U.S. NUCLEAR REGULATORY COMMISSION

STANDARD REVIEW PLAN

OFFICE OF NUCLEAR REACTOR REGULATION

3.9.6 INSERVICE TESTING OF PUMPS AND VALVES

REVIEW RESPONSIBILITIES

Primary - Mechanical Engineering Branch (EMEB[1])

Secondary - None

I. AREAS OF REVIEW

The EMEB[2] reviews the following areas of the applicant's safety analysis report (SAR) that cover the inservice testing of certain safety-related[3] pumps and valves typically[4] designated as Class 1, 2, or 3 under Section III of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (hereinafter "the Code"). Other pumps and valves not categorized as Code Class 1, 2, or 3 may be included if they are considered to be safety related by the staff. Compliance with the Code and the specific criteria guidance in subsection II of this Standard Review Plan (SRP) section[5] will ~~assure~~ensure[6] conformance with 10 CFR Part 50, Appendix A, General Design Criteria 1,[7] 37, 40, 43, 46, 54, and 10 CFR ~~Part 50, 50.55a(g),~~50.55a(f).[8]

In NUREG-1482, "Guidelines for Inservice Testing at Nuclear Power Plants," the staff provided additional guidance regarding the development and implementation of inservice testing programs for pumps and valves.[9]

1. Inservice Testing of Pumps

a. The descriptive information in the SAR covering the inservice test program is reviewed for those ASME[10] Code Class 1, 2, and 3 system pumps whose function

is required for safety,[11] and in addition includes pumps not categorized as Code Class 1, 2, or 3 but which are considered to be safety related.

b. Procedures[12] for testing for speed, fluid pressure, flow rate, vibration amplitude, lubricant level or pressure, and bearing temperature at normal pump operating conditions are reviewed.

c. The pump test schedule is reviewed.

d. The methods described in the SAR for measuring the reference values and inservice values for the pump parameters above are reviewed.

2. Inservice Testing of Valves

The descriptive information in the SAR covering the inservice test program is reviewed for those ASME[13] Code Class 1, 2 and 3 valves whose function is required for safety.[14] This review does not include those nonsafety-related[15] valves exempted by[16] the Code.

3. Relief Requests

~~10 CFR Part 50, §50.55a(g)~~Subsection 50.55a(f)(4) of 10 CFR[17] requires a nuclear power facility to periodically update its inservice testing program to meet the requirements of ~~future~~ revisions of Section XI[1] [18] of the ASME Code, as specified in 10 CFR 50.55a at the time the inservice testing program is revised.[19] However, if it proves impractical to implement these criteria, the applicant is allowed to submit requests for relief from ~~Section XI~~the ASME Code[20] requirements on a case-by-case basis. Accordingly, any requests for relief are reviewed by the staff to determine if the proposed exceptions ~~to Section XI~~[21] will degrade the overall plant safety. Due consideration is given to the burden upon the applicant that could result if the updated inservice testing criteria ~~of Section XI~~[22] were imposed on the facility.

4. Design and Qualification Provisions to Accommodate Inservice Testing

General system and component designs and equipment qualification provisions are reviewed to ensure that the design will accommodate anticipated inservice testing.[23]

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[1]As of August 1995, 10 CFR 50.55a(b)(2) cites addenda through the 1988 Addenda of ASME Code Section XI and editions of ASME Code Section XI through the 1989 Edition. The 1989 Edition of the ASME Code is currently appropriate for the new-plant reviews covered by the SRP. The 1989 Edition of ASME Code Section XI refers to ASME/ANSI OM (Part 6) for pump testing requirements and ASME/ANSI OM (Part 10) for valve testing requirements. Paragraph 4.3.1 of Part 10 refers, in turn, to ASME/ANSI OM (Part 1) for inservice testing of safety valves and relief valves. These ASME Code sections will be referred to as "OM 6," "OM 10," and "OM 1," respectively, in this SRP section. See Reference 8.

Review Interfaces

The EMEB reviews seismic and dynamic qualification of safety-related pumps and valves as part of its primary review responsibility for SRP Section 3.10. The EMEB also reviews the design and dynamic analysis, and dynamic testing of safety-related pumps and valves as part of its primary review responsibility for SRP Sections 3.9.2 and 3.9.3.

The Plant Systems Branch (SPLB) reviews the environmental qualification of safety-related pumps and valves as part of its primary review responsibility for SRP Section 3.11. The SPLB also reviews the plant programs for surveillance, testing, inspection and maintenance of service water systems under SRP Section 9.2.1. These programs may be coordinated with the IST reviewed by EMEB under this SRP Section.[24]

The Containment Systems and Severe Accident Branch (SCSB) reviews the containment isolation system as part of its primary review responsibility for SRP Section 6.2.4. The SCSB reviews the applicant's overall containment leakage testing program as part of its primary review responsibility for SRP Section 6.2.6.[25]

The Reactor Systems Branch (SRXB) reviews the design and leak testing provisions of pressure retaining systems and components that interface with the reactor coolant system as part of its primary review responsibility for intersystem loss-of-coolant accidents (ISLOCA) in SRP Section 3.12 (proposed).[26]

For those areas of review identified above 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 review branch.[27]

II. ACCEPTANCE CRITERIA

The acceptance criteria is based on meeting the relevant requirements set forth in General Design Criteria 1,[28] 37, 40, 43, 46, 54, and 10 CFR ~~Part 50,§50.55a(g)~~50.55a(f).[29] The relevant requirements are as follows:

A. General Design Criterion 1 (GDC 1), as it relates to testing components important to safety to quality standards commensurate with the importance of the safety functions to be performed.[30]

~~A~~B.[31] General Design Criterion 37 (GDC 37),[32] as it relates to periodic functional testing of the emergency core cooling system to ~~assure~~ensure the leak tight integrity and performance of its active components.

~~B~~C. General Design Criterion 40 (GDC 40),[33] as it relates to periodic functional testing of the containment heat removal system to ~~assure~~ensure the leak tight integrity and performance of its active components.

~~C~~D. General Design Criterion 43 (GDC 43),[34] as it relates to periodic functional testing of the containment atmospheric cleanup systems to ~~assure~~ensure the leak tight integrity and the performance of the active components, such as pumps and valves.

~~D~~E. General Design Criterion 46 (GDC 46),[35] as it relates to periodic functional testing of the cooling water system to ~~assure~~ensure the leak tight integrity and performance of the active components.

~~E~~F. General Design Criterion 54 (GDC 54),[36] as it relates to piping systems penetrating containment being designed with the capability to test periodically the operability of the isolation and determine valve leakage acceptability.

~~F~~G. ~~10 CFR Part 50, §50.55a(g)~~Subsection 50.55a(f) of 10 CFR,[37] as it relates to including pumps and valves whose function is required for safety in the Inservice Inspection Program to verify operational readiness by periodic testing.

Specific criteria necessary to meet the relevant requirements of the Commission regulations identified above are ~~as follows:~~provided in the following subsections.[38] Additional guidance regarding the historical and current perspectives on the regulatory requirements for inservice testing programs for pumps and valves is provided in NUREG-1482, which includes information on the suggested format and content for inservice testing programs and relief requests, examples of relief requests, clarification of issues described in NRC communications on inservice testing, and information regarding current staff positions on inservice testing. Applicants should use NUREG-1482 as guidance for developing inservice testing programs.[39]

ASME Code cases that refer to inservice testing of pumps and valves are acceptable as endorsed in Regulatory Guide 1.147.[40]

1. Inservice Testing of Pumps

   a. The scope of the applicant's test program is acceptable if it ~~is in agreement with IWP-1000 of Section XI of the Code~~ includes all of the ASME Code Class 1, 2, and 3 (or equivalent for older plants) pumps described in 10 CFR 50.55a(f), Section 1 of OM 6,[41] and, in addition, may include~~s~~[42] pumps not categorized as Code Class 1, 2, or 3, but which are considered to be safety-related[43] (see Position 11 of Generic Letter 89-04, Attachment 1 (Reference 12))[44]. Since the pump test program is based on the detection of changes in the hydraulic and mechanical condition of a pump relative to a reference test ~~specified in IWP-3000~~, the establishment of a ~~reference set of parameters~~set of reference values, as described in Section 2, and paragraphs 4.3 and 5.2 of OM 6,[45] and a consistent test method ~~is a~~are basic criteria~~on~~[46] of the program.

   b. The pump test program is acceptable if it meets the requirements for establishing reference values and the periodic testing schedule ~~of IWP-3000 of Section XI of the Code~~described in Sections 4 and 5 of OM 6.[47] The allowable ranges of inservice test quantities, corrective actions, and ~~bearing temperature~~ vibration[48] tests are established ~~by IWP-3000 and IWP-4000~~ in Sections 4, 5, and 6 of OM

6.[49] The pump test schedule in the plant technical specification is required to comply with ~~these rules~~paragraph 5.1 of OM 6.[50]

c. The ~~test frequencies and durations~~frequency of inservice tests and duration of tests[51] are acceptable if the provisions of ~~IWP-3000 of Section XI of the Code~~paragraphs 5.1 and 5.6 of OM 6[52] are met.

d. The methods of measurement are acceptable if the test program meets the requirements of ~~IWP-4000 of Section XI of the Code~~ Sections 4 and 5 of OM 6[53] with regard to instruments, pressure measurements, ~~temperature measurements,~~[54] rotational speed, vibration measurement, and flow measurements.

2. Inservice Testing of Valves

a. To be acceptable, the SAR valve test list must contain all safety-related[55] Code Class 1, 2, and 3 valves required by ~~IWV-1100~~10 CFR 50.55a(f) and paragraph 1.1 of OM 10,[56] except those ~~nonsafety-related~~[57] valves exempted by[58] the Code. ~~and in addition includes valves~~Valves not categorized as Code Class 1, 2, or 3 but which are considered safety related may also be included (see Position 11 of Generic Letter 89-04, Attachment 1).[59] The SAR valve list must include a valve categorization which complies with the provisions of ~~IWV-2000 of Section XI of the Code~~paragraph 1.4 of OM 10.[60] Each specific valve to be tested by the rules of ~~Subsection IWV~~OM 10[61] is to be [62]listed in the SAR by type, valve identification number, code class, and ~~IWV-2000~~[63] valve category.

b. The valve test requirements, procedures, acceptance criteria, and corrective actions are acceptable if the provisions of ~~IWV-3000 of Section XI of the Code~~Sections 3, 4, and 5 of OM 10[64] are met with regard to preservice and periodic inservice valve testing.

c. Inservice Testing of Motor Operated Valves (MOVs)

(1) In addition to the inservice testing described in subsection II.2.b, preoperational tests should be conducted on each MOV in the open and closed directions under static and maximum achievable conditions up to design-basis conditions.

(a) The use of diagnostic equipment and techniques that measure torque, thrust, and motor parameters, and that will permit an assessment of the performance and condition of the MOV and its components under actual and projected loading, is acceptable for preoperational and inservice testing. The equipment and its operating principles should be described and the techniques justified. The operation and accuracy of the diagnostic equipment and techniques should be verified adequate during preoperational testing.

(b) Each MOV should be tested under various differential pressure and flow conditions up to maximum achievable conditions. A sufficient number of tests should be performed to determine the torque and thrust requirements at design-basis conditions. The torque and thrust requirements to close the valve to the position at which there is diagnostic indication of hard seat contact should be determined.

(c) Design torque and thrust requirements should be determined considering such parameters as differential pressure, fluid flow, undervoltage, temperature, seismic effects, dynamic effects, and appropriate combinations. The design torque and thrust requirements should be determined allowing sufficient margin to account for diagnostic equipment inaccuracies.

(d) At the point of control switch trip, any loss in actuator torque and/or stem thrust that is related to increasing differential pressure and flow conditions (referred to as "load-sensitive MOV behavior") should be identified. The control switch trip setpoints should include margins for load-sensitive MOV behavior, control switch repeatability, diagnostic equipment error, and degradation of the assembly and its components.

(e) The total thrust and torque that is delivered by the MOV under static and dynamic conditions, including allowances for diagnostic equipment inaccuracies and control switch repeatability, should be compared to the allowable structural and undervoltage motor capability limits for the individual parts of the MOV.

(f) Remote position indication testing should be conducted, if applicable, to verify that proper disk position is indicated in the control room.

(2) In addition to the inservice testing described in subsection II.2.b, periodic inservice testing of MOVs should be conducted to permit an assessment of continuing operability under design basis conditions.

(a) Periodic testing should be conducted that objectively demonstrates continuing MOV capability to open and/or close under design-basis conditions, as established in subsection II.2.c(1).

A risk-based approach may be used to prioritize valve test activities, such as frequency of individual valve tests and selection of valves to be tested. The valve test program should ensure that safety-related MOVs will remain operable until the next scheduled test. The importance of the valve should be considered in determining an appropriate mix of exercising and diagnostic

testing. In establishing the mix of testing, consideration should be given to the benefits (such as identification of decreased thrust output and increased thrust requirements) and potential adverse effects (such as accelerated aging or valve damage) when determining the appropriate type of testing for each safety-related MOV. All safety-related MOVs should be considered in the development of the program. Valve performance and maintenance should be monitored with appropriate adjustments to the program.[65]

(b) The surveillance interval for the inservice testing described in subsection II.2.c(2) should not exceed 5 years or three refueling outages, whichever is longer, unless a longer interval can be justified.

(c) After testing, adjustments to control switch settings, as well as any other repairs, adjustments, and maintenance, should be made to the particular MOV, if necessary. The applicability of these repairs, adjustments, and maintenance to other MOVs should be considered. Common mode and common cause failure mechanisms should also be considered.

(d) Remote position indication should be verified, if applicable.

(e) A list of deficiencies, misadjustments, and degraded conditions that have been discovered in existing MOVs is attached as Appendix A to this SRP section. The applicant's inservice testing program and procedures for MOVs should be established and maintained to account for and minimize such deficiencies, misadjustments, and degraded conditions.

(3) Acceptance criteria for successful completion of the preservice and inservice testing of MOVs described in subsection II.2.c(1) and (2) should include the following:

(a) As required by the safety function, the valve must fully open and/or the valve must fully close. Diagnostic equipment must indicate hard seat contact.

(b) The testing must demonstrate adequate margin to achieve design requirements, including consideration of diagnostic equipment inaccuracies, degraded voltage, control switch repeatability, load-sensitive MOV behavior, and margin for degradation.

(c) The maximum torque and/or thrust (as applicable) achieved by the MOV, allowing sufficient margin for diagnostic equipment inaccuracies and control switch repeatability, must not exceed the

allowable structural and undervoltage motor capability limits for the individual parts of the MOV.

(d) Remote position indication testing must provide verification of the proper disk position at the remote location.[66]

d. Inservice Testing of Power-Operated Valves (POVs) Other Than MOVs

(1) POVs include those valves equipped with pneumatic, hydraulic, piston, and solenoid actuators.

(2) In addition to the inservice testing described in subsection II.2.b, preoperational tests should be conducted on each POV in the open and closed directions under static and maximum achievable conditions up to design-basis conditions.

(a) The use of diagnostic equipment and techniques that measure or provide information to determine total friction, stroke time, seat load, spring rate, travel under normal pneumatic or hydraulic pressure (if applicable), and minimum pneumatic or hydraulic pressure (if applicable) is acceptable for preoperational and inservice testing. The equipment and its operating principles should be described and the techniques justified. The operation and accuracy of the diagnostic equipment and techniques should be verified during preoperational testing.

(b) Each POV should be tested under various differential pressure and flow conditions up to maximum achievable conditions. A sufficient number of tests should be performed to determine the force requirements at design-basis conditions. The force requirements to close the valve to the position at which there is diagnostic indication of full valve closure (if required to fulfill the safety function for the particular valve) should be determined.

(c) Design force requirements should be determined for such parameters as differential pressure, fluid flow, undervoltage, power supply, temperature, seismic effects, dynamic effects, minimum hydraulic or pneumatic pressure, and appropriate combinations, as applicable. The design force requirements should be determined allowing sufficient margin to account for diagnostic equipment inaccuracies.

(e) The total force that is required to be delivered by the POV under static and dynamic conditions, including allowances for diagnostic equipment inaccuracies, should be compared to the allowable structural capability limits for the individual parts of the POV.

(f) Remote position indication testing should be conducted, if appropriate, to verify that proper open or closed position of the POV is indicated in the control room.

(3) In addition to the inservice testing described in subsection II.2.b, periodic inservice testing of POVs should be conducted to permit an assessment of continuing operability under design basis conditions.

(a) Periodic testing should be conducted under conditions, if applicable and practical, that objectively demonstrate continuing POV capability to open and/or close under design-basis conditions, as established in subsection II.2.d(2).

A risk-based approach may be used to prioritize valve test activities, such as frequency of individual valve tests and selection of valves to be tested. The valve test program should ensure that safety-related POVs will remain operable until the next scheduled test. The importance of the valve should be considered in determining an appropriate mix of exercising and diagnostic testing. In establishing the mix of testing, consideration should be given to the benefits (such as identification of decreased thrust output and increased thrust requirements) and potential adverse effects (such as accelerated aging or valve damage) when determining the appropriate type of testing for each safety-related POV. All safety-related POVs should be considered in the development of the program. Valve performance and maintenance should be monitored with appropriate adjustments to the program.[67]

(b) The surveillance interval for the inservice testing described in subsection II.2.d(3) should not exceed 5 years or three refueling outages, whichever is longer, unless a longer interval can be justified.

(c) After testing, adjustments and maintenance should be made to the particular POV, if necessary. The applicability of these repairs, adjustments, and maintenance to other POVs should be considered. Common mode and common cause failure mechanisms should be considered.

(d) Remote position indication should be verified, if applicable.

(4) Acceptance criteria for successful completion of the preservice and inservice testing of POVs described in subsections II.2.d(2) and (3) should include the following:

(a) As required by the safety function, the valve must fully open and/or the valve must fully close. Diagnostic equipment must indicate hard seat contact.

(b) The POV testing must demonstrate adequate margin to achieve design requirements, including consideration of diagnostic equipment inaccuracies, margin for degradation, degraded voltage if applicable, and minimum hydraulic or pneumatic pressure if applicable.

(c) The maximum torque and/or thrust achieved by the POV, allowing sufficient margin for diagnostic equipment inaccuracies and control switch repeatability, must not exceed the allowable structural capability limits for the individual parts of the POV.

(d) Remote position indication testing must provide verification of the proper disk position at the remote location.

(e) Class 1E electrical requirements are to be verified for solenoid-operated valves (SOVs). Each SOV should be verified, to the extent practical, to be capable of performing its safety functions for the appropriate electrical power supply amperage and voltage.[68]

e. Inservice Testing of Check Valves

(1) In addition to the inservice testing described in subsection II.2.b, preoperational tests should be conducted on each check valve. Each check valve should be tested in the open and/or closed direction, as required by the safety function, under normal operating system conditions.

(a) Diagnostic equipment or nonintrusive techniques that monitor internal component condition or measure such parameters as fluid flow, disk position, disk movement, disk impact forces, leak tightness, leak rates, degradation, and disk stability, should be used, if practical, for preoperational and inservice testing. The equipment and its operating principles should be described and the techniques justified. The operation and accuracy of the diagnostic equipment and techniques should be verified during preoperational testing.

(b) To the extent practical, testing should be performed under temperature and flow conditions which would exist during normal operation as well as cold shutdown. Testing at temperature and flow conditions that may exist in other modes should also be conducted if such conditions are significant.

(c) Test results should identify the flow required to open the valve to the full-open position.

(d) Testing should include the effects of rapid pump starts and stops, as required for expected system operating conditions. The testing should include any other reverse flow conditions which may be required by expected system operating conditions.

(2) In addition to the inservice testing described in subsection II.2.b, nonintrusive (diagnostic) techniques. as described in subsection II.2.e(1)(a) should be used to periodically assess degradation and the performance characteristics of check valves.

(3) Acceptance criteria for successful completion of the preservice and inservice testing of check valves described in subsections II.2.e(1) and (2) should include the following:

(a) During all test modes which simulate expected system operating conditions, the valve disk should fully open or fully close as expected based on the direction of the differential pressure across the valve.

(b) Leaktightness of the valve, when fully closed, should be within established limits.

(c) Valve disk positions should be determinable without disassembly.

(d) Testing should verify that there is free disk movement to and from the seat.

(e) The valve disk should be stable in the open position under normal and other required system operating fluid flow conditions.

(f) The valve should be correctly sized for the flow conditions specified (i.e., the disk is in full open position at normal full flow operating condition).

(g) Valve design features, material, and surfaces should accommodate nonintrusive diagnostic testing methods available in the industry or as specified.

(h) Piping system design features should be able to accommodate all the applicable check valve testing requirements.[69]

f. Pressure Isolation Valve Leak Testing

(1) Pressure isolation valves (PIVs) are the two normally closed valves, in series, that isolate the reactor coolant system (RCS) from an attached low-pressure system. PIVs are within the reactor-coolant pressure boundary (RCPB) which is defined in 10 CFR 50.2. The valve type, valve size, and operator (if any) vary. PIVs are classified as A or AC in accordance with the provisions of subsection 1.4 of OM 10.

(2) PIV seat leakage rate tests should be conducted in accordance with paragraph 4.2.2 of OM 10 on each individual PIV. Allowable leak rates and test intervals for each PIV should be specified in the plant Technical Specifications or FSAR. The maximum allowable leak rate for each PIV at full reactor pressure should be $\leq$1.9 liters per minute (L/m) (0.5 gallons per minute (gpm)) per nominal inch of valve size, and not to exceed 19 L/m (5 gpm). The test interval should be 18 months or every refueling outage, whichever is longer.

(3) A list of PIVs that includes the allowable leak rate for each valve should be provided in the applicant's safety analysis report.[70]

g. Containment Isolation Valve Leak Testing

(1) Containment isolation valves (CIVs) should be leak tested in accordance with paragraph 4.2.2 of OM 10. Allowable leak rates and test intervals for CIVs should be stated in the plant Technical Specifications. Analysis of leakage rates should be in accordance with paragraph 4.2.2.3(e) of OM 10. Corrective actions, if required, should be in accordance with paragraph 4.2.2.3(f) of OM 10. (If the requirements are removed from 10 CFR 50.55a(b), the testing per 10 CFR 50, Appendix J, is sufficient.)[71]

(2) A list of CIVs that includes the allowable leak rate for each valve or valve combination should be provided in the applicant's safety analysis report.[72]

3. Information Required for Review of Relief Requests and Proposed Alternatives[73]

a. Identify component for which relief is requested:

(1) Name and number as given in FSAR

(2) Function

(3) ASME Section III Code Class

(4) For valve testing, also specify the ~~ASME Section XI~~ valve category as defined in ~~IWV-2000~~ paragraph 1.4 of OM 10.[74]

b. Specifically identify the ASME Code requirement that has been determined to be impractical for each component.

c. Provide information to support the determination that the requirement in item (b) is impractical; i.e., state and explain the basis for requesting relief.

d. Specify the inservice testing that will be performed in lieu of the ~~ASME Code Section XI~~OM 10[75] requirements.

e. [76]For alternatives to the ASME Code requirements, p~~P~~rovide[77] an explanation ~~as to why~~to demonstrate that:

(1) Compliance with the specified requirement would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety, and noncompliance will provide an acceptable level of quality and safety, or

(2) The proposed inservice testing will provide an acceptable level of quality and safety ~~and not endanger the public health and safety~~.[78]

f. Provide the schedule for implementation of the procedure(s) in item (d).

4. Approval of Relief Requests or Alternatives

a. Approval of Relief for Impractical Code Requirements

Relief from impractical code requirements may be granted by the Commission upon application by the applicant. Consideration of the burden on the applicant is a factor in the NRC's review and evaluation.[79]

b. Approval of Alternatives to the ASME Code Requirements[80]

~~Requests for relief from~~Authorization of alternatives to[81] ~~Section XI~~inservice testing[82] requirements will be granted by the staff if the applicant has adequately demonstrated either of the following~~;~~:

~~a.~~(1) Compliance with the code requirements would result in hardships or unusual difficulties without a compensating increase in the level of safety, and noncompliance will provide an acceptable level of quality and safety.

~~b.~~(2) Proposed alternatives to the code requirements or portions thereof will provide an acceptable level of quality and safety.

5. Pump, Valve, and Other Design or Qualification Provisions Related To Inservice Testing of Pumps and Valves[83]

The following guidance should be applied in review of new applications, based, in part, on staff positions stated in SECY 90-016 (Reference 13) and SECY 93-087 (Reference 14):

a. Safety-related pump, valve, and piping designs should include provisions to allow full flow testing of pumps and check valves at maximum design flow.[84]

b. Prototypical testing of each size, type, and model of MOV and POV should be conducted, under a range of differential pressure and flow conditions up to the design conditions, to ensure the adequacy of the thrust and torque (if applicable) that the valve operator can deliver under design (design-basis and required operating) conditions.

(1) The design conditions include fluid flow, differential pressure (including pipe break), system pressure, fluid temperature, ambient temperature, minimum voltage (if applicable), air supply (if applicable), minimum and maximum stroke time requirements (if applicable), and appropriate combinations.

(2) The testing of each size, type, and model should include test data from the manufacturer (i.e., environmental qualification, seismic qualification, dynamic qualification, pressure testing), field test data for plant-specific dedication, empirical data supported by test, or test (such as prototype) of similar valves which support qualification of the required valve where similarity must be justified by technical data.

(3) The purpose of this testing is to provide benchmark data and to demonstrate that the results of the testing under in situ or installed conditions can be used to ensure the capability of the MOV or POV to operate under design conditions.

(4) Test data should be used to ensure that the structural capability limits of the individual parts of the MOV or POV will not be exceeded under design conditions.

(5) Test data should be used to ensure that the valve specified for each application is not susceptible to pressure locking or thermal binding.[85]

c. Prototypical testing of each size, type and model of check valve should be conducted, under a range of differential pressure and flow conditions up to the design conditions, to ensure the adequacy of check valves under design (design basis and required operating) conditions.

(1) The design conditions should include all the required system operating cycles to be experienced by the valve (numbers of each type of cycle and duration of each type cycle), environmental conditions under which the valve will be required to function, severe transient loadings expected during the life of the valve such as water hammer or pipe break, lifetime expectation between major refurbishment, sealing and leakage requirements, corrosion requirements, operating medium with flow and velocity definition, operating medium temperature and gradients, maintenance requirements, vibratory loading, planned testing and methods, test frequency and periods of idle operation. The design conditions may include other requirements as identified during detailed design of the plant systems.

(2) The testing of each size, type and model should include test data from the manufacturer, field test data for plant-specific dedication, empirical data supported by test, or test (such as prototype) of similar valves which support qualification of the required valve where similarity must be justified by technical data.

(3) Test data should be used to ensure proper check valve application, including selection of the valve size and type based on the system flow conditions, installed location of the valve with respect to sources of turbulence, and correct orientation of the valve in the piping (i.e., vertical vs. horizontal) as recommended by the manufacturer.

(4) Valve design features, material, and surface finish should ensure that nonintrusive diagnostic testing methods available in the industry or as specified can be accommodated. Flow through the valve should be determinable from installed instrumentation, if appropriate, and valve disk positions should be determinable without disassembly, such as by the use of nonintrusive diagnostic methods. Valve internal parts should be designed with self-aligning features to ensure correct installation.

(5) The maximum loading on the check valve under design basis and required operating conditions should be compared to the allowable structural capability limits for the individual parts of the check valve.[86]

Technical Rationale[87]

The technical rationale for application of these acceptance criteria to reviewing inservice testing of pumps and valves is discussed in the following paragraphs:[88]

1. Compliance with GDC 1 requires that components important to safety be tested to quality standards commensurate with the importance of the safety functions to be performed.

The inservice testing of pumps and valves described in this SRP section provides for such testing according to the type and service category of the valve. The inservice

testing requirements are based on sound engineering principles as well as service experience in nuclear plants.

Meeting the requirements of GDC 1 provides assurance that pumps and valves important to safety are capable of performing their intended safety function.[89]

2. Compliance with GDC 37 requires that the emergency core cooling system be designed to permit appropriate periodic and functional testing to ensure the structural and leak tight integrity of its components as well as the operability and performance of the active components of the system.

The acceptance criteria in SRP Section 3.9.6 cite inservice tests required by the ASME Code as well as other preoperational and inservice tests for pumps and valves to ensure their leak tight integrity as well as their operability and performance. This testing is specifically applicable to safety-related pumps and valves in the emergency core cooling system and is intended to meet the requirements of GDC 37.

Meeting the requirements of GDC 37 provides assurance that pumps and valves important to safety are capable of performing their intended safety function.[90]

3. Compliance with GDC 40 requires that the containment heat removal system be designed to permit appropriate periodic and functional testing to ensure the structural and leak tight integrity of its components as well as the operability and performance of the active components of the system.

The acceptance criteria in SRP Section 3.9.6 cite inservice tests required by the ASME Code as well as other preoperational and inservice tests for pumps and valves to ensure their leak tight integrity as well as their operability and performance. This testing is specifically applicable to safety-related pumps and valves in the containment heat removal system and is intended to meet the requirements of GDC 40.

Meeting the requirements of GDC 40 provides assurance that pumps and valves important to safety are capable of performing their intended safety function.[91]

4. Compliance with GDC 43 requires that the containment atmospheric cleanup system be designed to permit appropriate periodic and functional testing to ensure the structural and leak tight integrity of its components and the operability and performance of the active components of the system, including pumps and valves.

The acceptance criteria in SRP Section 3.9.6 cite inservice tests required by the ASME Code as well as other preoperational and inservice tests for pumps and valves to ensure their leak tight integrity as well as their operability and performance. This testing is specifically applicable to safety-related pumps and valves in the containment atmospheric cleanup system and is intended to meet the requirements of GDC 43.

Meeting the requirements of GDC 43 provides assurance that pumps and valves important to safety will perform their safety intended function.[92]

5. Compliance with GDC 46 requires that the cooling water system be designed to permit appropriate periodic and functional testing to ensure the structural and leak tight integrity of its components, and the operability and performance of the active components of the system.

The acceptance criteria in SRP Section 3.9.6 cite inservice tests required by the ASME Code as well as other preoperational and inservice tests for pumps and valves to ensure their leak tight integrity as well as their operability and performance. This testing is specifically applicable to safety-related pumps and valves in the cooling water system and is intended to meet the requirements of GDC 46.

Meeting the requirements of GDC 46 provides assurance that pumps and valves important to safety are capable of performing their intended safety function.[93]

6. Compliance with GDC 54 requires that piping systems penetrating the primary reactor containment be provided with leak detection and isolation capabilities. Such piping systems shall be designed with a capability to test the operability of the isolation valves periodically to determine if valve leakage is with acceptable limits.

The acceptance criteria in SRP Section 3.9.6 cite inservice tests required by the ASME Code as well as other preoperational and inservice tests for valves to ensure their leak tight integrity as well as their operability and performance. This testing is specifically applicable to safety-related valves in system that penetrate the primary containment and is intended to meet the requirements of GDC 54.

Meeting the requirements of GDC 54 provides assurance that valves important to safety are capable of performing their intended safety function.[94]

7. Compliance with 10 CFR 50.55a(f) requires that pumps and valves whose active function is required for safety be tested in accordance with the applicable revision of the ASME Code, as described therein.

The acceptance criteria in SRP Section 3.9.6 cite inservice tests required by the ASME Code as well as other tests for pumps and valves to ensure their operability and performance. This testing is specifically applicable to pumps and valves whose function is required for safety and is intended to meet the requirements of 10 CFR 50.55a(f).

Meeting the requirements of 10 CFR 50.55a(f) provides assurance that certain pumps and valves important to safety are capable of performing their intended safety function.[95]

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, the following review procedures are followed:~~[96] Additional guidance regarding the review procedures for inservice testing programs for pumps and valves is provided in NUREG-1482.[97]

1. Inservice Testing of Pumps

a. The scope of the applicant's program is reviewed for agreement with subsection II.1.a. The ~~program is acceptable if a~~ preservice test program ~~is~~should be[98] used to establish reference values. The periodic inservice program ~~must~~should be used to verify that the reference values are[99] within acceptable limits.

b. The pump test program procedures ~~must~~should[100] agree with the requirements of subsection II.1.b. The program is best presented in tabular form.

c. The inservice test frequencies and test durations are reviewed for agreement with subsection II.1.c.

d. The test procedures[101] described in the SAR are reviewed for agreement with subsection II.1.d. The SAR need only provide the necessary information to permit a conclusion that the methods of measurement and the data acquisition system will provide the needed data. The reviewer does not approve or disapprove the instruments or methods proposed or used.

2. Inservice Testing of Valves

a. The SAR valve test list and categorization are reviewed for agreement with subsection II.2.a.

b. The valve test program is ~~acceptable if the procedures follow the rules of subsection II.2.b for preservice and periodic inservice testing.~~ reviewed for agreement with subsection II.2.b.[102]

c. The staff will review preoperational tests, inservice tests, and acceptance criteria for MOVs, as described in subsection II.2.c. These procedures and inservice tests are to be performed in addition to the inservice tests described in subsections II.2.a and b.[103]

d. The staff will review preoperational tests, inservice tests, and acceptance criteria for POVs, as described in subsection II.2.d. These procedures and inservice tests are to be performed in addition to the inservice tests described in subsections II.2.a and b.[104]

e. The staff will review preoperational tests, inservice tests, and acceptance criteria for check valves, as described in subsection II.2.e. These procedures and inservice tests are to be performed in addition to the inservice tests described in subsections II.2.a and b.[105]

f. The staff will review the applicant's list of PIVs to ensure that it is complete and that the allowable leak rates for each PIV are in accordance with the guidance provided in subsection II.2.f.[106]

g. The staff will review the applicant's list of CIVs to ensure that it is complete and that the allowable leak rates for each CIV are in accordance with the guidance provided in subsection II.2.g.[107]

3. Relief Requests

a.[108] Requests for relief from ~~Section XI~~OM 6 or OM 10[109] requirements are reviewed to determine that sufficient information has been provided and that the acceptance criteria of subsections II.3 and II.4[110] have been met.

b. Requests for exemption from the additional procedures and inservice testing described in subsection II.2.c for MOVs, II.2.d for POVs, II.2.e for check valves, II.2.f for PIVs, and II.2.g. for CIVs are reviewed to determine that sufficient information has been provided and that acceptance criteria described in subsections II.3 and II.4 have been met.[111]

For standard design certification reviews under 10 CFR Part 52, the procedures above should be followed, as modified by the procedures in SRP Section 14.3 (proposed), to verify that the design set forth in the standard safety analysis report, including inspections, tests, analysis, and acceptance criteria (ITAAC), site interface requirements and combined license action items, meet the acceptance criteria given in subsection II. SRP Section 14.3 (proposed) contains procedures for the review of certified design material (CDM) for the standard design, including the site parameters, interface criteria, and ITAAC.[112]

IV. EVALUATION FINDINGS

The reviewer verifies that sufficient information is provided in accordance with the requirements of this SRP section and that his evaluation supports a conclusion of the following type, to be included in the staff's safety evaluation report:

> The staff concludes that the applicant's pumps and valves test program is acceptable and meets the requirements of 10 CFR Part 50, Appendix A, General Design Criteria 1,[113] 37, 40, 43, 46, 54, and ~~§~~50.55a(g) 10 CFR 50.55a(f).[114] This conclusion is based on the applicant having provided a test program to ensure that safety-related[115] pumps and valves will be in a state of operational readiness to perform necessary safety functions throughout the life of the plant. This program includes baseline preservice testing and periodic inservice testing. The program provides for both functional testing of the components in the operating state ~~and for visual inspection for leaks and other signs of distress~~.[116] The Applicant has also formulated ~~his~~the inservice test program to include all safety-related Code Class 1, 2, and 3 pumps and valves and to include those pumps and valves which are not Code Class 1, 2, and 3 but are considered to be safety-related.[117]

For design certification reviews, the findings will also summarize, to the extent that the review is not discussed in other safety evaluation report sections, the staff's evaluation of inspections, tests, analyses, and acceptance criteria (ITAAC), including design acceptance criteria (DAC), site interface requirements, and combined license action items that are relevant to this SRP section.[118]

V. IMPLEMENTATION

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

This SRP section will be used by the staff when performing safety evaluations of license applications submitted by applicants pursuant to 10 CFR 50 or 10 CFR 52.[119] 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.

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.[120]

VI. REFERENCES

1. 10 CFR Part 50, Appendix A, General Design Criterion 1, "Quality Standards and Records."[121]

~~1~~2. 10 CFR Part 50, Appendix A, General Design Criterion 37, "Testing of Emergency Core Cooling System."

~~2~~3. 10 CFR Part 50, Appendix A, General Design Criterion 40, "Testing of Containment Heat Removal System."

~~3~~4. 10 CFR Part 50, Appendix A, General Design Criterion 43, "Testing of Containment Atmosphere Cleanup Systems."

~~4~~5. 10 CFR Part 50, Appendix A, General Design Criterion 46, "Testing of Cooling Water Systems."

~~5~~6. 10 CFR Part 50, Appendix A, General Design Criterion 54, "Piping Systems Penetrating Containment."

~~6~~7. ASME Boiler and Pressure Vessel Code, Section III and Section XI, Subsections IWP and IWV, American Society of Mechanical Engineers.

~~7~~8. Code of Federal Regulations, Title 10, Part 50, Section 50.55a, "Codes and Standards."

9. ASME/ANSI OM-1987 (Including ASME/ANSI OMa-1988 Addenda), "Operation and Maintenance of Nuclear Power Plants," American Society of Mechanical Engineers.[122]

10. Regulatory Guide 1.147, "Inservice Inspection Code Case Acceptability, ASME Section XI, Division 1."[123]

11. NUREG-1482, "Guidelines for Inservice Testing at Nuclear Power Plants" (April 1995).[124]

12. NRC Letter to All Holders of Light Water Reactor Operating Licenses and Construction Permits, "Guidance on Developing Acceptable Inservice Testing Programs (Generic Letter No. 89-04)," April 3, 1989.[125]

13. SECY-90-016, "Evolutionary Light Water Reactor (LWR) Certification Issues and Their Relationship to Current Regulatory Requirements," January 12, 1990; SRM-93-087 issued on June 26, 1990.[126]

14. SECY-93-087, "Policy, Technical, and Licensing Issues Pertaining to Evolutionary and Advanced Light-Water Reactor (ALWR) Designs," April 2, 1993; SRM-93-087 issued on July 21, 1993.[127]

APPENDIX A

Summary of Common Motor-Operated Valve Deficiencies, Misadjustments, and Degraded Conditions

- Incorrect torque switch bypass settings
- Incorrect torque switch settings
- Unbalanced torque switch
- Spring pack gap or incorrect spring pack preload
- Incorrect stem packing tightness
- Excessive inertia
- Loose or tight stem-nut locknut
- Incorrect limit switch settings
- Stem wear
- Bent or broken stem
- Worn or broken gears
- Grease problems (hardening, migration into spring pack, lack of grease, excessive grease, contamination, nonspecified grease)
- Motor insulation or rotor degradation
- Incorrect wire size or degraded wiring
- Disk/seat binding (includes thermal binding)
- Water in internal parts or deterioration therefrom
- Motor undersized (for degraded voltage conditions or other conditions)
- Incorrect valve position indication
- Misadjustment or failure of handwheel declutch mechanism
- Relay problems (incorrect relays, dirt in relays, deteriorated relays, miswired relays)
- Incorrect thermal overload switch settings
- Worn or broken bearings
- Incorrect torque or limit switch installed (inside and outside containment applications)
- Broken or cracked limit switch and torque switch components
- Missing or modified torque switch limiter plate
- Improperly sized actuators
- Hydraulic lockup
- Incorrect metallic materials for gears, keys, bolts, shafts, etc.
- Degraded voltage (within design basis)
- Defective motor control logic
- Excessive seating or backseating force application
- Incorrect reassembly or adjustment after maintenance and/or testing
- Unauthorized modifications or adjustments
- Torque switch or limit switch binding
- Pressure locking of gate valves[128]

Item numbers in the following table correspond to superscript numbers in the redline/strikeout copy of the draft SRP section.

Item	Source	Description
1.	Primary review branch abbreviation	Changed "MEB" to "EMEB."
2.	Primary review branch abbreviation	Changed "MEB" to "EMEB."
3.	Editorial modification	Deleted underlining of the phrase "certain safety-related" in the sentence. Underlining is vague and unnecessary.
4.	Editorial modification	Deleted underlining of the word "typically" in the sentence. Underlining is vague and unnecessary.
5.	Integrated Impacts 403, 404, 405, 406, 407, and 409	Added phrase to the sentence to indicate that the Acceptance Criteria subsection describes guidance for pump and valve inservice testing in addition to that of the ASME Code.
6.	Editorial modification	Deleted "assure" and substituted "ensure" to correct grammar. This change will be made in the rest of the SRP section without further superscripted notation.
7.	SRP-UDP format item	Included citation of General Design Criteria 1 which refers directly to testing of components important to safety and components that are part of the reactor-coolant pressure boundary.
8.	Editorial modification Integrated Impact No. 402	Changed designation of CFR section to conform to standard nomenclature. Changed citation from 50.55a(g) to 50.55a(f).
9.	Integrated Impact No. 406	Added citation of NUREG-1482 in the Areas of Review.
10.	Editorial modification	Deleted underling of the acronym "ASME" in the sentence. Underlining is vague and unnecessary.
11.	Editorial modification	Deleted underlining of the phrase "whose function is required for safety." Underlining is vague and unnecessary.
12.	Editorial modification	Deleted underlining of the word "Procedures." Underlining is vague and unnecessary.
13.	Editorial modification	Deleted underlining of the phrase "is reviewed for those ASME." Underlining is vague and unnecessary.
14.	Editorial modification	Deleted underlining of the phrase "whose function is required for safety." Underlining is vague and unnecessary.
15.	Editorial modification	Deleted underlining of the phrase "nonsafety-related." Underlining is vague and unnecessary.

Item	Source	Description
16.	Editorial modification	Deleted underlining of the phrase "exempted by." Underlining is vague and unnecessary.
17.	Editorial modification, Integrated Impact No. 402	Revised designation of 10 CFR 50.55a at the beginning of the sentence to conform to standard practice. Changed citation from 50.55a(g) to 50.55a(f) to reflect the latest revision of 10 CFR.
18.	Integrated Impact No. 402	Added a footnote to describe how OM 6 and OM 10 are cited in the 1989 revision of ASME Code Section XI, which is the latest applicable revision cited in 10 CFR 50.55a(b).
19.	Editorial modification	Revised sentence for clarification. Deleted the word "future" and added a phrase at the end of the sentence to clarify that the source of inservice testing program revisions would be subsequent revisions of 10 CFR 50.55a.
20.	Integrated Impact No. 402	Modified the sentence to more accurately describe the source of requirements. The requirements are in the OM documents as invoked in Section XI, an thus a more general description of the requirements is required.
21.	Integrated Impact No. 402	Modified the sentence to more accurately describe the source of requirements. The requirements are in the OM documents as invoked in Section XI, an thus a more general description of the requirements is required.
22.	Integrated Impact No. 402	Modified the sentence to more accurately describe the source of requirements. The requirements are in the OM documents as invoked in Section XI, an thus a more general description of the requirements is required.
23.	**Integrated Impacts Nos. 403, 404, 406, and 407**. Added a new subsection I.4 to address review of design, qualification, and other requirements related to inservice testing of pumps and valves.	
24.	Potential Impact 11992	Added a Review Interface to SRP 9.2.1 for review of surveillance and testing programs for service water systems in accordance with Generic Letter 89-13.
25.	SRP-UDP format item	Added Review Interfaces subsection to describe interfacing reviews in other sections of the SRP.
26.	**Integrated Impact 405,** Editorial	Added a review interface with new SRP Section 3.12 with regard to ISLOCA reviews.

Item	Source	Description
27.	SRP-UDP format item	Added text describing the review responsibility of interfacing review branches.
28.	SRP-UDP format item	Included citation of General Design Criterion 1 which refers directly to testing of components important to safety and components that are part of the reactor-coolant pressure boundary.
29.	Editorial modification Integrated Impact No. 402	Revised designation of 10 CFR 50.55a at the end of the sentence to conform to standard practice. Changed citation from 50.55a(g) to 50.55a(f) to reflect the latest revision of 10 CFR.
30.	SRP-UDP format item	Added a description of the relevant requirements of GDC 1 that are pertinent to this SRP section.
31.	Editorial modification	Re-designated the subsection letters to provide for the addition of GDC 1.
32.	Editorial modification	Provided "GDC 37" as initialism for "General Design Criterion 37."
33.	Editorial modification	Provided "GDC 40" as initialism for "General Design Criterion 40."
34.	Editorial modification	Provided "GDC 43" as initialism for "General Design Criterion 43."
35.	Editorial modification	Provided "GDC 46" as initialism for "General Design Criterion 46."
36.	Editorial modification	Provided "GDC 54" as initialism for "General Design Criterion 54."
37.	Editorial modification Integrated Impact No. 402	Revised designation of 10 CFR 50.55a at the beginning of the sentence to conform to standard practice. Changed citation from 50.55a(g) to 50.55a(f) to reflect the latest revision of 10 CFR.
38.	Editorial	Edited sentence to accommodate addition of second sentence to this introductory paragraph.
39.	Integrated Impact No. 406	Added citation of NUREG-1482 for guidance concerning the acceptance criteria for inservice testing of pumps and valves.
40.	Integrated Impact No. 409	Added sentence that cites the Code Cases endorsed in Regulatory Guide 1.147 regarding inservice testing of pumps and valves.
41.	Integrated Impact No. 402	Updated citation of the pertinent section of the ASME Code. Cited Section 1 of OM 6 in place of IWP-1000 which is no longer appropriate.
42.	Incorporation of PRB Comments	Changed "includes" to "may include" to incorporate comments from EMEB.

Item	Source	Description
43.	Editorial modification	Added punctuation and hyphenated "safety-related" in the sentence.
44.	Integrated Impact No. 406, PRB Comments	Added reference to GL 89-04 Attachment 1. This addresses comments from EMEB.
45.	Editorial modification Integrated Impact No. 402	Revised wording in the sentence to conform to OM 6. Cited OM 6 in accordance with the provisions of 10 CFR 50.55a(f). Deleted citation of IWP-3000 which is no longer appropriate.
46.	Editorial, PRB Comments	Corrected grammar as indicated in EMEB comments.
47.	Integrated Impact No. 402	Cited Sections 4 and 5 of OM 6 in place of IWP-3000 which is no longer applicable.
48.	Integrated Impact No. 402	Deleted "bearing temperature" and cited "vibration" in the sentence. The bearing temperature test is replaced by vibration testing in OM 6.
49.	Integrated Impact No. 402	Deleted citation of IWP-3000 and IWP-4000 which are no longer appropriate. Cited Sections 4, 5, and 6 of OM 6 regarding test quantities, corrective actions, and analyses.
50.	Integrated Impact No. 402	Updated test schedule requirements to cite the provisions of paragraph 5.1 of OM-6.
51.	Integrated Impact No. 402	Deleted "test frequencies and durations" and substituted the titles of the paragraphs in OM 6. This clarification was included to avoid any possible confusion with vibration testing parameters.
52.	Integrated Impact No. 402	Deleted citation of IWP-3000 and replaced it with citations of paragraphs 5.1 and 5.6 of OM 6 regarding test frequency and duration.
53.	Integrated Impact No. 402	Deleted citation of IWP-4000 and replaced it with citations of Sections 4 and 5 of OM 6 regarding instruments, pressure measurements, etc.
54.	Integrated Impact No. 402	Deleted reference to temperature measurements. Such measurements are not required under OM 6.
55.	Editorial modification	Deleted underlining of the phrase "safety-related" Underlining is vague and unnecessary.
56.	Integrated Impact No. 402	Deleted citation of IWV-1100 which is no longer appropriate. Substituted citation of 10 CFR 50.55a(f) and paragraph 1.1 of OM 10
57.	Editorial, PRB Comments	Struck "nonsafety-related" to incorporate EMEB comment.

Item	Source	Description
58.	Editorial modification	Deleted underlining of the phrase "nonsafety-related valves exempted by." Underlining is vague and unnecessary.
59.	Editorial modification, Integrated Impact No. 406, PRB comments.	Divided the sentence in two and made minor grammatical changes, for clarification. Added reference to GL 89-04 to address PRB comments.
60.	Integrated Impact No. 402	Deleted citation of IWV-2000 which is no longer applicable. Substituted citation of paragraph 1.4 of OM 10 which covers valve categories.
61.	Integrated Impact No. 402	Substituted citation of OM 10 for subsection IWV.
62.	Editorial, PRB Comments	added "to be" as indicated in EMEB comments.
63.	Editorial modification	Deleted citation of subsection IWV-2000 which is redundant with the preceding sentence.
64.	Integrated Impact No. 402	Deleted citation of IWV-3000 of Section XI. Substituted citation of Sections 3, 4, and 5 of OM 10 and described the subjects in the sentence.
65.	PRB Comments	Included this paragraph to incorporate EMEB comments.
66.	Integrated Impact No. 403	Added subsection II.2.c regarding the IST program requirements for MOVs. The text was adapted from subsection 3.9.6.2.1 of the CE80+ FSER (NUREG-1462) and from subsection 3.9.6.2.1 of the CE80+ FSAR. This text meets the intent of Generic Letter 89-10 with respect to ensuring the design-basis operability of MOVs.
67.	PRB comments	Added paragraph supplied by EMEB comments.
68.	Integrated Impact No. 406	Added subsection II.2.d regarding the IST program requirements for POVs. The text was adapted from subsection 3.9.6.2.2 of the CE80+ FSER (NUREG-1462) and from subsection 3.9.6.2.2 of the CE80+ FSAR.
69.	Integrated Impact No. 404	Added subsection II.2.e regrading the IST program requirements for check valves. The text was adapted from subsection 3.9.6.2.3 of the CE80+ FSER (NUREG-1462) and from subsection 3.9.6.2.2 of the CE80+ FSAR.
70.	Integrated Impact No. 405	Added subsection II.2.f regarding the IST program requirements for leak testing pressure isolation valves (PIVs). The text was adapted from subsection 3.9.6.2.4 of the CE80+ FSER (NUREG-1462), subsection 3.9.6.2.4 of the CE80+ FSAR, and Section 3.4.13 of the CE80+ Technical Specifications.

Item	Source	Description
71.	PRB Comments	Parenthetical statement added to address EMEB comments.
72.	Integrated Impact No. 402	Added subsection II.2.g regarding the IST program requirements for leak testing containment isolation valves (CIVs). The text was constructed from an examination of subsection 3.9.6.2.4 of the CE80+ and ABWR FSERs. (These requirements may be deleted from the regulations.)
73.	PRB Comments	Revised subsection title to address EMEB comments.
74.	Integrated Impact No. 402	Substituted citation of paragraph 1.4 of OM 10 for IWV-2000 of Section XI in the sentence.
75.	Integrated Impact No. 402	Substituted citation of OM 10 in place of Section XI.
76.	Editorial modification	Deleted underlining of subsection II.3.e. Underlining is vague and unnecessary.
77.	PRB Comments	Added qualifying statement to address EMEB comments.
78.	Integrated Impact No. 402	Revised subsection II.3.e to reflect current wording of 10 CFR 50.55a.
79.	PRB Comment	Added new paragraph/subsection to address EMEB comments.
80.	Editorial modification, PRB Comments	Added subsection II.4 to existing text to provide non-repeating subsection designations in the existing text. Added title for new subsection, modified to address EMEB comments.
81.	Editorial, PRB Comments	Revised introductory sentence to address EMEB comments.
82.	Integrated Impact No. 402	Deleted "Section XI" and substituted "inservice testing" in the sentence. A direct reference to Section XI is no longer appropriate and the more general phrase was substituted.
83.	Integrated Impact Nos. 403, 404, 406, and 407	Added a new subsection II.5 to describe design, qualification, and other requirements related to inservice testing of pumps and valves.
84.	Integrated Impact No. 404, 406, and 407	Added subsection II.5.a regarding design of pumps and valves to allow full flow testing during inservice testing.
85.	Integrated Impact No. 403 and 406	Added subsection II.5.b regarding qualification of MOVs and POVs to provide for establishment of benchmarks and acceptable inservice testing.

Item	Source	Description
86.	Integrated Impact No. 404	Added subsection II.5.c. to indicate design requirements applicable to check valves which are interfacing with inservice testing.
87.	SRP-UDP format item	Added a "Technical Rationale" subsection to the Acceptance Criteria subsection to describe the bases for citing the GDC and 10 CFR provisions.
88.	SRP-UDP format item	Added a lead-in sentence to "Technical Rationale."
89.	SRP-UDP format item	Added technical rationale for GDC 1.
90.	SRP-UDP format item	Added technical rationale for GDC 37.
91.	SRP-UDP format item	Added technical rationale for GDC 40.
92.	SRP-UDP format item	Added technical rationale for GDC 43.
93.	SRP-UDP format item	Added technical rationale for GDC 46.
94.	SRP-UDP format item	Added technical rationale for GDC 54.
95.	SRP-UDP format item	Added technical rationale for 10 CFR 50.55a(f).
96.	Editorial modification	Deleted redundant sentence.
97.	Integrated Impact No. 406	Cited NUREG-1482 for review procedures applicable to inservice testing of pumps and valves.
98.	Editorial modification	Revised the wording in the sentence to convey the proper meaning. The word "should" is appropriate because the SRP provides guidance to the staff for review and is not a specification. The phrase "the program is acceptable" was deleted because it indicates that there is only one acceptance criterion.
99.	Editorial modification	Revised the wording in the sentence to convey the proper meaning. The word "should" is appropriate because the SRP provides guidance to the staff for review and is not a specification.
100.	Editorial modification	Revised the wording in the sentence to convey the proper meaning. The word "should" is appropriate because the SRP provides guidance to the staff for review and is not a specification.
101.	Editorial modification	Deleted underlining of the word "procedures." Underlining is vague and unnecessary.
102.	Editorial modification	Revised text of subsection III.2.b to agree with new subsections that follow.
103.	Integrated Impact No. 403	Added new subsection III.2.c to provide review procedures for additional inservice testing applicable to MOVs. The review procedures cite the acceptance criteria in subsection II.2.c of SRP Section 3.9.6.

Item	Source	Description
104.	Integrated Impact No. 406	Added new subsection III.2.d to provide review procedures for additional inservice testing applicable to POVs. The review procedures cite the acceptance criteria in subsection II.2.d of SRP Section 3.9.6.
105.	Integrated Impact No. 404	Added new subsection III.2.e to provide review procedures for additional inservice testing applicable to check valves. The review procedures cite the acceptance criteria in subsection II.2.e of SRP Section 3.9.6.
106.	Integrated Impact No. 405	Added new subsection III.2.f to provide review procedures for leak testing of PIVs. the procedures cite the acceptance criteria in subsection II.2.f. of SRP section 3.9.6.
107.	Integrated Impact No. 402	Added new subsection III.2.g. to provide review procedures for leak testing of CIVs. the procedures cite the acceptance criteria in subsection II.2.g. of SRP section 3.9.6.
108.	Editorial modification	Added subsection designation III.3.a to existing text.
109.	Integrated Impact No. 402	Changed citation in the existing text in new subsection III.3.a from "Section XI" to "OM 6 or OM 10" to conform to 1989 ASME Code.
110.	Editorial modification	Referred to new subsection designation for clarification.
111.	Integrated Impact Nos. 403, 404, and 405	Added subsection III.3.b regarding additional procedures and inservice testing for MOVs, POVs, check valves, PIVs, and CIVs.
112.	SRP-UDP Guidance, Implementation of 10 CFR 52	Added standard paragraph to address application of Review Procedures in design certification reviews.
113.	SRP-UDP format item	Included citation of General Design Criterion 1 which refers directly to testing of components important to safety and components that are part of the reactor-coolant pressure boundary.
114.	Integrated Impact No. 402	Changed citation from 50.55a(g) to 50.55a(f) to agree with the revised CFR.
115.	Editorial modification	Deleted underlining of the phrase "safety-related." Underlining is vague and unnecessary.
116.	Editorial, PRB Comments	Struck "and for visual inspection for leaks and other signs of distress" to address EMEB comments.
117.	Editorial, PRB Comment	Edited the sentence to be more grammatically correct and to eliminate gender-specific pronoun. These changes also address EMEB comments.

Item	Source	Description
118.	SRP-UDP Format Item, Implement 10 CFR 52 Related Changes	To address design certification reviews a new paragraph was added to the end of the Evaluation Findings. This paragraph addresses design certification specific items including ITAAC, DAC, site interface requirements, and combined license action items.
119.	SRP-UDP Guidance, Implementation of 10 CFR 52	Added standard sentence to address application of the SRP section to reviews of applications filed under 10 CFR Part 52, as well as Part 50.
120.	SRP-UDP Guidance	Added standard paragraph to indicate applicability of this section to reviews of future applications.
121.	SRP-UDP format item	Provided references to General Design Criterion 1 which refers directly to testing of components important to safety and components that are part of the reactor-coolant pressure boundary. Renumbered subsequent references.
122.	Integrated Impact No. 402	Added ASME/ANSI OM as a reference to reflect the latest ASME Code version cited in 10 CFR 50.55a. This document contains OM 1 regarding IST of safety valves and relief valves, OM 6 regarding IST of pumps, and OM 10 regarding IST of valves.
123.	Integrated Impact No. 409	Added Regulatory Guide 1.147 as Reference 10.
124.	Integrated Impact No. 406	Added NUREG-1482 as Reference 11.
125.	Integrated Impact No. 406, PRB Comments	Added reference listing of GL 89-04 to correspond with references to the GL added to address EMEB comments.
126.	**Integrated Impacts 404, 405, and 407**.	Added SECY-90-016 as a reference to this SRP section.
127.	**Integrated Impacts 404, and 407.**	Added SECY-93-087 as a reference to this SRP section.
128.	Integrated Impact No. 403	Added table of MOV deficiencies from Generic Letter 89-10 as Appendix A.

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Integrated Impact No.	Issue	SRP Subsections Affected
402	Revise SRP Section 3.9.6 to reflect changes to 10 CFR 50.55a.	AREAS OF REVIEW, Subsection I ACCEPTANCE CRITERIA, Subsection II REVIEW PROCEDURES, Subsection III EVALUATION FINDINGS, Subsection IV REFERENCES, Subsection VI
403	Develop Acceptance Criteria and Review Procedures for inservice testing of safety-related MOVs.	AREAS OF REVIEW, Subsection I ACCEPTANCE CRITERIA, Subsection II REVIEW PROCEDURES, Subsection III New Appendix A
404	Develop Acceptance Criteria and Review Procedures for inservice testing of safety-related check valves.	AREAS OF REVIEW, Subsection I ACCEPTANCE CRITERIA, Subsection II REVIEW PROCEDURES, Subsection III REFERENCES, Subsection VI
405	Develop Acceptance Criteria and Review Procedures for inservice testing of PIVs	AREAS OF REVIEW, Subsection I ACCEPTANCE CRITERIA, Subsection II REVIEW PROCEDURES, Subsection III REFERENCES, Subsection VI
406	Develop Acceptance Criteria and Review Procedures for inservice testing of pumps and valves of several types and in several services. Cite NUREG-1482 to provide guidance regarding inservice testing of pumps and valves.	AREAS OF REVIEW, Subsection I ACCEPTANCE CRITERIA, Subsection II REVIEW PROCEDURES, Subsection III REFERENCES, Subsection VI

SRP Draft Section 3.9.6

Attachment B - Cross Reference of Integrated Impacts

Integrated Impact No.	Issue	SRP Subsections Affected
407	Develop Acceptance Criteria for inservice testing of pumps and valves to insure testability under maximum flow conditions.	AREAS OF REVIEW, Subsection I ACCEPTANCE CRITERIA, Subsection II REFERENCES, Subsection VI
408	Develop Acceptance Criteria and Review Procedures for disassembly of pumps and valves as a supplement to inservice testing.	No changes made to SRP 3.9.6, based upon EMEB comments.
409	Cite Regulatory Guide 1.147 for ASME Code Cases regarding inservice testing of pumps and valves.	AREAS OF REVIEW, Subsection I ACCEPTANCE CRITERIA, Subsection II REFERENCES, Subsection VI