U.S. NUCLEAR REGULATORY COMMISSION

STANDARD REVIEW PLAN

OFFICE OF NUCLEAR REACTOR REGULATION

5.4.6 REACTOR CORE ISOLATION COOLING SYSTEM (BWR)

REVIEW RESPONSIBILITIES

Primary - Reactor Systems Branch (~~RSB~~SRXB[1])

Secondary - None

I. AREAS OF REVIEW

The reactor core isolation cooling (RCIC) system in a boiling water reactor (BWR) is a safety system which serves as a standby source of cooling water to provide a limited decay heat removal capability whenever the main feedwater system is isolated from the reactor vessel. Abnormal events which could cause such a situation to arise include an inadvertent isolation of all main steam lines, loss of condenser vacuum, pressure regulator failures, loss of feedwater, and the loss of offsite power. Each of these transients is analyzed in Chapter 15 of the applicant's safety analysis report (SAR). For each of these events, the high pressure part of the emergency core cooling system (ECCS) provides a backup function to the RCIC system. This review of the RCIC is performed to assure conformance with the requirements of General Design Criteria 4, 5, 29, 33, 34 and 54. In some plant designs, the RCIC system, in conjunction with the high pressure core flooder (HPCF) system, may be part of the emergency core cooling system. In such cases, the ECCS function of the RCIC system is reviewed under SRP Section 6.3.[2] In addition, the RCIC system may provide decay heat removal necessary for coping with a station blackout. The RCIC system capability to perform this function is reviewed as necessary to assure conformance with 10 CFR 50.63.[3]

The RCIC system consists of a steam-driven turbine-pump unit and associated valves and piping capable of delivering makeup water to the reactor vessel and supplying steam to and removing condensate from the RCIC steam turbine where applicable. Fluid removed from the reactor

vessel following a shutdown from power operation is normally made up by the feedwater system, supplemented by inleakage from the control rod drive system. If the feedwater system is inoperable, the RCIC turbine-pump unit starts automatically or is started by the operator from the control room. The water supply for the RCIC system comes from the condensate storage tank, with a secondary supply from the suppression pool.

The review of the RCIC system includes the system design bases, design criteria, description, and the points noted below.

The ~~RSB~~ SRXB[4] is responsible for performing the technical review of the RCIC system in the following areas:

1. The piping and instrumentation diagrams are reviewed to determine that the system is capable of performing its intended function and of being preoperationally and operationally tested.

2. The degree of separation of the RCIC system from the high pressure core spray (HPCS) system, ~~or~~ the high pressure coolant injection (HPCI) system, or the high pressure core flooder (HPCF) system[5] is reviewed for protection against common mode failure of redundant systems.

3. The process flow diagram is reviewed to confirm that the RCIC system design parameters are consistent with expected pressures, temperatures and flow rates.

4. The complete sequence of operation is reviewed to determine that the system can function as intended and that the system is capable of manual operation.

5. The system is reviewed for compliance with the applicable requirements of NUREG-0737 (Reference ~~.~~[6] 1[7]).

Review Interfaces:[8]

The SRXB also performs the following reviews under the SRP sections indicated:[9]

1. As part of its primary review responsibility for SRP Section 3.12 (proposed), the SRXB reviews the design of the RCIC system for evolutionary light-water reactor designs to verify, to the extent practical, that low-pressure portions of the RCIC that interface with the RCS will withstand full RCS pressure. If designing the RCIC with an ultimate rupture strength capable of withstanding full RCS pressure is not possible, the reviewer verifies that appropriate compensating measures have been taken in accordance with the review provided in SRP Section 3.12 (proposed).[10]

2. If applicable to the plant design being reviewed, the SRXB performs a review of the ECCS functions of the RCIC system as part of its primary review responsibility for SRP Section 6.3.[11]

In addition, the ~~RSB~~ SRXB[12] will coordinate other branch evaluations that interface with the overall review of the system as follows:

1. ~~Auxiliary Systems Branch (ASB)~~ Plant Systems Branch (SPLB)[13] reviews the RCIC and HPCI, ~~(or~~ HPCS, or HPCF[14]~~)~~ systems for protection against common mode failures from missiles as part of its primary review responsibility for Standard Review Plan (SRP) Sections 3.5.1.1, 3.5.1.2, 3.5.1.4, 3.5.1.5, 3.5.1.6 and 3.5.2.[15]

2. Protection against flooding of RCIC and redundant equipment is reviewed by ~~ASB~~ SPLB[16] as part of its primary review responsibility for SRP s~~B~~[17]ection 3.4.1.

3. Protection against damage from pipe whip and jet impingement is reviewed by the SPLB and the Mechanical Engineering Branch (EMEB) as part of ~~its~~ their primary review responsibilit~~y~~ies for SRP Sections 3.6.1 and 3.6.2 respectively.[18]

4. The ~~Standardization and Special Projects Branch (SSPB)~~ Technical Specifications Branch (TSB)[19] reviews the proposed technical specifications as part of its primary review responsibility for SRP Section 16.0.

5. The ~~Procedures and Systems Review Branch (PSRB)~~ Quality Assurance and Maintenance Branch (HQMB)[20] reviews the proposed preoperational and critical startup test programs as part of its primary review responsibility for SRP Section 14.2.

6. The ~~MEB~~ EMEB[21] reviews the RCIC system to assure that it has the proper seismic and quality group classification as part of its primary review responsibility for SRP Sections 3.2.1 and 3.2.2.

7. The RCIC is to be enclosed in a seismic Category I structure or building. The design adequacy of this structure or building is evaluated by the ~~Structural and Geotechnical Engineering Branch (SGEB)~~ Civil Engineering and Geosciences Branch (ECGB)[22] as part of its primary review responsibility for SRP Sections ~~3.3, 3.4, 3.5, 3.7, and 3.8~~ 3.3.1, 3.3.2, 3.4.2, 3.5.3, 3.7.1, 3.7.2, 3.7.3, 3.8.1, 3.8.3, 3.8.4 and 3.8.5.[23]

8. The ~~Containment Systems Branch (CSB)~~ Containment Systems and Severe Accident Branch (SCSB)[24] reviews the RCIC system, as part of its primary review responsibility for SRP Sections 6.2.2,[25] 6.2.4 and 6.2.6 to confirm that the design is compatible with the containment system and can be isolated. SCSB also reviews the containment heat removal capability and the suppression pool suction strainers as part of its review responsibility for SRP Section 6.2.2.[26]

9. The ~~Instrumentation and Control Systems Branch (ICSB)~~Instrumentation and Controls Branch (HICB)[27], as part of its primary review responsibility for SRP Section 7.3 and[28] 7.4, evaluates the adequacy of controls and instrumentation of the RCIC system with regard to the required features of automatic actuation, remote sensing and indication, and remote control.

10. The ~~Power Systems Branch (PSB)~~Electrical Engineering Branch (EELB)[29], as part of its primary review responsibility for SRP ~~Section~~Chapter ~~8.3~~[30], evaluates the adequacy and reliability of offsite and emergency onsite power, the sufficiency of battery capacity, ~~and~~ the use of d-c power only to support operation of specified systems/subsystems, and the plant's capabilities to cope with a Station Blackout (SBO) as required by 10 CFR 50.63.[31]

11. The ~~MEB~~ EMEB[32], as part of its primary review responsibility for SRP Section 3.9.3, ensures that the design and installation of the RCIC system meet applicable codes and are adequate for its proper functioning.

12. The ~~Equipment Qualification Branch (EQB)~~ EMEB reviews RCIC system equipment to determine that it is seismically ~~and environmentally~~ qualified for its intended use as part of its primary review responsibility for SRP Section~~s~~ 3.10 ~~and 3.11~~.[33]

13. The SPLB reviews RCIC system equipment to determine that it is environmentally qualified for its intended use as part of its primary review responsibility for SRP Section 3.11.[34]

14. The EMEB reviews the inservice testing of pumps and valves for the RCIC system as part of its primary review responsibility for SRP Section 3.9.6.[35]

15. The SPLB reviews the CST level detection and activation of switchover of suction of the RCIC pump to the suppression pool as part of its primary review responsibility for SRP Section 9.2.6.[36]

16. The SPLB reviews the RCIC pump room cooling as part of its primary review responsibility for Section 9.4.5.[37]

For those areas of review identified above as being reviewed ~~as part of the primary review responsibility of other branches for~~ in other SRP Sections, the acceptance criteria necessary for the review and their methods of application are contained in the referenced SRP Section ~~of the corresponding primary branch~~.[38]

II. ACCEPTANCE CRITERIA

~~RSB~~ SRXB[39] acceptance criteria are based on meeting the relevant requirements of General Design Criteria 4, 5, 29, 33, 34, ~~and~~ 54, and 10 CFR 50.63[40]. Specific criteria to meet the requirements of the above GDCs and 10 CFR 50.63[41] are as follows:

A. General Design Criteria 4, as related to dynamic effects associated with flow instabilities and loads (e.g., water hammer).

B. General Design Criterion 5 as it relates to structures, systems and components important to safety not being shared among nuclear power units unless it can be demonstrated that sharing will not impair its ability to perform its safety function.

C. General Design Criterion 29 as it relates to the system being designed to have an extremely high probability of performing its safety function in the event of anticipated operational occurrences.

D. General Design Criterion 33 as it relates to the system capability to provide reactor coolant makeup for protection against small breaks in the reactor coolant pressure boundary so the fuel design limits are not exceeded.

E. General Design Criterion 34 as it relates to the system design being capable of removing fission product decay heat and other residual heat from the reactor core to preclude fuel damage or reactor coolant pressure boundary overpressurization.

F. General Design Criterion 54 as it relates to piping systems penetrating primary containment being provided with leak detection and isolation capabilities.

G. 10 CFR 50, §50.63, "Loss of All Alternating Current Power," as related to design provisions to support the plant's ability to withstand and recover from an SBO of a specified duration.[42]

Specific acceptance criteria, Regulatory Guides, and Task Action Plan items that provide information, recommendations and guidance and in general describe a basis acceptable to the staff that may be used to implement the requirements of the Commission regulations identified above are as follows:

1. The general objective of the review is to determine that the RCIC system, in conjunction with the HPCS (or HPCI) system, the safety/relief valves, and the suppression pool cooling mode of the residual heat removal system meets the requirements of General Design Criterion 34 ~~(Ref. 2)~~[43] by providing the capability for decay heat removal to allow complete shutdown of the reactor under conditions requiring its use. It must maintain the reactor water inventory above the top of the active fuel until the reactor is depressurized sufficiently to permit operation of the low pressure cooling systems. The RCIC system, in conjunction with the HPCS (or HPCI) system, the safety/relief valves, and the suppression pool cooling mode of the RHR system must be capable of removing fission product decay heat and other residual heat from the reactor core following shutdown so as to preclude fuel damage or reactor coolant pressure boundary overpressurization. Since RCIC in conjunction with HPCS (or HPCI) is used to provide makeup inventory in some modes of residual heat removal, these systems should jointly meet the guidelines of BTP RSB 5-1 (Reference 17)[44], attached to SRP Section 5.4.7.

2. The RCIC system is also used to supply reactor coolant makeup for small leaks. Accordingly, the systems must meet the requirements of General Design Criterion 33 ~~(Ref. 4)~~[45] in this regard.

3. Historically, credit has been taken for RCIC system capability to mitigate the consequences of certain abnormal events; however, since the cooling function is redundant to the HPCI, HPCS, or HPCF[46] system, the RCIC system itself is not required to meet the single failure criterion, but in conjunction with HPCS, ~~(or~~ HPCI, or HPCF[47]~~)~~

must satisfy the single failure criterion in this regard. In addition, the RCIC system is to perform its function without the availability of any a-c power per the requirements of General Design Criterion 34 ~~(Ref. 2)~~,[48] and in conjunction with HPCS, ~~(or~~ HPCI, or HPCF[49]~~)~~ must be designed to assure an extremely high probability of accomplishing its safety function as required by General Design Criterion 29 ~~(Ref. 6)~~.[50]

4. As a system which must respond to certain abnormal events, the RCIC system must be designed to seismic Category I standards (discussed in SRP Section 3.2.1) and must not be shared among nuclear power units except as permitted by General Design Criterion 5 ~~(Ref. 7)~~.[51]

5. The RCIC and HPCS, ~~(or~~ HPCI, or HPCF[52]~~)~~ systems must be protected against natural phenomena, external or internal missiles, pipe whip, and jet impingement forces so that such events cannot fail both systems simultaneously. Acceptance criteria for these are discussed in SRP Sections 3.3.1 through 3.6.2. ~~Acceptance criteria for RCIC instrumentation are described in SRP Section 7.4.~~[53]

6. The RCIC system must meet the requirements of General Design Criterion 54 ~~(Ref. 8)~~[54] with regard to leak detection and isolation provisions for lines passing through the primary containment. Other containment isolation criteria for RCIC are described in SRP Sections 6.2.4 and 6.2.6.

~~7. The RCIC system must meet the recommendations of Task Action Plan items II.K.1.22, II.K.3.13, II.K.3.15, II.K.3.22, II.K.3.24, and III.D.1.1 of NUREG-0737 (Ref. 1) and NUREG-0718 (Ref. 11) with regard to actions needed for operation, system initiation setpoint and automatic restart capability, break detection provisions, automatic suction switchover to the suppression pool, adequacy of space cooling, and leakage minimization, respectively.~~[55]

7. The RCIC system must meet the following[56] Task Action Plan item recommendations of NUREG-0737 and NUREG-0718 (References 13 and 12)[57]:

   a. II.K.1.22 with regard to actions, both automatic and manual, necessary for proper functioning of the auxiliary heat removal systems that are used when the main feedwater system is not operable.[58] 10 CFR 50.34(f)(2)(xxi) establishes an equivalent requirement for those applicants subject to the requirements of 10 CFR 50.34(f).[59]

   b. II.K.3.13 with regard to initiation levels of the HPCI and RCIC system being separated so that the RCIC system initiates at a higher water level than the HPCI system and that RCIC system initiation logic will restart the RCIC system on low water level.[60] 10 CFR 50.34(f)(1)(v) establishes an equivalent requirement for those applicants subject to the requirements of 10 CFR 50.34(f).[61]

   c. II.K.3.15 with regard to preventing spurious isolation of the RCIC system from the line-break detection logic.[62]

d. II.K.3.22 with regard to automatic switchover of the RCIC system suction from the condensate storage tank to the suppression pool when the condensate storage tank level is low.[63]

e. II.K.3.24 with regard to space cooling to ensure reliable long-term operation of the RCIC system following a complete loss of offsite power to the plant for at least two hours.[64] 10 CFR 50.34(f)(1)(ix) establishes an equivalent requirement for those applicants subject to the requirements of 10 CFR 50.34(f).[65]

f. III.D.1.1 with regard to leakage detection and control in the design of systems outside containment that contain (or might contain) radioactive source term materials following an accident.[66] 10 CFR 50.34(f)(2)(xxvi) establishes an equivalent requirement for those applicants subject to the requirements of 10 CFR 50.34(f).[67]

8. If the RCIC system is used to control or mitigate the consequences of an accident, either by itself or as a backup to another system, it must meet the requirements of an engineered safety feature. The RCIC system must meet the guidelines of Regulatory Guide 1.1 ~~(Ref. 9)~~[68] regarding net positive suction head.

9. In order to meet the requirements of General Design ~~c~~Criterion 4 ~~(Ref. 12)~~[69] design features and operating procedures, designed to prevent damaging water hammer due ~~-~~[70] to such mechanisms as voided discharge lines, steam bubble collapse and water entrainment in steam lines, shall be provided.

10. If the RCIC system supports the demonstration of adequate plant SBO coping capability as required by 10 CFR 50.63, acceptance is based on positions in Regulatory Guide 1.155 regarding RCIC system design.[71]

Technical Rationale:[72]

The technical rationale for application of the above acceptance criteria to the reactor core isolation cooling system is discussed in the following paragraphs:

1. GDC 4 requires structures, systems and components that provide essential cooling for safety-related equipment to be designed to accommodate the effects of, and to be compatible with, the environmental conditions associated with normal operation, maintenance, testing, and postulated accidents, and to be appropriately protected against dynamic effects, including the effects of missiles, pipe whipping, and discharging fluids, that may result from equipment failures and from external events. The RCIC system provides cooling water necessary for decay heat removal and the dynamic effects of water hammer could degrade system effectiveness. Compliance with GDC 4 assures that the RCIC system will remain functional and provide essential cooling necessary for decay heat removal.

2. GDC 5 prohibits the sharing of structures, systems and components among nuclear power units unless it can be shown 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 RCIC system provides essential cooling water necessary for decay heat removal. The RCIC system needs to be designed such that the ability to accomplish these safety-related functions are not compromised for each unit regardless of equipment failures or other events that may occur in another unit. Meeting the requirements of GDC 5 provides assurance that unacceptable effects of equipment failures or other events occurring in one unit of a multi-unit site will not propagate to the unaffected unit(s).

3. GDC 29 establishes requirements that the protection and reactivity control systems be designed to assure an extremely high probability of accomplishing their safety functions in the event of anticipated operational occurrences. The RCIC system provides a standby source of cooling water and limited decay heat removal capability whenever the main feedwater system is isolated from the reactor vessel. This system can mitigate the consequences of anticipated operational occurrences such as loss of feed water, inadvertent isolation of main steam, or loss of offsite power; therefore, it must have an extreme high probability of accomplishing its function. The reactor protection or engineered safety features (ESF) system activates initiation of the RCIC system during appropriate anticipated operational occurrences. The RCIC interface with this system is to be designed to continue this extremely high probability of accomplishing its safety functions. Application of GDC 29 provides assurance that specified acceptable fuel design limits are not exceeded as a result of anticipated operational occurrences.

4. GDC 33 specifies requirements for a system to supply reactor coolant makeup for protection against small breaks in the reactor coolant pressure boundary and either onsite or offsite a-c power not available. The RCIC system is designed as a high-pressure reactor coolant makeup system with flow rates sufficient to meet the criteria for small breaks in the reactor coolant pressure boundary without a-c power. Compliance with GDC 33 assures that specified acceptable fuel design limits are not exceeded due to reactor coolant pressure boundary leakage or rupture of small piping or other small components which are part of the boundary.

5. GDC 34 establishes requirements for a system to transfer fission product decay heat and other residual heat from the reactor core. The RCIC system provides the capability for decay heat removal. Compliance with GDC 34 precludes fuel damage or reactor coolant pressure boundary overpressurization in the event of anticipated operational occurrences which would adversely affect functions of systems that provide normal heat removal from the reactor core.

6. GDC 54 requires that piping systems penetrating primary reactor containment be provided with leak detection, isolation, and containment capabilities having redundancy, reliability, and performance capabilities which reflect the importance to safety of isolating these piping systems. Such piping systems are required to be designed with a capability to test periodically the operability of the isolation valves and associated apparatus and to determine if valve leakage is within acceptable limits. Piping in the RCIC system passes through the containment boundary, and is provided with isolation valves and integrity verification capabilities. Containment isolation and leak detection,

as required by GDC 54, provide high level of assurance that the containment will perform its safety function in the event of a postulated accident and will maintain the capability to prevent significant uncontrolled release of radioactivity.

7. 10 CFR 50.63 invokes explicit requirements on the plant regarding the capability to ensure that the core is cooled in the event of a station blackout for a determined duration. The RCIC system provides decay heat removal from the reactor core. Its design capability to operate regardless of a-c power source availability enables performance of the decay heat removal function to support the plant in coping with a station blackout. Regulatory Guide 1.155 identifies methods acceptable for complying with the requirements of 10 CFR 50.63. Compliance with this Regulatory Guide and 10 CFR 50.63 provides assurance that the RCIC system is capable of performing its intended function in the event of a station blackout.

III. REVIEW PROCEDURES

The procedures below are used during the construction permit (CP) review to assure 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 the operating license (OL) review, the procedures are used 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 OL and design certification (DC)[73] review also includes the proposed technical specifications, to assure that they are adequate in regard to limiting conditions of operation and periodic surveillance testing.

Upon request from the primary reviewer, other 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~~[74] is complete.

1. Using the RCIC operating requirements specified in SAR Section 5.4.6 and Chapter 15, the reviewer confirms that the RCIC system can maintain coolant inventory in the reactor vessel to keep the core covered and assure cladding integrity. This determination is based on engineering judgment and independent calculations (where deemed necessary), using information as specified in steps 2 and 3 below. The reviewer ~~consults with the CPB to assure~~ verifies that the decay heat loads used in the RCIC analyses are applicable, consistent with SRP Section 4.2,[75] and suitably conservative.

2. Using the description given in Section 5.4.6 of the SAR, including component lists and performance specifications, the reviewer determines that the RCIC system piping and instrumentation are such as to allow the system to operate as intended. This is accomplished by reviewing the piping and instrumentation diagrams to confirm that piping arrangements permit the required flow paths to be achieved and that sufficient process sensors are available to measure and transmit required information.

3. Using the comparison tables of SAR Section 1.3, the RCIC system is compared to designs and capacities of such systems in similar plants to see that there are no

unexplained departures from previously reviewed plants. Where possible, comparisons should be made with actual performance data from similar systems in operating plants.

4. The reviewer checks the piping and instrumentation diagrams and equipment layout drawings for the RCIC and HPCS, ~~(or~~ HPCI, or HPCF[76]~~)~~ systems to see that the systems are physically separated and can function independently.

5. The reviewer examines the system design in SAR Section 5.4.6 to verify that the capability for automatic switchover of suction from the condensate storage tank to the suppression pool has been provided per the requirements of item II.K.3.22 of NUREGs-0737 and 0718 ~~(Ref. 1 and 11)~~[77]. The reviewer also judges whether adequate control and monitoring information is available to allow the operator to actuate the system manually or to realign the RCIC system manually within the time allowed (i.e., change the RCIC system suction from the condensate storage tank to the suppression pool, or to the steam condensing mode of the residual heat removal system).

6. The reviewer contacts ~~ICSB~~ HICB[78] to confirm that automatic actuation and remote-manual valve controls are capable of performing the functions required and that sensor and monitoring provisions are adequate. The instrumentation and controls of the RCIC system, in conjunction with the HPCS, ~~(or~~ HPCI, or HPCF[79]~~)~~ system are to have sufficient redundancy to satisfy the single failure criterion.

7. The reviewer contacts ~~PSB~~ EELB[80] to ascertain that the RCIC system operation is not dependent on a-c power sources, and that there is sufficient battery capability to permit operation of the RCIC for a period of two hours without the availability of a-c power, and the RCIC pump room coolers meet the power supply requirements of Task Action Plan item II.K.3.24 of NUREG-0737.[81]

8. The reviewer checks with ~~MEB~~ EMEB[82] to verify that essential RCIC system components are designated seismic Category I.

9. The reviewer contacts ~~PSRB~~ HQMB[83] to verify that the applicant's proposed preoperational and initial startup test programs are in compliance with Regulatory Guide 1.68 ~~(Ref. 10)~~[84]. At the OL stage, the reviewer confirms with ~~PSRB~~ HQMB[85] that sufficient information is provided by the applicant to identify the test objectives, methods of testing, and test acceptance criteria (see ~~par.~~ C.2.~~b~~, C.3, and C.4[86] of Regulatory Guide 1.68). ~~PSRB~~ HQMB[87] also verifies that the proposed test programs will provide reasonable assurance that the RCIC system will perform its safety function. As an alternative to this detailed evaluation, the reviewer may compare the RCIC system design to that of previously reviewed plants. If the design is essentially identical and if the proposed test programs are essentially the same, the reviewer may conclude that the proposed test programs are adequate for the RCIC system. If the RCIC system differs significantly from that of previously reviewed designs, the impact of the proposed changes on the required preoperational and initial startup testing programs are reviewed at the CP stage. This effort should particularly evaluate the need for any special design features required to perform acceptable test programs.

10. The ~~SSPB~~ TSB[88] is contacted in regard to the proposed plant technical specifications to:

    a. Confirm the suitability of the limiting conditions of operation, including the proposed time limits and reactor operating restrictions for periods when system equipment is inoperable due to repairs and maintenance.

    b. Verify that the frequency and scope of periodic surveillance testing is adequate.

11. The reviewer confirms that the RCIC is housed in a structure whose design and design criteria have been reviewed by other branches (i.e., ~~ASB~~ SPLB[89], ~~SGEB~~ ECGB[90] and EMEB[91]) to assure that it provides adequate protection against wind, tornadoes, floods, and missiles, as appropriate.

~~12. Upon request from the primary reviewer, other 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 is complete.~~[92]

1~~3~~2.[93] The reviewer checks the automatic and manual actions necessary for proper functioning of the RCIC system (in conjunction with the HPCS or HPCI, the safety relief valves and the suppression pool cooling mode of RHR) for completeness and practicality when used for residual heat removal per the requirements of item II.K.1.22 of NUREGs-0737 and ~~0178~~ 0718[94] ~~(Ref. 1 and 11)~~[95].

1~~4~~3. The reviewer checks the RCIC system break detection provisions to see that the system is protected against spurious trip signals per the requirements of item II.K.3.15 of NUREGs-0737 and 0718 ~~(Ref. 1 and 11)~~[96]. For plants using a time delay for this protection, the reviewer verifies that the design is consistent with staff positions in Generic Letter 83-02 (Reference 15) with regard to minimum and maximum expected response times.

For plants which do not use a time delay for spurious isolation protection, the reviewer verifies that the applicant has provided proper justification for the design, and that the applicant's test program and test results demonstrate that the system meets the intent of II.K.3.15 in preventing spurious isolation of the RCIC system on initiation.[97]

1~~5~~4. The reviewer confirms, in conjunction with ~~ASB~~ SPLB[98] as necessary, that the RCIC system can withstand a loss of offsite power to its support systems, including space coolers, for at least two hours per the requirement of item II.K.3.24 of NUREGs-0737 and 0718 ~~(Ref. 1 and 11)~~[99].

1~~6~~5. The reviewer confirms per the requirements of item II.K.3.13 of NUREGs-0737 and ~~0178~~ 0718[100] ~~(Ref. 1 and 11)~~[101] that analyses have been provided or referenced to determine the need to separate the RCIC and the HPCS (or HPCI) initiation levels. Based on these study results, the reviewer checks the RCIC design for appropriate provisions. In addition, the reviewer checks to see that automatic restart capability is provided for RCIC.

176. The reviewer checks (by calculation as necessary) to see that adequate net positive suction head is available for RCIC suction from all potential sources (i.e., condensate storage tank, suppression pool, or RHR steam condensing mode discharge).

187. The reviewer examines the RCIC in conjunction with the HPCS or HPCI, the safety/relief valves and the suppression pool cooling mode of RHR for conformance to the recommendations of BTP RSB 5-1 to SRP Section 5.4.7 regarding residual heat removal.

198. The RCIC system is reviewed to evaluate the adequacy of design features that have been provided to prevent damaging water (steam) hammer due to such mechanisms as voided discharge lines, water entrainment and steam bubble collapse. If the normal water supply is above the discharge lines, voided lines are prevented by proper vent location and filling and venting procedures. The vents should be located for ease of operation and testing on a periodic basis. If the normal alignment of the suction valves is to a source below the highest level of the pump discharge lines (e.g., the suppression pool,) back leakage through the pump discharge check valves will result in line voiding. Proper vent location and filling and venting procedures are still needed. In addition, a special keep-full system with appropriate alarms is needed to supply water to the discharge lines at sufficiently high pressure to prevent voiding. Operating and maintenance procedures shall be reviewed by the applicant to assure that adequate measures are taken to avoid water hammer due to voided line conditions. Guidance for water hammer prevention and mitigation is found in NUREG-0927 (Reference 18).[102]

19. The reviewer confirms that the RCIC system capability is sufficient with respect to the plant's ability to cope with, and recover from an SBO of a specified duration by determining compliance with Regulatory Guide 1.155 positions C.3.2, C.3.3, and C.3.5 as related to the design of the RCIC system. This review is coordinated with the review of the SBO event under SRP Section 8.3.1.[103]

20. The reviewer contacts EMEB to verify that test results on the steam line containment isolation valves show the valves will isolate under expected conditions as discussed in Generic Letter 89-10, Supplement 3 (Reference 14).[104]

21. The reviewer verifies that a leakage reduction program has been implemented and that the program and RCIC system design meet the criteria of NUREG-0737, Action Plan Item III.D.1.1.[105]

22. The reviewer contacts SCSB to verify that the design of the suppression pool suction strainers, as reviewed in SRP Section 6.2.2, are adequate and meet specified requirements for operation of the RCIC pump.[106]

23. The reviewer checks the RCIC pump minimum flow design capacity and minimum flow testing to verify that the flow rate meets the pump manufacturer's recommendations to prevent pump damage and overheating (Reference 16).[107]

The RCIC system uses a steam-driven turbine. Typical design features for the steam supply line include (a) drain pots, (b) sloped lines, and (c) limitations on opening and closing sequences and= [108]seal-ins for manual operation of the isolation valves to preclude introducing water slugs into the line. The turbine exhaust line features include sloped lines and vacuum breakers.

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.[109]

IV. EVALUATION FINDINGS

The reviewer verifies that the SAR contains sufficient information and his review supports the following kinds of statements and conclusions, which should be included in the staff's safety evaluation report:

> The reactor core isolation cooling (RCIC) system includes the piping, valves, pumps, turbines, instrumentation, and controls used to maintain water inventory in the reactor vessel whenever it is isolated from the main feedwater system. Certain engineered safety features (HPCS, ~~or~~ HPCI or HPCF[110]) provide a redundant backup for this function. The scope of review of the RCIC system for the _____ plant included piping and instrumentation diagrams, equipment layout drawings, and functional specifications for essential components. The review has included the applicant's proposed design criteria and design bases for the RCIC system, his analysis of the adequacy of the criteria and bases, and the conformance of the design to these criteria and bases.

The staff concludes that the reactor core isolation cooling system design is acceptable and meets the requirements of General Design Criteria 4, 5, 29, 33, 34, ~~and~~ 54, and 10 CFR 50.63.[111] This conclusion is based on the following:

1. The applicant has met the requirements of (cite Reg.) with respect to (state limits of review) by: (Use one or more of the following as applicable)

   a. meeting the regulatory position in Regulatory Guide _____,

   b. providing and meeting an alternative method to the regulatory position in Regulatory Guide _____, that the staff has reviewed and found to be acceptable,

   c. meeting the regulatory position in BTP _____

d. The calculational method used by the applicant for (state) has been previously reviewed by the staff and found acceptable; the staff has reviewed the key parameters in this case and found them to be suitably conservative.

e. The applicant has met the requirements of (industry standard - number and title) that has been reviewed by the staff and determined to be appropriate for this application.

2. Repeat the above discussion for each GDC listed.

In addition, conformance with General Design Criterion~~a~~[112] 55, 56, and 57 regarding containment isolation is discussed in Section 6.2 of this report. Conformance with General Design Criterion~~a~~[113] 2 and 4 for protection against natural phenomena, environmental hazards and potential missiles is discussed in Sections 3.3 through 3.6 of this report.

The RCIC and HPCS (or HPCI) systems, in conjunction with the safety/relief valves and the suppression pool cooling mode of the residual heat removal system, have been found capable of removing core decay heat following feedwater system isolation and reactor shutdown so that sufficient coolant inventory is maintained in the reactor vessel to keep the core covered and ensure cladding integrity. This capability has been found to be available even with a loss of offsite power and with a single active failure.

The capability and capacity of the RCIC system is sufficient with respect to the plant's ability to cope with, and recover from, an SBO of a specified duration by determining compliance with Regulatory Guide 1.155 positions C.3.2, C.3.3, and C.3.5 as related to the design of the RCIC system. Conformance with 10 CFR 50.63 for station blackout is discussed in Section 8.4 of this report.[114]

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, analysis, and acceptance criteria (ITAAC), including design acceptance criteria (DAC), site interface requirements, and combined license action items that are relevant to this SRP Section.[115]

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.[116] 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.[117]

Implementation schedules for conformance to parts of the method discussed herein are contained in the referenced regulations, regulatory guides, and NUREGs ~~and~~ except that implementation of acceptance criteri~~on~~a[118] subsections II.A and II.9 is as follows:

~~(a) Operating plants and OL applicants need not comply with the provisions of this revision.~~

~~(b) CP applicants will be required to comply with the provisions of this revision.~~

(a) Plants with operating license applications docketed prior to April, 1984 need not comply with the provisions of these items but may do so voluntary.

(b) Operating licenses, construction permit, design certification, and combined license applications docketed on or after April, 1984 will be reviewed according to the provisions of these items.[119]

VI. REFERENCES

1. 10 CFR 50.34(f), "Additional TMI-related requirements"[120]

2. 10 CFR 50, §50.63, "Loss of all alternating current power."[121]

~~1~~3.[122] 10 CFR Part 50, Appendix A, General Design Criterion 4, "Environmental and Missile Design Bases".

~~7~~4. 10 CFR Part 50, Appendix A, General Design Criterion 5, "Sharing of Structures, Systems, and Components."

~~6~~5. 10 CFR Part 50, Appendix A, General Design Criterion 29, "Protection Against Anticipated Operational Occurrences."

~~4~~6. 10 CFR Part 50, Appendix A, General Design Criterion 33, "Reactor Coolant Makeup."

~~2~~7. 10 CFR Part 50, Appendix A, General Design Criterion 34, "Residual Heat Removal."

~~5. Regulatory Guide 1.53, "Single Failure Criterion."~~[123]

~~8~~8. 10 CFR Part 50, Appendix A, General Design Criterion 54, "Piping Systems Penetrating Containment."

~~9~~9. Regulatory Guide 1.1, "Net Positive Suction Head for Emergency Core Cooling and Containment Heat Removal Systems."

~~10~~10. Regulatory Guide 1.68, "Initial Test Programs for Water-Cooled Reactor Power Plants."

11. Regulatory Guide 1.155, "Station Blackout."[124]

12. NUREG-0718, "Licensing Requirements for Pending Applications for Construction Permits ~~and Manufacturing License.~~," Revision 2.[125]

13. NUREG-0737, "Clarification of TMI Action Plan Requirements," November 1980.

14. NRC Letter to all Licensees and Applicants, (Generic Letter 89-10), dated June 28, 1989, and supplements 1 through 6, "Safety Related Motor-Operated Valve Testing."[126]

15. NRC Letter to Boiling Water Reactor Licensees, "NUREG-0737 Technical Specifications, (Generic Letter 83-02)," January 10, 1983.[127]

16. NRC Bulletin to all Holders of Operating Licenses or Construction Permits for Nuclear Power Reactors, "Potential Safety-Related Pump Loss," NRC Bulletin No. 88-04, May 5, 1988.[128]

~~3~~17. Branch Technical Position RSB 5-1, "Design Requirements of the Residual Heat Removal System," attached to SRP Section 5.4.7.

18. NUREG-0927, Revision 1, "Evaluation of Water Hammer Occurrences in Nuclear Power Plants," March 1984.[129]

SRP Draft Section 5.4.6
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.	SRP-UDP Format Item, Update PRB names.	Changed PRB name to reflect latest responsibility assignments for SRP Section 5.4.6.
2.	Potential Impacts 24318 and 24414	As stated in the ABWR FSER, the RCIC system is part of the ECCS in the ABWR. This RCIC safety function is not currently addressed in the SRP. The appropriate Acceptance Criteria and Review Procedures for reviewing the ECCS function of RCIC are contained in SRP Section 6.3.
3.	**Integrated Impact 317**	Revise Areas of Review to discuss RCIC functions related to Station Blackout events and to cite 10 CFR 50.63 similar to existing citations of GDCs 4, 5, 29, 34, and 54.
4.	SRP-UDP Format Item, Update PRB names.	Changed PRB name to reflect latest responsibility assignments for SRP section 5.4.6.
5.	Disposition of Potential Impact 24401	An Area of Review, Review Interface was added to identify the HPCF system as requiring separation from the RCIC system for protection against common-mode failures in plants where the RCIC system is part of the ECCS.
6.	SRP-UDP Format Item, update reference citations.	Revised reference citation to be consistent with SRP-UDP required format that specifies spelling out the word Reference.
7.	Editorial	Changed reference number to agree with changes in the Reference subsection numbering.
8.	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 SRXB reviews aspects of the RCIC under other SRP Sections and how other branches support the review.
9.	Editorial	Added the typical lead-in sentence for interfaces that are the responsibility of the same PRB. This change was made to accommodate the addition of the interface for SRP Section 3.12.

Item	Source	Description
10.	Potential Impact # 24406	Added an Areas of Review (review interface) discussion for SRXB to clearly describe the reviews applicable to ISLOCA. Proposed new SRP section 3.12 will address the NRC staff positions for ISLOCA and will provide the detailed review procedures necessary to verify an evolutionary plant design has met the applicable positions. Because the details for an ISLOCA review will be contained in SRP Section 3.12, no additional Review Procedures are proposed for inclusion in the RCIC SRP Section.
11.	Potential Impact 24318	A Review Interface to SRP Section 6.3 was added for those plants that include the RCIC system as a part of the ECCS. For additional detail see Attachment A, item 2.
12.	SRP-UDP Format Item, Update PRB names.	Changed PRB name to reflect latest responsibility assignments for SRP Section 5.4.6.
13.	SRP-UDP Format Item, Update PRB names.	Changed PRB name to reflect latest responsibility assignments for SRP Sections 3.5.1.1.1 through 3.5.1.6 and 3.5.2.
14.	Potential Impact 24414	Editorial addition to include the HPCF system interface in the review of the RCIC system. For additional detail see Attachment A, item 2.
15.	Editorial.	Expanded list of SRP Sections related to review of protection against missiles to comprehensively reflect the SRP Sections under which missile protection issues are reviewed.
16.	SRP-UDP Format Item, Update PRB names.	Changed PRB name to reflect latest responsibility assignments for SRP Section 3.4.1.
17.	SRP-UDP format item.	Capitalized the word "Section" in accordance with SRP-UDP standard format.
18.	SRP-UDP Format Item, Update PRB names.	Changed PRB names to reflect the latest responsibility assignments for SRP Sections 3.6.1 and 3.6.2.
19.	SRP-UDP Format Item, Update PRB names.	Changed PRB name to reflect latest responsibility assignments for SRP Section 16.0.
20.	SRP-UDP Format Item, Update PRB names.	Changed PRB name to reflect latest responsibility assignments for SRP Section 14.2.
21.	SRP-UDP Format Item, Update PRB names.	Changed PRB name to reflect latest responsibility assignments for SRP Sections 3.2.1 and 3.2.2.
22.	SRP-UDP Format Item, Update PRB names.	Changed PRB name to reflect latest responsibility assignments for SRP Sections 3.3.1, 3.3.2, 3.4.2, 3.5.3, 3.7.1, 3.7.2, 3.7.3, 3.8.1, 3.8.3, 3.8.4 and 3.8.5.

Item	Source	Description
23.	SRP-UDP Format Item, Update PRB names and editorial.	Revised the listing of the SRP Sections under which structural adequacy is reviewed by ECGB.
24.	SRP-UDP Format Item, Update PRB names.	Changed PRB name to reflect latest responsibility assignments for SRP Sections 6.2.2, 6.2.4 and 6.2.6.
25.	**Integrated Impact 880**	Revised Areas of Review, Review Interfaces to address the RCIC system interface with the suppression pool and strainers.
26.	**Integrated Impact 880**	Revised Areas of Review, Review Interfaces to address the RCIC system interface with the suppression pool and strainers.
27.	SRP-UDP Format Item, Update PRB names.	Changed PRB name to reflect latest responsibility assignments for SRP Section 7.4.
28.	Potential Impact 24402	Identified a Review Interface between the RCIC system and SRP Section 7.3 addressing review of RCIC (an ESF system) controls. Controls for the RCIC system are not explicitly reviewed in SRP Section 5.4.6. The appropriate Acceptance Criteria and Review Procedures for reviewing RCIC control functions are contained in SRP Section 7.3.
29.	SRP-UDP Format Item, Update PRB names.	Changed PRB name to reflect latest responsibility assignments for SRP Section 8.3.1 and 8.3.2.
30.	Editorial	Revised to reference SRP Chapter 8 since relevant reviews may be provided under SRP Sections 8.1, 8.2, 8.3.1, 8.3.2, 8.4 and/or Chapter 8 Appendices. Note that a new SRP Section 8.4 has been developed covering an overall review of compliance with station blackout requirements.
31.	Editorial	Added clarification that power source <u>reliability</u> and ability to withstand (where applicable) a station blackout are reviewed. Also added clarification of “the use of dc power only” and reference to reviews of offsite power since the reliability of offsite power is relevant to the station blackout issue.
32.	SRP-UDP Format Item, Update PRB names.	Changed PRB name to reflect latest responsibility assignments for SRP Section 3.9.3.
33.	SRP-UDP Format Item, Update PRB names and editorial.	Changed PRB name to reflect latest responsibility assignments for SRP Sections 3.10 and 3.11. Also organized the interfaces into two separate paragraphs to distinguish between seismic and environmental qualification reviews which are performed by two different PRBs.

Item	Source	Description
34.	SRP-UDP Format Item, Update PRB names and editorial.	Changed PRB name to reflect latest responsibility assignments for SRP Sections 3.10 and 3.11. Also organized the interfaces into two separate paragraphs to distinguish between seismic and environmental qualification reviews which are performed by two different PRBs.
35.	Potential Impact No. 24429	Added Review Interface to SRP Section 3.9.6 for review of the inservice testing program for the RCIC system to reflect the complete review of the RCIC system which is conducted under the SRP. Since several RCIC components are subject to inservice testing, review of inservice testing was explicitly acknowledged.
36.	Potential Impact No. 5744	As stated in Generic letter 83-02 and TMI action item II.K.3.22, the testing of RCIC System functions are to be reviewed. The Review Procedure for review of system suction switchover to the suppression pool is located in SRP Section 9.2.6. An interface was thus added between the RCIC system review and the review of condensate storage facilities/functions.
37.	Potential Impact No. 24403	Provided a Review Interface between the RCIC system and RCIC pump room cooling as reviewed in SRP Section 9.4.5. This RCIC support system is not currently addressed in this SRP Section. The appropriate Acceptance Criteria and Review Procedures for reviewing the ventilation of the RCIC system pump room are contained in SRP Section 9.4.5.
38.	Editorial	Revised sentence to include SRXB reviews under other sections as well as all other PRBs.
39.	SRP-UDP Format Item, Update PRB names.	Changed PRB name to reflect latest responsibility assignments for SRP Section 5.4.6.
40.	**Integrated Impact 317**	Added 10 CFR 50.63 to include criteria for SBO.
41.	**Integrated Impact 317**	Added 10 CFR 50.63 to include criteria for SBO.
42.	**Integrated Impact 317**	Added reference to 10 CFR 50.63 to Acceptance Criteria, which provides specific requirements for plant ability to withstand a Station Blackout.
43.	SRP-UDP Format Item, update reference citations.	Revised reference citation to be consistent with SRP-UDP required format that excludes parenthetical notation for CFR and GDC citations.
44.	SRP-UDP Format Item, update reference citations.	Revised reference citation to be consistent with SRP-UDP required format which provides for identification by reference number using parenthetical notation for the first citation of most reference documents.

Item	Source	Description
45.	SRP-UDP Format Item, update reference citations.	Revised reference citation to be consistent with SRP-UDP required format that excludes parenthetical notation for CFR and GDC citations.
46.	Potential Impact 24414	Editorial addition to include the HPCF system interface in the review of the RCIC system. For additional detail see Attachment A, item 2.
47.	Potential Impact 24414	Editorial addition to include the HPCF system interface in the review of the RCIC system. For additional detail see Attachment A, item 2.
48.	SRP-UDP Format Item, update reference citations.	Revised reference citation to be consistent with SRP-UDP required format that excludes parenthetical notation for CFR and GDC citations.
49.	Potential Impact 24414	Editorial addition to include the HPCF system interface in the review of the RCIC system. For additional detail see Attachment A, item 2.
50.	SRP-UDP Format Item, update reference citations.	Revised reference citation to be consistent with SRP-UDP required format that excludes parenthetical notation for CFR and GDC citations.
51.	SRP-UDP Format Item, update reference citations.	Revised reference citation to be consistent with SRP-UDP required format that excludes parenthetical notation for CFR and GDC citations.
52.	Potential Impact 24414	Editorial addition to include the HPCF system interface in the review of the RCIC system. For additional detail see Attachment A, item 2.
53.	Editorial	Deleted a redundant statement. SRP Section 7.3 is cited in the Review Interfaces subsection.
54.	SRP-UDP Format Item, update reference citations.	Revised reference citation to be consistent with SRP-UDP required format that excludes parenthetical notation for CFR and GDC citations.
55.	Editorial	Reformatted the existing paragraph citing TMI action plan items to break-out each action plan item as a separate line item to allow provision of a more complete description of each item and to accommodate the changes of integrated impacts 1016, 1062, 1090, and 1095.
56.	Editorial	Reworded text to accomodate breaking-out each TMI action plan item as a separate line.
57.	SRP-UDP Format Item, Update Reference Citations	Revised reference designators to be consistent with SRP-UDP format guidelines.

Item	Source	Description
58.	Editorial	Reformatted the existing citation of TMI action plan item II.K.1.22 as a separate line item and provided a more detailed description of the issue.
59.	**Integrated Impact 1095**	Added citation of 10 CFR 50.34(f)(2)(xxi) which is related to the existing SRP citation of II.K.1.22.
60.	Editorial	Reformatted the existing citation of TMI action plan item II.K.3.13 as a separate line item and provided a more detailed description of the issue.
61.	**Integrated Impact 1062**	Added citation of 10 CFR 50.34(f)(1)(v) which is related to the existing SRP citation of II.K.3.13.
62.	Editorial	Reformatted the existing citation of TMI action plan item II.K.3.15 as a separate line item and provided a more detailed description of the issue.
63.	Editorial	Reformatted the existing citation of TMI action plan item II.K.3.22 as a separate line item and provided a more detailed description of the issue.
64.	Editorial	Reformatted the existing citation of TMI action plan item II.K.3.24 as a separate line item and provided a more detailed description of the issue.
65.	**Integrated Impact 1090**	Added citation of 10 CFR 50.34(f)(1)(ix) which is related to the existing citation of II.K.3.24
66.	Editorial	Reformatted the existing citation of TMI action plan item III.D.1.1 as a separate line item and provided a more detailed description of the issue.
67.	**Integrated Impact 1016**	Added citation of 10 CFR 50.34(f)(2)(xxvi) which is related to the existing citation of III.D.1.1.
68.	SRP-UDP Format Item, update reference citations.	Revised reference citation to be consistent with SRP-UDP required format that excludes parenthetical notation for Regulatory Guide citations.
69.	SRP-UDP Format Item, update reference citations.	Revised reference citation to be consistent with SRP-UDP required format that excludes parenthetical notation for CFR and GDC citations. Also capitalized the first letter of the word "criterion."
70.	Editorial	Removed dash to provide correct representation of phrase.
71.	**Integrated Impact** 317	Added reference to Regulatory Guide 1.155 to Acceptance Criteria, which provides specific requirements for plant ability to withstand a Station Blackout.

Item	Source	Description
72.	SRP-UDP format item, develop Technical Rationales.	Technical Rationale were developed and added for the Acceptance Criteria GDC 4, 5, 29, 33, 34, 54, and 10 CFR 50, §50.63. The SRP-UDP program requires that Technical Rationale be developed for the Acceptance Criteria.
73.	Editorial	This statement was modified to indicate that Technical Specification reviews are also part of the review of the design certification applications. Technical Specifications are part of the DC application as established in 10 CFR 50.34(b)(vi)(6) and 10 CFR 52.47(a)(1)(i).
74.	Editorial	Delete the word "procedure" to reflect the fact the intention is to complete the review not just the procedure.
75.	SRP-UDP Format Item, Update PRB names.	Deleted PRB name to reflect latest responsibility assignments, and revised statement to reflect the situation that decay heat load determination is now also the responsibility of SRXB, the PRB who is responsible for this section.
76.	Potential Impact 24414	Editorial addition to include the HPCF system interface in the review of the RCIC system. For additional detail see Attachment A, item 2.
77.	SRP-UDP Format Item, update reference citations.	Revised reference citation to be consistent with SRP-UDP required format which provides for identification by reference number using parenthetical notation for the first citation of a document. Subsequent citations are not identified parenthetically.
78.	SRP-UDP Format Item, Update PRB names.	Changed PRB name to reflect latest responsibility assignments for SRP Section 7.4.
79.	Potential Impact 24414	Editorial addition to include the HPCF system interface in the review of the RCIC system. For additional detail see Attachment A, item 2.
80.	SRP-UDP Format Item, Update PRB names.	Changed PRB name to reflect latest responsibility assignments for SRP Sections 8.3.1 and 8.3.2.
81.	Potential Impact 24416	Added verification of adequacy of power supply for the pump room HVAC cooler as required by TMI item II.K.3.24. The adequacy of the power supply is not currently addressed in the SRP. TMI item II.K.3.24 provides the appropriate Acceptance Criteria for this review.
82.	SRP-UDP Format Item, Update PRB names.	Changed PRB name to reflect latest responsibility assignments for SRP Section 3.2.1.

Item	Source	Description
83.	SRP-UDP Format Item, Update PRB names.	Changed PRB name to reflect latest responsibility assignments for SRP Section 14.2.
84.	SRP-UDP Format Item, update reference citations.	Revised reference citation to be consistent with SRP-UDP required format that excludes reference citation for Regulatory Guides.
85.	SRP-UDP Format Item, Update PRB names.	Changed PRB name to reflect latest responsibility assignments for SRP Section 14.2.
86.	Editorial	Identified the applicable positions per the latest revision of Regulatory Guide 1.68. Regulatory positions C.2, C.3, and C.4 of Regulatory Guide 1.68 cover the subject testing addressed in this Review Procedure.
87.	SRP-UDP Format Item, Update PRB names.	Changed PRB name to reflect latest responsibility assignments for SRP Section 14.2.
88.	SRP-UDP Format Item, Update PRB names.	Changed PRB name to reflect latest responsibility assignments for SRP Section 16.0.
89.	SRP-UDP Format Item, Update PRB names.	Changed PRB name to reflect latest responsibility assignments for SRP Sections related to design basis missiles and floods.
90.	SRP-UDP Format Item, Update PRB names.	Changed PRB name to reflect latest responsibility assignments for SRP Sections related to structural evaluations.
91.	SRP-UDP Format Item, Update PRB names.	Changed PRB name to reflect latest responsibility assignments for SRP Section 3.6.2.
92.	Editorial	The information in this paragraph is introductory, therefore it was moved to beginning of the Review Procedures.
93.	Editorial	Changed item numbers to accommodate moving item 12 to the introduction of the Review Procedures.
94.	Editorial	Corrected a typographical error. The document cited should be NUREG-0718, "Licensing Requirements for Pending Applications for Construction Permits." (title reflects Rev. 2 of this document)
95.	SRP-UDP Format Item, update reference citations.	Revised reference citation to be consistent with SRP-UDP required format which provides for identification by reference number using parenthetical notation for the first citation of a document. Subsequent citations are not identified parenthetically.

Item	Source	Description
96.	SRP-UDP Format Item, update reference citations.	Revised reference citation to be consistent with SRP-UDP required format which provides for identification by reference number using parenthetical notation for the first citation of a document. Subsequent citations are not identified parenthetically.
97.	**Integrated Impact 878**	Modified this Review Procedure to incorporate guidance of Generic Letter 83-02 and staff findings in the ABWR FSER.
98.	SRP-UDP Format Item, Update PRB names	Changed PRB name to reflect latest PRB abbreviations and responsibility for SRP Section 9.4.5.
99.	SRP-UDP Format Item, update reference citations.	Revised reference citation to be consistent with SRP-UDP required format which provides for identification by reference number using parenthetical notation for the first citation of a document. Subsequent citations are not identified parenthetically.
100.	Editorial	Corrected a typographical error. The cited document should be NUREG-0718, "Licensing Requirements for Pending Applications for Construction Permits."
101.	SRP-UDP Format Item, update reference citations.	Revised reference citation to be consistent with SRP-UDP required format which provides for identification by reference number using parenthetical notation for the first citation of a document. Subsequent citations are not identified parenthetically.
102.	PRB Comment	Added reference to NUREG-0927 in response to PRB comment, NRC Memo Li to Lyons dated November 1, 1995.
103.	**Integrated Impact 317**	Added a Review Procedure for compliance with Regulatory Guide 1.155 to assure that the RCIC will support core cooling during an SBO.
104.	**Integrated Impact 316**	Added procedure to verify MOV operability verification test results as identified in GL 89-10.
105.	**Integrated Impact 879**	Added procedure to verify that the leakage reduction program meets the requirements of NUREG-0737, Action Plan Item III.D.1.1.
106.	**Integrated Impact 880**	Added procedure to verify proper design of the suppression pool suction strainers.

Item	Source	Description
107.	**Integrated Impact 913**	NRC Bulletin 88-04 identified a concern and requested licensee actions relating to the potential for damage to safety-related centrifugal pumps from operation and testing in the minimum flow mode. Addressees were requested to evaluate the adequacy of minimum flow bypass lines and verify minimum flow rates with pump suppliers. The Bulletin also provides acceptable minimum flow rate and pump operation recommendations. Review Procedures were thus added providing verification of RCIC pump minimum flow capacity in accordance with pump manufacturer's recommendations.
108.	Editorial	Deleted hyphen between "and" and "seal" to correct typographical error in the original document.
109.	SRP-UDP Guidance, Implementation of 10 CFR 52	Added standard paragraph to address application of Review Procedures in design certification reviews.
110.	Potential Impact 24414	Editorial addition to include the HPCF system interface in the review of the RCIC system. For additional detail see Attachment A, item 2.
111.	**Integrated Impact 317**	Added 10 CFR 50.63 to include criteria for SBO.
112.	Editorial	Changed criterion to criteria to use the same term as is used in the Code Of Federal Regulations.
113.	Editorial	Changed criterion to criteria to use the same term as is used in the Code Of Federal Regulations.
114.	**Integrated Impact 317**	Added reference to SRP Section 8.4 (or SER Section 8.4) for evaluation of conformance with 10 CFR 50.63 and results of the review of SBO.
115.	SRP-UDP format item.	Added a general description of additional items that should be discussed in the Evaluation Findings for the design certification reviews.
116.	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.
117.	SRP-UDP Guidance	Added standard paragraph to indicate applicability of this section to reviews of future applications.
118.	Editorial	Changed criterion to criteria to use the same term as is used in the Code Of Federal Regulations.
119.	SRP-UDP format item.	Modified the Implementation subsection to reflect the implementation date of two items in this Section which are dependent on the existing SRP revision date of April 1984.

Item	Source	Description
120.	**Integrated Impacts 1016, 1062, 1090, and 1095.**	Added reference to 10 CFR 50.34(f)(2)(xviii) with regard to related TMI Action Plan requirements.
121.	**Integrated Impact 317**	Added 10 CFR 50.63 to the reference subsection.
122.	SRP-UDP format update item.	Reordered references to conform with Supplemental Guidance format.
123.	SRP-UDP Format Item, update references.	Revised References subsection to be consistent with SRP-UDP required format. Only references cited in the body of the section are listed in the References subsection.
124.	**Integrated Impact 317**	Added listing of Regulatory Guide 1.155 in the References subsection since the Regulatory Guide is cited in this SRP Section.
125.	Editorial	Corrected the title and revision number for latest revision of NUREG-0718.
126.	**Integrated Impact 316**	Added reference to Generic Letter 89-10 for the verification of MOV operability verification test results.
127.	**Integrated Impact 316**	Added reference to Generic Letter 83-02 for the verification of suppression pool suction strainer design.
128.	**Integrated Impact 913**	Added reference to Bulletin 88-04 as a source regulatory document identifying concerns relating to safety-related pump minimum flow capacity.
129.	PRB Comment	Added reference to NUREG-0927 in response to PRB comment, NRC Memo Li to Lyons dated November 1, 1995.

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Integrated Impact No.	Issue	SRP Subsections Affected
316	Modify Review Procedures to include a review of the ability of RCIC steam line containment isolation valves to operate under design-bases conditions consistent with Generic Letter 89-10.	Subsection III: Added a review procedure addressing verification of MOV operability test results. Subsection V: Added reference 13, GL 89-10.
317	Incorporate 10 CFR 50.63 and Regulatory Guide 1.155 requirements and guidance in Acceptance Criteria and RCIC review with the SBO review of SRP Section 8.3.1.	Subsection I: 1st §, Added reference 10 CFR 50.63 and modified item 10 to specify review of SBO. Subsection II: Added item G and 10, and under Technical Rationale added item 7. Subsection III: Added item 19. Subsection IV: Added reference to 10 CFR 50.63 and statement after last paragraph. Subsection VI: Added reference 1 for 10 CFR 50.63 and 10 for Regulatory Guide 1.155
878	Modify Review Procedures associated with TMI Task Action Plan Item II.K.3.15 to incorporate the staff guidance of Generic Letter 83-02	Subsection III.13: Added review of spurious trip prevention provisions, reference to Item II.K.3.15 and criteria from GL 83-02. Subsection VI: Added reference 14 for Generic Letter 83-02.
879	Add a Review Procedure to review the leak reduction, detection, and measurement program as it applies to the RCIC system.	Subsection III: Added item 21, a review procedure to verify implementation of the leakage reduction program.
880	Add a Review Interface and a Review Procedure to verify proper design of the suppression pool suction strainers.	Subsection I, item 8: Added review of SRP Section 6.2.2 Subsection III: Added item 22, a procedure to contact SCSB to verify design of strainers.

SRP Draft Section 5.4.6
Attachment B - Cross Reference of Integrated Impacts

Integrated Impact No.	Issue	SRP Subsections Affected
913	Added a Review Procedure to incorporate the guidance of Bulletin 88-04 regarding adequacy of the minimum flow lines.	Subsection III: Added item 23, a procedure to verify the design of the minimum flow lines. Subsection VI: Added listing of Bulletin 88-04 as reference 15.
1016	Update the Acceptance Criteria and other portions of the SRP Section to reflect the requirement of 10 CFR 50.34(f)(2)(xxvi) and NUREG-0737 TMI action plan item III.D.1.1 related to leakage detection and control.	Subsection II, Item 7.f.
1062	Revise Acceptance Criteria and Review Procedures to incorporate TMI action plan item II.K.3.13 regarding reporting of safety and relief valve failures and challenges.	Subsection II, Item 7.b.
1090	Revise Acceptance Criteria, Specific Criteria, to cite 10 CFR 50.34(f)(1)(ix) in connection with TMI action plan item II.K.3.24.	Subsection II, Item 7.e.
1095	Revise current Acceptance Criteria and associated Review Procedures related to TMI Item II.K.1.22 regarding automatic and manual actions when feedwater is not available.	Subsection II, Item 7.a.