U.S. NUCLEAR REGULATORY COMMISSION

STANDARD REVIEW PLAN

OFFICE OF NUCLEAR REACTOR REGULATION

6.2.1.1.B ICE CONDENSER CONTAINMENTS

REVIEW RESPONSIBILITIES

Primary - Containment Systems and Severe Accident Branch (SCSB)[1]

Secondary - None

I. AREAS OF REVIEW

The SCSB[2] review of ice condenser containments includes the following areas:

1. The pressure and temperature conditions in the containment due to a spectrum (including break size and location) of loss-of-coolant accidents (i.e., reactor coolant system pipe breaks) and steam and feedwater line breaks.

2. The maximum expected external pressure to which the containment may be subjected.

3. The design of the ice condenser system.

4. The pressure conditions within containment internal structures that act on system components and supports due to high energy line breaks.

5. The maximum allowable operating deck steam bypass area for a full spectrum of reactor coolant system pipe breaks.

6. The design provisions and proposed surveillance program to assure that the ice condenser will remain operable for all plant operating conditions.

7. The design of the return air fan systems.

8. The effectiveness of static and active heat removal mechanisms.

9. The minimum containment pressure that is used in the analyses of emergency core cooling system capability.

10. The range and accuracy of instrumentation that is provided to monitor and record containment conditions during and following an accident.

Review Interfaces:[3]

SCSB will coordinate the primary review responsibilities of other branches that interface with the SCSB[4] evaluation of the containment functional design. These interfaces include the following:

1. The Instrumentation &~~and~~ Control Systems Branch ~~(ICSB)~~(HICB)[5], as part of its primary responsibility under SRP Section 7.5, evaluates the instrumentation provided to monitor and record containment conditions during and following an accident.

2. The ~~Equipment Qualification Branch (EQB)~~Plant Systems Branch (SPLB)[6], as part of its primary review responsibility under SRP Section 3.11, will review the acceptability of, and the qualification test program for, the ice condenser components, sensing and actuation instrumentation of the plant protection system and the post-accident monitoring instrumentation and recording equipment.

3. The review of the design adequacy of the containment and its internal structures is coordinated and performed by the ~~Structural~~Civil Engineering and Geosciences Branch ~~(SEB)~~(ECGB)[7] as part of its primary review responsibility under SRP Sections 3.8.1 through 3.8.3.[8]

4. The review of mechanical components and their supports is coordinated and performed by the Mechanical Engineering Branch (EMEB)[9], as part of its primary review responsibility under SRP Sections 3.9.1 through 3.9.3.[10] ~~The Mechanical Engineering Branch (~~EMEB~~)~~[11] will also[12] review the seismic design and quality group classification of systems and components as part of its primary review responsibility under SRP Sections 3.2.1 and 3.2.2,[13] and the locations and dynamic effects associated with postulated pipe ruptures as part of its primary review responsibility for SRP Section 3.6.2.[14]

5. The fission product removal capability of the ice condenser is evaluated by the ~~Accident Evaluation Branch (AEB)~~Materials and Chemical Engineering Branch (EMCB)[15], as part of its primary review responsibility under SRP Section 6.5.4.[16] General Design Criterion 4 allows the exclusion of dynamic effects of pipe ruptures if analyses (i.e., leak-before-break analyses) demonstrate the probability of rupture is extremely low. For containment design, the applicability of these analyses is limited to localized effects only. The EMCB performs a review of those applications that propose to eliminate

consideration of design loads associated with the dynamic effects of pipe rupture, as part of its primary review responsibility for SRP Section 3.6.3 (later).[17]

6. The review of proposed technical specifications at the operating license stage of review, pertaining to the surveillance requirements for steam bypass area, return air fan system operability, ice condenser operability, and vacuum relief devices is performed by the ~~Licensing Guidance Branch (LGB)~~Technical Specifications Branch (TSB)[18] as part of its primary review responsibility under SRP Section 16.0.

7. For new plant applicants, the Probabilistic Safety Assessment Branch (SPSB) coordinates and performs shutdown risk assessment reviews, including containment analysis issues, as part of its primary review responsibility for SRP Section 19.1 (Proposed).[19]

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

II. ACCEPTANCE CRITERIA

SCSB[20] acceptance criteria are based on meeting the following regulations:

1. General Design Criterion (GDC) 16, as it relates to the reactor containment and associated systems being designed to assure that containment design conditions important to safety are not exceeded for as long as postulated accident conditions require. Since the primary reactor containment is the final barrier of the defense-in-depth concept to protect against the uncontrolled release of radioactivity to the environs, preserving containment integrity under the dynamic conditions imposed by postulated loss-of-coolant accidents is essential.

2. General Design Criterion 50, as it relates to the reactor containment structure and associated heat removal system(s) being designed so that the containment structure and its internal compartments can accommodate the calculated pressure and temperature conditions resulting from any loss-of-coolant accident without exceeding the design leakage rate and with sufficient margin.

3. General Design Criterion 38, as it relates to the containment heat removal system(s) function to rapidly reduce the containment pressure and temperature following any loss-of-coolant accident and maintain them at acceptably low levels.

4. General Design Criterion 39, as it relates to the containment heat removal system(s) being designed to permit periodic inspection of important components to assure their integrity and capability.

5. General Design Criterion 40, as it relates to the appropriate periodic testing to assure system operability.

6. General Design Criterion 13, as it relates to instrumentation and control, requires instrumentation be provided to monitor variables and systems over their anticipated ranges for normal operation and for accident conditions as appropriate to assure adequate safety.

7. General Design Criterion 64, as it relates to monitoring radioactivity releases, requires that means be provided for monitoring the reactor containment atmosphere for radioactivity that may be released from normal operations and from postulated accidents.

8. For those applicants subject to 10 CFR 50, §50.34(f):

   a. 10 CFR 50, §50.34(f)(3)(v)(A)(1) as it relates to containment integrity being maintained during an accident that releases hydrogen generated from a 100-percent fuel clad metal-water reaction accompanied by either hydrogen burning or the added pressure from post accident inerting.[21]

   b. 10 CFR 50, §50.34(f)(3)(v)(B)(1) as it relates to containment integrity being maintained during inadvertent full actuation of the post-accident inerting system, if installed.[22]

Specific criterion or criteria that pertain to design and functional capability of PWR ice condenser containment that are used to meet the relevant requirements of the Commission regulations identified above are as follows:

~~1~~a.[23] In meeting the requirements of General Design Criteria 16, 38, and 50 regarding the functional capability of the containment and associated heat removal system to preserve containment integrity under postulated high-energy line break accident conditions, the containment pressure and temperature response should be calculated using the LOTIC-1 (or an equivalent) computer code (Reference~~.~~ ~~25~~22).[24]

For plants under review for construction permits, the containment design pressure should provide at least a 20% margin above the highest calculated accident pressure. For plants under review for operating licenses, the highest calculated accident pressure should not exceed the design pressure of the containment.

The containment pressure and temperature response to postulated secondary system pipe ruptures should be based on the most severe single active failure of the isolation provisions in the secondary system (e.g., main steam isolation valve failure or feedwater line isolation valve failure). The analysis should also be based on a spectrum of pipe break sizes and reactor power levels. The accident conditions selected should result in the highest calculated containment pressure or temperature, depending on the purpose of the analysis. Acceptable methods for the calculation of the containment environmental response to main steam line break accidents are found in NUREG-0588 (Reference~~.~~ ~~35~~ 29).[25]

~~2~~b. In meeting the requirements of General Design Criterion 50 regarding the integrity of containment internal structures, the containment subcompartment or control volume differential (internal) pressures should be calculated using the Transient Mass Distribution (TMD) computer code as described in the proprietary report WCAP-8077[26] (Reference~~.~~ ~~22~~19)[27], without the augmented critical flow correlation. The TMD calculation[28] should incorporate the heat transfer correlation developed from the 1974 full-scale ice condenser tests and should include the compressibility factor "Y" in the incompressible flow equation.

For plants being reviewed for construction permits, the design differential pressures for all ice condenser control volumes or subcompartments, and system components (e.g., reactor vessel, pressurizer, steam generators) and supports, should provide at least a 40% margin above the highest calculated differential pressures. For plants being reviewed for operating licenses, the highest calculated differential pressures for all ice condenser control volumes or subcompartments should not exceed the corresponding design differential pressures.

The operating deck, steam generator and pressurizer enclosures, and ice condenser lower inlet doors should be designed to withstand the maximum calculated reverse differential pressures between the upper and lower compartments using the LOTIC-2 computer code (Reference~~.~~ ~~26~~23).[29] To account for uncertainties in the analysis of reverse differential pressures, an adequate margin should be provided above the maximum calculated reverse differential pressure.

~~3~~c. In meeting the requirements of General Design Criteria 16 and 38 regarding the functional capability of the containment heat removal system to reduce rapidly, and without exceeding containment design conditions, the containment pressure and temperature under postulated accident conditions, the maximum allowable area for steam bypass of the ice condenser should be greater than the identifiable bypass area for the plant (e.g., the drainage provisions to allow containment spray water to return from the upper compartment to the sumps in the lower compartment). The bypass area capability of the plant should be based on analyses of the spectrum of postulated reactor coolant system pipe breaks, and should be about 3.3 square meters (35 square feet)[30] or greater.

~~4~~d. In meeting the requirements of General Design Criteria 39 and 40 regarding the inspection and testing of containment heat removal systems, the design of the ice condenser system and return fan system should incorporate provisions for periodic inservice inspection and testing of essential system components; e.g., the ice baskets and doors, the ice condenser temperature monitoring system, the available mass of ice, and return air fan performance and controls.

~~5~~e. In meeting the requirements of General Design Criterion 16 regarding the containment design conditions important to safety, inadvertent operation of engineered safety features (e.g., the return air fan system or the containment spray system) should not cause the external design pressure of the primary containment to be exceeded. This may be accomplished through conservative containment design, use of vacuum relief devices, or electrical interlocks that preclude inadvertent operation of the spray and fan systems.

~~6~~f. In meeting the requirements of General Design Criteria 13 and 64, and 10 CFR 50.34(f)(2)(xvii) (for those applicants subject to 10 CFR 50.34(f)),[31] instrumentation capable of operating in the post-accident environment should be provided to monitor the containment atmosphere pressure and temperature and the sump water level and temperature following an accident. The instrumentation should have adequate range, accuracy, and response to assure that the above parameters can be tracked and recorded throughout the course of an accident. Item II.F.1 of NUREG-0737 and NUREG-0718 (References 24 and 25)[32], and Regulatory Guide 1.97, "Instrumentation For Light-Water-Cooled Nuclear Power Plants to Assess Plant Conditions During and Following an Accident," should be followed.

~~7~~g. The minimum calculated containment pressure as determined by the LOTIC-2 Code ~~(Ref. 26)~~[33] should not be less than that used in the analysis of the emergency core cooling system capability (see SRP Section 6.2.1.5, "Minimum Containment Pressure Analysis for Emergency Core Cooling System Performance Capability Studies").

h. In meeting the requirements of 10 CFR 50, §50.34(f)(3)(v)(A)(1), applicants subject to this article should evaluate an accident that releases hydrogen generated from a 100% fuel clad metal-water reaction. The evaluation should demonstrate that the appropriate article for service level C limits (considering pressure and dead load only), for either concrete or steel containments, from ASME Boiler Pressure Vessel Code, Section III, are met. In addition to the containment pressurization caused directly by this accident, the increase in pressure from either hydrogen burning in containment or initiation of the post-accident inerting system, if installed, should be analyzed. Unless specifically known, the post-accident inerting gas should be assumed to be carbon dioxide.[34]

i. In meeting the requirements of 10 CFR 50, §50.34(f)(3)(v)(B)(1), applicants subject to this article should evaluate the containment design's capability to withstand full actuation of the post-accident inerting system, if installed. The peak pressure caused by inadvertent actuation of the post-accident inerting system should be less than the containment design pressure.[35]

<u>Technical Rationale:</u>[36]

The technical rationale for application of the above acceptance criteria to ice condenser containments is discussed in the following paragraphs:

1. GDC 16 requires the containment to be designed as a leak tight barrier that will withstand the most extreme accident conditions for the duration of any postulated accident. This SRP Section evaluates the peak pressure and temperature conditions for which the containment must be designed. Containment must be leak tight and withstand accidents because it is the final barrier against the release of radioactivity to the environment. Meeting GDC 16 provides assurance that radioactivity will not be released to the environment.

2. GDC 50 requires the containment structure and associated heat removal system to be designed with margin to accommodate any loss-of-coolant accident such that the

containment design leak rate is not exceeded. A loss-of-coolant accident potentially causes the greatest pressure surge and release of fission products when compared to any other accident. Since it is the most severe challenge expected, containment must be designed to definitively withstand this accident. Following GDC 50 will ensure that containment integrity is maintained under the most severe accident conditions thus precluding the release of radioactivity to the environment.

3. GDC 38 requires the establishment of a containment heat removal system that will rapidly reduce containment pressure and temperature following any loss-of-coolant accident. The containment heat removal system supports the containment function by minimizing the duration and intensity of the pressure and temperature increase following a loss-of-coolant accident thus lessening the challenge to containment integrity. Meeting GDC 38 will help ensure that containment can fulfill its role as the final barrier against the release of radioactivity to the environment.

4. GDC 39 requires that the containment heat removal system be designed to permit appropriate periodic inspection of important components. The containment heat removal system is relied upon to minimize the duration and intensity of the pressure and temperature increase following a loss-of-coolant accident thus lessening the challenge to the containment barrier. Periodic inspection will verify the operability and integrity of the containment heat removal system and help ensure that it fulfills its role in precluding the release of radioactivity to the environment.

5. GDC 40 requires that the containment heat removal system be designed to permit appropriate periodic testing of important components. The capability of the containment heat removal system to reduce containment temperature and pressure is dependent upon the functionality of system components. Periodic functional testing of the containment heat removal system components validates the safety analysis assumptions regarding the system's effectiveness in reducing post LOCA temperature and pressure and provides assurance of operability and the capability to perform following a design basis accident.

6. GDC 13 requires that instrumentation be provided to monitor all expected parameters of normal operation, anticipated operational occurrences, and accidents to assure adequate reactor safety is maintained. Since containment plays a vital safety role, appropriate instrumentation, such as temperature and pressure, must be provided so that operators can verify containment is properly fulfilling its function. Meeting GDC 13 will help ensure that containment accomplishes its mission of precluding the release of radioactivity to the environment.

7. GDC 64 requires that the containment atmosphere be monitored for the release of radioactivity from normal operations, anticipated operational occurrences, and accidents. In order to ensure that containment functions properly, operators must be aware of any radioactive releases within containment so that they can take appropriate manual action or monitor automatic action. Regulatory Guide 1.97 provides specific criteria for the design of containment instrumentation which have been found acceptable by the NRC as fulfilling GDC 64. Meeting GDC 64 and the specific requirements of Regulatory Guide

1.97 will assist operators in ensuring that containment meets its safety function of preventing the release of radioactivity to the environment.

8. 10 CFR 50, §50.34(f)(3)(v)(A)(1) requires that the containment be designed to withstand either hydrogen burning or initiation of the post-accident inerting system, if installed, during an accident that releases hydrogen from a 100% fuel clad metal-water reaction. During the accident at TMI-2, metal-water reactions generated hydrogen in excess of the amounts originally anticipated. As a result of this finding, the Commission issued requirements on hydrogen control in 10 CFR 50.34(f). Other criteria require the containment to be designed to withstand postulated accidents. If such a postulated accident releases or generates hydrogen, an added containment pressurization effect beyond the initial accident may be experienced due to burning of hydrogen or initiation of the post-accident inerting system, if installed. The containment must be designed to withstand this additional pressure to ensure that its integrity is maintained, thus precluding the release of radioactivity to the environment.

9. 10 CFR 50, §50.34(f)(3)(v)(B)(1) requires that the containment be designed to withstand inadvertent actuation of the post-accident inerting system, if installed. 10 CFR 50.34(f) promulgates hydrogen control requirements which include the option of a post-accident inerting system. A post-accident inerting system floods containment with an inert gas, such as carbon dioxide, during a hydrogen releasing accident. If inadvertently actuated during normal operation, containment could potentially be pressurized by the inerting system. The containment must be designed to withstand this potential inadvertent pressurization to ensure that its integrity is maintained, thus precluding the release of radioactivity to the environment.

III. <u>REVIEW PROCEDURES</u>

The procedures described below are followed for the review of ice condenser containments. The reviewer selects and emphasizes material from these procedures as may be appropriate for a particular case. Portions of the review may be carried out on a generic basis for aspects of functional design common to a class of ice condenser containments or by adopting the results of previous reviews of plants with essentially the same containment functional design.

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

1. The SCSB evaluates the design of the ice condenser type containment by comparing it to the design information presented in Appendices M and N to the D. C. Cook FSAR, and discussed in the staff's safety evaluation report on the plant (Reference~~:~~ ~~21~~18).[37] The SCSB has reviewed the design of the Cook ice condenser as reported in these documents and has found that it satisfies the acceptance criteria stated in subsection II of this SRP section. Any differences from the design reported in the Cook documents are evaluated. The SCSB[38] determines that all design changes have been justified.

2. The SCSB reviews the analysis of the containment pressure and temperature response to postulated loss-of-coolant accidents. The SCSB has reviewed the LOTIC-1 code which is used to determine the containment pressure and temperature response, and has determined that the code is acceptable for containment analysis. The SCSB[39] assures that the LOTIC-1 code has been used and that the input assumptions to the code are conservative. Code revisions and improvements will also be considered.

The SCSB reviews the analysis of the containment temperature and pressure response to postulated secondary system pipe ruptures. The NRC staff has reviewed the LOTIC-3 code[40] and has determined that it is acceptable for the calculation of ice condenser containment analysis for steam line break accidents. The SCSB[41] assures that the LOTIC-3 code has been used and that plant-sensitive input assumptions used in the analysis of the containment response are conservative.

SCSB determines from the results of analyses of postulated loss-of-coolant accidents and secondary system pipe ruptures that the peak calculated containment pressure does not exceed the design pressure of the containment, for plants at the operating license stage of review. For plants at the construction permit stage of review, the SCSB[42] will ascertain from the results of analyses reported in the safety analysis report that the design pressure provides a margin of at least 20% above the maximum calculated pressure. Design certification applicants should also be reviewed against the 20% margin for containment design pressure.[43]

The SCSB verifies that the containment is designed to withstand either hydrogen burning or initiation of the post-accident inerting system, if installed, during an accident that releases hydrogen from a 100% fuel clad metal-water reaction as described in specific criterion II.h of this SRP section.[44]

If a post-accident inerting system is utilized, the SCSB verifies the containment is designed to withstand inadvertent actuation of this system.[45]

Upon request of the ~~EQB~~SPLB[46], the SCSB[47] will (a) determine that[48] the maximum temperature transients calculated for postulated loss-of-coolant accidents and secondary system pipe ruptures have been considered in establishing the environmental qualification requirements for equipment and components required to mitigate the consequences of loss-of-coolant accidents and secondary system pipe ruptures, respectively; and (b) review the analytical methods and assumptions used in the thermal analysis, if thermal analysis is used to establish the qualification of instrumentation and components for use in superheated steam environments.
~~The CONTEMPT-4 code is being developed to provide improved capability to analyze the long-term response of an ice condenser containment to a loss-of-coolant accident. When the CONTEMPT-4 code is available, the CSB will perform confirmatory analyses using this code.~~[49]

3. The TMD code is used to evaluate the transient pressure responses (internal) of the ice condenser containment subcompartments. The code is described in the proprietary report WCAP-8077~~(Ref. 22)~~.[50] The TMD code utilizes an ice condenser heat transfer

coefficient obtained from the 1974 full-scale section tests of the ice condenser. The TMD code also utilizes a compressibility factor "Y" to account for compressible flow effects. As stated in the D. C. Cook Safety Evaluation Report, the SCSB[51] has reviewed the assumptions and equations used in the TMD-code and with the exception of the critical flow model used to predict subcompartment vent mass flow rates, has concluded that the TMD code conservatively calculates transient pressure response.

The TMD code calculates the critical flow of a two-component, two-phase fluid (air, steam, and water) assuming a thermal equilibrium condition. However, a correction factor is then applied to the calculated critical flow. The SCSB[52] has not accepted the use of this corrected critical flow, referred to as "augmented flow," and has required that the short-term transient responses of subcompartments be determined using the TMD code without applying a correction factor to the critical flow; i.e., without the "augmented flow" correlation.

Before accepting the containment transient responses calculated by the TMD code, the SCSB[53] reviews the modeling of the containment subcompartments, the size and area of assumed vents between nodes, volumes of nodes, the flow loss coefficients for each vent modeled, and the heat transfer coefficients within the ice condenser.

The SCSB will determine from the safety analysis report that the TMD code, without the "augmented flow" correlation, has been utilized to determine the transient pressure response in each subcompartment that contains a high energy line, and in adjoining subcompartments. The SCSB reviews the maximum calculated differential pressures and pressure profiles for each subcompartment. For plants at the construction permit stage of review, the SCSB will ascertain that it is the applicant's intent to design all internal structures with a margin of 40% between the maximum calculated differential pressure and the design differential pressure of the structure or component. Design certification applicants should also be reviewed against the 40% margin for containment internal structure design differential pressure.[54] At the operating license stage of review, the SCSB will ascertain that an appropriate margin exists. However, changes in technology and calculational methods may affect the margin. The SCSB will then determine that the maximum calculated differential pressures do not exceed the design differential pressures for the internal structures. When maximum calculated differential pressures which exceed the pressures used in the design of the internal structures are identified, the SCSB will request the ~~SEB~~ECGB[55] to evaluate the adequacy of the affected internal structures. The loads on components or their supports installed within the compartment due to possible pressure gradients will be evaluated by EMEB. The SCSB will coordinate the review of dynamic pressure loads for components and equipment supports, and when the design basis loads have been identified the SCSB[56] will request the EMEB[57] to evaluate the design adequacy of the components and supports.

Modification to the RELAP4 code (Reference 12)[58] to include two-phase, two-component mixtures and ice condenser modeling have been made. This will improve the capability of the code for use in short-term response analysis of ice condenser plants. The SCSB[59] will use the RELAP4 code to conduct confirmatory analyses. The COMPARE code (Reference 11)[60] is also ~~being modified to permit~~used for[61] the short term response analysis of ice condenser plants.

4. The SCSB reviews the methods, input assumptions, and results of the applicant's steam bypass analysis. The applicant's analysis should show considerable margin between the maximum tolerable bypass leakage area and the identifiable bypass area required to allow spray water drainage back to the containment sump. The SCSB[62] determines the adequacy of the margins provided for the full spectrum of reactor coolant pipe ruptures. Factors affecting the determination include the proposed inspections and tests to determine bypass leakage area and whether the design of the plant will permit access to seals between the upper and lower compartments for inspection.

5. The SCSB reviews the initial programs for ice loading and subsequent verification of individual ice basket and total ice loads. In addition, it reviews design provisions for monitoring the status of the ice condenser during plant operation to assure that the ice condenser retains its full capability. The SCSB also reviews the aspects of the ice condenser design which will allow inspection and functional testing of ice condenser components during various modes of plant operation. Specific areas to be evaluated are the ice condenser temperature instrumentation system, lower inlet door position monitoring system, proposed ice basket inspection programs to determine total ice weight, proposed inspection and testing programs for intermediate and top deck doors, floor drains, lower inlet doors, ice condenser flow passages, divider barrier seals, and access hatches. The SCSB[63] determines that the proposed surveillance programs and attendant design provisions fulfill the intent of General Design Criteria 39 and 40.

6. The SCSB reviews the environmental conditions used in the qualification testing of the return air fan system components. The SCSB determines whether the test conditions are representative of post-accident conditions to which the equipment may be subjected. The SCSB[64] reviews analyses demonstrating that, where required, the return air fan system and its components are designed to withstand the transient differential pressures to which the systems would be subjected following a loss-of-coolant accident.

   The SCSB reviews the provisions made in the design of the return air fan system and the proposed program for periodic inspection and functional testing of the system and components for compliance with the intent of General Design Criteria 39 and 40. The SCSB[65] determines the acceptability of the proposed periodic surveillance program for the return air fan system, taking into account the extent and frequency of testing proposed and the practices established for previous ice condenser plants.

7. The SCSB reviews the analysis of the maximum depressurization transient due to inadvertent operation of the containment sprays or return air fans. The SCSB[66] reviews the assumed containment initial conditions, methods of calculation, and spray system efficiency to determine whether the containment depressurization analysis is conservative.

8. The SCSB[67] reviews the accuracy and range of the instrumentation provided to monitor the post-accident environment. The ~~ICSB~~HICB[68], under SRP Section 7.5, and the

~~EQB~~SPLB[69], under SRP Section 3.11, have review responsibility for the acceptability of, and the qualification test program for, the sensing and actuation instrumentation of the plant protection system and the postaccident monitoring instrumentation and recording equipment.

9. The SCSB[70] reviews the minimum containment pressure analysis for the emergency core cooling system performance evaluation in accordance with SRP Section 6.2.1.5, "Minimum Containment Pressure Analysis for Emergency Core Cooling System Performance Capability Studies."

10. For new plant applicants and those PWRs subject to Generic Letter 88-17 (Reference 45), the containment analyses should also consider shutdown conditions, when appropriate, to ensure that a basis is provided for procedures, instrumentation, operator response, equipment interactions and equipment response during shutdown operations. The analyses should encompass shutdown thermodynamic states and physical configurations to which the plant can be subjected during shutdown conditions (such as containment closure time, temperature and time to uncover the core during loss of decay heat removal).[71]

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.[72]

IV. EVALUATION FINDINGS

The conclusions reached on completion of the review of this section are presented in SRP Section 6.2.1.

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.[73] 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.[74]

Implementation schedules for conformance to parts of the method discussed herein are contained in the referenced regulatory guides and NUREGs.

VI. REFERENCES

The references for this SRP section are listed in SRP Section 6.2.1.

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SRP Draft Section 6.2.1.1.B

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 name and responsibility for this SRP Section.
2.	Current PRB names and abbreviations.	Editorial change made to reflect current PRB name and responsibility for this SRP Section.
3.	SRP-UDP format item.	Added "Review Interfaces" heading to Areas of Review. Reformatted existing description of review interfaces in numbered format to describe how SCSB reviews aspects of the Ice Condenser under other SRP Sections and how other branches support the review.
4.	Current PRB names and abbreviations.	Editorial change made to reflect current PRB name and responsibility for this SRP Section (2 identical changes in this paragraph).
5.	Current PRB names and abbreviations.	Editorial change made to reflect current PRB name and responsibility for SRP Section 7.5.
6.	Current PRB names and abbreviations.	Editorial change made to reflect current PRB name and responsibility for SRP Section 3.11.
7.	Current PRB names and abbreviations.	Editorial change made to reflect current PRB name and responsibility for SRP Sections 3.8.1-3.8.3.
8.	Editorial	Changed from a generic reference to all 3.8 series SRP sections to specific reference to sections 3.8.1 through 3.8.3 to provide a more precise description of the sections ECGB actually reviews.
9.	Current PRB names and abbreviations.	Editorial change made to reflect current PRB name and responsibility for SRP Sections 3.9.1-3.9.3.
10.	Editorial	Changed from a generic reference to all 3.9 series SRP sections to specific reference to sections 3.9.1 through 3.9.3 to provide a more precise description of the sections EMEB actually reviews.
11.	Editorial/Current PRB names and abbreviations.	Deleted the full title of EMEB and referred to it by abbreviation only to be consistent with the second reference to PRBs in other sections. Also, editorial change made to reflect current PRB name and responsibility for SRP Sections 3.2.1-3.2.2.
12.	Editorial	Added the word "also" to support consolidating EMEB responsibilities into one paragraph.
13.	Editorial	Changed from a generic reference to all 3.2 series SRP sections to specific reference to sections 3.2.1 and 3.2.2 to provide a more precise description of the sections ECGB actually reviews.

Item	Source	Description
14.	Editorial	Added a Review Interface with SRP Section 3.6.2 regarding reviews of pipe ruptures and related dynamic effects. SRP Section 6.2.1.1B Areas of Review, Acceptance Criteria, and Review Procedures contain provisions regarding containment subcompartment analysis for pressurization effects related to pipe rupture. Therefore, it is appropriate that a review interface be developed with SRP Section 3.6.2.
15.	Current PRB names and abbreviations.	Editorial change made to reflect current PRB name and responsibility for SRP Section 6.5.4.
16.	Editorial.	Changed the referenced SRP section from 6.5 to 6.5.4. There is no section 6.5 in the SRP. Section 6.5.4 is titled "Ice Condenser as a Fission Product Cleanup System" and is the correct section for this paragraph.
17.	**Potential Impact 25739**	Added a Review Interface with SRP Section 3.6.3 (later) regarding review of leak-before-break analyses. Although leak-before-break cannot be applied to eliminate consideration of global effects of pipe ruptures that are the design basis for containment, certain localized effects on structures and equipment supports can be excluded . The EMCB was identified as the responsible PRB in NRC comments received on ROC 88 (SRP Section 3.6.2).
18.	Current PRB names and abbreviations.	Editorial change made to reflect current PRB name and responsibility for SRP Section 16.0.
19.	**Integrated Impact 1501**	This review interface identifies reviews conducted to satisfy SECY 93-087 guidance on Shutdown and Low Power Operations. The staff requested that design certification applicants complete an assessment of shutdown and low-power risk. The shutdown and low-power risk assessment must identify design-specific vulnerabilities and weaknesses and document consideration and incorporation of design features that minimize such vulnerabilities. Containment analysis issues related to containment integrity during shutdown conditions are included in the shutdown risk assessments. Consideration of this issue in the shutdown and low-power risk assessment is the responsibility of the SPSB and will be included in the proposed SRP Section 19.1 on risk assessments.
20.	Current PRB names and abbreviations.	Editorial change made to reflect current PRB name and responsibility for this SRP Section.
21.	**Integrated Impact 887**	Added a general criterion for 10CFR50.34(f)(3)(v)(A)(1) regarding designing containment to meet hydrogen burning or post-accident inerting system actuation during an accident.

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Attachment A - Proposed Changes in Order of Occurrence

Item	Source	Description
22.	**Integrated Impact 851**	Added a general criterion for 10CFR50.34(f)(3)(v)(B)(1) regarding designing containment to withstand inadvertent actuation of the post-accident inerting system, if installed.
23.	Editorial	Specific acceptance criteria were changed from a number format to a letter format. Numbers are already used above in the general acceptance criteria. Using numbers for both could lead to confusion when referencing specific criterion. This change is consistent with other SRP sections.
24.	SRP-UDP format item/Unverified reference	Format change to make the citation of references consistent with the SRP-UDP format requirements. Additionally, this reference cannot be verified to be the most current reference that is still being used by the NRC. Also, corrected the reference number to be consistent with changes to the SRP 6.2.1 Reference section.
25.	SRP-UDP format item.	Format change to make the citation of references consistent with the SRP-UDP format requirements. Also, corrected the reference number to be consistent with changes to the SRP 6.2.1 Reference section.
26.	Editorial	Added the phrase "as described in the proprietary report WCAP-8077" for clarity and to be consistent with a later citation of the same reference.
27.	SRP-UDP format item/Unverified reference	Format change to make the citation of references consistent with the SRP-UDP format requirements. Additionally, this reference cannot be verified to be the most current reference that is still being used by the NRC. Also, corrected the reference number to be consistent with changes to the SRP 6.2.1 Reference section.
28.	Editorial	Changed "TMD" to "The TMD calculation" since this sentence is referring to a calculation to be performed with the TMD code, not the code itself.
29.	SRP-UDP format item/Unverified reference	Format change to make the citation of references consistent with the SRP-UDP format requirements. Additionally, this reference cannot be verified to be the most current reference that is still being used by the NRC. Also, corrected the reference number to be consistent with changes to the SRP 6.2.1 Reference section.
30.	SRP-UDP format item, Metrication policy implementation	The existing criteria of 35 square feet for the approximate size of the ice condenser steam bypass area was converted to 3.3 square meters using the guidance of Federal Standard 376B. See enclosed conversion documentation.

Item	Source	Description
31.	**Integrated Impact 997**	Added citation of 10 CFR 50.34(f)(2)(xvii) related to the existing citation of II.F.1 of NUREG 0737/NUREG 0718.
32.	SRP-UDP format item.	Format change to make the citation of references consistent with the SRP-UDP format requirements.
33.	SRP-UDP format item.	Format change to make the citation of references consistent with the SRP-UDP format requirements.
34.	**Integrated Impact 887**	Added a specific criterion for 10CFR50.34(f)(3)(v)(A)(1) regarding designing containment to meet hydrogen burning or post-accident inerting system actuation during an accident.
35.	**Integrated Impact 851**	Added a specific criterion for 10CFR50.34(f)(3)(v)(B)(1) regarding designing containment to meet inadvertent actuation of the post-accident inerting system if installed.
36.	SRP-UDP format item, Develop Technical Rationale	Added Technical Rationale for GDCs 16, 50, 38, 39, 40, 13, and 64 and 10 CFR 50.34(f)(3)(v), articles (A)(1) and (B)(1). Technical Rationale is a new SRP-UDP format item.
37.	SRP-UDP format item/Unverified reference	Format change to make the citation of references consistent with the SRP-UDP format requirements. Additionally, this reference cannot be verified to be the most current reference that is still being used by the NRC. Also, corrected the reference number to be consistent with changes to the SRP 6.2.1 Reference section.
38.	Current PRB names and abbreviations.	Editorial change made to reflect current PRB name and responsibility for this SRP Section (3 identical changes in this paragraph).
39.	Current PRB names and abbreviations.	Editorial change made to reflect current PRB name and responsibility for this SRP Section (3 identical changes in this paragraph).
40.	SRP-UDP format item/Unverified reference	This reference cannot be verified to be the most current reference that is still being used by the NRC. Additionally, this reference is not listed in the References section and therefore cannot be cited with a reference number.
41.	Current PRB names and abbreviations.	Editorial change made to reflect current PRB name and responsibility for this SRP Section (2 identical changes in this paragraph).
42.	Current PRB names and abbreviations.	Editorial change made to reflect current PRB name and responsibility for this SRP Section (2 identical changes in this paragraph).

Item	Source	Description
43.	**Integrated Impact 287**	Added a sentence to Review Procedures that DC applicants are reviewed for incorporation of the CP containment design pressure margin.
44.	**Integrated Impact 887**	Added a Review Procedure for 10CFR50.34(f)(3)(v)(A)(1) regarding evaluating containment design to meet hydrogen burning or post-accident inerting system actuation during an accident.
45.	**Integrated Impact 851**	Added a Review Procedure for 10CFR50.34(f)(3)(v)(B)(1) regarding evaluation of containment design pressure against inadvertent actuation of the post-accident inerting system if such a system is installed.
46.	Current PRB names and abbreviations.	Editorial change made to reflect current PRB name and responsibility for SRP Sections.
47.	Current PRB names and abbreviations.	Editorial change made to reflect current PRB name and responsibility for this SRP Section.
48.	Editorial	Added the word "that" to correct the grammar and clarify the sentence.
49.	Editorial/SRP-UDP format item/Unverified reference	Since the current revision of the SRP is over 13 years old, it is assumed that CONTEMPT-4 is no longer being developed. However, this reference cannot be verified as the most current reference that is being used by the NRC.
50.	SRP-UDP format item.	Format change to make the citation of references consistent with the SRP-UDP format requirements.
51.	Current PRB names and abbreviations.	Editorial change made to reflect current PRB name and responsibility for this SRP Section.
52.	Current PRB names and abbreviations.	Editorial change made to reflect current PRB name and responsibility for this SRP Section.
53.	Current PRB names and abbreviations.	Editorial change made to reflect current PRB name and responsibility for this SRP Section.
54.	**Integrated Impact 287**	Added a sentence to Review Procedures that DC applicants are reviewed for incorporation of the CP containment internal structure design differential pressure margin.
55.	Current PRB names and abbreviations.	Editorial change made to reflect current PRB names and responsibilities for SRP Sections.
56.	Current PRB names and abbreviations.	Editorial change made to reflect current PRB name and responsibility for this SRP Section (8 identical changes in this paragraph).

Item	Source	Description
57.	Current PRB names and abbreviations.	Editorial change made to reflect current PRB name and responsibility for SRP Section 3.9 (2 identical changes in this paragraph).
58.	SRP-UDP format item.	Format change to make the citation of references consistent with the SRP-UDP format requirements.
59.	Current PRB names and abbreviations.	Editorial change made to reflect current PRB name and responsibility for this SRP Section.
60.	SRP-UDP format item/Unverified reference	Format change to make the citation of references consistent with the SRP-UDP format requirements. Additionally, this reference cannot be verified to be the most current reference that is still being used by the NRC.
61.	Editorial/Unverified reference	Deleted "being modified to permit" and added "used for" to reflect the assumption that this code has already been modified. A version of the COMPARE code is utilized in the ABWR-FSER for subcompartment analysis. However, the code cited in this SRP cannot be verified to be the most current reference that is still being used by the NRC.
62.	Current PRB names and abbreviations.	Editorial change made to reflect current PRB name and responsibility for this SRP Section (2 identical changes in this paragraph).
63.	Current PRB names and abbreviations.	Editorial change made to reflect current PRB name and responsibility for this SRP Section (3 identical changes in this paragraph).
64.	Current PRB names and abbreviations.	Editorial change made to reflect current PRB name and responsibility for this SRP Section (3 identical changes in this paragraph).
65.	Current PRB names and abbreviations.	Editorial change made to reflect current PRB name and responsibility for this SRP Section (2 identical changes in this paragraph).
66.	Current PRB names and abbreviations.	Editorial change made to reflect current PRB name and responsibility for this SRP Section (2 identical changes in this paragraph).
67.	Current PRB names and abbreviations.	Editorial change made to reflect current PRB name and responsibility for this SRP Section.
68.	Current PRB names and abbreviations.	Editorial change made to reflect current PRB name and responsibility for SRP Section 7.5.
69.	Current PRB names and abbreviations.	Editorial change made to reflect current PRB name and responsibility for SRP Section 3.11.
70.	Current PRB names and abbreviations.	Editorial change made to reflect current PRB name and responsibility for SRP Section 6.2.1.5.

Item	Source	Description
71.	**Integrated Impact 1501**	This paragraph describes the type of containment analyses required during shutdown conditions. Containment interaction and response (including containment closure times for PWRs) will be dependent upon the results of analyses to develop a bases for critical thermodynamic events such as containment temperatures and postulated times to core uncovery during a loss of shutdown decay heat removal.
72.	SRP-UDP Guidance, Implementation of 10 CFR 52	Added standard paragraph to address application of Review Procedures in design certification reviews.
73.	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.
74.	SRP-UDP Guidance	Added standard paragraph to indicate applicability of this section to reviews of future applications.

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Attachment B - Cross Reference of Integrated Impacts

Integrated Impact No.	Issue	SRP Subsections Affected
287	Consider revising Acceptance Criteria and Review Procedures to apply containment design margins to design certification applicants.	III, Review Procedures, items 2 and 3
851	Consider revising Acceptance Criteria and Review Procedures to reference review of the inadvertent actuation of the post-accident inerting system if such a system is installed.	II, Acceptance Criteria, general criterion 8.b, and specific criterion i. III, Review Procedures, item 2
887	Consider revising Acceptance Criteria and Review Procedures to discuss that the containment must be designed to withstand either burning of hydrogen or actuation of the post-accident inerting system (if installed) during an accident that releases hydrogen.	II, Acceptance Criteria, general criterion 8.a, specific criterion h. III, Review Procedures, item 2.
997	Consider citing 10 CFR 50.34(f)(2)(xvii) related to TMI action plan item II.F.1.	II, Acceptance Criteria, specific criterion f.
1501	Consider revising Review Procedures to add staff guidance on containment analyses that must be performed to develop sufficient bases for shutdown operations.	I, Areas of Review, new Review Interface 7. III, Review Procedures, item 10.