U.S. NUCLEAR REGULATORY COMMISSION

STANDARD REVIEW PLAN

9.2.1 STATION SERVICE WATER SYSTEM

REVIEW RESPONSIBILITIES

Primary - Organization responsible for the review of cooling water systems

Secondary - None

I. AREAS OF REVIEW

The service water system (SWS) provides essential cooling to safety-related equipment and may also cool nonsafety-related auxiliary components used for normal plant operation. The system is reviewed from the service water pump intake to the points of cooling water discharge for compliance with the requirements of General Design Criteria (GDCs) 2, 4, 5, 44, 45, and 46. The ultimate heat sink (reviewed under Standard Review Plan (SRP) Section 9.2.5) is the intake source of water to the SWS for long-term cooling of station features required for plant shutdown and also of any special equipment required to prevent or mitigate the consequences of postulated accidents and as such is an SWS interface system. The SWS pump performance characteristics are compared to the high and low water levels of the ultimate heat sink to assure pumping capability for extended periods of operation following postulated events.

Site-specific SWS portions may not be within the scope of the design submitted by applicants for design certification (DC) under 10 CFR Part 52. The SWS piping, valves, instrumentation, and controls within the DC applicant's scope are reviewed as part of the DC submission. Site-specific portions of the design (may include the SWS pumps) are the responsibility of the Combined license (COL) applicant. The DC applicant's submission should provide a conceptual design and interface requirements for that SWS portion outside the scope of the DC as required by 10 CFR Part 52.

The specific areas of review are as follows:

1. The characteristics of the SWS components (pumps, heat exchangers, pipes, valves) are reviewed as to their functional performance as affected by adverse operational (i.e., water hammer) and environmental occurrences including cold weather protection, by abnormal operational requirements, and by such accident conditions as a loss-of-coolant accident with the loss of offsite power. As the SWS normally has requirements for cooling functions during normal plant operation as well as for safety functions, the review includes an evaluation of system capability to perform these multiple functions.

2. The SWS design is reviewed for:

   A. The capability to detect, control, and isolate system leakage including the capability to detect and control radioactive leakage into and out of the system and prevent accidental releases to the environment.

   B. Measures to preclude long-term corrosion and organic fouling tending to degrade system performance.

   C. Provisions for system and component operational testing, including the instrumentation and control features that determine and confirm whether the system operates in a correct mode (*i.e.*, valve position, pressure and temperature indication).

   D. The effects of the failure of nonseismic Category I equipment, structures or components on safety-related SWS portions taken into account.

3. SWS capability to flood the reactor containment if required in a post-accident recovery situation is reviewed.

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

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

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

Review Interfaces

The system is reviewed for whether a malfunction, a failure of a component, or the loss of a cooling source could reduce the safety-related functional performance capabilities of the system.

Other SRP sections interface with this section as follows:

1. Sections 3.2.1 and 3.2.2: review of the acceptability of the seismic and quality group classifications for system components.

2. Sections 3.3.1, 3.3.2, 3.5.3, 3.7.1 through 3.7.4, 3.8.4, and 3.8.5: review of the acceptability of the design analyses, procedures, and criteria establishing the capability of seismic Category I structures housing the system and supporting systems to withstand the effects of natural phenomena like the safe shutdown earthquake (SSE), probable maximum flood, and tornado missiles.

3. Section 3.4.1: review for flood protection.

4. Section 3.5.1.1: review of the protection against internally-generated missiles.

5. Sections 3.5.1.4 and 3.5.2: review of the SSCs to be protected against externally-generated missiles.

6. Section 3.6.1: review of high- and moderate-energy pipe breaks.

7. Sections 3.9.1 through 3.9.3: review for whether components, piping and structures are designed in accordance with applicable codes and standards.

8. Section 3.9.6: review of the adequacy of the inservice testing program of pumps and valves.

9. Section 5.4.7: review of essential components associated with the reactor coolant system required during normal operations or accident conditions.

10. Section 5.4.8: review of essential components associated with the reactor water cleanup system of a boiling-water reactor required during normal operations or accident conditions, and verification of the compatibility of the materials of construction with service conditions.

11. Section 6.3: review of essential components associated with the emergency core cooling systems required during normal operations or accident conditions.

12. Section 6.6: verification of whether system components meet inservice inspection requirements and, upon request, verification of the compatibility of the materials of construction with service conditions.

13. Sections 7.1 and 8.1: review of the system controls, instrumentation, and power sources as to capabilities, capacity, and reliability for supplying power during normal and emergency conditions to safety-related pumps, valves and other components. The review evaluation includes the signals for isolating safety-related from nonsafety-related SWS portions in postulated accidents with special emphasis on proper isolation of interconnected trains in unusual conditions like SWS low pressures or low current draws for safety-related pumps.

14. Section 9.5.1: review for fire protection.

15. Section 13.6: review for security considerations for such SWS portions as intake structures.

16. Section 14.2: review of the proposed pre-operational and startup test programs.

17. Chapter 15: review of accident cooling load functional requirements and minimum time intervals.

18. Section 16.0: review of technical specifications.

19. Section 17.5: review for quality assurance.

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

II. ACCEPTANCE CRITERIA

Requirements

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

1. GDC 2 as to capability of the structures housing the service water system and the system itself to withstand the effects of earthquakes.

2. GDC 4 as to effects of missiles inside and outside of containment, pipe whip, jets, and environmental conditions from high- and moderate-energy line breaks and dynamic effects of flow instabilities and loads (e.g., water hammer) during normal plant operation as well as during upset or accident conditions.

3. GDC 5 as to the capability of shared systems and components important to safety to perform required safety functions.

4. GDC 44 as to heat transfer from SSCs important to safety to an ultimate heat sink. Acceptance is based on the following:

   A. The capability to transfer heat loads from safety-related SSCs to a heat sink under both normal operating and accident conditions.

   B. Component redundancy for safety function performance assuming a single, active component failure coincident with the loss of offsite power.

   C. The capability to isolate components, subsystems, or piping if required so that the system safety function will not be compromised.

5. GDC 45 as to design provisions for inservice inspection of safety-related components and equipment.

6. GDC 46 as to design provisions for operational functional testing of safety-related systems and components.

7. 10 CFR 52.47(b)(1), which requires that a DC application contain the proposed inspections, tests, analyses, and acceptance criteria (ITAAC) that are necessary and sufficient to provide reasonable assurance that, if the inspections, tests, and analyses are performed and the acceptance criteria met, a plant that incorporates the design certification is built and will operate in accordance with the design certification, the provisions of the Atomic Energy Act, and the NRC's regulations.

8. 10 CFR 52.80(a), which requires that a COL application contain the proposed inspections, tests, and analyses, including those applicable to emergency planning, that the licensee shall perform, and the acceptance criteria that are necessary and sufficient

to provide reasonable assurance that, if the inspections, tests, and analyses are performed and the acceptance criteria met, the facility has been constructed and will operate in conformity with the combined license, the provisions of the Atomic Energy Act, and the NRC'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 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.

1. Protection Against Natural Phenomena. Information that addresses the requirements of GDC 2 regarding the capability of structures housing the SWS and the SWS itself to withstand the effects of natural phenomena will be considered acceptable if the guidance of Regulatory Guide (RG) 1.29, Position C.1 for safety-related portions of the SWS and Position C.2 for nonsafety-related portions of the SWS are appropriately addressed.

2. Environmental and Dynamic Effects. Information that addresses the requirements of GDC 4 regarding consideration of environmental and dynamic effects will be considered acceptable if the acceptance criteria in the following SRP sections, as they apply to the SWS, are met: SRP Sections 3.5.1.1, 3.5.1.4, 3.5.2, and SRP Section 3.6.1.

   In addition, the information will be considered acceptable if the design provisions presented in GL 96-06 and to GL 96-06, Supplement 1 are appropriately addressed.

3. Sharing of Structures, Systems, and Components. Information that addresses the requirements of GDC 5 regarding the capability of shared systems and components important to safety to perform required safety functions will be considered acceptable if the use of the SWS in multiple-unit plants during an accident in one unit does not significantly affect the capability to conduct a safe and orderly shutdown and cool-down in the unaffected unit(s).

   In addition, the information will be considered acceptable if the provisions GL 89-13 and GL 91-13 are appropriately addressed.

4. Cooling Water System. Information that addresses the requirements of GDC 44 regarding consideration of the cooling water system will be considered acceptable if a system to transfer heat from SSCs important to safety to an ultimate heat sink is provided. In addition, the SWS can transfer the combined heat load of these SSCs under normal operating and accident conditions, assuming loss of offsite power and a single failure, and that system portions can be isolated so the safety function of the system is not compromised.

5. Cooling Water System Inspection. Information that addresses the requirements of GDC 45 regarding the inspection of cooling water systems will be considered acceptable if the design of the SWS permits inservice inspection of safety-related components and equipment and operational functional testing of the system and its components.

6. Cooling Water System Testing. Information that addresses the requirements of GDC 46 regarding the testing of cooling water systems will be considered acceptable if the SWS is designed for testing to detect degradation in performance or in the system pressure

boundary so that the SWS will function reliably to provide decay heat removal and essential cooling for safety-related equipment.

Technical Rationale

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

1. GDC 2 requires that the SWS SSCs providing essential cooling for safety-related equipment be designed to withstand the effects of natural phenomena without loss of capability to perform safety functions. Based on numerous SAR reviews, a seismic design classification system developed for identifying plant features should be designed to withstand SSE effects. RG 1.29 describes an acceptable method for classifying light-water reactor nuclear power plant features that should be designed to withstand SSE effects. SSCs that should be designed to remain functional in SSEs are designated as Seismic Category 1. RG 1.29, Position C.1, states that systems required for safe shutdown, including their foundations and supports, are designated as Seismic Category I and should be designed to withstand SSE effects and remain functional. RG 1.29, Position C.2, states that SSCs with continued functions not required, the failure of which could reduce the functioning of any seismic Category I plant feature to an unacceptable safety level or could result in incapacitating injury to control room occupants, should be designed and constructed so that SSEs would not result in such failures. RG 1.29, Positions C.1 and C.2, assure that the SWS will remain functional during a SSE and provide essential cooling water necessary for the operation of safety-related components and decay heat removal.

2. GDC 4 requires that SWS SSCs providing essential cooling for safety-related equipment be designed to accommodate the effects of, and to be compatible with, the environmental conditions of normal operation, maintenance, testing, and postulated accidents and be protected appropriately against dynamic effects, including those of missiles, pipe whipping, and discharging fluids, from equipment failures and external events. GDC 4 assures that the SWS will remain functional under postulated environmental conditions and provide essential cooling water necessary for the operation of safety-related components and decay heat removal.

3. GDC 5 prohibits the sharing of SSCs among nuclear power units unless such sharing can be shown not to significantly impair their ability to perform safety functions, including, in an accident in one unit, an orderly shutdown and cool-down of the remaining unit(s). The SWS provides essential cooling water necessary for the operation of safety-related components and decay heat removal and be designed for each unit's ability to perform safety-related functions without compromise regardless of equipment failures or other events in another unit. GDC 5 requirements provide assurance that unacceptable effects of equipment failures or other events in one unit of a multi-unit site will not propagate to the unaffected unit(s).

4. GDC 44 requires an SWS to transfer heat from SSCs important to safety to an ultimate heat sink and specifies performance and design requirements that the SWS must meet. GDC 44 requirements assure that the SWS will function to provide essential cooling to safety-related equipment and decay heat removal during normal, transient, and accident conditions.

5. GDC 45 requires that the SWS, which provides essential cooling for safety-related equipment, be designed for appropriate periodic inspection of important components like heat exchangers and piping to assure system integrity and capability. By periodic monitoring to detect signs of system degradation or incipient failure, GDC 45 provides

assurance that the SWS will function reliably to provide decay heat removal and essential cooling for safety-related equipment.

6. GDC 46 requires that the SWS, which provides essential cooling for safety-related equipment, be designed for appropriate periodic pressure and functional testing of the structural and leak-tight integrity of its components, the operability and the performance of system active components, and the operability of the system as a whole and, under conditions as close to design as practical, the performance of the full operational sequence that brings the system into operation for reactor shutdown and for loss-of-coolant accidents, including operation of portions of the protection system and transfer between normal and emergency power sources. By designing the SWS for testing to detect degradation in performance or in the system pressure boundary, GDC 46 assures that the SWS will function reliably to provide decay heat removal and essential cooling for safety-related equipment.

III. REVIEW PROCEDURES

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

These review procedures are based on the identified SRP acceptance criteria. For deviations from these 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.

The procedures set forth below determine during the construction permit application review whether the design criteria and bases and the preliminary design in the preliminary SAR meet the acceptance criteria of subsection II of this SRP section. For review of operating license applications, the review procedures and acceptance criteria verify whether the initial design criteria and bases are implemented appropriately in the final design as in the final SAR.

Upon request from the primary reviewer, the coordinating reviewers provide input for the areas of review stated in subsection I of this SRP section. The primary reviewer uses such input as required to complete this review procedure.

For the various SWS designs there will be variations in system requirements. For purposes of this SRP section, a typical system is assumed to have fully redundant systems, each with identical essential (safety features) and nonessential (used for normal operation) portions. For variations from the typical arrangement, the reviewer adjusts the review procedures; however, the system design must meet the acceptance criteria of subsection II. Also, the reviewer needs to refer to SRP sections for other systems interfacing with the SWS depending upon the nature and conditions of the ultimate heat sink cooling water (e.g., salt water).

Evaluation of various generic issues and plant-specific probabilistic risk assessments show that the loss of the SWS may contribute significantly to the potential for a core damage accident. A review of industry experience and plant-specific probabilistic risk assessments is available in NUREG-1461 (Reference 15), which provides insights into SWS vulnerabilities.

1. The SAR is reviewed for whether the system description and piping and instrumentation diagrams (P&IDs) show the SWS equipment used for normal operation and the minimum system heat transfer and flow requirements for normal plant operation. The system performance requirements also are reviewed for whether the SAR describes component allowable operational degradation (e.g., pump leakage) and the procedures followed to detect and correct these conditions when they become excessive.

2. The reviewer, using the results of failure modes and effects analyses as appropriate, comparisons with previously approved systems, or independent calculations, determines whether the system can sustain the loss of any active component and meet minimum system requirements (cooling load and flow) for the degraded conditions. The system P&IDs, layout drawings, and component descriptions and characteristics then are reviewed for the following points:

   A. Essential SWS portions are identified correctly and can be isolated from nonessential portions. The P&IDs are reviewed for whether they clearly indicate both the physical division between each portion and the required classification changes. System drawings are also reviewed for whether they show how isolation is accomplished and the SAR description is reviewed for minimum performance requirements for the isolation valves. The drawings and descriptions are reviewed for whether automatically-operated isolation valves separate nonessential and essential portions and components. Redundant interconnected trains are considered specially for assurance of the operation of at least one safety-related train by proper isolation in an accident or transient.

   B. Essential SWS portions, including the isolation valves separating essential and nonessential portions, are classified Quality Group C and seismic Category 1. SAR component and system descriptions of mechanical and performance characteristics are reviewed for whether the seismic and safety classifications are included and whether the P&IDs indicate any points of change in piping quality group classification.

   C. Design provisions permit appropriate inservice inspection and functional testing of system components important to safety. The design is acceptable if the SAR information delineates a testing and inspection program and if the system drawings show the necessary test recirculation loops around pumps or isolation valves required by this program.

3. The reviewer determines whether the safety function of the system will be maintained, as required, in adverse environmental phenomena like earthquakes, tornadoes, hurricanes, and floods or in certain pipe breaks or loss of offsite power. The reviewer uses engineering judgment, the results of a failure mode and effects analyses, and the results of reviews under other SRP sections to verify whether:

   A. The failure of portions of the system or of other systems not designed to seismic Category I and located close to essential portions of the system or of non-seismic Category I structures that house, support, or are in close proximity to essential SWS portions do not preclude their operation. Reference to SAR Chapter 2 describing site features and the general arrangement and to layout drawings is necessary as well as to the SAR tabulation of seismic design classifications for structures and systems. SAR statements that the above conditions are met are acceptable.

   B. Essential SWS portions are protected from the effects of floods, hurricanes, tornadoes, and internally- or externally-generated missiles. Flood protection and missile protection criteria are evaluated in detail under the SRP Section 3 series. The reviewer utilizes the procedures in these SRP sections for assurance that the analyses presented are valid. A statement to the effect that the system is located in a tornado-, missile-, and flood-protected seismic Category I structure or that system components are in individual cubicles or rooms that withstand the effects of both flooding and missiles is acceptable. The location and the design of the system, structures, and pump rooms (cubicles) are reviewed for whether the protection is adequate.

C. The SWS pumps have sufficient available net positive suction head at the pump suction locations with low water levels. Reference to SRP Section 2.4, which indicates the lowest probable water level of the heat sink, and to drawings indicating the elevation of service water pump impellers, is necessary. An independent calculation verifying the applicant's conclusion is necessary for acceptance.

D. There are provisions to detect and control leakage of radioactive contamination into and out of the system. The design is acceptable if the system P&IDs show radiation monitors located on the system discharge and at components susceptible to leakage, and these components can be isolated by one automatic and one manual valve in series.

E. Essential system portions are protected from the effects of high- and moderate-energy line breaks. Layout drawings are reviewed for the absence of high- or moderate-energy piping systems close to essential SWS portions or for protection from the effects of failure. The means for such protection are in SAR Section 3.6, and the procedures for reviewing this information are in the corresponding SRP sections.

F. Essential components and subsystems necessary for safe shutdown can function as required in a loss of offsite power. The system design is acceptable if the SWS meets minimum system requirements as stated in the SAR, assuming a concurrent failure of a single, active component, including a single failure of an auxiliary electric power source. The SAR is reviewed to determine whether each SWS component or subsystem affected by the loss of offsite power system flow and heat transfer capability meets or exceeds minimum requirements. The results of failure modes and effects analyses are considered for assurance that the system meets these requirements. This verification of system functional reliability is acceptable.

G. The essential service water supply is protected from potential failures or malfunctions caused by freezing, icing, and other adverse environmental conditions. SAR statements that safety grade heating sources fulfill this purpose, considering the equipment necessary for safe shutdown, are acceptable.

4. The SAR descriptive information, P&IDs, SWS drawings, and failure modes and effects analyses are reviewed for whether essential system portions can function following design-basis accidents, assuming a concurrent, single, active component failure. The reviewer evaluates the SAR failure mode and effects analysis for assured function of required components, traces the availability of these components on system drawings, and checks that the SAR verifies that minimum system flow and heat transfer requirements are met for each accident situation for the required time spans. For each case the design is acceptable if it meets minimum system requirements.

5. The SAR is reviewed for applicant commitments for venting and filling of open loop systems to address the potential for water hammer, for operating procedures for avoidance of water hammer, and for system design to maintain functions following an inadvertent water hammer occurrence. Guidance for water hammer prevention and mitigation is in NUREG-0927 (Reference 14).

6. To address concerns about SWS fouling, the reviewer verifies whether the applicant addresses the following SWS design provisions and inspection activities consistently with Generic Letter (GL) 89-13 (Reference 8) and GL 89-13, Supplement 1 (Reference 9):

A. A program of surveillance and control techniques to reduce significantly the incidence of flow blockage problems from biofouling.

B. A test program, consisting of an initial test program and a periodic retest program, to verify the heat transfer capability of all safety-related heat exchangers cooled by service water.

C. A routine inspection and maintenance program for SWS piping and components for assurance that corrosion, erosion, protective coating failure, silting, and biofouling cannot degrade the performance of the safety-related systems supplied by service water.

7. For multi-unit sites with SWS cross-tie capability, the reviewer verifies whether:

A. The sharing of SSCs does not significantly impair SWS capability to perform its safety function, including, in an accident in one unit, an orderly shutdown and cool-down of the remaining unit(s).

B. Flushing and flow testing provisions from implementation of GL 89-13 are applied to the cross-tie lines.

C. Applicants proposing designs with only two SWS pumps per unit address the provisions of GL 91-13 (Reference 10).

8. To address concerns about SWS equipment operability and containment integrity during design-basis accident conditions, the reviewer verifies whether the applicant addresses the following SWS design provisions consistently with GL 96-06 (Reference 11) and to GL 96-06, Supplement 1 (Reference 12):

A. Capability of cooling water systems serving the containment air coolers to withstand the hydrodynamic effects of water hammer and to satisfy system design and operability requirements.

B. Capability of cooling water systems serving the containment air coolers to meet heat removal assumptions for design-basis accident scenarios, even during two-phase flow conditions.

C. Capability of isolated water-filled sections of piping in containment to withstand thermally-induced overpressurization.

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

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

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

IV. EVALUATION FINDINGS

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

The SWS includes all components and piping from the SWS pump intake to the points of cooling water discharge. Portions of the SWS necessary for safe shutdown, accident prevention, or accident mitigation, are designed to seismic Category I, Quality Group C requirements. After review of the applicant's proposed SWS design criteria, design bases, and safety classification for required continuous cooling of safety-related components necessary for a safe plant shutdown, the staff concludes that the SWS design is acceptable and meets the requirements of GDCs 2, 4, 5, 44, 45, and 46. This conclusion is based on the following findings:

1. The applicant meets GDC 2 requirements for system safety-related portions capable of withstanding the effects of earthquakes. Acceptance is based on RG 1.29, Position C.1 for the safety-related portions and Position C.2 for the nonsafety-related portions.

2. The applicant meets GDC 4 requirements for the effects of missiles inside and outside of containment, effects of pipe whip, jets, and environmental conditions from high- and moderate-energy line breaks, and dynamic effects of flow instabilities (i.e., water hammer loads) as to impairment of required SWS functions during normal plant operations and under upset or accident conditions. Acceptance for water hammer effects is based on the following:

   A. Vents are provided at high points for liquid-filled, but normally idle, piping (or systems) where voiding can occur. These vents should be designed for ease of periodic operational testing.

   B. Consideration is given to voiding following pump shutdown or during standby. If in the system design voiding could occur, the design should provide for a slow system fill upon pump start to avoid water hammer, or the design should maintain functions following an inadvertent water hammer occurrence.

   C. Operating and maintenance procedures are reviewed by the applicant for assurance of sufficient measures for avoiding water hammer (e.g., rapid fill due to pump start, periodic fill and vent checks, avoidance of sudden valve movement or realignment).

3. The applicant meets GDC 5 requirements for sharing of SSCs by demonstrating that such sharing does not significantly impair SWS capability to perform its safety function, including in an accident in one unit an orderly shutdown and cool-down of the remaining unit(s). In addition, the applicant complies with the guidance of GL 91-13.

4. The applicant meets GDC 44 requirements for cooling water by providing a system to transfer heat from SSCs important to safety to an ultimate heat sink. The applicant has demonstrated that the SWS can transfer the combined heat load of these SSCs under normal operating and accident conditions, assuming loss of offsite power and a single failure, and that system portions can be isolated so the safety function of the system is not compromised.

5. The applicant meets GDC 45 requirements for inspection and for testing of cooling water systems by an SWS design which permits inservice inspection of safety-related

components and equipment and operational functional testing of the system and its components.

6. The applicant meets GDC 46 requirements for testing of SWSs by SWS design features for operational functional testing of the system and its components.

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

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

V. IMPLEMENTATION

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

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

VI. REFERENCES

1. 10 CFR Part 50, Appendix A, GDC 2, "Design Bases for Protection Against Natural Phenomena."

2. 10 CFR Part 50, Appendix A, GDC 4, "Environmental and Dynamic Effects Design Bases."

3. 10 CFR Part 50, Appendix A, GDC 5, "Sharing of Structures, Systems, and Components."

4. 10 CFR Part 50, Appendix A, GDC 44, "Cooling Water."

5. 10 CFR Part 50, Appendix A, GDC 45, "Inspection of Cooling Water System."

6. 10 CFR Part 50, Appendix A, GDC 46, "Testing of Cooling Water Systems."

7. RG 1.29, "Seismic Design Classification."

8. NRC Letter to All Holders of Operating Licenses or Construction Permits for Nuclear Power Plants, "Service Water System Problems Affecting Safety-Related Equipment (Generic Letter No. 89-13)," July 18, 1989.

9. NRC Letter to All Holders of Operating Licenses or Construction Permits for Nuclear Power Plants, "Service Water System Problems Affecting Safety-Related Equipment (Generic Letter No. 89-13, Supplement 1)," April 4, 1990.

10. NRC Letter to Specified Licensees and Applicants of Pressurized-Water Reactor Nuclear Power Plants, "Request for Information Related to the Resolution of Generic Issue 130, 'Essential Service Water System Failures at Multi-Unit Sites,' (Generic Letter No. 91-13)," July 18, 1989.

11. NRC Letter to All holders of operating licenses for nuclear power reactors, except for those licenses that have been amended to possession-only status, “Assurance of Equipment Operability And Containment Integrity During Design-Basis Accident Conditions (Generic Letter No. 96-06),” September 30, 1996.

12. NRC Letter to All holders of operating licenses for nuclear power reactors, except for those licenses that have been amended to possession-only status, “Assurance of Equipment Operability And Containment Integrity During Design-Basis Accident Conditions (Generic Letter No. 96-06, Supplement 1),” November 13, 1997.

13. NUREG-0718, “Proposed Licensing Requirements for Pending CP’s and Manufacturing License.”

14. NUREG-0927, Revision 1, “Evaluation of Water Hammer Occurrences in Nuclear Power Plants,” March 1984.

15. NUREG-1461, “Regulatory Analysis for the Resolution of Generic Issue 153: Loss of Essential Service Water in LWRs,” August 1993.