



U.S. NUCLEAR REGULATORY COMMISSION

STANDARD REVIEW PLAN

3.11 ENVIRONMENTAL QUALIFICATION OF MECHANICAL AND ELECTRICAL EQUIPMENT

REVIEW RESPONSIBILITIES

Primary - Organization responsible for the review of environmental qualification of electrical equipment

Secondary - Organization responsible for **digital** instrumentation and controls

Organization responsible for the review of environmental qualification of mechanical equipment

I. AREAS OF REVIEW

The information presented in Section 3.11 of the applicant's safety analysis report (SAR) should be sufficient to support the conclusion that all items of equipment that are important to safety (mechanical and electrical, including **digital** instrumentation and controls) are capable of performing their design safety functions under all normal environmental conditions, anticipated operational occurrences, and accident and post-accident environmental conditions. The "normal environmental conditions, anticipated operational occurrences, and accident and post-accident environmental conditions" include all environmental conditions that may result from any normal mode of plant operation, anticipated operational occurrences, design basis events, post-design basis events, and containment tests.

The review will be performed to ensure conformance with the requirements of **10 CFR 50.34(f)(2)(ix)**, 10 CFR 50.49, **10 CFR 50.67**, 10 CFR Part 50, Appendix A, General

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USNRC STANDARD REVIEW PLAN

This Standard Review Plan, NUREG-0800, has been prepared to establish criteria that the U.S. Nuclear Regulatory Commission staff responsible for the review of applications to construct and operate nuclear power plants intends to use in evaluating whether an applicant/licensee meets the NRC's regulations. The Standard Review Plan 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 an acceptable method of complying with the NRC regulations.

The standard review plan sections are numbered in accordance with corresponding sections in the Regulatory Guide 1.70, "Standard Format and Content of Safety Analysis Reports for Nuclear Power Plants (LWR Edition)." Not all sections of the standard format have a corresponding review plan section. The SRP sections applicable to a combined license application for a new light-water reactor (LWR) will be based on Regulatory Guide 1.206, "Combined License Applications for Nuclear Power Plants (LWR Edition)," until the SRP itself is updated.

These documents are made available to the public as part of the NRC's policy to inform the nuclear industry and the general public of regulatory procedures and policies. Individual sections of NUREG-0800 will be revised periodically, as appropriate, to accommodate comments and to reflect new information and experience. Comments may be submitted electronically by email to NRR_SRP@nrc.gov.

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Design Criteria 1, 2, 4, and 23; 10 CFR Part 50, and Appendix B, Quality Assurance Criteria III, XI, and XVII. Section 50.49 of 10 CFR contains specific requirements regarding the qualification of electrical equipment important to safety that are located in a harsh environment. Electrical equipment important to safety are described in 10 CFR 50.49(b).

The specific areas of review are as follows:

1. Mechanical and electrical **including digital instrumentation and control** equipment associated with systems described in this paragraph are reviewed to determine whether they are designed to meet the requirements described under the acceptance criteria of this SRP section. Mechanical and electrical equipment covered by this SRP section include the following:
 - A. Equipment associated with systems that are essential for 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,
 - B. Equipment that initiates the above functions automatically,
 - C. Equipment that is used by the operators to initiate the above functions manually,
 - D. Equipment whose failure can prevent the satisfactory accomplishment of one or more of the above safety functions,
 - E. Other electrical equipment important to safety, as described in 10 CFR 50.49(b)(1) and (2), and
 - F. Certain post-accident monitoring equipment, as described in 10 CFR 50.49(b)(3) and Regulatory Guide 1.97.
2. Section 3.11 of the SAR is reviewed to determine whether the required environmental qualification of all equipment important to safety will be, or has been adequately demonstrated. The term "environmental qualification" means verification of design, limited to demonstrating that electrical or mechanical **or digital instrumentation and control** equipment are capable of performing their safety function under significant environmental stresses resulting from design basis events in order to avoid common-cause failure.
3. At the construction permit (CP) stage, the staff review considers the conceptual approach for the environmental qualification program addressing the following areas:
 - A. Identification of all mechanical and electrical systems required to perform the functions defined in Subsection I, Item 1, above.
 - B. Identification of the environmental design bases for the equipment identified, including the definition of anticipated operational occurrences and normal, accident, and post-accident environments.
 - C. Requirements for documentation of the qualification tests and analyses that have been, or will be performed on the equipment to meet the design bases.
 - D. Demonstration of the adequacy of the environmental qualification program.

4. At the operating license (OL) stage, the staff's review includes the following:
 - A. A review of the applicant's environmental qualification program and the submitted results of its implementation.
 - B. An audit of the applicant's central file, including a review of the documentation provided in the file to demonstrate tangible evidence of qualification. The staff's review is performed to determine (1) proper implementation of criteria established in the CP review, and (2) adequate environmental qualification for all mechanical and electrical equipment covered by this SRP section.
5. The staff's review for design certification consists of an evaluation of the applicant's approach for selecting and identifying equipment required to be environmentally qualified for the standard design.
6. For a combined license (COL) application, the staff reviews the environmental qualification program descriptions and their proposed implementation milestones. The staff's review is performed using the acceptance criteria and review procedures described in this SRP section.
7. Inspection, Test, Analysis, and Acceptance Criteria (ITAAC). For design certification (DC) and COL reviews, the applicant's proposed information on the ITAAC associated with the systems, structures, and components (SSCs) related to this SRP section is reviewed in accordance with SRP Section 14.3, "Inspections, Tests, Analyses, and Acceptance Criteria - Design Certification." The staff recognizes that the review of ITAAC is performed after review of the rest of this portion of the application against acceptance criteria contained in this SRP section. Furthermore, the ITAAC are reviewed to assure that all SSCs in this area of review are identified and addressed as appropriate in accordance with SRP Section 14.3.

Protection of mechanical and electrical equipment against other natural phenomena and external events is addressed in other SRP sections, as described under Review Interfaces in this subsection.

Review Interfaces

The listed SRP sections interface with this section as follows:

1. Review of seismic and dynamic qualification of mechanical and electrical equipment is performed under in SRP Section 3.10.
2. Review of potential adverse flow effects on mechanical and electrical equipment (such as electromatic relief valves in plant steam systems) from pressure fluctuations and vibration caused by acoustic resonances and hydrodynamic forces are addressed in SRP 3.9.5.
3. Review of the adequacy of the design, installation, inspection, and testing of containment systems is performed under SRP Sections 6.2.1 through 6.2.6. The review confirms that (1) the SAR identifies each item of equipment described in Subsection I, Item 1, of this SRP Section, (2) the validity of the descriptions of anticipated operational occurrences, and normal, accident, and post-accident environments provided in the SAR for this equipment, and (3) the acceptability of the values provided in the SAR for

the length of time that the equipment is required to operate under accident environments. The review also confirms that the SAR identifies the location of each item of equipment described in Subsection I, Item 1, of this SRP section, both inside and outside the containment. Inside the containment, the location must be specified, whether inside or outside of the missile shield for pressurized-water-reactor (PWR) plants, or whether inside or outside of the drywell for boiling-water-reactor (BWR) plants.

4. The adequacy of the design, installation, inspection, and testing of the Reactor Core Isolation Cooling system, the Residual Heat Removal system, and the Emergency Core Cooling system, and the accident analysis are reviewed as part of SRP Sections 5.4.6, 5.4.7, 6.3, and applicable sections of Chapter 15, respectively. The reviews confirm that (1) the SAR identifies each item of equipment described in Subsection I, Item 1, of this SRP section, (2) the validity of the descriptions of anticipated operational occurrences, and normal, accident, and post-accident environments provided in the SAR for this equipment, and (3) the acceptability of the values provided in the SAR for the length of time that the equipment is required to operate under accident environments.
5. The adequacy of the design, installation, inspection, and testing of digital instrumentation and controls is reviewed as part of SRP Chapter 7. Guidance for the qualification of digital instrumentation and control equipment located in both mild and harsh environment is also provided in SRP Chapter 7. The review confirms that (1) the SAR identifies each item of equipment described in Subsection I, Item 1, of this SRP section, (2) the validity of the descriptions of anticipated operational occurrences, and normal, accident, and post-accident environments provided in the SAR for this equipment, and (3) the acceptability of the values provided in the SAR for the length of time that the equipment is required to operate under accident environments.
6. The adequacy of the design, installation, inspection, and testing of electric power systems is reviewed as part of SRP Chapter 8. The review confirms that (1) the SAR identifies each item of equipment described in Subsection I, Item 1, of this SRP section, (2) the validity of the descriptions of anticipated operational occurrences, and normal, accident, and post-accident environments provided in the SAR for this equipment, and (3) the acceptability of the values provided in the SAR for the length of time that the equipment is required to operate under accident environments.
7. The adequacy of the design, installation, inspection, and testing of the containment spray system is reviewed as part of SRP Section 6.5.2. The review confirms that (1) the SAR identifies each item of equipment described in Subsection I, Item 1, of this SRP section, (2) the validity of the descriptions of anticipated operational occurrences, and normal, accident, and post-accident environments provided in the SAR for this equipment, and (3) the acceptability of the values provided in the SAR for the length of time that the equipment is required to operate under accident environments.
8. With regard to the environments resulting from loss of environmental control systems (heat tracing, ventilation, heating, air conditioning), the organization responsible for reviewing digital instrumentation and controls will confirm the description of these environments, as provided in the SAR, for those areas that contain equipment, including electrical control and instrumentation equipment, and instrument sensing lines that rely on heat tracing for freeze protection.
9. The organization responsible for SRP Chapter 17 determines that the applicant's quality assurance (QA) program satisfies the requirements of 10 CFR Part 50, Appendix B, Criteria III, XI, and XVII.

10. The organization responsible for reviewing emergency preparedness and radiation protection confirms the adequacy of the radiation and chemical conditions for qualification for accident and post-accident environments, as well as anticipated operational occurrences.
11. The organization responsible for reviewing the containment spray system reviews 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, as part of its primary review responsibility for SRP Section 3.13 Draft Rev. 0 - April 1996.
12. The functional design and qualification of mechanical and electrical equipment are addressed in several subsections of SRP Section 3. For example, SRP 3.9.5 includes evaluation of potential adverse flow effects on mechanical and electrical equipment (such as electromatic relief valves in BWR steam systems) from pressure fluctuations and vibration caused by acoustic resonances and hydrodynamic forces. SRP 3.9.6 includes functional design and qualification of pumps, valves, and dynamic restraints at a nuclear power plant. SRP Section 3.10 includes seismic and dynamic qualification of mechanical and electrical equipment.

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

II. ACCEPTANCE CRITERIA

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

1. 10 CFR 50.34 (f)(2)(ix), "Contents of Applications; Technical Information," "Additional TMI-Related Requirements".
2. 10 CFR 50.49, "Environmental Qualification of Electric Equipment Important to Safety for Nuclear Power Plants."
3. 10 CFR 50.67, "Accident Source Term."
4. 10 CFR Part 50, Appendix A, General Design Criterion 1, "Quality Standards and Records."
5. 10 CFR Part 50, Appendix A, General Design Criterion 2, "Design Bases for Protection Against Natural Phenomena."
6. 10 CFR Part 50, Appendix A, General Design Criterion 4, "Environmental and Dynamic Effects Design Bases."
7. 10 CFR Part 50, Appendix A, General Design Criterion 23, "Protection System Failure Modes."
8. 10 CFR Part 50, Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants," Section III, "Design Control."

9. 10 CFR Part 50, Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants," Section XI, "Test Control."
10. 10 CFR Part 50, Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants," Section XVII, "Quality Assurance Records."
11. 10 CFR 52.47(a)(1)(vi), which requires ITAAC (for design certification) sufficient to assure that the SSCs in this area of review will operate in accordance with the certification.
12. 10 CFR 52.97(b)(1), which requires ITAAC (for combined licenses) sufficient to assure that the SSCs in this area of review have been constructed and will be operated in conformity with the license and the Commission's regulations.

The general requirements for environmental design and qualification can be summarized as follows: (1) the equipment shall be designed to have the capability of performing its design safety functions under all anticipated operational occurrences and normal, accident, and post-accident environments, and for the length of time for which its function is required; (2) the equipment's environmental qualification shall be demonstrated by appropriate testing and analyses; and (3) a quality assurance program meeting the requirements of 10 CFR Part 50, Appendix B, shall be established and implemented to provide assurance that all requirements have been satisfactorily accomplished. The environmental qualification of mechanical and electrical equipment is acceptable when it can be ascertained that all three requirements have been met.

Specific criteria acceptable to meet¹ the relevant requirements of the Commission's regulations identified above are as follows for each review described in Subsection I of this SRP section:

1. NUREG-0588, "Interim Staff Position on Environmental Qualification of Safety-Related Electrical Equipment," Revision 1, July 1981 provides specific criteria for assessing the acceptability of the environmental qualification program. NUREG-0588 (endorsed by the Commission Memorandum and Order CLI-80-21, dated May 23, 1980) discusses the staff's position and acceptance criteria on the environmental qualification of electrical equipment. These criteria are general in nature and can also be applied to mechanical equipment.

NUREG-0588 includes two sets of qualification requirements, Category I and Category II. Category I refers to IEEE Std 323-1974, "IEEE Standard for Qualifying Class 1E Equipment for Nuclear Power Generating Stations." Category I applies to plants whose construction permit SERs were dated after July 1, 1974, and is applicable to all future plants. Category II refers to IEEE Std 323-1971, and applies to plants whose construction permit SERs were dated before July 1, 1974, unless the licensee made a commitment in the construction permit record to use the 1974 standard, or unless the operating license application indicates the 1974 standard is to be used, in

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which case Category I will be the applicable criteria to be used. Category II will not be applicable to any future plants.

2. IEEE Std 323 contains a clear presentation of the principles and criteria that are generic to the environmental qualification process. Although specifically written for Class 1E electric equipment, IEEE Std 323 is considered applicable to the environmental qualification of other types of equipment. IEEE Std 323 contains detailed criteria applicable to whatever method of qualification is used, i.e., type testing, analyses, operating experience, ongoing qualification, or combined qualification. The following clarifications related to the criteria in IEEE Std. 323 should be considered.

IEEE Std 323 requires that the service environment, including the installed configuration of the equipment, be considered as part of the qualification process. In meeting this requirement, the potential for flooding of electrical equipment that are installed above the flood level, but are subject to water and moisture intrusion, should be considered as part of the environmental qualification program. Operating experience, documented in Information Notice 89-63, shows that electrical enclosures that are located above the flood level and are subject to water and moisture intrusion could result in submergence of electrical components inside the enclosures, if the enclosures do not have drainage holes. The reviewer should confirm that equipment in such locations, whose design is such that water accumulation is possible, have drainage holes to allow drainage of any accumulated water.

IEEE Std 323 requires that the equipment service environment, including the environmental conditions under which the equipment must operate, be considered as part of the qualification process. In meeting this requirement, the potential for a deficiency relating to environmental qualification of electrical cable/connection systems due to overly accelerated aging should be considered as part of the review of the environmental qualification program. Test Results, summarized in Information Notice 98-21, show that degradation of electrical cable/connections that were aged using lower aging acceleration rates than those commonly used in qualification tests resulted in very low or marginal insulation resistance values, and failure of several types of cable connectors. This raised potential concerns relating to the long-term environmental qualification of these components. As a result, qualification test results should be evaluated while considering the specific application and set of environmental conditions under which the equipment must operate. The reviewer should confirm that the environmental qualification program has addressed this concern.

IEEE Std 323 requires that the equipment being tested be connected in a manner that simulates its expected installation when in actual use, including cables and connections. In meeting this requirement, the need for integrated qualification testing of high-range radiation monitors (HRRMs) together with the cables and containment penetration pigtailed used on these monitors should be considered as part of the review of the environmental qualification program. Operating experience, documented in Information Notice 97-45 and Supplement 1 to IN 97-45, shows that lack of integrated testing of the HRRM system as a whole may have contributed to a deficiency in the environmental qualification of this equipment at some plants. This deficiency resulted in qualified HRRMs indicating spurious changes in radiation levels while in service due to environmental transients (e.g., temperature fluctuations) that were unrelated to actual changes in radiation levels. The reviewer should confirm that the environmental qualification program has addressed this concern.

3. Regulatory Guide 1.30 (Safety Guide 30), "Quality Assurance Requirements for the Installation, Inspection, and Testing of Instrumentation and Electric Equipment," provides guidance acceptable to the staff for meeting the quality assurance requirements for instrumentation and electric equipment. These criteria, as supplemented by those of Regulatory Guide 1.89, should be used to evaluate the quality assurance aspects of the environmental qualification program for safety-related instrumentation and electric equipment.
4. Regulatory Guide 1.40, "Qualification Tests of Continuous-Duty Motors Installed Inside the Containment of Water-Cooled Nuclear Power Plants," endorses IEEE Std 334, "IEEE Trial Use Guide for Type Tests of Continuous-Duty Class 1 Motors Installed Inside the Containment of Nuclear Power Generating Stations." These documents contain guidance acceptable to the staff for the environmental qualification of Class 1E motors, and should be used in conjunction with NUREG-0588 and Regulatory Guide 1.89, as appropriate, for evaluating the environmental qualification of Continuous-Duty Class 1E Motors.
5. Regulatory Guide 1.63, "Electrical Penetration Assemblies in Containment Structures for Nuclear Power Plants," endorses IEEE Std 317, "IEEE Standard for Electric Penetration Assemblies in Containment Structures for Nuclear Power Generating Stations." These documents contain general guidance that is acceptable to the staff for the qualification of electrical penetration assemblies, and should be used in conjunction with NUREG-0588 and Regulatory Guide 1.89, as appropriate, for evaluating the environmental qualification of electrical penetration assemblies.
6. Regulatory Guide 1.73, "Qualification Tests of Electric Valve Operators Installed Inside the Containment of Nuclear Power Plants," endorses IEEE Std 382, "IEEE Trial Use Guide for Type Test of Class 1E Electric Valve Operators for Nuclear Power Generating Stations." These documents contain guidance acceptable to the staff for the environmental qualification of Class 1E electric valve operators, and should be used in conjunction with NUREG-0588 and Regulatory Guide 1.89, as appropriate, for evaluating the environmental qualification of Class 1E electric valve operators.
7. Regulatory Guide 1.89, "Environmental Qualification of Certain Electric Equipment Important to Safety in Nuclear Power Plants," provides guidance for implementing the requirements and criteria of 10 CFR 50.49 for environmental qualification of electrical equipment that is important to safety and located in a harsh environment. Regulatory Guide 1.89 endorses the provisions of IEEE Std 323 as being acceptable to the staff, and provides supplementary guidance for satisfying the Commission's regulations regarding the environmental qualification of electrical equipment located in a harsh environment.
8. Regulatory Guide 1.97, "Instrumentation for Light-Water-Cooled Nuclear Power Plants to Assess Plant and Environs Conditions During and Following an Accident," provides guidance acceptable to the staff for qualifying the post-accident monitoring equipment described in Subsection I, Item 1(f), of this SRP section as well as instruments and controls for the equipment described in Subsection I, Items 1(a) to 1(e), of this SRP section. These criteria, as supplemented by those of Regulatory Guide 1.89, should be used to evaluate the environmental qualification of the I&C equipment.
9. Regulatory Guide 1.131, "Qualification Tests of Electric Cables and Field Splices for Light-Water-Cooled Nuclear Power Plants," endorses IEEE Std 383, "Standard for Type Test of Class 1E Electric Cables and Field Splices for Nuclear Power Generating

Stations." These documents contain guidance acceptable to the staff for the environmental qualification of Class 1E electric cables and field splices, and should be used in conjunction with NUREG-0588 and Regulatory Guide 1.89, as appropriate, for evaluating the environmental qualification of Class 1E electric cables and field splices.

10. Regulatory Guide 1.151, "Instrument Sensing Lines," provides guidance acceptable to the staff to address the potentially adverse effects of inadvertent condensate formation in, and/or freezing of, safety related instrument sensing lines, which could prevent the affected instrumentation from performing its intended safety function. The reviewer should confirm that the applicant has identified any safety related sensing lines that rely on heat tracing and/or room heating for prevention of possible condensate formation or freezing, and ensured that the I&C equipment used to control the environment for this equipment are included in the environmental qualification program. The guidance provided in Regulatory Guide 1.151 should be followed in this regard.
11. Regulatory Guide 1.156, "Environmental Qualification of Connection Assemblies for Nuclear Power Plants," endorses IEEE Std 572, "IEEE Standard for Qualification of Class 1E Connection Assemblies for Nuclear Power Generating Stations." These documents contain guidance acceptable to the staff for the environmental qualification of Class 1E connection assemblies, and should be used in conjunction with NUREG-0588 and Regulatory Guide 1.89, as appropriate, for evaluating the environmental qualification of Class 1E connection assemblies.
12. Regulatory Guide 1.158, "Qualification of Safety-Related Lead Storage Batteries for Nuclear Power Plants," endorses IEEE Std 535, "IEEE Standard for Qualification of Class 1E Lead Storage Batteries for Nuclear Power Generating Stations." These documents contain guidance acceptable to the staff for the environmental qualification of Class 1E lead storage batteries, and should be used in conjunction with NUREG-0588 and Regulatory Guide 1.89, as appropriate, for evaluating the environmental qualification of lead storage batteries.
13. Regulatory Guide 1.180, "Guidelines for Evaluating Electromagnetic and Radio-Frequency Interference in Safety-Related Instrumentation and Control Systems," provides guidance acceptable to the staff for determining electromagnetic compatibility for I&C equipment during service. These criteria, as supplemented by those of Regulatory Guide 1.89, should be used to evaluate the environmental qualification of safety-related I&C equipment in harsh environment. Guidance for the qualification of digital instrumentation and control equipment located in both mild and harsh environment is also provided in SAR Chapter 7.
14. Regulatory Guide 1.183, "Alternative Radiological Source Terms for Evaluating Design Basis Accidents at Nuclear Power Reactors," provides guidance acceptable to the staff for determining the radiation dose and dose rate for equipment during postulated accident conditions. These criteria, as supplemented by those of Regulatory Guide 1.89, should be used to evaluate the accident source term used in the environmental qualification of equipment important to safety. The following supplemental information related to source term requirements and radiation environments, as they relate to environmental qualification, should also be considered.

10 CFR 50.67, "Accident Source Term," provides the requirements for licensees to revise the accident source term used in design basis radiological analyses for plants licensed prior to 1997. This allows older plants to use the newer alternative source terms in their design basis analyses.

Radiation dose and dose rate used to determine the radiation environment for qualification of electrical and mechanical equipment must be based on an NRC staff-approved source term and methodology, as discussed in NUREG-0588 and as supplemented by Section II.B.2 of NUREG-0737, "Clarification of TMI Action Plan Requirements," and NUREG-0718, "Licensing Requirements for Pending Applications for Construction Permits and Manufacturing License," or as discussed in NUREG-1465, "Accident Source Terms for Light-Water Nuclear Power Plants." The radiation environment must be based on the integrated effects of the normally expected radiation environment over the equipment's installed life, plus the effects associated with the most severe design basis event during or following which the equipment is required to remain functional. The effects of beta radiation must also be considered in the qualification program. The effects of radiation exposure due to recirculatory fluid must be considered for equipment located outside the containment.

The staff's definition of what constitutes a mild radiation environment for electronic components, such as semiconductors or electronic components containing organic material, differs from that for other equipment. The staff's position, as stated in NUREG-1462, "Final SER CE80, Chapter 3, Design of Structures, Components, Equipment, and Systems: Application of National Codes and Standards in Design Certification," NUREG-1503, "Final SER ABWR, Chapter 3, Design of Structures, Components, Equipment, and Systems," and NUREG-1793, "Final SER AP1000, Chapter 3, Design of Structures, Components, Equipment, and Systems," is that a mild radiation environment for electronic equipment is a total integrated dose less than 10 Gy (10^3 rad), and a mild radiation environment for other equipment is less than 100 Gy (10^4 rad).

15. IEEE Std 381, "IEEE Standard Criteria for Type Tests of Class 1E Modules Used in Nuclear Power Generating Stations," IEEE Std 627, "IEEE Standard for Design Qualification of Safety Systems Equipment Used in Nuclear Power Generating Station;" IEEE Std 649, "IEEE Standard for Qualifying Class 1E Motor Control Centers for Nuclear Power Generating Stations;" and IEEE Std 650, "IEEE Standard for Qualification of Class 1E Static Battery Chargers and Inverters for Nuclear Power Generating Stations," can be used for reference purposes even though NRC has not formally endorsed these standards through the issuance of a regulatory guide.
16. The effects of chemical exposure must be addressed in the environmental qualification program. The concentration of chemicals used for qualification must be equivalent to, or more severe than that resulting from the most limiting mode of plant operation (e.g., containment spray, emergency core cooling system initiation, or recirculation phase). If the chemical composition of the chemical spray can be affected by equipment malfunctions, the most severe chemical environment that results from a single failure in the spray system must be assumed. If only demineralized water spray is used, then the effect of the demineralized water spray must be included in the equipment qualification.
17. The environmental qualification program must ensure that equipment that is necessary for achieving and maintaining safe shutdown of the plant, and maintaining containment integrity, will perform its safety function during and after being exposed to the environmental conditions resulting from the release of hydrogen generated by the equivalent of a 100% fuel-clad metal-water reaction, as stated in 10 CFR 50.34(f)(2)(ix). The postulated environmental conditions must include those created by activation of the hydrogen control system. If the method chosen for hydrogen control is a post-accident

inerting system, inadvertent actuation of the system during plant operation must be considered.

18. Mechanical components must be designed to be compatible with postulated environmental conditions, including those associated with loss-of-coolant accidents (LOCAs). A process must be established to determine the suitability of materials, parts, and equipment needed for safety-related functions, and to verify that the design of such materials, parts, and equipment is adequate. Also, equipment qualification records must be maintained, and these records must include the results of tests and material analyses used as part of the environmental qualification process for each component.

For mechanical equipment, the staff concentrates its review on materials that are sensitive to environmental effects (e.g., seals, gaskets, lubricants, fluids for hydraulic systems, and diaphragms). The reviewer confirms that the applicant has (1) identified safety-related mechanical equipment located in harsh environment areas, including its required operating time; (2) identified nonmetallic subcomponents of such equipment; (3) identified the environmental conditions for which this equipment must be qualified; (4) identified nonmetallic material capabilities; and (5) evaluated environmental effects.

19. For electrical and mechanical equipment located in a mild environment, acceptable environmental qualification can be demonstrated by the "Design/Purchase" specifications for the equipment. The specifications must contain a description of the functional requirements for a specific environmental zone during normal environmental conditions and anticipated operational occurrences.

A well-supported maintenance/surveillance program, in conjunction with a good preventive maintenance program, is sufficient to ensure that equipment that meets the design/purchase specifications is qualified for the designed life. Furthermore, the maintenance/surveillance program data and records must be reviewed periodically (not more than 18 months) to ensure that the qualified design life has not been reduced by thermal, radiation, and/or cyclic degradation resulting from unanticipated operational occurrences or service conditions. Engineering judgment is to be used to modify the replacement program and/or replace the equipment, as deemed necessary.

20. For COL applicants, in addition to the meeting the acceptance criteria for the program elements described above, acceptable implementation milestones must be identified for operational programs. An acceptable implementation milestone for the environmental qualification program is to have all qualification requirements met prior to the loading of fuel.
21. 10 CFR 52.47(a)(1)(vi), as it relates to ITAAC (for design certification) sufficient to assure that the SSCs in this area of review will operate in accordance with the certification.
22. 10 CFR 52.97(b)(1), as it relates to ITAAC (for combined licenses) sufficient to assure that the SSCs in this area of review have been constructed and will be operated in conformity with the license and the Commission's regulations.

SRP Acceptance Criteria

Specific SRP acceptance criteria acceptable to meet the relevant requirements of the NRC's regulations identified above are as follows for review described in Subsection I of 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.

Technical Rationale

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

1. Compliance with 10 CFR 50.34(f)(2)(ix) requires that a system be provided for hydrogen control that can safely accommodate hydrogen generated by the equivalent of a 100% fuel-clad metal water reaction. Further, equipment needed to achieve and maintain safe shutdown of the plant, and to maintain containment integrity, must be capable of performing their safety function during and after exposure to the environmental conditions associated with the release of hydrogen generated by the equivalent of a 100% fuel-clad metal-water reaction, including the environmental conditions created by activation of the hydrogen control system.

Equipment important to safety must be able to perform their design safety functions under all anticipated operating conditions, which includes normal environmental conditions, anticipated operational occurrences, and accident and post-accident environmental conditions. The environmental qualification process described by the various documents, regulations, regulatory guides, and industry standards cited in Subsection II of this SRP section provides a method of demonstrating that equipment will be able to perform acceptably during all anticipated operating conditions, even after being degraded due to exposure to service conditions during its qualified life. Meeting the requirements of 10 CFR 50.34(f)(2)(ix) provides assurance that the environmental conditions created by a hydrogen release, and activation of the hydrogen control system, are considered in the environmental qualification process.

2. Compliance with 10 CFR 50.49, "Environmental Qualification of Electric Equipment Important to Safety for Nuclear Power Plants," requires that the applicant establish a program, as described therein, for qualifying electrical equipment important to safety located in a harsh environment.

Equipment important to safety must be able to perform their design safety functions under all anticipated operating conditions, which includes normal environmental conditions, anticipated operational occurrences, and accident and post-accident environmental conditions. The environmental qualification process described by the various documents, regulations, regulatory guides, and industry standards cited in Subsection II of this SRP section provides a method of demonstrating that equipment will be able to perform acceptably during all anticipated operating conditions, even after being degraded due to exposure to service conditions during its qualified life. Meeting the requirements of 10 CFR 50.49 provides assurance that electric equipment important to safety that are located in a harsh environment are environmentally qualified and are capable of performing their intended safety function.

3. Compliance with 10 CFR 50.67, "Accident Source Term," requires that licensees of plants licensed prior to 1997 seeking to revise the accident source term used in design basis radiological analyses apply for a license amendment, and provide an analysis of the consequences of applicable design basis accidents previously analyzed in the plant's safety analysis report.

Equipment important to safety must be able to perform their design safety functions under all anticipated operating conditions, which includes normal environmental conditions, anticipated operational occurrences, and accident and post-accident environmental conditions. The environmental qualification process described by the various documents, regulations, regulatory guides, and industry standards cited in Subsection II of this SRP section provides a method of demonstrating that equipment will be able to perform acceptably during all anticipated operating conditions, even after being degraded due to exposure to service conditions during its qualified life. The accident conditions under which the equipment must operate, and for which the equipment are qualified, will be impacted by the accident source term used in the postulated design basis accident. Meeting 10 CFR 50.67 provides assurance that a revision to the accident source term will include an analysis of the consequences of such a change, including impacts to the environmental qualification of equipment important to safety.

4. Compliance with 10 CFR Part 50, Appendix A, General Design Criterion 1 (GDC 1), "Quality Standards and Records," requires that components important to safety be designed, fabricated, erected, and tested to quality standards commensurate with the importance of the safety function to be performed.

Equipment important to safety must be able to perform their design safety functions under all anticipated operating conditions, which includes normal environmental conditions, anticipated operational occurrences, and accident and post-accident environmental conditions. The environmental qualification process described by the various documents, regulations, regulatory guides, and industry standards cited in Subsection II of this SRP section provides a method of demonstrating that equipment will be able to perform acceptably during all anticipated operating conditions, even after being degraded due to exposure to service conditions during its qualified life. Meeting GDC 1 provides assurance that the equipment is of sufficiently high quality to be capable of performing their design safety functions acceptably during all anticipated operating conditions, as demonstrated by successful completion of the environmental qualification process.

5. Compliance with 10 CFR Part 50, Appendix A, General Design Criterion 2 (GDC 2), "Design Bases for Protection Against Natural Phenomena," requires that components important to safety be designed to withstand the effects of natural phenomena without loss of capability to perform their safety function. The design bases for these components must consider the effects of the most severe natural phenomena anticipated for the site, together with normal and accident plant operating conditions (i.e., environmental qualification) and the importance of the safety function to be performed.

Equipment important to safety must be able to perform their design safety functions under all anticipated operating conditions, which includes normal environmental conditions, anticipated operational occurrences, and accident and post-accident environmental conditions. The environmental qualification process described by the various documents, regulations, regulatory guides, and industry standards cited in Subsection II of this SRP section provides a method of demonstrating that equipment will be able to perform acceptably during all anticipated operating conditions, even after being degraded due to exposure to service conditions during its qualified life. Meeting GDC 2 provides assurance that appropriate combinations of the effects of normal and accident conditions with the effects of the natural phenomena are considered in the environmental qualification process.

6. Compliance with 10 CFR Part 50, Appendix A, General Design Criterion 4 (GDC 4), "Environmental and Dynamic Effects Design Bases," 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. Components must be protected against dynamic effects, including those of missiles, pipe whipping, and discharging fluids, that may result from equipment failures and from events and conditions outside the nuclear power unit.

Equipment important to safety must be able to perform their design safety functions under all anticipated operating conditions, which includes normal environmental conditions, anticipated operational occurrences, and accident and post-accident environmental conditions. The environmental qualification process described by the various documents, regulations, regulatory guides, and industry standards cited in Subsection II of this SRP section provides a method of demonstrating that equipment will be able to perform acceptably during all anticipated operating conditions, even after being degraded due to exposure to service conditions during its qualified life. Meeting GDC 4 ensures that equipment important to safety are environmentally qualified, and provides assurance that the equipment are designed to accommodate the effects of, and be compatible with, the environmental conditions associated with normal operation, maintenance, testing, and postulated accidents, including LOCAs.

7. Compliance with 10 CFR Part 50, Appendix A, General Design Criterion 23 (GDC 23), "Protection System Failure Modes," requires that the protection system be designed to fail in a safe state, or in a state demonstrated to be acceptable on some other defined basis, if conditions such as postulated adverse environments (e.g., extreme heat or cold, pressure, steam, water, or radiation) are experienced.

Equipment important to safety must be able to perform their design safety functions under all anticipated operating conditions, which includes normal environmental conditions, anticipated operational occurrences, and accident and post-accident environmental conditions. The environmental qualification process described by the various documents, regulations, regulatory guides, and industry standards cited in Subsection II of this SRP section provides a method of demonstrating that equipment will be able to perform acceptably during all anticipated operating conditions, even after being degraded due to exposure to service conditions during its qualified life. Meeting GDC 23 provides assurance that the failure mode of protection system components is considered in the environmental qualification process.

8. Compliance with 10 CFR Part 50, Appendix B, Criterion III, "Design Control," requires that measures be established to ensure that applicable regulatory requirements and the associated design bases are correctly translated into specifications, drawings, procedures, and instructions. These measures should include provisions to ensure that appropriate quality standards are included in design documents and that deviations from established standards are controlled. A process should also be established to determine the suitability of equipment that is essential to safety-related functions and to identify, control, and coordinate design interfaces between participating design organizations. Where a test program is used to verify the adequacy of a specific design feature, it shall include suitable qualification testing of a prototype unit under the most adverse design conditions.

Equipment important to safety must be able to perform their design safety functions under all anticipated operating conditions, which includes normal environmental

conditions, anticipated operational occurrences, and accident and post-accident environmental conditions. The environmental qualification process described by the various documents, regulations, regulatory guides, and industry standards cited in Subsection II of this SRP section provides a method of demonstrating that equipment will be able to perform acceptably during all anticipated operating conditions, even after being degraded due to exposure to service conditions during its qualified life. Meeting 10 CFR Part 50, Appendix B, Criterion III provides assurance that the environmental qualification process includes suitable qualification testing of a prototype unit under the most adverse design conditions.

9. Compliance with 10 CFR Part 50, Appendix B, Criterion XI, "Test Control," requires that a test control plan be established to ensure that all tests needed to demonstrate a component's capability to perform satisfactorily in service be identified and performed in accordance with written procedures that incorporate the requirements and acceptance limits contained in applicable design documents.

Equipment important to safety must be able to perform their design safety functions under all anticipated operating conditions, which includes normal environmental conditions, anticipated operational occurrences, and accident and post-accident environmental conditions. The environmental qualification process described by the various documents, regulations, regulatory guides, and industry standards cited in Subsection II of this SRP section provides a method of demonstrating that equipment will be able to perform acceptably during all anticipated operating conditions, even after being degraded due to exposure to service conditions during its qualified life. Meeting 10 CFR Part 50, Appendix B, Criterion XI provides assurance that a test control plan is established as part of the environmental qualification program to ensure that all tests needed to demonstrate a component's capability to perform satisfactorily in service are identified and performed in accordance with written procedures that incorporate the requirements and acceptance limits contained in applicable design documents.

10. Compliance with 10 CFR Part 50, Appendix B, Criterion XVII, "Quality Assurance Records," requires that sufficient records be maintained to furnish evidence of activities affecting quality. The records must include inspections, tests, audits, monitoring of work performance, and materials analysis. Records must be identifiable and retrievable.

Equipment important to safety must be able to perform their design safety functions under all anticipated operating conditions, which includes normal environmental conditions, anticipated operational occurrences, and accident and post-accident environmental conditions. The environmental qualification process described by the various documents, regulations, regulatory guides, and industry standards cited in Subsection II of this SRP section provides a method of demonstrating that equipment will be able to perform acceptably during all anticipated operating conditions, even after being degraded due to exposure to service conditions during its qualified life. Meeting 10 CFR Part 50, Appendix B, Criterion XVII provides assurance that sufficient records are maintained as part of the environmental qualification program to furnish evidence of activities affecting quality, which includes environmental qualification testing.

11. In Staff Requirements memo SECY-05-0197, "Review of Operational Programs in a Combined License Application and Generic Emergency Planning Inspections, Tests, Analyses, and Acceptance Criteria," dated February 22, 2006, the Commission approved the use of a license condition for operational program implementation milestones that are fully described or referenced in the final safety analysis report. The

environmental qualification program was identified as an operational program in that memo.

III. REVIEW PROCEDURES

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

For each area of review specified in subsection I of this SRP section, the review procedure is identified below. These review procedures are based on the identified SRP acceptance criteria. For deviations from these specific acceptance criteria, the staff should review the applicant's evaluation of how the proposed alternatives to the SRP criteria provide an acceptable method of complying with the relevant NRC requirements identified in subsection II.

1. At the CP stage, the staff reviews the program that the applicant has described in the preliminary safety analysis report (PSAR) for the environmental qualification of the mechanical and electrical equipment. The program is measured against the acceptance criteria listed in Subsection II of this SRP section. Of particular interest to the reviewer is the proper use of test and analytical procedures. Equipment should be tested unless testing of the component is impractical due to size limitations or partial type-test data are provided to support the analytical assumptions and conclusions reached. The qualification program is reviewed for the identification of normal, accident, and post-accident environmental conditions; anticipated operational occurrences; required operating time; and chemical, submergence, aging, and margin considerations, including the acceptance criteria of the test results.
2. At the OL stage, the staff reviews the program again, as described by the applicant in the FSAR. In addition, the FSAR is reviewed for documentation of the successful implementation of the environmental qualification program, including test and analytical results. The reviewer verifies that the applicant's list of systems, which includes the list of equipment associated with each such system, is consistent with the definition of the systems and equipment described in Subsection I, Item 1, of this SRP section.

At the time of the OL application, the reviewer confirms that complete and auditable records are available, and maintained at a central location, which describe the environmental qualification method used for all mechanical and electrical equipment in sufficient detail to document the degree of compliance with the requirements discussed herein. The reviewer also confirms that, thereafter, such records will be updated and maintained current as equipment is replaced, tested, or otherwise qualified.

To confirm the extent to which the equipment meets the requirements of Subsection II, the staff audits the equipment qualification file and conducts a plant site review. For selected equipment, the staff reviews the test procedure and test results, and examines the equipment configuration and mounting, and then determines whether the test or analysis referenced demonstrates compliance with the established criteria. The staff may require that component evaluation worksheets (CES) for all equipment be submitted to the staff. After the visit, the applicant may be required to submit certain selected documents and reports for further staff review. If the staff has reviewed an applicant's qualification file for a previous application, they may elect not to require the applicant to submit all the qualification summary data sheets, but instead elect to audit the qualification files at the applicant's central storage location.

3. For new applications, the staff may accept an exemption from the requirement of 10 CFR 50.49(b)(3) to qualify certain types of post-accident monitoring equipment in accordance with Revision 2 to Regulatory Guide 1.97, if the applicant commits to conformance with the latest revision of Regulatory Guide 1.97, which meets the underlying purpose of the 10 CFR 50.49 rule.
4. In addition to the evaluation of full environmental qualification, potential degradation of the operating performance of mechanical and electrical equipment under adverse environmental conditions needs to be addressed by the applicant and reviewed by the NRC staff. For example, electric motors might produce less torque output under high temperature conditions than under ambient conditions that could impact the capability to operate their individual pumps or valves. The industry has developed guidance to address potential degraded performance of equipment under adverse environmental conditions. SRP 3.9.6 provides guidance for the evaluation of the functional design and qualification of pumps and valves, including their motor operators, to perform their safety functions. In addition, NRC staff will review the soon-to-be-issued revision to ASME standard QME-1, "Qualification of Active Mechanical Equipment Used in Nuclear Power Plants," for possible acceptance.
5. For reviews of DC and COL applications under 10 CFR Part 52, the reviewer should follow the above procedures to verify that the design set forth in the safety analysis report, and if applicable, site interface requirements meet the acceptance criteria. For DC applications, the reviewer should identify necessary COL action items. With respect to COL applications, the scope of the review is dependent on whether the COL applicant references a DC, an ESP or other NRC-approved material, applications, and/or reports.

After this review, SRP Section 14.3 should be followed for the review of Tier I information for the design, including the postulated site parameters, interface criteria, and ITAAC.

6. For a COL application, the staff reviews the environmental qualification program descriptions and the proposed implementation milestones.

The staff reviews the discussion on the environmental qualification program and its implementation. The implementation description should contain one or more milestones depending on whether the program will be implemented all at once, or using a phased approach. The staff will obtain a reasonable-assurance finding on the program and its proposed implementation, including the adequacy of the implementation milestones. These findings will be documented in the Evaluation Findings section of the staff's safety evaluation report (SER). In addition, the staff proposes a license condition that will link program implementation milestones to the license. This review guidance implements Commission policy contained in SECY-05-0197, "Review of Operational Programs in a Combined License Application and Generic Emergency Planning Inspections, Tests, Analyses, and Acceptance Criteria."

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 safety evaluation report. The reviewer also states the bases for those conclusions.

The staff concludes that the environmental qualification of mechanical and electrical equipment that are important to safety is acceptable and meets the relevant requirements of 10 CFR 50.34; 10 CFR 50.49; 10 CFR 50.67; 10 CFR Part 50, Appendix A, General Design Criteria 1, 2, 4, and 23; and 10 CFR Part 50, Appendix B, Quality Assurance Criteria III, XI, and XVII; with respect to systems and components being designed to withstand the effects of, and being capable of performing their safety function, in the environmental conditions associated with normal operation, maintenance, testing, and accident conditions.

This conclusion is based on the finding that the applicant has implemented an environmental qualification program that provides adequate assurance that mechanical and electrical equipment that are important to safety will function as intended in the event of anticipated operational occurrences, as well as in the normal, accident, and post-accident environmental conditions. The applicant's environmental qualification program is in accordance with the acceptance criteria in SRP Section 3.11, including the requirements and guidance described in the regulations, regulatory guides and industry standards identified in Subsection II of SRP Section 3.11.

For DC and COL reviews, the findings will also summarize (to the extent that the review is not discussed in other SER sections) the staff's evaluation of the ITAAC, including design acceptance criteria, as applicable, and interface requirements and combined license action items relevant to this SRP section.

For a COL application review, the findings include a specific conclusion regarding the implementation of the environmental qualification program, as follows:

The applicant's environmental qualification program implementation milestones are adequate to meet the relevant requirements of 10 CFR 50.34; 10 CFR 50.67; 10 CFR 50.49; 10 CFR Part 50, Appendix A, General Design Criteria 1, 2, 4, and 23; and 10 CFR Part 50, Appendix B, Quality Assurance Criteria III, XI, and XVII.

In addition, for a COL application review, the findings will include a license condition as follows:

The licensee shall implement the environmental qualification program, or portions of the environmental qualification program, identified in Table ___ on or before the associated milestones in Table ___.

V. IMPLEMENTATION

This section is intended to provide guidance to applicants and licensees regarding the NRC staff's plan for using this SRP section.

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 six months or more after the date of issuance of this SRP section, unless superseded by a later revision.

Each plant is required to have a complete environmental qualification file that demonstrates compliance with this review plan (or uses established bases for alternate requirements) before submittal of an OL application. For COL applicants referencing a certified design, the staff will review specific details of the plant's environmental qualification program using the acceptance criteria and review procedures described in this SRP section.

VI. REFERENCES

1. 10 CFR 50.34, "Contents of Applications, Technical Information," Subsection(f)(2)(ix).
2. 10 CFR 50.49, "Environmental Qualification of Electric Equipment Important to Safety for Nuclear Power Plants."
3. 10 CFR 50.67, "Accident Source Term."
4. 10 CFR Part 50, Appendix A, General Design Criterion 1, "Quality Standards and Records;" General Design Criterion 2, "Design Bases for Protection Against Natural Phenomena;" General Design Criterion 4, "Environmental and Dynamic Effects Design Bases;" and General Design Criterion 23, "Protection System Failure Modes."
5. 10 CFR Part 50, Appendix B, Criterion III, "Design Control"; Criterion XI, "Test Control"; and Criterion XVII, "Quality Assurance Records."
6. 10 CFR 52.47, "Contents of Applications."
7. 10 CFR 52.97, "Issuance of Combined Licenses."
8. Commission Memorandum and Order CLI-80-21, "Interim Staff Position on Electrical Equipment," May 23, 1980.
9. IEEE Std 317-1983 (reaffirmed 1992), "IEEE Standard for Electric Penetration Assemblies in Containment Structures for Nuclear Power Generation Stations," Institute of Electrical and Electronics Engineers (endorsed by Regulatory Guide 1.63).
10. IEEE Std 323-1974, "IEEE Standard for Qualifying Class 1E Equipment for Nuclear Power Generating Stations," Institute of Electrical and Electronics Engineers (endorsed by Regulatory Guide 1.89 and NUREG-0588).
11. IEEE Std 334-1971, "IEEE Trial-Use Guide for Type Tests of Continuous-Duty Class 1 Motors Installed Inside the Containment of Nuclear Power Generating Stations," Institute of Electrical and Electronics Engineers (endorsed by Regulatory Guide 1.40).
12. IEEE Std 381-1977 (reaffirmed 1984), "IEEE Standard Criteria for Type Tests of Class 1E Modules Used in Nuclear Power Generating Stations," Institute of Electrical and Electronics Engineers.
13. IEEE Std 382-1972, "IEEE Trial-Use Guide for Type Test of Class 1 Electric Valve Operators for Nuclear Power Generating Stations," Institute of Electrical and Electronics Engineers. (as endorsed by Regulatory Guide 1.73.)

14. IEEE Std 383-2003, "IEEE Standard for Type Test of Class 1E Electric Cables and Field Splices for Nuclear Power Generating Stations," Institute of Electrical and Electronics Engineers (endorsed by Regulatory Guide 1.131).
15. IEEE Std 535-1986, "IEEE Standard for Qualification of Class 1E Lead Storage Batteries for Nuclear Power Generating Stations," Institute of Electrical and Electronics Engineers.
16. IEEE Std 572-1985, "IEEE Standard for Qualification of Class 1E Connection Assemblies for Nuclear Power Generating Stations," Institute of Electrical and Electronics Engineers (endorsed by Regulatory Guide 1.156).
17. IEEE Std 627-1980 (reaffirmed 1991), "IEEE Standard for Design Qualification of Safety Systems Equipment Used in Nuclear Power Generating Station," Institute of Electrical and Electronics Engineers.
18. IEEE Std 649-1980, "IEEE Standard for Qualifying Class 1E Motor Control Centers for Nuclear Power Generating Stations," Institute of Electrical and Electronics Engineers.
19. IEEE Std 650-1979, "IEEE Standard for Qualification of Class 1E Static Battery Chargers and Inverters for Nuclear Power Generating Stations," Institute of Electrical and Electronics Engineers.
20. NRC Information Notice 97-45, "Environmental Qualification Deficiency for Cables and Containment Penetration Pigtailed."
21. NRC Information Notice 97-45, Supplement 1, "Environmental Qualification Deficiency for Cables and Containment Penetration Pigtailed."
22. NRC Information Notice 98-21, "Potential Deficiency of Electrical Cable/Connection Systems."
23. NUREG-0588, "Interim Staff Position on Environmental Qualification of Safety-Related Electrical Equipment."
24. NUREG-0718, "Licensing Requirements for Pending Applications for Construction Permits and Manufacturing License."
25. NUREG-0737, "Clarification of TMI Action Plan Requirements."
26. NUREG-1462, "Final Safety Evaluation Report Related to the Certification of the System 80+ Design."
27. NUREG-1465, "Accident Source Terms for Light-Water Nuclear Power Plants."
28. NUREG-1503, "Final Safety Evaluation Report Related to the Certification of the Advanced Boiling Water Reactor Design."
29. NUREG-1793, "Final Safety Evaluation Report Related to Certification of the AP1000 Standard Design."
30. Regulatory Guide 1.30, (Safety Guide 30), "Quality Assurance Requirements for the Installation, Inspection, and Testing of Instrumentation and Electric Equipment."

31. Regulatory Guide 1.40, "Qualification Tests of Continuous-Duty Motors Installed Inside the Containment of Water-Cooled Nuclear Power Plants" (this guide endorses IEEE Std. 334-1971).
32. Regulatory Guide 1.63, "Electric Penetration Assemblies in Containment Structures for Light Water-Cooled Nuclear Power Plants" (this guide endorses IEEE Std 317-1983).
33. Regulatory Guide 1.73, "Qualification Tests of Electric Valve Operators Installed Inside the Containment of Nuclear Power Plants" (this guide endorses IEEE Std 382-1972).
34. Regulatory Guide 1.89, " Environmental Qualification of Certain Electric Equipment Important to Safety for Nuclear Power Plants" (this guide endorses IEEE Std 323-1974).
35. Regulatory Guide 1.97, "Instrumentation For Light-Water-Cooled Nuclear Power Plants To Assess Plant and Environs Conditions During and Following an Accident."
36. Regulatory Guide 1.131, "Qualification Tests of Electric Cables and Field Splices for Light-Water-Cooled Nuclear Power Plants" (this guide endorses IEEE Std 383-2003).
37. Regulatory Guide 1.151, "Instrument Sensing Lines."
38. Regulatory Guide 1.156, "Environmental Qualification of Connection Assemblies for Nuclear Power Plants" (endorses IEEE Std 572-1985).
39. Regulatory Guide 1.158, "Qualification of Safety-Related Lead Storage Batteries for Nuclear Power Plants" (endorses IEEE Std 535-1986).
40. Regulatory Guide 1.180, "Guidelines for Evaluating Electromagnetic and Radio-Frequency Interference in Safety-Related Instrumentation and Control Systems."
41. Regulatory Guide 1.183, "Alternative Radiological Source Terms for Evaluating Design Basis Accidents at Nuclear Power Reactors."
42. SECY-05-0197, "Review of Operational Programs in a Combined License Application and Generic Emergency Planning Inspections, Tests, Analyses, and Acceptance Criteria."

PAPERWORK REDUCTION ACT STATEMENT

The information collections contained in the draft 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.

SRP Section 3.11

Description of Changes

This SRP section affirms the technical accuracy and adequacy of the guidance previously provided in (Draft) Revision 3, dated April 1996 of this SRP. See ADAMS accession number ML052070288.

In addition this SRP section was administratively updated in accordance with NRR Office Instruction, LIC-200, SRP process. The revision also adds standard paragraphs to extend application of the updated SRP section to prospective submittals by applicants pursuant to 10 CFR Part 52, with the following exceptions:

1. Reference to NUREG-0588, Category II equipment was not deleted from SRP Section 3.11 since there are still plants operating that use this as their licensing basis.
2. Reference to equipment qualified life being based on the proposed licensing period was not added since qualified life is not determined by the licensing period of the plant.

In addition to the exceptions noted above, the following summarizes the changes incorporated in Revision 3, dated xxx 2007.

REVIEW RESPONSIBILITIES

1. Removed reference to specific branch names for review responsibility and replaced them with a generic reference to the responsible organization. This change is reflected throughout the SRP.

I. AREAS OF REVIEW

1. Included references to 10 CFR 50.34(f)(2)(ix) and 10 CFR 50.67 as they relate to environmental qualification requirements that are reviewed.
2. Included guidance for the review of COL applications.
3. Included a reference to SRP 3.9.5 for pressure fluctuations and vibration caused by acoustic resonances and hydrodynamic forces.
4. Included a reference to SRP Chapter 7 for digital instrumentation and control equipment located in mild and harsh environment.
5. Added a review interface functional design and qualification of mechanical and electrical equipment.

II. ACCEPTANCE CRITERIA

1. Revised to include separate line items for 10 CFR 50.34(f)(2)(ix); 10 CFR 50.67; 10 CFR Part 50, Appendix B, Criteria III, XI, and XVII; 10 CFR 52.47(a)(1)(vi); and 10 CFR 52.97(b)(1) as general acceptance criteria that must be met.

2. Included a discussion of 10 CFR 50.67 for accident source term, as it relates to environmental qualification.
3. Included a reference to Regulatory Guide 1.30 to address the review of quality assurance aspects of the environmental qualification program.
4. Added a reference to Regulatory Guide 1.180 for qualifying digital and advanced analog systems for the projected electromagnetic environment.
5. Added a reference to Regulatory Guide 1.183 for guidance on developing integrated doses for environmental qualification purposes for plants using alternative source terms.
6. Modified to address IN 89-63, equipment wetting concerns, i.e., flooding above the flood level.
7. Added a discussion to address the concerns identified in IN 97-45 and IN 97-45S1 with regard to qualification of cables and penetration pigtails for high-range radiation monitors.
8. Added a discussion to address the concerns raised in IN 98-21 with regard to evaluation of EQ results for cable/connection systems.
9. Included guidance for the review of COL applications to address the review of operational programs, including acceptable implementation milestones.
10. Revised technical rationale to explain the basis for meeting each of the acceptance criteria.
11. Included a reference to SRP Chapter 7 for digital instrumentation and control equipment located in mild and harsh environment.

III. REVIEW PROCEDURES

1. Included guidance for the review of COL applications to address the review of operational programs, including acceptable implementation milestones.
2. Included guidance for the review of potential degradation of the operating performance of mechanical and electrical equipment.

IV. EVALUATION FINDINGS

1. Included guidance to address findings for design certifications and COL applications.

V. IMPLEMENTATION

No changes.

VI. REFERENCES

1. Added reference listings for regulations 10 CFR 50.67, 10 CFR 52.47, and 10 CFR 52.97.
2. Added reference listings for Regulatory Guides 1.30, 1.180, and 1.183.
3. Added reference listings for NUREGs 1462, 1503, and 1793.
4. Added reference listings for NRC Information Notices 97-45, 97-45 S1, and 98-21.
5. Added reference listing for IEEE Std. 383-2003.
6. Added reference listing for SECY-05-0197.