U.S. NUCLEAR REGULATORY COMMISSION

STANDARD REVIEW PLAN

OFFICE OF NUCLEAR REACTOR REGULATION

3.10 SEISMIC AND DYNAMIC QUALIFICATION OF MECHANICAL AND ELECTRICAL EQUIPMENT

REVIEW RESPONSIBILITIES

Primary - Equipment Qualification Branch (EQB)

Secondary - None

I. AREAS OF REVIEW

Information concerning the methods of test and analysis employed to assure the operability of mechanical and electrical equipment (includes instrumentation and control) under the full range of normal and accident loadings (including seismic) should be provided in the applicant's safety analysis report (SAR) and is reviewed by the EQB to assure conformance with the requirements of General Design Criteria 1, 2, 4, 14 and 30 of Appendix A to 10 CFR Part 50, as well as Appendix B to 10 CFR Part 50 and Appendix A to 10 CFR Part 100. 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 covered by this 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, or otherwise are 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 functions manually, and (3) whose failure can prevent the satisfactory accomplishment of one or more of the above safety functions. Examples of mechanical equipment included in these systems are pumps, valves, fans, valve operators, battery and instrument racks, control consoles, cabinets, and panels. Examples of electrical equipment are valve operator motors, solenoid valves, pressure switches, level transmitters, electrical penetrations, and pump and fan motors.

At the construction permit (CP) stage, the staff review covers the following specific areas:

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

2. The methods and procedures including tests and analyses, used to assure structural integrity and the operability of mechanical and electrical equipment in the event of a safety 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.

3. The 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.

At the operating license (OL) stage, the staff audits the equipment qualification files and reviews the results of tests and analyses to assure the proper implementation of criteria established in the CP review, to assure that adequate qualification has been demonstrated for all equipment and their supports, and to verify that all applicable loads have been properly defined and accounted for in the testing/analyses performed.

EQB will coordinate other branches' evaluations that interface with the overall review as follows.

SEB has the responsibility in accordance with SRP Section 3.7 for defining the seismic and dynamic input motion for all floor and wall mounted equipment. MEB has the responsibility in accordance with SRP Section 3.9.2 for defining the seismic and dynamic input motion for all pipe mounted equipment. In addition, MEB has the primary responsibility, in accordance with SRP Section 3.2.2, for defining the systems that perform the functions delineated in paragraph 2 of subsection I of this SRP section.

For those areas of review identified above as being reviewed as part of the primary review responsibility of other branches, the acceptance criteria necessary for the review and their methods of application are contained in the referenced SRP section of the corresponding primary branch.

II. ACCEPTANCE CRITERIA

The acceptance criteria for the areas of review designated in subsection I are based on meeting the relevant requirements of the following regulations:

A. General Design Criteria 1 and 30 as they relate to qualifying equipment to appropriate quality standards commensurate with the importance of the safety functions to be performed.

B. General Design Criterion 2 and Appendix A to 10 CFR Part 100 as they relate to qualifying equipment to withstand the effects of natural phenomena such as earthquakes.

C. General Design Criterion 4 as it relates to qualifying equipment being capable of withstanding the dynamic effects associated with external

missiles and internally generated missiles, pipe whip, and jet impingement forces.

D. General Design Criterion 14 as it relates to qualifying equipment associated with the reactor coolant boundary so as to have an extremely low probability of abnormal leakage, of rapidly propagating failure and of gross rupture.

E. Appendix B to 10 CFR Part 50 as it relates to qualifying equipment using the quality assurance criteria provided.

Specific criteria, regulatory guides, and industry standards that provide information, recommendations and guidance, and in general describe a basis acceptable to the staff that may be used to implement the requirements of the regulations identified above are as follows.

Acceptable load combinations and methods for combining dynamic responses for mechanical equipment are defined in SRP Section 3.9.3. The same criteria is acceptable for electrical equipment.

Acceptable testing and analysis procedures for confirming the operability of equipment for the defined load condition are presented in paragraphs 1 and 2 below. These criteria, when satisfied, will fulfill the requirements of GDC 2 and 4, as discussed above, and paragraphs XI of Appendix B to 10 CFR 50 and VI (a)(1) and (2) of Appendix A to 10 CFR Part 100 as they relate to the qualification of equipment.

1. For plants for which the CP application was docketed after October 27, 1972, the qualification of electrical equipment and their supports should meet the requirements and recommendations of IEEE Std. 344-1975 and the Regulatory Position of Regulatory Guide 1.100, which endorses IEEE Std. 344-1975. These documents are generally applicable to all types of equipment and should be used to the extent practicable for the qualification of mechanical equipment as well. Specifically, conformance to the following criteria should be demonstrated.

   a. Qualification for Equipment Operability

      (1) Tests and analyses are required to confirm the operability 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, transient and accident conditions. Prior to SSE qualification, it should be demonstrated that the equipment can withstand the OBE excitation without loss of structural integrity. Analyses alone, without testing, are acceptable as a basis for qualification only if the necessary functional operability of the equipment is assured by its structural integrity alone. When complete testing is impractical, a combination of tests and analyses is acceptable.

      Equipment that has been previously qualified by means of tests and analyses equivalent to those described here are acceptable provided that proper documentation of such tests and analyses is submitted.

(2) Equipment should be tested in the operational condition. Operability 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. Particular attention should be paid, in operability qualification of mechanical equipment subjected to flow-induced loading, to incorporate degraded flow conditions such as those that might be encountered by the presence of debris, impurities, and contaminants in the fluid system. An example of this may be the operability of the containment sump pump recirculating water full of debris.

(3) The characteristics of the required seismic and dynamic input motions should be specified by response spectrum or time history methods. These characteristics, derived from the structures or systems seismic and dynamic analyses, should be representative of the input motions at the equipment mounting locations.

(4) 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 envelope the required response spectrum (RRS) over the critical frequency range).

(5) Since seismic and the 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 sufficient 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.

(6) 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.

Components that have been previously tested to IEEE Std. 344-1971 should be requalified using biaxial test input motions unless

justification for using a single axis test input motion is provided.

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

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

(9) For pumps and valves, the loads imposed by the attached piping should be properly taken into account. In order to assure operability under combined loadings, the stresses resulting from the applied test loads should envelope the specified service stress limit for which the component's operability is intended.

(10) 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.

(11) 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 operability of the device when it is shown that a meaningful test can be made in this way.

(12) The test program may be based upon selectively testing a representative number of components according to type, load level, size, etc., on a prototype basis.

(13) Selection of damping values for equipment to be qualified should be made in accordance with Regulatory Guide 1.61 and IEEE Std. 344-1975. Higher damping values may be used if justified by documented test data with proper identification of the source and mechanism.

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

(a) 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 operator 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 operability.

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

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

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

iii. 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.

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

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

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

vii. 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 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.

viii. When analyses are used for qualification, the combination of multimodal and multidirectional responses should be made in accordance with Regulatory Guide 1.92.

b. Design Adequacy of Supports

(1) Analyses or tests should be performed for all supports of mechanical and electrical equipment to assure their structural capability.

(2) The analytical results should include the required input motions to the mounted equipment as obtained and characterized in the manner stated in subsection II.1.a.(3) above, and the combined

stresses of the support structures should be in accordance with the criteria specified in SRP Section 3.9.3.

(3) Supports 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 as stated in subsection II.1.a(3) above. In such a case, equipment should be tested separately for operability and the actual input motion to the equipment in this test should be more conservative in amplitude and frequency content that the monitored response from the support test.

(4) The criteria of subsections II.1.a(3), (4), (5), (6), (7), (8), and (13) above, are applicable when tests are conducted on the equipment supports.

c. Verification That Seismic and Dynamic Qualification Is Performed in the Proper Sequences of the Overall Qualification Program

As defined in Part B of Regulatory Guide 1.100, IEEE Std. 344-1975 is an ancilliary standard of IEEE Std 323-1974 (endorsed with exceptions by Regulatory Guide 1.89. In accordance with this standard, for plants whose construction permit SER is dated July 1, 1974, or later, the seismic and dynamic testing portion of the overall qualification should be performed in its proper sequence as indicated in Section 6 of IEEE Std. 323-1974.

2. For plants for which the CP application was docketed before October 27, 1972, applicants should describe the extent to which the seismic and dynamic qualification of mechanical and electrical equipment and their supports meet the criteria of subsection II.1 above. For equipment that does not meet these requirements, justification should be provided for the use of other criteria. As a minimum, the electrical equipment and their supports should meet the requirements of IEEE Std. 344-1971. It should be demonstrated that all equipment has adequate margin to perform their intended design functions during seismic and dynamic events when considering the effects of possible multi-mode response and simultaneous vertical and horizontal excitations on equipment operability. Specifically, in addition to the criteria of subsection II.1.a(1), (2), (7), (8), (9), (10), (11), (12), (13), and (14) above, the following criteria are applicable.

a. Qualification for Equipment Operability

(1) Single frequency input excitations, such as continuous single frequency sinusoidal motions or sine beat motions may be used; however, multifrequency input excitations as delineated in IEEE Std. 344-1975 are preferable and should be utilized whenever possible. In either case, the maximum input motion acceleration should equal or exceed the maximum seismic and dynamic acceleration expected at the equipment mounting location. See subsection II.2.b(3) below for a discussion of the participation of the equipment supports.

(2) For single frequency input excitation, the discrete frequencies at which the test input motion is applied should cover 1-33 Hz for seismic loads. For other dynamic loads, such as in the case of hydrodynamic loads for Mark II and III containments, larger frequency ranges may be required. If resonant frequencies of the equipment and equipment supports are identified by prior analysis or "sweep" testing or both, tests conducted only at the resonant frequencies are acceptable. However, if multi-frequency input excitations are used, the level of response spectrum derived from the test input should envelope the corresponding response spectrum level required for seismic and dynamic qualification at the component mounting location.

(3) The test motion may be applied to one vertical and two orthogonal horizontal axes separately. However, biaxial input with simultaneous vertical and horizontal excitations as delineated in IEEE Std. 344-1975 is preferable and should be utilized whenever possible.

b. Design Adequacy of Supports

(1) Analyses or tests should be performed for all supports of mechanical and electrical equipment to assure their structural capability.

(2) The analytical results should include the maximum accelerations and associated frequencies at the equipment mounting location, and the combined stresses of the support structures should be in accordance with the criteria specified in SRP Section 3.9.3.

(3) Supports should be tested with equipment installed or with a dummy simulating the equivalent inertial mass effects and dynamic coupling to the support. If the equipment is installed in a nonoperational mode for the support test, the response at the equipment mounting location should be monitored such that the maximum accelerations and associated frequencies can be defined. In such a case, equipment should be tested separately for operability and the actual input motion to the equipment should be more conservative in amplitude and frequency content than the monitored response.

(4) The criteria of subsections II.1.a(7), (8), and (13) and II.2.a(1), (2), and (3), above, are applicable when tests are conducted on the equipment supports.

3. GDC 1 of Appendix A and paragraph XVII of Appendix B to 10 CFR 50 establish requirements for records concerning the qualification of equipment. In order to satisfy these requirements, complete and auditable records must be available and maintained by the applicant, for the life of the plant, at a central location. Their 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 maintained current as equipment is replaced, further tested, or otherwise further qualified.

The equipment qualification file should contain a list of all systems equipment and the equipment support structures, as defined in paragraph 2 of subsection I. The equipment list should identify which equipment is NSSS supplied and which equipment is BOP supplied. 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 should be so identified.

b. Physical description, including dimensions, weight and field mounting condition. 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 confirm to the Regulatory Position of Regulatory Guide 1.148.

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

i. 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.

j. Indicate whether the equipment has met the qualification requirements.

k. Availability for inspection, i.e., identify whether the equipment is already installed.

l. 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.

4. General Design Criterion 14 of Appendix A to 10 CFR 50 requires, in part, that the reactor coolant pressure boundary shall be designed, fabricated, erected, and tested so as to have an extremely low probability of abnormal leakage. General Design Criterion 30 further requires, in part, that

components which are part of the reactor coolant pressure boundary shall be designed , fabricated, erected, and tested to the highest quality standards practical.

In order to satisfy these requirements, the qualification program for valves that are part of the reactor coolant pressure boundary should include testing or testing and analyses that demonstrate these valves will not experience any leakage, or increase in leakage, as a result of any loading or combination of loadings that the valves must be qualified for.

5. In documenting the implementation of the qualification program described above, the following information should be included in the indicated documents.

   a. The PSAR should contain:

      (1) A detailed description of NSSS and 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, 2, 3, and 4 above.

      (2) 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 of the 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 FSAR should contain:

      (1) A list of all systems required to perform the functions defined in paragraph 2 of subsection I.

      (2) 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:

      (1) The list of systems required to perform the functions defined in paragraph 2 of subsection I.

      (2) The list of equipment, and their supports, associated with each system, and any other equipment required in accordance with paragraph 2 of subsection I.

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

III. REVIEW PROCEDURES

The reviewer will select and emphasize material from the procedures described below as may be appropriate for a particular case. The reviewer obtains and uses information from SRP Sections 3.7 and 3.9.2 and consults with SEB and MEB as necessary to be assured that the proper seismic and dynamic input motion is being used for the equipment qualification. For each area of review the following review procedures are used:

1. At the CP stage, the staff reviews the program which the applicant has described in the PSAR for the qualification of mechanical and electrical equipment. The program is measured against the requirements listed in subsection II. Of particular interest are the proper use of test and analytical procedures. Equipment which is too complex for reliable mathematical modeling should be tested unless the analytical procedures and corresponding design are convincingly conservative. Both the test and the analysis methods are reviewed for assurance that all important modes of response will be excited in tests or considered in analysis. Proper consideration of input motions so as to envelope the required input, whether in terms of response spectra or time history in all necessary directions is verified. The use and treatment of supports is also reviewed.

2. At the OL stage, the staff reviews the program again as described by the applicant in the FSAR. In addition, the SQR may be reviewed 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.

   To confirm the extent to which the equipment meets the requirements of subsection II, the staff audits the equipment qualification and central files and conducts a plant site review. The staff may require that the Seismic Qualification Report (SQR) be submitted to the staff six weeks prior to the plant site visit. If the staff has reviewed an applicant's qualification file for a previous application, they may elect not to require the applicant to submit the SQR, but instead elect 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 site visit, the applicant may be required to submit selected documents for further review.

c. For selected equipment, the staff reviews the combined required response spectra (RRS) or the combined dynamic response, examines the equipment configuration and mounting, and then determines whether the test of analysis which has been conducted demonstrates compliance with the RRS if the equipment was qualified by test, or the acceptable analytical criteria if qualified by analysis.

d. A sampling of design (functional) specifications shall be reviewed for completeness. For pumps and valves the reviewer utilizes the information contained in the following documents in addition to the acceptance criteria cited under subsections II.1 and II.2 in order to evaluate the functional specifications selected for review:

(1) NRC Regulatory Guide 1.148, "Functional Specification for Active Valve Assemblies in Systems Important to Safety in Nuclear Power Plants."

(2) ANSI N278.1-1975, "Self-Operated and Power-Operated Safety-Related Valves Functional Specification Standard" (endorsed by Regulatory Guide 1.148, as supplemental and modified).

(3) ANSI/ASME N551.1, "Standard for Qualification of ASME Code Class 2 & 3 Pump Assemblies for Safety Systems Service, General Requirements" (DRAFT). (Although this draft standard has not been endorsed by the NRC, it will be used for guidance purposes.)

It is important that the applicants program is complete in this area so that the staff may be assured 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 test procedures are reviewed against the criteria set forth in subsections II.1 or II.2. In evaluating an applicant's program for pumps and valves, the reviewer also utilizes, for guidance purposes, the information contained in the following documents, although these draft documents have not been endorsed by the NRC:

(1) ANSI B.16.41, "Functional Qualification Requirements for Power Operated Active Valve Assemblies for Nuclear Power Plants" (DRAFT)

(2) ANSI N41.6, "Functional Qualification Requirements for Actuators for Power Operated Valve Assemblies for Nuclear Power Plants" (DRAFT)

(3) ANSI/ASME N551.2, "Standard for Qualification of ASME Code Class 2 & 3 Pumps for Safety Systems Service" (DRAFT)

(4) ANSI N45 N551.4, "Functional Qualification of Motor Drives for Safety Related Code Class 2 and 3 Pumps for Nuclear Power Plants" (DRAFT)

In addition to the above documents, references 23 and 24 are utilized by the reviewer to evaluate the operability assurance programs for purge and vent valves and deep draft pumps.

f. The analytical procedures which are used in conjunction with testing or by itself to demonstrate operability are reviewed by comparing the information submitted in the applicants program with the acceptance criteria delineated in subsections II.1 or II.2. For pumps and valves, the references cited in subsection III.2.e provide additional criteria for demonstrating operability by analysis and are utilized by the reviewer to supplement the staff's review procedures.

IV. EVALUATION FINDINGS

The reviewer should verify that sufficient information has been provided and that the review supports conclusions of the following type (for a CP review), to be included in the staff's safety evaluation report:

The staff concludes that the applicant's equipment qualification program is acceptable and meets the relevant requirements of General Design Criteria 1, 2, 4, 14, and 30, Appendix B to 10 CFR Part 50 and Appendix A to 10 CFR Part 100. This conclusion is based on the following:

> The qualification program which will be implemented for mechanical, instrumentation and electrical equipment meets the requirements and recommendations of IEEE 344-1975 and the Regulatory Positions of Regulatory Guides 1.61, 1.89, 1.92, 1.100, and 1.148 and provides adequate assurance that such equipment will function properly under all imposed design and service loads including the loadings imposed by the safe shutdown earthquake, postulated accidents, and loss-of-coolant accidents. This program constitutes an acceptable basis for satisfying the applicable requirements of GDC 2, 4, 14 and 30 of Appendix A to 10 CFR 50 and paragraphs XI of Appendix B to 10 CFR 50 and VI(a)(1) and (2) of Appendix A to 10 CFR 100 as they relate to qualification of equipment. The applicant's equipment qualification file also constitutes an acceptable basis for satisfying the requirements of GDC 1 of Appendix A to 10 CFR 50 and paragraph XVII of Appendix B to 10 CFR 50.

At the OL stage, the review should provide justification for a finding similar to that above with the phrase "will be implemented" modified to read "has been implemented."

V. IMPLEMENTATION

The following is intended to provide guidance to applicants and licensees regarding the NRC staff's plan for using this SRP section. Except in those cases in which the applicant proposes an acceptable alternative method for complying with specified portions of the Commission's regulations, the method described herein will be used by the staff in its evaluation of conformance with Commission regulations.

Implementation schedules for conformance to parts of the method discussed herein are contained in the referenced regulatory guides.

VI. REFERENCES

1. 10 CFR Part 50, Appendix A, General Design Criterion 1, "Quality Standards and Records."

2. 10 CFR Part 50, Appendix A, General Design Criterion 2, "Design Bases for Protection Against Natural Phenomena."

3. 10 CFR Part 50, Appendix A, General Design Criterion 4, "Environmental and Missile Design Bases."

4. 10 CFR Part 50, Appendix A, General Design Criterion 14, "Reactor Coolant Pressure Boundary."

5. 10 CFR Part 50, Appendix A, General Design Criterion 30, "Quality of Reactor Coolant Pressure Boundary."

6. 10 CFR Part 50, Appendix B, "Quality Assurance Criteria For Nuclear Power Plants and Reprocessing Plants."

7. 10 CFR 100, Appendix A, "Seismic and Geologic Siting Criteria For Nuclear Power Plants."

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

9. IEEE Std 344-1975, "Recommended Practices for Seismic Qualification of Class 1E Equipment for Nuclear Power Generating Stations," Institute of Electrical and Electronics Engineers.

10. K. M. Skreiner, E. G. Fischer, S. N. Hou, and G. Shipway, "New Seismic Requirements for Class 1 Electrical Equipment," IEEE Paper T 74 048-5, 1974 Winter Meeting of IEEE Power Engineering Society, Institute of Electrical and Electronics Engineers.

11. NRC Regulatory Guide 1. 61, "Damping Values for Seismic Design of Nuclear Power Plants."

12. NRC Regulatory Guide 1.89, "Qualification of Class 1E Equipment for Nuclear Power Plants."

13. NRC Regulatory Guide 1.92, "Combining Modal Responses and Spatial Components in Seismic Response Analysis."

14. NRC Regulatory Guide 1.100, "Seismic Qualification of Electric Equipment for Nuclear Power Plants."

15. IEEE Std 323-1974, "IEEE Standard for Qualifying Class IE Equipment for Nuclear Power Generating Stations," Institute of Electrical and Electronics Engineers.

16. NRC Regulatory Guide 1.148, "Functional Specification for Active Valve Assemblies in Systems Important to Safety in Nuclear Power Plants."

17. ANSI N278.1-1975, "Self-Operated and Power-Operated Safety-Related Valves Functional Specification Standard."

18. ANSI/ASME N551.1, "Standard for Qualification of ASME Code Class 2 & 3 Pump Assemblies for Safety Systems Service, General Requirements" (DRAFT)

19. ANSI B.16.41, "Functional Qualification Requirements for Power Operated Active Valve Assemblies for Nuclear Power Plants" (DRAFT)

20. ANSI N41.6, "Functional Qualification Requirements for Actuators for Power Operated Valve Assemblies for Nuclear Power Plants" (DRAFT)

21. ANSI/ASME N551.2, "Standard for Qualification of ASME Code Class 2 & 3 Pumps for Safety Systems Service" (DRAFT)

22. ANSI N45 N551.4, "Functional Qualification of Motor Drives for Safety Related Code Class 2 and 3 Pumps for Nuclear Power Plants" (DRAFT)

23. Enclosure to September 27, 1979, Letter from D. G. Eisenhut, Acting Director, Division of Operating Reactors, NRR, USNRC, to all Licensees of Operating Reactors, entitled, "Guidelines for Demonstration of Operability of Purge and Vent Valves."

24. Enclosure to June 22, 1981, Memorandum from R. Vollmer, Director, Division of Engineering, NRR, USNRC, to D. Eisenhut, Director, Division of Licensing, NRR, USNRC, entitled, "Guidelines for Demonstration of Operability of Deep Draft Pumps."