equipment not covered in DC.

D. COL applications should include the information described in Subsections II.6.A, II.6.B, and II.6.C of this SRP Section, as well as the following:

i. A description of the environmental parameters applicable to the specific plant and its equipment qualification program.

ii. Documentation to demonstrate that properly defined and enveloped seismic and dynamic input response spectra have been applied to the specific plant and its equipment qualification program.

Technical Rationale

The technical rationale for application of these acceptance criteria to the areas of review addressed by this SRP section is discussed in the following paragraphs:

1. Compliance with GDC 1 requires that (1) testing be done in accordance with quality standards commensurate with the importance of the safety functions to be performed, (2) where generally recognized codes and standards are used, they shall be identified

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and evaluated to determine their applicability, adequacy, and sufficiency, and (3) appropriate records be maintained.

GDC 1 applies to this SRP section because the reviewer evaluates seismic and dynamic test and evaluation programs for electrical and mechanical equipment, and associated supports, designated as important to safety. IEEE Std. 344-2004, as endorsed by RG 1.100, Revision 3, provides guidance for establishing acceptable seismic and dynamic test (and/or evaluation) qualification and documentation criteria for electrical and mechanical equipment in nuclear power plants. ~~SRP Section 3.10~~The IEEE Std. C37.98-2013 is, in general, acceptable to the NRC staff for the seismic qualification testing of protective relays and auxiliaries. SRP Section 3.10, "Seismic and Dynamic Qualification of Mechanical and Electrical Equipment," offers supplemental guidance regarding acceptable techniques for combining seismic loads with other loads and conditions, modeling of supports, documentation, and evaluation of results.

Meeting the requirements of GDC 1 provides assurance that the seismic and dynamic qualification of electrical and mechanical equipment important to safety will comply with established criteria, thereby ensuring its capability to perform required safety functions during and after exposure to design-basis seismic and dynamic loads.

2. Compliance with GDC 2 requires that SSCs important to safety be designed to withstand the effects of design basis natural phenomena, combined with appropriate effects of normal and accident conditions, without loss of capability to perform their safety functions.

GDC 2 applies to this SRP section because the reviewer evaluates testing and analysis of electrical and mechanical equipment, and associated supports, for the capability to resist seismic and dynamic loads. Pertinent staff positions include extensive and specific provisions for tests and analyses to consider all appropriate seismic and dynamic loads in combination with normal and accident loads. SRP Section 3.10 cites guidance for testing and analysis that is acceptable to the staff for ensuring that mechanical and electrical equipment will withstand all appropriate combinations of seismic and dynamic effects caused by natural phenomena.

Meeting the requirements of GDC 2 provides assurance that the seismic and dynamic qualification of electrical and mechanical equipment important to safety will be performed in accordance with criteria and standards (or their equivalent) cited in this SRP section, thereby ensuring that such equipment can withstand the seismic and dynamic load effects of natural phenomena in combination with normal and accident conditions.

3. Compliance with GDC 4 requires that components important to safety be designed to accommodate the effects of, and be compatible with, the environmental conditions associated with normal operation, maintenance, testing, and postulated accidents, including LOCAs and dynamic effects (e.g., pipe whip, missiles, and discharging fluids).

GDC 4 applies to this SRP section because the reviewer evaluates dynamic testing and analysis of electrical and mechanical equipment, and associated supports, to ensure that such equipment will withstand dynamic loads as a result of, or in combination with, other environmental loads, which may include or result from seismic loads.

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Meeting the requirements of GDC 4 provides assurance that the dynamic qualification of electrical and mechanical equipment important to safety will be performed in accordance with criteria and standards (or their equivalent) cited in this SRP section, thereby ensuring that such equipment can withstand the dynamic load effects of environmental conditions associated with normal and accident conditions, including seismic events.

4. Compliance with GDC 14 requires that the RCPB be tested to demonstrate an extremely low probability of abnormal leakage, rapidly propagating failure, and gross rupture.

   GDC 14 applies to this SRP section~~-~~ because the reviewer evaluates seismic and dynamic testing of RCPB components to determine their capability to withstand applicable design-basis seismic and dynamic loads in combination with loads caused by other environmental and natural phenomena without leakage, rapidly propagating failure, or rupture. IEEE Std. 344-2004, as endorsed in RG 1.100, Revision 3, provides guidance acceptable to the staff for establishing acceptable seismic and dynamic test (or evaluation) criteria for RCPB components.

   Meeting the requirements of GDC 14 provides assurance that seismic and dynamic qualification of RCPB components will be performed in accordance with criteria and standards (or their equivalent) cited in this SRP section, thereby ensuring that the RCPB will have an extremely low probability of leakage or failure.

5. Compliance with GDC 30 requires that components that are part of the RCPB be tested to the highest quality standards practical.

   GDC 30 applies to this SRP section because the reviewer verifies the adequacy of dynamic test and evaluation programs for RCPB components. IEEE Std. 344-2004, as endorsed by RG 1.100, Revision 3, provides guidance acceptable to the staff for establishing acceptable seismic and dynamic test (or evaluation) qualification criteria for these components. SRP Section 3.10 provides additional guidance for identifying individual components of the RCPB and demonstrating (through testing and analysis, or combination of both) that a given component will not leak as a result of any combination of loadings for which it must be qualified. These staff positions include extensive and specific provisions for tests and associated analyses to consider all appropriate seismic and dynamic loads in combination with normal and accident loads.

   Meeting the requirements of GDC 30 provides assurance that seismic and dynamic qualification of components that are part of the RCPB will be performed in accordance with criteria and standards (or their equivalent) cited in this SRP section, thereby ensuring that RCPB components will be tested to the highest quality standards practical.

6. Compliance with 10 CFR Part 50, Appendix B requires that applicants establish and maintain an acceptable quality assurance program, including design, testing, and records control.

   Regulations in 10 CFR Part 50, Appendix B apply to this SRP section because the reviewer evaluates design, testing, and records for the qualification of equipment, and

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associated supports, designated as important to safety. Subsection ~~I~~II.1 of this SRP section describes testing and analysis related to seismic and dynamic qualification of equipment. Subsection ~~I~~II.3 of this SRP section describes recordkeeping requirements for seismic and dynamic qualification of equipment. IEEE Std. 344-2004, as endorsed by RG 1.100, Revision 3, provides additional guidance for the design, testing, and documentation of the seismic and dynamic qualification of equipment important to safety.

Meeting the requirements of 10 CFR Part 50, Appendix B provides assurance that designs, tests, and documentation related to qualification of equipment important to safety will comply with established standards and criteria, thereby ensuring that such equipment will be capable of performing its intended safety functions.

7. Compliance with 10 CFR Part 50, Appendix S, requires that SSCs important to safety be designed to withstand seismic events.

Regulations in 10 CFR Part 50, Appendix S apply to this SRP section because the reviewer evaluates seismic and dynamic test and evaluation programs for electrical and mechanical equipment, and associated supports, designated as important to safety. IEEE Std. 344-2004, as endorsed by RG 1.100, Revision 3, provides additional guidance for establishing acceptable seismic and dynamic test (or evaluation) qualification criteria for electrical and mechanical equipment and associated supports in nuclear power plants. The criteria are applied based on the seismic loads established for a particular site in accordance with 10 CFR Part 50, Appendix S.

Meeting the requirements of 10 CFR Part 50, Appendix S provides assurance that seismic and dynamic qualification of mechanical and electrical equipment, and associated supports, designated as important to safety is performed in accordance with the criteria and standards (or their equivalent) cited in this SRP section, thereby ensuring that SSCs important to safety will perform acceptably when subjected to SSE loads and the equivalent effect of five OBE loads.

III. REVIEW PROCEDURES

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The reviewer will select material from the procedures described below, as may be appropriate for a particular case.

These review procedures are based on the identified SRP acceptance criteria. For deviations from these acceptance criteria, the staff should review the applicant's evaluation of how the proposed alternatives provide an acceptable method of complying with the relevant NRC requirements identified in Subsection I.

1. At the construction permit (CP) stage, the staff reviews the program described by the applicant in the PSAR for the qualification of mechanical, electrical, and instrumentation equipment and measures the program against the requirements listed in Subsection I of this SRP section. Of particular interest is the proper use of test and analytical, or the combination of both, procedures. Equipment that is too complex for reliable mathematical modeling should be tested unless the analytical procedures and corresponding design are conservative. The staff reviews both the test and the analysis

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methods to ensure that all important modes of response will be excited in tests or considered in analysis. The staff verifies that input motions, in terms of response spectra or time history in all necessary directions, envelop the required input. The staff also reviews the adequacy of equipment supports. If qualification by an experience-based approach is proposed, the staff reviews ~~both the applicant's justification to use an experience-based approach, and~~ the details of the experience database, including applicable implementation procedures, to ensure structural integrity and functionality of the in-scope mechanical and electrical equipment. Supporting documentation for equipment identified in the experience database should confirm that such equipment remained functional during and after an SSE and the equivalent effect of five postulated occurrences of OBE in combination with other relevant static and dynamic loads.

2. At the operating license (OL) stage or the DC or the COL application stage, the staff reviews the program as described by the applicant in the FSAR. In addition, the staff may review the SQR for documentation of the successful implementation of the qualification program including test and analysis results. The reviewer verifies that the applicant's list of systems is consistent with the list provided in accordance with SRP Section 3.2.2. If qualification by an experience-based approach is proposed, the reviewer examines ~~both the applicant's justification to use an experience-based approach, and~~ the details of the experience database, including applicable implementation procedures, to ensure structural integrity and functionality of the mechanical and electrical equipment not covered in the DC. Supporting documentation for equipment identified in the database should confirm that such equipment remained functional during and after an SSE and the equivalent effect of five postulated occurrences of OBE in combination with other relevant static and dynamic loads.

   To confirm the extent to which the equipment meets the provisions of Subsection I of this SRP section, the staff audits the equipment qualification and central files and conducts a plant site review. The staff may require that the SQR be submitted to the staff 6 weeks before the plant site visit. If the staff has reviewed an applicant's qualification file for a previous application, it may elect not to require the applicant to submit the SQR, but instead choose only to audit the equipment qualification and central files.

   The review of the SQR, if applicable, and the audit of the applicant's equipment qualification and central files will include the following:

   A. For each system, the reviewer should verify that summary data sheets are available for all components of these systems and perform a detailed review of these data sheets for selected components.

   B. The reviewer will audit the central files to verify that the referenced qualification documentation and test reports are available and perform a detailed review of selected documents to verify that they support the qualification of the equipment. After the audit, the staff may request the applicant to submit selected documents for further review.

   C. For selected equipment, the staff reviews the combined RRS and the combined dynamic response, examines the equipment configuration and mounting, and then determines whether the test or analysis conducted, or the experience

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database used, demonstrates compliance with the RRS if the equipment was qualified by test or experience-~~base~~based approach, or compliance with the acceptable analytical criteria if qualified by analysis.

D. The staff will review a sampling of design (functional) specifications for completeness. As discussed in the review procedures in SRP Section 3.9.6~~,~~ for functional design and qualification of pumps, valves, and dynamic restraints, the reviewer uses the information contained in the following documents in addition to the acceptance criteria cited under Subsections II.1 and II.2 of this SRP section to evaluate the functional specifications selected for review:

i. ASME QME-1-2007, "Qualification of Active Mechanical Equipment used in Nuclear Power Plants."

It is important that the applicant's program is complete in this area so that the staff can be sure that the proper system parameters are specified and appropriate loads defined. The review will screen several key components in the systems to establish the program objectives.

E. The staff reviews the test procedures against the criteria in Subsections II.1 or II.2 of this SRP section. In evaluating an applicant's program for pumps, valves, and dynamic restraints, the reviewer also uses, for guidance purposes, the information contained in the following documents:

i. ASME QME-1-2007

ii. IEEE Std. 344-2004

In addition to the above documents, the reviewer will use References ~~10~~12 and ~~11~~13 to evaluate the functionality assurance programs for purge and vent valves and deep draft pumps.

F. The staff will review the analytical procedures used alone or in conjunction with testing to demonstrate functionality by comparing the information submitted in the applicant's program with the acceptance criteria delineated in Subsections II.1 or II.2 of this SRP section. For pumps, valves, and dynamic restraints, the references cited in Subsection ~~III~~II.2.E of this SRP section provide additional criteria for demonstrating functionality by analysis, and the reviewer will use them to supplement the staff's review procedures.

3. Reviews of COL applications should include audits of the equipment qualification file. The staff should review the results of tests and analyses to accomplish the following:

A. Ensure that the criteria in the certified design were properly implemented.

B. Ensure that adequate qualification was demonstrated for all equipment and supports.

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C. Verify that the testing and analyses performed, or experience database used, properly defined and accounted for all applicable loads.

In the advanced boiling-water reactor (ABWR) and System 80+ DC final safety evaluation reports (SERs), the staff accepted an exemption from the requirement in Appendix A to 10 CFR Part 100, "Seismic and Geologic Siting Criteria for Nuclear Power Plants," that all safety-related SSCs be designed to remain functional and within applicable stress and deformation limits when subjected to an OBE. This exemption was based on the licensees' alternative analyses performed for the SSE and procedural requirements to perform an inspection of the plant following an earthquake at or above one-third the SSE (see Appendix S to 10 CFR Part 50). The staff concluded in SECY 93-087, "Policy, Technical, and Licensing Issues Pertaining to Evolutionary and Advanced Light-Water Reactor (ALWR) Designs," that the effect of eliminating the OBE from equipment qualification by analysis should be negligible. Mechanical equipment is generally seismically rugged when properly anchored, and its tolerance limits are controlled by the SSE rather than the OBE. However, some electrical equipment qualified by seismic analysis requires five OBE events followed by one SSE event. With the elimination of OBE, analysis checks for fatigue effects can be performed at a fraction of the SSE. The NRC concluded in Staff Requirement Memorandum on SECY-93-087 that electrical equipment should be qualified with five one-half SSE events followed by one full SSE event. Or alternatively, a number of fractional peak cycles equivalent to the maximum peak cycle for five one-half SSE events may be used in accordance with Appendix D to IEEE Std. 344-1987 when followed by one full SSE, even if the OBE of the plant is defined to be one-third of SSE or less. For other reactors, the staff will review the seismic qualification based on the OBE level, in accordance with the licensing basis.

4. For review of a DC application, the reviewer should follow the above procedures to verify that the design, including requirements and restrictions (e.g., interface requirements and site parameters), set forth in the FSAR meets the acceptance criteria. DCs have referred to the FSAR as the design control document (DCD). The reviewer should also consider the appropriateness of identified COL action items. The reviewer may identify additional COL action items; however, to ensure these COL action items are addressed during a COL application, they should be added to the DC FSAR.

For review of a COL application, the scope of the review is dependent on whether the COL applicant references a DC, an early site permit or other NRC approvals (e.g., manufacturing license, site suitability report or topical report).

For review of both DC and COL applications, SRP Section 14.3 should be followed for the review of ITAAC. The review of ITAAC cannot be completed until after the completion of review under this SRP section.

IV. EVALUATION FINDINGS

The reviewer verifies that the applicant has provided sufficient information and that the review and calculations (if applicable) support conclusions of the following type to be included in the staff's SER. The reviewer also states the bases for those conclusions.

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The staff concludes that the applicant's equipment qualification program is acceptable and meets the relevant requirements of 10 CFR Part 50, Appendix B, 10 CFR Part 50, Appendix S; and GDC 1, 2, 4, 14, and 30. This conclusion is based on the following:

> The qualification program which will be implemented for mechanical and electrical equipment, including I&C components, meets the requirements and recommendations of IEEE Std. 344-2004 and ASME QME-1-2007, and the regulatory positions of RGs 1.61, 1.89, 1.97, and 1.~~100and~~100 and provides adequate assurance that such equipment will function properly under all imposed design and service loads including the loadings imposed by the SSE, postulated accidents, and LOCAs. This program constitutes an acceptable basis for satisfying the applicable requirements of 10 CFR Part 50, Appendix A, GDC 2, 4, 14, and 30, 10 CFR Part 50, Appendix B, Criteria XI, and 10 CFR Part 50 Appendix S as they relate to qualification of equipment. The applicant's equipment qualification file also constitutes an acceptable basis for satisfying the requirements of 10 CFR Part 50, Appendix B, 10 CFR Part 50, Appendix A, GDC 1 and 10 CFR Part 50, Appendix B, ~~paragraph~~Paragraph XVII.

For DC and COL reviews, the findings will also summarize the staff's evaluation of requirements and restrictions (e.g., interface requirements and site parameters) and COL action items relevant to this SRP section.

In addition, to the extent that the review is not discussed in other SER sections, the findings will summarize the staff's evaluation of the ITAAC, including design acceptance criteria, as applicable.

V. IMPLEMENTATION

The staff will use this SRP section in performing safety evaluations of DC applications and license applications submitted by applicants pursuant to 10 CFR Part 50 or 10 CFR Part 52. Except when the applicant proposes an acceptable alternative method for complying with specified portions of the Commission's regulations, the staff will use the method described herein to evaluate conformance with Commission regulations.

The provisions of this SRP section apply to reviews of applications docketed 6 months or more after the date of issuance of this SRP section, unless superseded by a later revision.

VI. REFERENCES

1. Institute of Electrical and Electronics Engineers, IEEE Standard 344-1971, "Guide for Seismic Qualification of Class 1 Electric Equipment for Nuclear Power Generating Stations," Institute of Electrical and Electronics Engineers.

2. Institute of Electrical and Electronics Engineers, IEEE Standard 344-1987, "IEEE Recommended Practice for Seismic Qualification of Active Mechanical Equipment Used in Nuclear Power Plants."

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

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4. Institute of Electrical and Electronics Engineers, IEEE Standard C.97.98-2013, ""IEEE Standard for Seismic Qualification Testing of Protective Relays and Auxiliaries for Nuclear Facilities."

~~4.~~5. U.S. *Code of Federal Regulations*, "Domestic- Licensing of Production and Utilization," Part 50, Chapter 1, Title 10, "Energy," Appendix A, "General Design Criteria for Nuclear Power Plants," General Design Criterion 1, "Quality Standards and Records."

~~5.~~6. U.S. *Code of Federal Regulations*, "Domestic Licensing of Production and Utilization," Part 50, Chapter 1, Title 10, "Energy," Appendix A, "General Design Criteria for Nuclear Power Plants," General Design Criterion 2, "Design Bases for Protection Against Natural Phenomena."

~~6.~~7. U.S. *Code of Federal Regulations*, "Domestic Licensing of Production and Utilization," Part 50, Chapter 1, Title 10, "Energy," Appendix A, "General Design Criteria for Nuclear Power Plants," General Design Criterion 4, "Environmental and Dynamic Effects Design Bases."

~~7.~~8. U.S. *Code of Federal Regulations*, "Domestic Licensing of Production and Utilization," Part 50, Chapter 1, Title 10, "Energy," Appendix A, "General Design Criteria for Nuclear Power Plants," General Design Criterion 14, "Reactor Coolant Pressure Boundary."

~~8.~~9. U.S. *Code of Federal Regulations*, "Domestic Licensing of Production and Utilization," Part 50, Chapter 1, Title 10, "Energy," Appendix A, "General Design Criteria for Nuclear Power Plants," General Design Criterion 30, "Quality of Reactor Coolant Pressure Boundary."

~~9.~~10. U.S. *Code of Federal Regulations*, "Domestic Licensing of Production and Utilization," Part 50, Chapter 1, Title 10, "Energy," Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants."

~~10.~~11. U.S. *Code of Federal Regulations*, "Domestic Licensing of Production and Utilization," Part 50, Chapter 1, Title 10, "Energy," Appendix S, "Earthquake Engineering Criteria for Nuclear Power Plants."

~~11.~~12. U.S. *Code of Federal Regulations*, "Licenses, Certifications, and Approvals for Nuclear Power Plants," Part 52, Chapter 1, Title 10, "Energy."

~~12.~~13. U.S. Nuclear Regulatory Commission, "Guidelines for Demonstration of Operability of Purge and Vent Valves," Enclosure to September 27, 1979, Letter from D.G. Eisenhut, Acting Director, Division of Operating Reactors, NRR, USNRC, to all Licensees of Operating Reactors.

~~13.~~14. U.S. Nuclear Regulatory Commission, "Guidelines for Demonstration of Operability of Deep Draft Pumps," Enclosure to June 22, 1981, Memorandum from R. Vollmer, Director, Division of Engineering, NRR, USNRC, to D. Eisenhut, Director, Division of Licensing, NRR.

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~~14.~~15. U.S. Nuclear Regulatory Commission, "Damping Values for Seismic Design of Nuclear Power Plants," Regulatory Guide 1.61, Revision 1, March 2007. ADAMS Accession No. ML070260029.

~~15.~~16. U.S. Nuclear Regulatory Commission, "Environmental Qualification of Certain Electric Equipment Important to Safety for Nuclear Power Plants," Regulatory Guide 1.89, Revision 1, June 1984. ADAMS Accession No. ML003740271.

~~16.~~17. U.S. Nuclear Regulatory Commission, "Combining Modal Responses and Spatial Components in Seismic Response Analysis," Regulatory Guide 1.92, Revision 3, September 2012. ADAMS Accession No. ML12220A043.

~~17.~~18. U.S. Nuclear Regulatory Commission, "Instrumentation for Light-Water-Cooled Nuclear Power Plants to Assess Plant and Environs Conditions During and Following and Accident." Regulatory Guide 1.97, Revision 2, December 1980, Revision 3, May 1983. ADAMS Accession No. ML060750525 and ML003740282, respectively.

~~18.~~19. U.S. Nuclear Regulatory Commission, "Criteria for Accident Monitoring Instrumentation for Nuclear Power Plants," Regulatory Guide 1.97, Revision 4, June 2006. ADAMS Accession No. ML061580448.

~~19.~~20. U.S. Nuclear Regulatory Commission, "Seismic Qualification of Electric and Mechanical Equipment for Nuclear Power Plants," Regulatory Guide 1.100, Revision 3. ADAMS Accession No. ML091320468.

~~20.~~21. U.S. Nuclear Regulatory Commission, "Policy, Technical, and Licensing Issues Pertaining to Evolutionary and Advanced Light-Water Reactor (ALWR) Designs," SECY- 93-087, July 21, 1993.

PAPERWORK REDUCTION ACT STATEMENT

The information collections contained in the Standard Review Plan are covered by the requirements of 10 CFR Part 50 and 10 CFR Part 52, and were approved by the Office of Management and Budget, approval number 3150-0011 and 3150-0151.

PUBLIC PROTECTION NOTIFICATION

The NRC may not conduct or sponsor, and a person is not required to respond to, a request for information or an information collection requirement unless the requesting document displays a currently valid OMB control number.

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SRP Section 3.10
Description of Changes

Section 3.10, "Seismic and Dynamic Qualification of Mechanical and Electrical Equipment"

This section has been updated to clarify the applicability of General Design Criterion (GDC) 4 in Appendix A to 10 CFR Part 50 to seismic and dynamic qualification of mechanical and electrical equipment.

In addition to the changes itemized below, editorial changes were made throughout for clarity, consistency, and applicability. Changes incorporated into Revision 4 include:

II. ACCEPTANCE CRITERIA

- The requirements of GDC 4 on the seismic and dynamic qualification of mechanical and electrical equipment were clarified.
- A reference addressing cases where the applicant proposes qualification by and experience-based approach was clarified.
- The technical rationale associated with compliance with GDC 4 was updated for clarity.

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