U.S. NUCLEAR REGULATORY COMMISSION

STANDARD REVIEW PLAN

OFFICE OF NUCLEAR REACTOR REGULATION

10.4.9 AUXILIARY FEEDWATER SYSTEM (PWR)

REVIEW RESPONSIBILITIES

Primary - ~~Auxiliary Systems Branch (ASB)~~Plant Systems Branch (SPLB)[1]

Secondary - None

I. AREAS OF REVIEW

The auxiliary feedwater system (AFWS) normally operates during startup, hot standby and shutdown as the feedwater system for pressurized water reactor (PWR) plants. In conjunction with a seismic Category I water source, it also functions as an emergency system for the removal of heat from the primary system when the main feedwater system is not available for emergency conditions including small LOCA cases. The AFWS operates over a time period sufficient either to hold the plant at hot standby for several hours or to cool down the primary system, at a rate not to exceed limits specified in technical specifications, to temperature and pressure levels at which the low pressure decay heat removal system can operate. The review verifies compliance with~~design of the AFWS should meet the requirements of~~[2] General Design Criteria 2, 4, 5, 19, 34, 44, 45 and 46. The AFWS may also be used to provide decay heat removal necessary for withstanding or coping with a station blackout. If so, the review also includes verification of compliance with the requirements of 10 CFR 50.63 as they relate to the AFWS design.[3]

The ~~ASB~~SPLB[4] reviews the AFWS from the condensate storage tank (normal operation), or the seismic Category I water supply including valving and cross-connects (emergency operation), to the connections with the steam generators, which are made either through a connection to the main feedwater piping or through separate auxiliary feedwater piping connected directly to the steam generators. All inter-connections and cross-connections are included in the review.

The review also includes AFWS components, e.g., pumps, valves, and piping, with respect to their functional performance as affected by adverse environmental occurrences, abnormal operational requirements, and off-normal conditions, e.g., small breaks in the primary system or the loss of offsite power.

The system is reviewed to determine that a single malfunction, a failure of a component, or the loss of a cooling source does not reduce the safety-related functional performance capabilities of the system. The ~~ASB~~SPLB[5] review assures that:

1. System components and piping have sufficient physical separation or shielding to protect the essential portions of the system from the effects of internally and externally generated missiles. This review is performed according to SRP Section 3.5.1.1 for internally generated missiles and Sections 3.5.1.4 and 3.5.2 for externally generated missiles.

2. The system is protected against the effects of pipe whip and jet impingement that may result from high or moderate energy piping breaks or cracks. This review is performed according to SRP Section 3.6.1.

3. The failure of non-essential equipment or components does not affect essential functions of the system.

4. The system is capable of withstanding a single active failure.

5. The system possesses diversity in motive power sources such that system performance requirements may be met with either of the assigned power sources, e.g., a system with an a-c subsystem and a redundant steam/d-c subsystem.

6. The system design precludes the occurrence of fluid flow instabilities, e.g., water hammer, in system inlet piping during normal plant operation or during upset or accident conditions (see SRP Section 10.4.7).

7. Functional capability is assured by suitable protection during abnormally high water levels (adequate flood protection considering the probable maximum flood). This review is performed according to SRP Section 3.4.1.

8. The capability exists to detect, collect, and control system leakage and to isolate portions of the system in case of excessive leakage or component malfunctions.

9. Provisions are made for operational testing.

10. Instrumentation and control features are provided to verify the system is operating in a correct mode.

11. The system is capable of automatically initiating auxiliary feedwater flow upon receipt of a system actuation signal.

12. The system satisfies the recommendations of Regulatory Guide 1.62 with respect to the system capability to manually initiate protective action by the auxiliary feedwater system.

13. The system design possesses the capability to automatically terminate auxiliary feedwater flow to a depressurized steam generator, and to automatically provide feedwater to the intact steam generator. Or as an alternative if it is shown that the intact steam generator will receive the minimum required flow without isolation of the depressurized steam generator and containment design pressure is not exceeded, then operator action may be relied upon to isolate the depressurized steam generator.

14. The system possesses sufficient auxiliary feedwater flow capacity so that a cold shutdown can be achieved. Upon request from ~~ASB~~SPLB[6], the Reactor Systems Branch (~~RSB~~SRXB)[7] will verify that the system meets the minimum flow requirements for decay heat removal.

15. The applicant's proposed technical specifications are such as to assure the continued reliability of the AFWS during plant operation; i.e., the limiting conditions for operation and the surveillance testing requirements are specified and are consistent with the Standard Technical Specifications.

16. In conjunction with the Instrumentation and Controls ~~Systems~~ Branch (~~ICSB~~HICB)[8] the ~~ASB~~SPLB[9] verifies that the system design meets the generic short and long term recommendations identified in NUREGS-0611 and -0635 (References 16 and 17)[10]. These recommendations will apply to all PWRs.

17. An AFWS reliability analysis is performed ~~in accordance with~~ as required by TMI Action Plan Item II.E.1.1 of NUREG-0737 (Reference 18)[11] and 10 CFR 50.34(f)(1)(ii) for applicants subject to 10 CFR 50.34(f)~~using the methodology defined by Appendix III and Annex 1 of Appendix X in NUREG-0611 and NUREG-0635 to determine the system reliability and major contributors to AFW system failure under various loss of main feedwater transients~~.[12]

18. The reviewer coordinates with ~~ICSB~~HICB[13] ~~will evaluate~~and verifies that the design ~~to determine that~~ meets the requirements ~~and guidance~~ of TMI Action Plan item II.E.1.2 of NUREG-0737 ~~are met~~ regarding the automatic and manual initiation of the AFWS, and 10 CFR 50.62(c)(1) regarding the automatic initiation of the AFWS on conditions indicative of an anticipated transient without scram (ATWS).[14]

19.[15] The reviewer verifies that the system design has the capability to permit operation at hot shutdown for at least four hours followed by cooldown to the RHR cut-in temperature from the control room using only safety grade equipment and assuming the worst case single active failure in accordance with Branch Technical Position RSB 5-1 (Reference 14)[16].

20. The SPLB reviews the diversity and performance of the AFWS with regard to the decay heat removal capability and capacity for station blackout events.[17]

Review Interfaces:[18]

SPLB also performs the following reviews under the SRP sections indicated:[19]

1. The review for Fire Protection is coordinated and performed by the ~~Chemical Engineering Branch~~SPLB[20] as part of ~~their~~its[21] primary review responsibility for SRP Section 9.5.1.

2. The ~~Equipment Qualification Branch (EQB)~~SPLB[22] reviews the environmental qualification of mechanical and electrical equipment as part of ~~their~~its[23] primary review responsibility for SRP Section 3.11.

~~Coordinated reviews are performed by other branches and the results used by the ASB to complete the overall evaluation of the system. The coordinated reviews are as follows:~~

In addition, the SPLB will coordinate other branches' evaluations that interface with the overall review of the system as follows:[24]

1. The ~~RSB~~SRXB[25] identifies any functional interfaces between essential components of the reactor coolant or emergency core cooling systems and the AFWS that are required for operation during normal operations or accident conditions. The ~~RSB~~SRXB[26] establishes postaccident heat loads and the associated time intervals available for cooling various components. The SRXB also reviews the performance of the AFWS relative to ATWS events as part of its review responsibilities for SRP Section 15.8.[27]

2. The ~~Structural~~Civil Engineering and Geosciences Branch ~~(SEB)~~(ECGB)[28] determines the acceptability of the design analyses, procedures, and criteria used to establish the ability of seismic Category I structures housing the system and supporting systems to withstand the effects of natural phenomena such as the safe shutdown earthquake (SSE), the probable maximum flood (PMF), and tornado missiles as part of its primary review responsibility for SRP Sections 3.3.1, 3.3.2, 3.5.3, 3.7.1 through 3.7.4, 3.8.4 and 3.8.5. The ECGB also verifies that inservice inspection requirements are met for system components as part of its primary review responsibility for SRP Section 6.6.[29]

3. The Mechanical Engineering Branch (EMEB)[30] determines that the components piping and structures are designed in accordance with applicable codes and standards as part of its primary review responsibility for SRP Sections 3.9.1 through 3.9.3. The EMEB[31]~~,~~ also~~,~~ determines the acceptability of the seismic and quality group classifications for system components as part of its primary review responsibility for SRP Sections 3.2.1 and 3.2.2. The EMEB[32] also reviews the adequacy of the inservice testing program of pumps and valves as part of its primary review responsibility for SRP Section 3.9.6.

4. The ~~Materials Engineering Branch (MTEB)~~Materials and Chemical Engineering Branch (EMCB)[33] ~~verifies that inservice inspection requirements are met for system components as part of its primary review responsibility for SRP Section 6.6, and~~[34], upon request, verifies the compatibility of the materials of construction with services conditions.

5. The review for Technical Specifications is coordinated and performed by the ~~Licensing Guidance Branch~~Technical Specifications Branch (TSB)[35] as part of ~~their~~its[36] primary review responsibility for SRP Section 16.0.

6. The review for Quality Assurance is coordinated and performed by the Quality Assurance and Maintenance Branch (HQMB) as part of ~~their~~its primary review responsibility for SRP ~~Section~~Chapter 17~~.0~~.[37]

7. The ~~Equipment Qualification Branch (EQB)~~EMEB[38] review~~s~~ the seismic qualification of Category I instrumentation and electrical equipment as part of its review responsibility for SRP Section 3.10.

8. The ~~ICSB~~HICB ~~and Power Systems Branch (PSB)~~ evaluates system controls~~,~~ and instrumentation~~, and power sources~~ with respect to capability, capacity, and reliability during normal and emergency conditions, including ATWS events,[39] as part of ~~their~~its primary review responsibility for SRP Sections 7.1, ~~and~~ 7.3 through 7.5, and 7.8 (proposed) ~~for HICB and Section 8.3 for PSB~~.[40]

9. The ~~ICSB and Power Systems Branch (PSB)~~Electrical Engineering Branch (EELB) evaluates ~~system controls, instrumentation, and~~ power sources with respect to capability, capacity, and reliability during normal, abnormal, and emergency conditions, and evaluates conformance with station blackout requirements,[41] as part of ~~their~~its primary review responsibility for SRP ~~Sections 7.1 and 7.3 through 7.5 for HICB and Section 8.3 for PSB~~Chapter 8.[42]

For those areas of review identified above as being reviewed as part of the ~~primary responsibility of~~review under other ~~branches~~SRP sections, the acceptance criteria and their methods of application are contained in the referenced SRP sections ~~corresponding to those branches~~.[43]

II. ACCEPTANCE CRITERIA

Acceptability of the design of the auxiliary feedwater system, as described in the applicant's safety analysis report (SAR), is based on specific regulations,[44] general design criteria and regulatory guides. Listed below are the specific criteria used in this SRP section as they relate to the AFWS.

1. General Design Criterion 2, as related to structures housing the system and the system itself being capable of withstanding the effects of earthquakes. Acceptability is based on meeting position C.1 of Regulatory Guide 1.29 for safety-related portions and position C.2 for nonsafety-related portions.

2. General Design Criterion 4, with respect to structures housing the system and the system itself being capable of withstanding the effects of external missiles and internally generated missiles, pipe whip, and jet impingement forces associated with pipe breaks. The basis for acceptance for meeting this criterion is set forth in the SRP ~~Section~~ 3.5 and 3.6 series sections.[45]

3. General Design Criterion 5, as related to the capability of shared systems and components important to safety to perform required safety functions.

4. General Design Criterion 19, as related to the design capability of system instrumentation and controls for prompt hot shutdown of the reactor and potential capability for subsequent cold shutdown. Acceptance is based on meeting Branch Technical Position RSB 5-1 with regards to cold shutdown from the control room using only safety grade equipment.

5. General Design Criteria 34 and 44, to assure:

   a. The capability to transfer heat loads from the reactor system to a heat sink under both normal operating and accident conditions.

   b. Redundancy of components so that under accident conditions the safety function can be performed assuming a single active component failure. (This may be coincident with the loss of offsite power for certain events.) Branch Technical Position ASB 10-1 (Reference 15)[46] as it relates to AFW pump drive and power supply diversity shall be used in meeting these criteria.

   c. The capability to isolate components, subsystems, or piping if required so that the system safety function will be maintained.

   In meeting these criteria, the recommendations of NUREG-0611 and 0635 shall also be met. As required by TMI Action Plan item II.E.1.1 of NUREG 0737 and 10 CFR 50.34(f)(1)(ii) for applicants subject to 10 CFR 50.34(f), a reliability analysis should be performed for the AFWS.[47] An acceptable AFWS should have an unreliability in the range of 10^{-4} to 10^{-5} per demand exclusive of station blackout scenarios~~based on an analysis using methods and data presented in NUREG-0611 and NUREG-0635~~.[48] Compensating factors such as other methods of accomplishing the safety functions of the AFWS or other reliable methods for cooling the reactor core during abnormal conditions may be considered to justify a larger unavailability of the AFWS.

6. General Design Criterion 45, as related to design provisions made to permit periodic inservice inspection of system components and equipment.
7. General Design Criterion 46, as related to design provisions made to permit appropriate functional testing of the system and components to assure structural integrity and leak-tightness, operability and performance of active components, and capability of the integrated system to function as intended during normal, shutdown, and accident conditions. In meeting this criteria the technical specifications should specify that the monthly AFWS pump test shall be performed on a staggered test basis to reduce the likelihood of leaving more than one pump in a test mode following the tests.

8. 10 CFR 50.63, as related to the design provisions for withstanding and recovering from a station blackout, including an acceptable degree of independence from the ac power system and the capability for removal of decay heat at an appropriate rate for an

appropriate duration. Acceptance is based upon meeting the applicable positions of Regulatory Guide 1.155 as related to the AFWS design.[49]

Technical Rationale:[50]

The technical rationale for application of the above acceptance criteria to the auxiliary feedwater system is discussed in the following paragraphs.

1. GDC 2 requires that structures, systems and components (SSCs) important to safety shall be designed to withstand the effects of earthquakes. Regulatory Guide 1.29 position C.1 identifies those structures, systems and components that should be designed as seismic Category I and that should remain functional following a Safe Shutdown Earthquake (SSE). Regulatory Guide 1.29 position C.2 provides criteria for those systems whose continued function is not required following a SSE, but whose failure could affect the functioning of those systems important to safety. The AFWS provides for heat removal from the reactor coolant system via the steam generators. The system performs this function during startup and shutdown under normal operations, and during emergency or accident conditions involving a loss of normal feedwater. In the event of an SSE, severe damage may occur to those systems not designed as seismic Category I, such as the main feedwater system. Compliance with GDC 2 provides assurance that the AFWS will perform its safety function in the event of a SSE.

2. GDC 4 requires the protection of SSCs important to safety from external missiles, internally generated missiles, and the dynamic effects of pipe breaks. The safety function of the AFWS is to remove decay heat from the reactor coolant system following a loss of normal feedwater, by providing an emergency source of feedwater to the steam generators. Normal feedwater may be lost as a result of numerous anticipated operational occurrences and design basis accidents. These accidents may involve missile generation or piping failures. External missiles may be generated by natural phenomena, such as tornados, or may result from onsite or nearby industrial accidents. The failure of systems with high internal or kinetic energies can generate internal missiles as a result of component failure and fragmentation. In addition to missiles, failure of high energy piping systems, and to a lessor extent moderate energy systems, can result in pipe whip, jet impingement, flooding, and other environmental conditions that can effect the operability of safety-related systems like the AFWS. Compliance with GDC 4 provides assurance that the AFWS will be protected from anticipated environmental conditions and events such that it can support removal of reactor decay heat.

3. GDC 5 prohibits the sharing of SSCs important to safety among nuclear power units unless it can be demonstrated that such sharing will not significantly impair their ability to perform their safety functions including in the event of an accident in one unit, an orderly shutdown and cooldown of the remaining units. The AFWS performs the safety function of emergency heat removal from the reactor coolant system and the shutdown and cooldown of the reactor coolant system to low pressure residual heat removal system cut-in conditions. If the AFWS is shared between units, it must be demonstrated that it can accomplish these functions for both units simultaneously. Compliance with GDC 5

provides assurance that equipment failures and events occurring in one unit of the site will not propagate to the other units of the site.

4. GDC 19 establishes requirements for design of control room instrumentation and controls for prompt hot shutdown of the reactor and subsequent cold shutdown. Branch Technical Position RSB 5-1 provides guidance for compliance with GDC 19 with regard to achieving cold shutdown from the control room only using safety grade equipment. The AFWS is required for safe shutdown of the reactor during normal and accident conditions, including cooldown of the reactor to the cut-in conditions for low pressure residual heat removal. Compliance with GDC 19 and BTP RSB 5-1 ensures the availability of adequate instrumentation and controls to perform the required safety function under all anticipated conditions.

5. GDC 34 and 44 establish the requirements to assure the capability to transfer heat from the reactor to a heat sink under normal and accident conditions with sufficient redundancy and isolation capability to ensure the safety function can be accomplished including in the event of a single failure of a active component with or without a coincident loss of offsite power. The capability to transfer heat loads during normal and accident conditions is necessary to ensure that the integrity of the fuel, the reactor pressure boundary, and containment are maintained. The AFWS functions to transfer the heat from the reactor coolant system via the steam generators. Suitable redundancy provides additional assurance that the system will be capable of performing the safety function in the event of system or component failures. The capability to isolate components, subsystems, or piping if required provides assurance that the AFWS will accomplish the safety function of reactor coolant system heat removal by ensuring delivery of feedwater from functional supplies to functional steam generators. In support of these criteria, the AFWS should have a low unreliability to reduce the core damage frequency due to loss of reactor coolant system heat removal capability. Compliance with the design criteria provides assurance that heat removal will be accomplished and reactor coolant system and fuel integrity will be maintained.

6. GDC 45 establishes the requirements for periodic inspection of cooling water systems to ensure the integrity and capability of the system to transfer heat loads from SSCs important to safety. The safety function of the AFWS is to provide emergency cooling capability for the reactor coolant system in the event of an accident. The periodic testing of the system to comply with GDC 45 provides assurance that the system will be capable of performing its intended function.

7. GDC 46 establishes the requirements for functional testing of cooling water systems. This testing assures the integrity and operability of the cooling water system and its components necessary for the removal of heat loads from SSCs important to safety. The safety function of the AFWS is to provide emergency cooling capability for the reactor coolant system, in the event of an accident, by transferring heat from the reactor coolant system via the steam generators. Compliance with GDC 46 provides assurance that the AFWS will be capable of performing its intended function to remove reactor decay heat following anticipated operational occurrences and design basis accidents.

8. 10 CFR 50.63 requires that all light-water-cooled nuclear power plants be able to withstand and recover from a station blackout. Guidance for compliance with 10 CFR 50.63 is provided in Regulatory Guide 1.155. Since many safety systems necessary to remove decay heat from the reactor are dependent on ac power, the consequences of a station blackout can be severe. In the event of a station blackout, where no alternate ac source is provided, the capability to cool the reactor core is dependent on the availability of systems that are not reliant upon ac power from the essential and nonessential buses, or on the ability to restore ac power in a timely manner. The AFWS is required for removal of decay heat in the event of a station blackout and must have sufficient capability and capacity to perform the heat removal function for an appropriate duration. To ensure such capability, motive power for motors, pumps, valves, controls and instrumentation for at least one AFW train of adequate capacity for station blackout is verified to be provided independent of the normal and emergency ac power systems. Compliance with 10 CFR 50.63 and the positions of Regulatory Guide 1.155 regarding the ability to withstand or cope with a station blackout provides additional defense-in-depth against unacceptable offsite radiological consequences should both offsite and onsite emergency ac power systems fail concurrently, by ensuring that the core can be cooled for such an event.

III. REVIEW PROCEDURES

The procedures below are used during the construction permit (CP) review to determine that the design criteria and bases and the preliminary design as set forth in the preliminary safety analysis report meet the acceptance criteria given in subsection II. For operating license (OL) or applications, the procedures are utilized to verify that the initial design criteria and bases have been appropriately implemented in the final design as set forth in the final safety analysis report. The procedures for OL applications also include a determination that the content and intent of the technical specifications prepared by the applicant are in agreement with the requirements for system testing, minimum performance and surveillance developed as a result of the staff's review.

Upon request from the primary reviewer, the coordinating review branches will provide input for the areas of review stated in subsection I. The primary reviewer obtains and uses such input as required to assure that this review ~~procedure~~[51] is complete.

For the purpose of this SRP section, a typical system is assumed which has redundant auxiliary feedwater trains, with a 50% capacity motor-driven pump in each train feeding directly to the steam generators~~.~~,[52] and a 100% capacity steam turbine-driven pump able to supply either of the redundant trains. The pumping capacity should permit the system to hold the plant at hot standby and subsequently to cool down the reactor at specified cooldown rates. The 50% capacity pump is assumed to have sufficient capacity for decay heat removal following any accident or transient although cooldown to RHR cut in temperature may take longer than design. This requirement should also be met for conditions involving a small break area loss-of-coolant accident (LOCA) or a pipe break outside containment. For cases where there are variations from the typical arrangement, the reviewer adjusts the review procedures to suit the design. However, the system design is required to meet the acceptance criteria given in subsection II.

1. The SAR is reviewed to determine that the system description and piping and instrumentation diagrams (P&IDs) identify the AFWS equipment and arrangement that is used for normal operation and for safe plant shutdown (essential) operation. The system P&IDs, layout drawings, and component descriptions and characteristics are then reviewed to verify that:

    a. Minimum performance requirements for the system are sufficient for the various functions of the AFWS.

    b. Essential portions of the AFWS are isolable from non-essential portions, so that system performance is not impaired in the event of a failure of a non-essential component.

    c. Component and system descriptions in the SAR include appropriate seismic and quality group classifications, and the P&IDs indicate any points of change in piping quality group classification. The review for seismic design is performed by the ~~SEB~~ECGB[53] and the review for seismic and quality group classification is performed by the EMEB[54] as indicated in Subsection I of this SRP section.

    d. Design provisions have been made that permit appropriate inservice inspection and functional testing of system components important to safety. It is acceptable if the SAR information delineates a testing and inspection program if the system drawings show the necessary recirculation loops around pumps or isolation valves as may be required by this program.

    e. Design provisions have been made that ensure detection and mitigation of steam binding of the AFWS pumps due to back-leakage from the main feedwater system (MFWS) through isolation valves between the AFWS and the MFWS (Reference 21).[55]

2. The reviewer verifies that the system safety function will be maintained as required, in the event of adverse environmental phenomena, breaks or cracks in fluid system piping outside containment, system component failures, loss of an onsite motive power source, or loss of offsite power. The reviewer uses engineering judgment and the results of failure modes and effects analyses to determine that:

    a. The failure of portions of the system or of other systems not designed to seismic Category I standards and located close to essential portions of the system, or of nonseismic Category I structures that house, support, or are close to essential portions of the AFWS, will not preclude operation of the essential portions of the AFWS. Reference to SAR sections describing site features and the general arrangement and layout drawings will be necessary, as well as the SAR tabulation of seismic design classifications for structures and systems.

    b. The essential portions of the AFWS are protected from the effects of floods, hurricanes, tornadoes, and internally or externally generated missiles. Flood protection and missile protection criteria are discussed and evaluated in detail

under the SRP Section 3 series. The location and design of the system, structures, and pump rooms (cubicles) are reviewed to determine that the degree of protection provided is adequate. A statement to the effect that the system is located in a seismic Category I structure that is tornado missile and flood protected, or the components of the system will be located in individual seismic Category I cubicles or rooms that will withstand the effects of both flooding and missiles is acceptable.

c. The essential portions of the system are protected from the effects of high and moderate energy line breaks. Layout drawings are reviewed to assure that no high or moderate energy piping systems are close to essential portions of the AFWS, or that protection from the effects of failure will be provided. The means of providing such protection will generally be given in Section 3.6 of the SAR and procedures for reviewing this information are given in SRP Section 3.6.1.

d. Essential components and subsystems necessary for safe shutdown can function as required in the event of loss of offsite power. The SAR is reviewed to see that for each AFWS component or subsystem affected by the loss of offsite power, system flow and heat transfer capability meet minimum requirements. Statements in the SAR and the results of failure modes and effects analyses are considered in assuring that the system meets these requirements.

e. The system is designed with adequate redundancy to accommodate a single active component failure without loss of function. This includes redundant piping and valves from the condensate storage tank (or other primary source) to the AFW pump suctions.

f. Diversity in pump motive power sources and essential instrumentation and control power sources has been provided. The diverse system including pump(s), controls and valves should be independent of offsite and onsite AC power sources in accordance with the guidelines of Branch Technical Position ASB 10-1 (Reference 15)[56].

g. The system is designed with adequate instrumentation to automatically initiate auxiliary feedwater flow to the steam generators upon receipt of an actuation signal. The initiation signal should start all auxiliary feedwater pumps and supporting systems, align the auxiliary feedwater sources, and open flow paths from the auxiliary feedwater pumps to the steam generator(s). The system is also designed with the capability to manually initiate the necessary protective actions. The AFWS is designed with redundant instrumentation so that the system will automatically limit (may be flow limiting orifice rather than instrumentation) or terminate auxiliary feedwater flow to a depressurized steam generator, and to assure that the minimum required flow is directed to the intact steam generator(s). The electrical portion of this review is performed by ~~ICSB~~HICB[57] as indicated in subsection I of this SRP section. If a flow limiter is used then it must be demonstrated that sufficient flow still goes to the intact steam generator and

containment design pressure is not exceeded by the AFW flow to the depressurized generator.

hj[58]. The AFWS is designed with sufficient flow capacity so that the system can remove residual heat over the entire range of reactor operation and cool the plant to the decay heat removal system cut-in temperature. This review is performed by ~~RSB~~SRXB[59] upon request as indicated in subsection I of this SRP section.

3. The reviewer verifies that the design has features to meet the generic recommendations of NUREG-0611 and -0635. For additional short term recommendation No. 2 regarding AFW pump endurance tests, a 48 hour test is acceptable rather than the 72 hour test specified in the NUREGS. The ~~ASB~~SPLB[60] reviewer coordinates with the ~~ICSB~~HICB[61] reviewer to assure that the instrumentation and control system aspects of these recommendations are met by the system design.

4. The reviewer verifies that an AFWS reliability evaluation has been performed in accordance with 10 CFR 50.34(f)(1)(ii) as clarified in[62] item II.E.1.1 of NUREG-0737. The reliability analysis is reviewed to determine the potential for AFW system failure under various loss of main feedwater transients. The AFWS unreliability is determined based on analysis using methods and data presented in NUREG-0611 and NUREG-0635.[63] As an alternative to determining AFWS unreliability using the methods of NUREG-0611 and -0635, AFWS unreliability may be established through probabilistic risk assessment methods accepted by the staff [e.g., NUREG/CR 2300 (Reference 19) and NUREG/CR 2815 (Reference 20)]. The acceptance criteria of 10^{-4} to 10^{-5} per demand (exclusive of station blackout scenarios) must be met regardless of the method selected.[64]

5. The reviewer coordinates with the EELB to assure that the AFWS has sufficient capability, capacity, and independence from essential and nonessential ac power to provide adequate decay heat removal for withstanding or coping with, as applicable, and recovering from, a station blackout in accordance with 10 CFR 50.63 and Regulatory Guide 1.155, Positions C.3.2.2, C.3.3.2, and C.3.3.4.[65]

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.[66]

IV. EVALUATION FINDINGS

The reviewer verifies that sufficient information has been provided and his review supports conclusions of the following type, to be included in the staff's safety evaluation report:

The auxiliary feedwater system includes all components and equipment from the condensate storage tank (normal operation) or the seismic Category I emergency water supply (including valves and cross connections) to the connection with the steam generators. The AFWS is designed to seismic Category I requirements since system operation is necessary to mitigate the consequences of an accident. This includes an automatic seismic Category I, tornado protected supply of water to the AFW pump suction. Based on the review of the applicant's proposed design criteria, design bases and safety classification for the auxiliary feedwater system, and system performance requirements during normal, abnormal, and accident conditions, the staff concludes that the design of the auxiliary feedwater system and supporting systems is acceptable and meets the Commission's regulations as set forth in 10 CFR 50.63 and[67] General Design Criteria 2, 4, 5, 19, 34, 44, 45, and 46. This conclusion is based on the following:

1. The AFW system design meets the requirements of General Design Criterion 2 with respect to protection against the effects of earthquakes since the safety related portions are designed to seismic Category I requirements in accordance with position C.1 of Regulatory Guide 1.29 and the nonsafety-related portions are designed in accordance with position C.2 of Regulatory Guide 1.29.

2. The AFW system design meets the requirements of General Design Criterion 4 with respect to protection against the effects of pipe breaks and missiles. Acceptance was based on locating the AFW system pumps and trains in individual cubicles which separate redundant components and are protected against the effects of tornado missiles. Refer to the Chapter 3 sections of this report for a description of how this protection is accomplished.

3. The AFW system is designed in accordance with the requirements of General Design Criterion 5 with respect to sharing of structures systems and components. This is accomplished since a failure of any component including a pipe break and single active failure will not prevent the safe shutdown and cooldown of either unit (together or singularly).

4. The system design meets the requirements of General Design Criterion 19 as related to the design capability of system instrumentation and controls for prompt hot shutdown of the reactor and potential capability for subsequent cold shutdown since the design meets the requirement of Branch Technical Position RSB 5-1 which requires the capability to bring primary plant temperature to the RHR cut-in point following four hours at hot standby from the control room using only safety grade equipment and assuming any single active failure.

5. The system design meets the requirements of General Design Criteria 34 and 44 since it has the capability to transfer heat loads, including decay heat from the reactor, during normal operating and accident conditions assuming any single active failure. The system has suitable redundancy such that it can withstand a pipe break and single active failure and still perform its safety function. The system design[68] also has sufficient diversity such that it meets the requirements of Branch Technical Position ASB 10-1. In meeting these General Design Criteria

the applicant has also met the generic recommendations identified in NUREGS-0611 and -0635 and has performed a reliability analysis in accordance with 10 CFR 50.34(f)(1)(ii) as clarified in[69] NUREG-0737, item II.E.1.1. The results of the reliability analyses were acceptable since it was shown that the AFWS has an unreliability in the range of 10^{-4} to 10^{-5} per demand.

6. The pumps, valves, heat exchangers and piping of the system, to the extent practicable, are designed and located to facilitate periodic inspection as required by General Design Criterion 45. This is accomplished by providing adequate accessibility to conduct the required examinations.

7. To meet the requirements of General Design Criterion 46, the auxiliary feedwater system is designed to include the capability for testing through the full operational sequence that brings the system into operation for reactor shutdown and for loss-of-coolant accidents, including operation of applicable portions of the protection system and the transfer between normal and emergency buses.

8. To meet the requirements of 10 CFR 50.63, the AFWS is designed to provide sufficient decay heat removal for a station blackout in accordance with Positions 3.2.2, 3.3.2 and 3.3.4 of Regulatory Guide 1.155.[70]

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.[71]

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.[72] 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.[73]

Implementation schedules for conformance to part of the method discussed herein are contained in the referenced regulations,[74] regulatory guides and NUREGs.

VI. REFERENCES

1. 10 CFR 50.62, "Requirements for reduction of risk from anticipated transients without scram (ATWS) events for light-water nuclear power plants."[75]

2. 10 CFR 50.63, "Loss of all alternating current power."[76]

3~~1~~.[77] 10 CFR Part 50, Appendix A, General Design Criterion 2, "Design Bases for Protection Against Natural Phenomena."

4~~2~~. 10 CFR Part 50, Appendix A, General Design Criterion 4, "Environmental and ~~Missile~~ Dynamic Effects[78] Design Bases."

5~~3~~. 10 CFR Part 50, Appendix A, General Design Criterion 5, "Sharing of Structures, Systems, and Components."

6~~4~~. 10 CFR Part 50, Appendix A, General Design Criterion 19, "Control Room."

7~~5~~. 10 CFR Part 50, Appendix A, General Design Criterion 34, "~~Decay~~ Residual[79] Heat Removal."

8~~6~~. 10 CFR Part 50, Appendix A, General Design Criterion 44, "Cooling Water."

9~~7~~. 10 CFR Part 50, Appendix A, General Design Criterion 45, "Inspection of Cooling Water System."

10~~8~~. 10 CFR Part 50, Appendix A, General Design Criterion 46, "Testing of Cooling Water System."

11~~9~~. Regulatory Guide 1.29, "Seismic Design Classification."

12. Regulatory Guide 1.62, "Manual Initiation of Protective Actions."[80]

13. Regulatory Guide 1.155, "Station Blackout."[81]

~~10~~14. Branch Technical Position RSB 5-1, "Design Requirements of the Residual Heat Removal System," attached to SRP Section 5.4.7.

~~11~~15. Branch Technical Position ASB 10-1, "Design Guidelines for Auxiliary Feedwater System Pump Drive and Power Supply Diversity for Pressurized Water Reactor Plants," attached to this SRP section.

~~12~~16. NUREG-0611 "Generic Evaluation of Feedwater Transients and Small Break Loss-of-Coolant Accidents in Westinghouse - Designed Operating Plants," January 1980.

~~13~~17. NUREG-0635 "Generic Evaluation of Feedwater Transients and Small Break Loss-of-Coolant Accidents in Combustion Engineering - Designed Operating Plants," January 1980.

~~14~~18. NUREG-0737 "Clarification of TMI Action Plan Requirements," November 1980.

19. NUREG/CR-2300, "PRA Procedures Guide", January 1983.[82]

20. NUREG/CR-2815, "Probabilistic Safety Analysis Procedures Guide", January 1984.[83]

21. IE Bulletin, "Steam Binding of Auxiliary Feedwater Pumps," October 29, 1985.[84]

BRANCH TECHNICAL POSITION ASB 10-1
(Currently the responsibility of the Plant Systems Branch - SPLB)[85]

DESIGN GUIDELINES FOR AUXILIARY FEEDWATER SYSTEM PUMP DRIVE AND POWER SUPPLY DIVERSITY FOR PRESSURIZED WATER REACTOR PLANTS

A. BACKGROUND

Heat removal from pressurized water reactor plants following reactor trip and a loss of offsite power is accomplished by the operation of several systems including the secondary system via the steam relief system. Similar capability is required to mitigate the consequences of certain postulated piping breaks. Such heat removal involves heat transfer from the reactor to the steam generators, resulting in the production of steam which is then released to the atmosphere. In this process it becomes necessary to supply makeup water to the steam generators. This is accomplished by the use of an auxiliary feedwater system, which generally consists of redundant components that are powered by both electrical and steam-driven sources.

The auxiliary feedwater system functions as an engineered safety system because it is the only source of makeup water to the steam generators for decay heat removal when the main feedwater system becomes inoperable. It must, therefore, be designed to operate when needed, using the principles of redundancy and diversity in order to assure that it can function under postulated accident conditions. The majority of current systems are powered by electrical or steam-driven sources. Operating experience demonstrates that each type of motive power can be subject to a failure of the driving component itself, its source of energy, or the associated control system. The effects of such failures can be minimized by the utilization of diverse systems that include energy sources of at least two different and distinct types.

The provision of several independent flow paths for the auxiliary feedwater system serves to preclude the possibility of a complete loss of function due to a single event, either occurring alone, or in conjunction with the failure of an active component. The auxiliary feedwater system is categorized as a high energy system, because either that section of line which connects to the main feedwater piping or the steam generator is pressurized during plant operation or else the entire system is pressurized when in use during startup, hot standby, and shutdown.

The staff believes that it is necessary to establish design guidelines for the auxiliary feedwater system, and in this regard has developed guidelines that may be used to select the minimum diversity acceptable for auxiliary feedwater system pump drives and power supplies.

B. BRANCH TECHNICAL POSITION

1. The auxiliary feedwater system should consist of at least two full- capacity, independent systems that include diverse power sources.

2. Other powered components of the auxiliary feedwater system should also use the concept of separate and multiple sources of motive energy. An example of the required diversity would be two separate auxiliary feedwater trains, each capable of removing the afterheat load of the reactor system, having one separate train powered from either of two a-c sources and the other train wholly powered by steam and d-c electric power.

3. The piping arrangement, both intake and discharge, for each train should be designed to permit the pumps to supply feedwater to any combination of steam generators. This arrangement should take into account pipe failure, active component failure, power supply failure, or control system failure that could prevent system function. One arrangement that would be acceptable is crossover piping containing valves that can be operated by remote manual control from the control room, using the power diversity principle for the valve operators and actuation systems.

4. The auxiliary feedwater system should be designed with suitable redundancy to offset the consequences of any single-active component failure; however, each train need not contain redundant active components.

5. When considering a high energy line break, the system should be so arranged as to assure the capability to supply necessary emergency feedwater to the steam generators, despite the postulated rupture of any high energy section of the system, assuming a concurrent single active failure.

C. REFERENCES

None

SRP Draft Section 10.4.9
Attachment A - Proposed Changes in Order of Occurrence

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

Item	Source	Description
1.	Current PRB names and abbreviations.	Editorial change made to reflect current PRB names and responsibilities for SRP Section 10.4.9.
2.	Editorial	The text was modified to state that the design should comply with the GDCs.
3.	**Integrated Impact 217.**	Text was added to incorporate 10 CFR 50.63 with the description of applicable requirements for consistency with the acceptance criteria subsection.
4.	Current PRB names and abbreviations.	Editorial change made to reflect current PRB names and responsibilities for SRP Section 10.4.9.
5.	Current PRB names and abbreviations.	Editorial change made to reflect current PRB names and responsibilities for SRP Section 10.4.9.
6.	Current PRB names and abbreviations.	Editorial change made to reflect current PRB names and responsibilities for SRP Section 10.4.9.
7.	Current PRB names and abbreviations.	Editorial change made to reflect current PRB names and responsibilities.
8.	Current PRB names and abbreviations.	Editorial change made to reflect current PRB names and responsibilities.
9.	Current PRB names and abbreviations.	Editorial change made to reflect current PRB names and responsibilities for SRP Section 10.4.9.
10.	SRP-UDP format item, Reformat reference citations.	Added parenthetical reference identification to the existing citation of NUREGs 0611 and 0635.
11.	SRP-UDP format item, Reformat reference citations.	Added parenthetical reference identification to the existing citation of NUREG-0737.
12.	**Integrated Impact 218.**	The paragraph in the Areas of Review was revised to provide editorial clarification, to add reference to 10 CFR 50.34(f), and to delete details regarding the methods used in determining reliability. These methods are contained in the acceptance criteria and review procedures and it is not necessary to include them in the Areas of Review.
13.	Current PRB names and abbreviations.	Editorial change made to reflect current PRB names and responsibilities.
14.	**Integrated Impact 219.**	Editorial change to separate discussion of TMI Action Plan item II.E.1.2 from II.E.1.1, and to expand the review area coordinated with the HICB to include ATWS per 10 CFR 50.62.
15.	Editorial	Paragraph was renumbered to accommodate new paragraph 18.

Item	Source	Description
16.	SRP-UDP format item, Reformat reference citations.	Added parenthetical reference identification to the existing citation of BTP RSB 5-1.
17.	**Integrated Impact 217.**	Added Area of Review for auxiliary feedwater system with regard to station blackout.
18.	SRP-UDP format item, Reformat Areas of Review	Added "Review Interfaces" heading to Areas of Review. Reformatted existing description of review interfaces in numbered format to describe how the SPLB reviews aspects of the AFW system under other SRP sections and how other branches support the review.
19.	SRP-UDP format item, Editorial change.	Added a lead-in sentence to the paragraphs that identify other SRP sections that interface with the review of SRP Section 10.4.9, and are also the responsibility of the SPLB.
20.	Current PRB names and abbreviations.	Editorial change to separate text and reflect current PRB name and responsibility for SRP Section 9.5.1.
21.	Editorial	"Their" was changed to "its" as a result of separating the previous text and for consistency with the other review interfaces.
22.	Current PRB names and abbreviations.	Editorial change to separate text and reflect current PRB name and responsibility for SRP Section 3.11.
23.	Editorial	"Their" was changed to "its" as a result of separating the previous text and for consistency with the other review interfaces.
24.	SRP-UDP format item, Editorial.	Revised the lead-in sentence for those paragraphs identifying other SRP Sections that interface with the review of SRP Section 10.4.9 to be consistent with SRP-UDP format guidance and other SRP Sections.
25.	Current PRB names and abbreviations.	Editorial change to reflect current PRB name and responsibilities.
26.	Current PRB names and abbreviations.	Editorial change to reflect current PRB name and responsibilities.
27.	**Integrated Impact 219.**	Added review interface for SRXB to indicated its review responsibilities with regard to the AFWS and its performance under ATWS events.
28.	Current PRB names and abbreviations.	Editorial change to reflect current PRB name and responsibilities for SRP Sections 3.3.1, 3.3.2, 3.5.3, 3.7.1 through 3.7.4, 3.8.4, and 3.8.5.
29.	PRB Assignments	Relocated interface to SRP 6.6 to reflect reassignment to ECGB.
30.	Current PRB names and abbreviations.	Editorial change to reflect current PRB name and responsibilities for SRP Sections 3.9.1 through 3.9.3.

Item	Source	Description
31.	Current PRB names and abbreviations.	Editorial change to reflect current PRB name and responsibilities for SRP Sections 3.2.1 and 3.2.2.
32.	Current PRB names and abbreviations.	Editorial change to reflect current PRB name and responsibilities for SRP Section 3.9.6.
33.	Current PRB names and abbreviations.	Editorial change to reflect current PRB name and responsibility for review of materials compatibility.
34.	PRB Assignments	Relocated interface to SRP 6.6 to reflect reassignment to ECGB.
35.	Current PRB names and abbreviations.	Editorial change to separate text and reflect current PRB name and responsibility for SRP Section 16.0.
36.	Editorial	"Their" was changed to "its" as a result of separating the previous text and for consistency with the other review interfaces.
37.	Current PRB names and abbreviations.	Editorial change to separate text and reflect current PRB name and responsibility for SRP Chapter 17. Note that "Section 17.0" has been revised to be "Chapter 17", because SRP Section 17.0 does not exist, and all Chapter 17 sections appear to apply within the context of this interface.
38.	Current PRB names and abbreviations.	Editorial change to separate text and reflect current PRB name and responsibility for SRP Section 3.10.
39.	**Integrated Impact 219.**	Added ATWS to review interface for HICB.
40.	Current PRB names and abbreviations, **Integrated Impact 219**.	Editorial change to separate text and reflect current PRB name and responsibilities for SRP Sections 7.1, and 7.3 through 7.5. Also added an interface with proposed SRP Section 7.8 related to ATWS.
41.	**Integrated Impact 217.**	Added review interface with the EELB for review of the AFWS with regard to station blackout..
42.	Current PRB names and abbreviations.	Editorial change to separate and revise text and reflect current PRB name and responsibilities for SRP Chapter 8.
43.	Editorial.	Changes identifying that acceptance criteria and methods of application for interfacing SRP Sections are contained within those sections are for clarification only.
44.	**Integrated Impact 217.**	Added regulations to the list of acceptance criteria source documents to accommodate the addition of 10 CFR 50.63.
45.	Editorial	Revised the text to improve clarity
46.	SRP-UDP format item. Reformat References	Added parenthetical identifier for reference to ASB 10-1.

Item	Source	Description
47.	**Integrated Impact 218.**	Revised Acceptance Criteria to add reference to TMI Action Item II.E.1.1 and 10 CFR 50.34(f)(1)(ii) with regard to reliability analysis requirements for the auxiliary feedwater system.
48.	**Integrated Impact 218.**	The reference to the methods and data contained in NUREGs 0611 and 0635 was deleted from the Acceptance Criteria and moved to the Review Procedures.
49.	**Integrated Impact 217.**	Revised the Acceptance Criteria to include 10 CFR 50.63 as it relates to auxiliary feedwater system design for coping with station blackout.
50.	SRP-UDP format item, Develop Technical Rationale	Added Technical Rationale for GDC 2, 4, 5, 19, 34, 44, 45, 46, and 10 CFR 50.63. Technical Rationale is a new SRP-UDP format item.
51.	Editorial	Deleted the word "procedure." Subsection III of the SRP contains multiple review procedures that as a whole make up the system review. The change revises the paragraph to direct the reviewer to ensure that the review (and not an individual review procedure) is complete, which is appropriate in the context of this paragraph.
52.	Editorial.	Correction of typographical error. The period following "steam generators" was replaced with a comma.
53.	Current PRB names and abbreviations.	Editorial change to reflect current PRB name and responsibilities.
54.	Current PRB names and abbreviations.	Editorial change to reflect current PRB name and responsibilities.
55.	**Integrated Impact 216.**	Revised the Review Procedures to include a paragraph directing the reviewer to consider the potential for steam binding in the design of the auxiliary feedwater system.
56.	SRP-UDP format item, Reformat reference citations.	Added parenthetical reference identification to the existing citation of BTP SPLB 10-1 (formerly ASB 10-1).
57.	Current PRB names and abbreviations.	Editorial change to reflect current PRB name and responsibilities for SRP Chapter 7.
58.	Editorial	Paragraph (j) was redesignated as paragraph (h). There was no deletion of text associated with this change. There are no (h) or (i) lettered paragraphs in the existing Review Procedures.
59.	Current PRB names and abbreviations.	Editorial change to reflect current PRB name and responsibilities.

Item	Source	Description
60.	Current PRB names and abbreviations.	Editorial change to reflect current PRB name and responsibilities.
61.	Current PRB names and abbreviations.	Editorial change to reflect current PRB name and responsibilities.
62.	**Integrated Impact 218.**	Editorial change to identify the 10 CFR requirement governing the performance of reliability analyses for the AFWS.
63.	**Integrated Impact 218.**	The sentence referring to the reliability methods and data in NUREGs -0611 and -0635 was moved from the Acceptance Criteria, paragraph II.5.c, and modified to fit the context of the paragraph. This change moved the details of the reliability review to the Review Procedures subsection and provided a lead-in to the new text describing alternative reliability analysis methods.
64.	**Integrated Impact 218.**	Revised the Review Procedures to incorporate alternative methods of predicting auxiliary feedwater reliability as accepted by the staff in the ABB-CE System 80+ FSER.
65.	**Integrated Impact 217.**	Added a Review Procedures to direct the reviewer to consider the design of the auxiliary feedwater system with regards to the requirements for station blackout.
66.	SRP-UDP Guidance, Implementation of 10 CFR 52	Added standard paragraph to address application of Review Procedures in design certification reviews.
67.	**Integrated Impact 217.**	Incorporated the station blackout rule, 10 CFR 50.63, into the Evaluation Findings lead-in paragraph to the conclusions regarding compliance with the acceptance criteria of SRP Section 10.4.9.
68.	Editorial.	Correction of typographical error. "Deign" was corrected to "design".
69.	**Integrated Impact 218.**	Revised the Evaluation Findings to cite 10 CFR 50.34 as the regulatory basis for TMI requirements contained within the SRP.
70.	**Integrated Impact 217.**	Added an Evaluation Finding to specifically address the compliance of the auxiliary feedwater system design with the requirements of 10 CFR 50.63 and the guidance of Regulatory Guide 1.155 for station blackout.
71.	SRP-UDP format item, 10 CFR 52 applicability.	Added paragraph to Evaluation Findings to address findings associated with reviews conducted in accordance with 10 CFR 52.

Item	Source	Description
72.	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.
73.	SRP-UDP Format Item	Add statement regarding the applicability of the revised SRP section to new applications.
74.	**Integrated Impact 217.**	Added the word "regulations" to the list of regulatory documents listed in the Implementation subsection as sources of implementation schedules. This change accommodates the addition of 10 CFR 50.63 to the acceptance criteria of the SRP.
75.	**Integrated Impact 219.**	Added reference to 10 CFR 50.62, because it is cited in changes proposed for subsection I, Areas of Review.
76.	**Integrated Impact 217.**	Added reference to 10 CFR 50.63.
77.	Editorial	Renumbered references to accommodate the addition of 10 CFR 50.63.
78.	SRP-UDP format item, Verification of References.	Updated the title of GDC 4.
79.	SRP-UDP format item, Verification of References.	Corrected the title of GDC 34.
80.	SRP-UDP format item, Verification of References	Regulatory Guide 1.62 is cited in the existing Areas of Review subsection of the SRP but was not previously included in the Reference subsection.
81.	**Integrated Impact 217.**	Added reference to Regulatory Guide 1.155.
82.	**Integrated Impact 218.**	Added reference to NUREG/CR-2300.
83.	**Integrated Impact 218.**	Added reference to NUREG/CR-2815.
84.	**Integrated Impact 216.**	Added reference to IE Bulletin 85-01 regarding AFWS pump steam binding.
85.	Current PRB names and abbreviations.	Text was added to identify the current PRB responsible for BTP ASB 10-1.

Integrated Impact No.	Issue	SRP Subsections Affected
216	Develop Review Procedures to address the potential for auxiliary feedwater system (AFWS) pump steam binding.	Subsection III, Review Procedures; VI, References.
217	Revise Acceptance Criteria and Review Procedures to include station blackout requirements and guidance applicable to the Auxiliary Feedwater System (AFWS).	Subsections I, Areas of Review; II, Acceptance Criteria; III, Review Procedures; IV, Evaluation Findings; and VI, References.
218	Revise Review Procedures to identify alternative methods for establishing auxiliary feedwater system (AFWS) unreliability.	Subsections I, Areas of Review; II, Acceptance Criteria; III, Review Procedures; IV, Evaluation Findings; and VI, References.
219	Revise Acceptance Criteria and Review Procedures to include anticipated transient without scram (ATWS) considerations relative to the Auxiliary Feedwater System (AFWS).	Subsection I, Areas of Review and Review Interfaces; and VI, References.
1091	Revise SRP Section to include the requirements of 10 CFR 50.34(f)(1)(ii) related to TMI Action Plan item II.E.1.1 and design review of the auxiliary feedwater system.	No changes to the SRP.
1124	Revise Acceptance Criteria and Review Procedures to incorporate the TMI action plan item II.K.2.2 related to procedures and training to initiate and control Auxiliary Feedwater independent of integrated control system for B&W reactors.	No changes to the SRP.