U.S. NUCLEAR REGULATORY COMMISSION

DESIGN-SPECIFIC REVIEW STANDARD FOR mPOWER^{TM} iPWR DESIGN

3.2.2 SYSTEM QUALITY GROUP CLASSIFICATION

REVIEW RESPONSIBILITIES

Primary - Organization responsible for mechanical engineering reviews

Secondary - Organizations responsible for the review of component performance and testing

I. AREAS OF REVIEW

Nuclear power plant systems and components important to safety should be designed, fabricated, erected, and tested to quality standards commensurate with the importance of the safety function to be performed. Important to safety structures, systems and components (SSCs) are those SSCs that provide reasonable assurance that the facility can be operated with adequate protection to the health and safety of the public. Described herein is an acceptable primarily deterministic approach to classify fluid systems important to safety and identify their applicable construction codes and standards depending on the system or component function and relative importance to safety. The deterministic approach should be complemented by applying insights from the design-specific probabilistic risk assessment (PRA). An alternative approach identified in Title 10 of the *Code of Federal Regulations* (10 CFR) 50.69 is a risk-informed categorization process that applies industry guidelines for categorizing SSCs according to a risk-informed safety class. The risk-informed approach described in Regulatory Guide (RG) 1.201 is optional and subject to the limitations of 10 CFR 50.69. Successful application of an acceptable risk-informed categorization approach depends on a high quality probabilistic risk assessment (PRA) and an approved method to assign applicable codes and standards. Given that RG 1.201 currently is to be used only as interim guidance for trial use and that an acceptable risk-informed method to assign applicable codes and standards to a risk-informed safety class does not exist, this Design Specific Review Standard (DSRS) section does not include criteria for reviewing a risk-informed categorization approach. Guidance in other referenced standard review plans can support a risk-informed classification approach. For integral pressurized-water reactor (iPWR) designs, SECY11-0024 describes a risk-informed approach to enhance the safety focus for small modular reactor reviews. Risk-informed classification review guidance in RG 1.201 may assist in iPWR reviews when combined with pilot studies.

The specific areas of review are as follows:

1. The applicant's classification design criteria for pressure-retaining components and their supports such as pressure vessels, heat exchangers, storage tanks, pumps, piping, and valves in fluid systems important to safety, and the applicant’s assignment of quality groups to those portions of systems necessary to perform safety functions. Excluded from this review are items that do not provide pressure integrity functions or their supports, including structures; internal parts of mechanical components such as shafts, seals, impellers, packing, and gaskets; fuel, electrical, and instrumentation systems; electrical

ADAMS Accession No. ML12272A015

valve actuation devices; and pump motors. Non pressure-retaining items such as reactor pressure vessel (RPV) internals may have unique requirements that are covered by the ASME Section III Code Subsection NG if they are core support structures or if they are nonsafety-related components such as steam dryers not covered by this DSRS or RG 1.26. DSRS 3.9.5 specifies special treatment for RPV internals.

2. The applicant's data, presented in the safety analysis report (SAR) in the form of a table that identifies the fluid systems important to safety; the system components including pressure vessels, heat exchangers, storage tanks, pumps, piping, and valves; the associated quality group classification, applicable American Society for Mechanical Engineers (ASME), Boiler and Pressure Vessel Code (Code) and code class; and the quality assurance criteria such as 10 CFR 50 Appendix B, ASME NQA-1, or other special treatment for risk-significant mechanical systems and components. Where sufficient level of detail is not included in the table, the review may include the applicant's presentation, on suitable system descriptions and schematics or simplified piping and instrumentation diagrams (P&IDs), if applicable, of the system quality group classifications. Other branches responsible for the review of each system description and schematics or P&IDs, if applicable, included in other sections may identify to the DSRS 3.2.2 reviewer any discrepancies in classifications from the corresponding SRP or DSRS section for that system.

3. Inspections, Tests, Analyses, and Acceptance Criteria (ITAAC). For design certification (DC) and combined license (COL) reviews, the staff reviews the applicant's proposed ITAAC associated with the SSCs related to this DSRS section in accordance with Standard Review Plan (SRP) Section 14.3, "Inspections, Tests, Analyses, and Acceptance Criteria." The staff recognizes that the review of ITAAC cannot be completed until after the rest of this portion of the application has been reviewed against acceptance criteria contained in this DSRS section. Furthermore, the staff reviews the ITAAC to ensure that all SSCs in this area of review are identified and addressed as appropriate in accordance with SRP Section 14.3. The application may include ITAAC or an equivalent design verification process to verify quality group classifications and the corresponding ASME Code class.

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

   For a COL application referencing a DC, a COL applicant must address COL action items (referred to as COL license information in certain DCs) included in the referenced DC. Additionally, a COL applicant must address requirements and restrictions (e.g., interface requirements and site parameters) included in the referenced DC. For more specific guidance see RG 1.206.

Review Interfaces

Other SRP and DSRS sections interface with this section as follows:

1. The acceptability of the seismic classification of system components is determined in accordance with DSRS Section 3.2.1. The seismic classification information may be combined and/or cross-referenced with the quality group classification information

reviewed in this DSRS section to minimize repetition of similar information (e.g., tables or lists of components, system drawings, etc.).

2. The systems and components important to safety that are designated as Quality Groups A, B, C, or D items are reviewed to determine if they will be constructed in accordance with the regulatory guides, industry codes, and standards that are referenced in SRP or DSRS Sections 3.2.1, 3.9.1 through 3.9.3, 3.9.5 and 3.11.

3. The adequacy of the qualification and inservice testing program for pumps and valves is determined in accordance with DSRS Section 3.9.6.

4. The seismic qualification of equipment is assessed in accordance with SRP 3.10.

5. The quality group classification of systems and components comprising the reactor coolant pressure boundary (RCPB) is reviewed and the adequacy of proposed RCPB construction codes and code cases is determined, as part of the staff's primary review responsibility for DSRS Sections 5.2.1.1 and 5.2.1.2. Editions of codes and standards are reviewed by those reviewers involved in endorsing each code and standard to be consistent with guidance in SECY-93-087.

6. The identification and evaluation of non safety-related risk-significant SSCs is reviewed in accordance with the guidance in SRP Chapters 17 and 19 and DC/COL-ISG -018 concerning quality assurance (QA) and reliability assurance.

7. The proposed ITAAC for quality group classifications is reviewed in accordance with SRP 14.3 and 14.3.3.

To assist in the review of quality group, the staff in other branches that review information presented in other SRP and DSRS sections referenced in Appendix A will coordinate evaluations that interface with the overall review of system safety and quality group classification addressed in those sections as follows:

1. The staff in other branches identifies any discrepancies in system and component safety and quality group classifications, application of the quality assurance program, and codes and standards applicability in accordance with criteria and methods contained in the SRP or DSRS sections corresponding to the review of the particular systems. Safety functions are not included in Section 3.2.2 tables for each component. Therefore, if any quality group classification shown on a system description and schematics or P&IDs, if applicable, is inconsistent with the specific design basis safety function of a fluid system component, the reviewer of that system is to identify that apparent discrepancy to the 3.2.2 reviewer for resolution.

2. Electrical and instrument systems that are not pressure-retaining are beyond the scope of RG 1.26 and this DSRS section. Therefore, the review of quality criteria and standards pertaining to electrical and instrument systems is reviewed in other SRP and DSRS sections including Sections 3.10 and 3.11 and in Chapters 7 and 8.

3. The staff in other branches determines the adequacy of the inservice inspection programs for the RCPB and for ASME Code Class 2 and 3 components, as part of the primary review responsibilities for DSRS Sections 5.2.4 and 6.6.

4. The staff in other branches verifies that all items are addressed under the QA program consistent with their importance to safety, as part of the staff's primary review responsibilities for SRP Section 17.5.

5 The regulatory treatment of nonsafety systems (RTNSS) process is addressed in other NRC guidance and reviewed by staff responsible for those SRPs. Identification of risk-significant non safety-related SSCs that are important to safety, including RTNSS SSCs, is primarily reviewed using RG 1.206 Part IV, SRP Section 17.4 and SRP Section 19.0 to ensure their reliability for design basis events and severe accidents.

6. Structures are not within scope of RG 1.26 and this DSRS, but ASME Code requirements may apply to RPV internal structures. Therefore, quality group is not applicable to structures and quality criteria plus the codes and standards for structures are reviewed in other SRP sections, including Section 3.8.

7. Simplified system description and schematics or P&IDs, if applicable, typically duplicate quality group information or ASME Code class included in the SRP or DSRS Section 3.2.2 classification table. Simplified system description and schematics or P&IDs, if applicable, included in other sections of the application are reviewed by staff in other branches responsible for the review of each system and any discrepancies with quality group classifications may be identified to the section 3.2.2 reviewer.

8 The applicant's QA list referenced in 10 CFR 50.34 and other SRP and DSRS sections should identify all important to safety SSCs covered by the quality assurance program. The QA list may also reference licensing or design basis documents that specify the specific graded quality requirements and basis for quality group classification, including safety functions. The SSCs included in the Final Safety Analysis Report (FSAR) Section 3.2 tables may include items on the QA list that are not pressure-retaining and beyond the scope of DSRS 3.2.2, in addition, the acceptability of the entire QA list is beyond scope of the DSRS 3.2.2 review.

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

II. ACCEPTANCE CRITERIA

Requirements

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

1. 10 CFR Part 50, Appendix A, General Design Criterion (GDC) 1 and 10 CFR Part 50.55a, as they relate to structures, systems, and components important to safety being designed, fabricated, erected, and tested to quality standards commensurate with the importance of the safety function to be performed.

2. 10 CFR 52.47(b)(1), which requires that a DC application contain the proposed inspections, tests, analyses, and acceptance criteria (ITAAC) that are necessary and sufficient to provide reasonable assurance that, if the inspections, tests, and analyses are performed and the acceptance criteria met, a facility that incorporates the design certification has been constructed and will be operated in conformity with the design

certification, the provisions of the Atomic Energy Act (AEA), and the U.S. Nuclear Regulatory Commission's (NRC's) regulations.

3. 10 CFR 52.80(a), which requires that a COL application contain the proposed inspections, tests, and analyses, including those applicable to emergency planning, that the licensee shall perform, and the acceptance criteria that are necessary and sufficient to provide reasonable assurance that, if the inspections, tests, and analyses are performed and the acceptance criteria met, the facility has been constructed and will operate in conformity with the combined license, the provisions of the AEA, and the NRC's regulations.

4. 10 CFR 52.47 which requires that the information submitted for a design certification must include performance requirements and design information sufficiently detailed to permit the preparation of acceptance and inspection requirements by the NRC, and procurement specifications and construction and installation specifications by an applicant. The Commission will require, before design certification, that information normally contained in certain procurement specifications and construction and installation specifications be completed and available for audit if the information is necessary for the Commission to make its safety determination.

5. 10 CFR 50.34 and 10 CFR 52.47 which require that the FSAR include the design bases and the technical justification upon which the design requirements have been established. Design bases as defined in 10 CFR Part 50.2 means that information which defines the specific functions to be performed by SSCs and the specific values or ranges of values chosen for controlling parameters as reference bounds for design.

DSRS Acceptance Criteria

Specific DSRS acceptance criteria acceptable to meet the relevant requirements of the NRC's regulations identified above are as follows for review described in this DSRS section. The DSRS is not a substitute for the NRC's regulations, and compliance with it is not required. Identifying the differences between this DSRS section and the design features, analytical techniques, and procedural measures proposed for the facility, and discussing how the proposed alternative provides an acceptable method of complying with the regulations that underlie the DSRS acceptance criteria, is sufficient to meet the intent of 10 CFR 52.47(a)(9), "Contents of applications; technical information."

To meet the requirements of GDC 1 and 10 CFR 50.55a, the following regulatory guide is used:

1. RG 1.26, "Quality Group Classification and Standards for Water-, Steam-, and Radioactive-Waste-Containing Components of Nuclear Power Plants." This guide describes an acceptable method for determining quality standards for Quality Group B, C, and D water- and steam-containing components important to safety of water-cooled nuclear power plants.

Technical Rationale

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

GDC 1 and 10 CFR 50.55a require that systems and components be designed, fabricated, erected, constructed, tested, and inspected to quality standards commensurate with the

importance of the safety function to be performed. 10 CFR 50.55a also incorporates by reference the applicable editions and addenda of the ASME Boiler and Pressure Vessel Code that is concerned with pressure integrity. RG 1.26 establishes an acceptable method for complying with these requirements by classifying fluid systems and components important to safety and applying corresponding quality codes and standards to such systems and components. Fluid systems important to safety may perform any of the following functions: fission product containment, core cooling, reactor shutdown, reactivity control, post-accident containment heat removal, post-accident containment atmosphere cleanup, post-accident fission product removal, residual heat removal from the reactor and/or from the spent fuel storage pool, and containment of radioactive materials. Portions of fluid systems which provide cooling or heating, sealing, lubrication, fuel, motive power, isolation, flood protection, or leakage detection necessary to support accomplishment of any of the above functions are also considered important to safety. Application of 10 CFR 50.55a and GDC 1 provides assurance that established standard practices of proven or demonstrated effectiveness are used to achieve a high likelihood that these safety functions will be performed and that the codes and standards applied are commensurate with the importance to safety of these functions. Section 3.2 FSAR Tables typically do not include safety functions for individual components and additional design basis information defining the safety function used to establish the quality group classification may be needed. NEI 97-04 Appendix B referenced in RG 1.186 may be used to define design basis information regarding the specific safety function in the FSAR. An audit of available design basis information included in design specifications and other design documents, or alternatively an ITAAC, may be credited to confirm an effective design process exists for: (1) design verification of quality group and (2) respective ASME Code class, based on component design functions.

III. REVIEW PROCEDURES

These review procedures are based on the identified DSRS acceptance criteria. For deviations from these acceptance criteria, the staff should review the applicant's evaluation of how the proposed alternatives provide an acceptable method of complying with the relevant NRC requirements identified in Subsection II. For design certifications, Tier 1 information is derived from Tier 2. Consequently any design information presented in Tier 1 also should be in the appropriate Tier 2 sections.

The staff assigned to the review of quality group classification has primary review responsibility of information included in application section 3.2.2 concerning pressure-retaining systems and their supports. The staff assists in reviews of such systems to ensure compliance with GDC 1 and coordinates the overall review with other SRP sections to ensure that the applicant has an acceptable classification process for all fluid systems and components important to safety such that these are acceptably classified with appropriate quality assurance measures, including construction codes and standards, applied with respect to the criteria presented in this SRP section. In Staff Requirements Memoranda (SRM) dated July 21, 1993, the Commission approved the staff's position in SECY 93-087, " Policy, Technical and Licensing Issues Pertaining to Evolutionary and Advanced Light Water Reactor (ALWR) Designs," the staff should review applications for evolutionary and advanced light water reactors using the newest codes and standards that have been endorsed by the NRC. Unapproved editions will be reviewed on a case-by-case basis. Code and standard editions used by the applicant should be identified in the application and specific editions should be reviewed by those responsible for endorsement or acceptance of those specific codes and standards. The specific edition of an adopted code or standard should be cited in Tier 2 rather than Tier 1.

Selection and emphasis of various aspects of the areas covered by this DSRS section will be made by the reviewer on each case. The reviewer's judgment with respect to the areas to be given attention during the review is to be based on an inspection of the material presented, on the similarity of the material to that recently reviewed for other plants, and on whether items of special safety significance are involved.

1. Programmatic Requirements and Guidance - In accordance with the guidance in NUREG-0800 "Introduction," Part 2 as applied to this DSRS Section, the staff will review the programs proposed by the applicant to satisfy the following programmatic requirements. If any of the proposed programs satisfies the acceptance criteria described in Subsection II, it can be used to augment or replace some of the review procedures. It should be noted that the wording of "to augment or replace" applies to nonsafety-related risk-significant SSCs, but "to replace" applies to nonsafety-related nonrisk-significant SSCs according to the "graded approach" discussion in NUREG-0800 "Introduction," Part 2. Commission regulations and policy mandate programs applicable to SSCs. Examples of those programs and associated guidance follows:

   - Maintenance Rule SRP Section 17.6 (DSRS Section 13.4, Table 13.4, Item 17, Regulatory Guides 1.160, "Monitoring the Effectiveness of Maintenance at Nuclear Power Plants." and RG 1.182; "Assessing and Managing Risk Before Maintenance Activities at Nuclear Power Plants".

   - Quality Assurance Program SRP Sections 17.3 and 17.5 (DSRS Section 13.4, Table 13.4, Item 16).

   - Technical Specifications (DSRS Section 16.0 and SRP Section 16.1) – including brackets value for DC and COL. Brackets are used to identify information or characteristics that are plant specific or are based on preliminary design information.

   - Reliability Assurance Program (SRP Section 17.4).

   - Initial Plant Test Program (RG 1.68, "Initial Test Programs for Water-Cooled Nuclear Power Plants, "DSRS Section 14.2, and DSRS Section 13.4, Table 13.4, Item 19).

   - ITAAC (DSRS Chapter 14).

2. In accordance with 10 CFR 52.47(a)(8),(21), and (22), and 10 CFR 52.79(a)(17) and (20), for new reactor license applications submitted under Part 52, the applicant is required to (1) address the proposed technical resolution of unresolved safety issues and medium- and high-priority generic safety issues which are identified in the version of NUREG-0933 current on the date up to six months before the docket date of the application and which are technically relevant to the design; (2) demonstrate how the operating experience insights have been incorporated into the plant design; and, (3) provide information necessary to demonstrate compliance with any technically relevant portions of the Three Mile Island requirements set forth in 10 CFR 50.34(f), except paragraphs (f)(1)(xii), (f)(2)(ix), and (f)(3)(v). These cross-cutting review areas should be addressed by the reviewer for each technical subsection and relevant conclusions documented in the corresponding safety evaluation report (SER) section.

3. The staff reviews the classification criteria presented in the FSAR and consistency of that criteria with regulations and regulatory guidance. 10 CFR 50.55a identifies those ASME Section III, Code Class 1 components of light-water-cooled reactors important to safety that are part of the RCPB. The detailed review of these components is conducted by the reviewer under other SRP and DSRS sections as described in Subsection I. These components are designated in RG 1.26 as Quality Group A. In addition, RG 1.26 identifies, on a functional basis, water- and steam-containing components of those systems important to safety that are designated as Quality Groups B and C. Quality Group D applies to water- and steam-containing components of systems that are less important to safety. An applicant may use the NRC Group Classification system identified in RG 1.26 or, alternately, the corresponding American Nuclear Society (ANS) classification system of Safety Classes if they are cross-referenced with the classification groups in RG 1.26. Although, the NRC does not currently endorse ANS classification standards, including ANS 51.1, 52.1 and ANS 58.14 that are considered too broad to endorse, reference documents, such NUREG/CR-5973 (reference 21), can support identifying acceptable industry standards. There are also systems of light-water-cooled reactors important to safety that are not identified in RG 1.26 for which there are established staff positions regarding quality group classification. These systems, and references establishing their acceptable classifications, are identified in Appendix A and the non safety-related risk-significant systems and components important to safety are to be identified by the RTNSS process or similar risk-informed process further described in RG 1.206 and SRPs for Sections 17.4 and 19.0. GL 84-01 (reference 15), the referenced Denton correspondence, and other related guidance, can also support application of the term “important to safety” in satisfying GDC 1 relative to risk assessment.

4. The information supplied in the application identifying application of the quality group classification criteria to fluid systems important to safety is reviewed for completeness, and the quality group classification, ASME Code and code class, and quality assurance criteria of selected individual major component are checked for compliance with the above criteria. Safety functions for each component are not specifically identified in the FSAR classification table. The staff may question the basis for a particular component classification and/or confirm the classification basis during an audit or via an ITAAC to validate that the applicant has an appropriate classification process. The various modes of system operation are to be considered to ensure that the assigned NRC quality groups are acceptable. Completeness of a QA list is beyond scope of RG 1.26 and this DSRS.

5. Quality groups and their respective ASME Code class for fluid systems and major pressure-retaining components are to be included in a table. The system description and schematics or P&IDs, if applicable, typically duplicate the quality group or corresponding code class information presented in the table. Where the table does not clearly describe boundaries, the system description and schematics or P&IDs, if applicable, may be reviewed to ensure that the applicant has delineated in detail the system quality group classification boundaries for systems important to safety. ASME Code class and/or quality group is to be shown on Tier 1 P&IDs that are to be consistent with Tier 2 information. If during the review of Tier 1 diagrams according to SRP 14.3, discrepancies are identified between Tier 1 and Tier 2 system description and schematics or P&IDs, and if applicable, concerning quality group or ASME Code class, the applicant should be requested to verify consistency between the figures. Changes in quality group classification are considered to be acceptable normally only at valve locations, with the valve assigned the higher classification. A change in quality group classification with no

valve present is normally considered acceptable only when it can be demonstrated that the safety function of the system is not impaired by a failure on the lower-classification side of the boundary.

6. On the basis of GDC 1, where generally recognized codes and standards are used, they shall be identified and evaluated to determine their applicability, adequacy, and sufficiency and shall be supplemented or modified as necessary to assure a quality product in keeping with the required safety function. The overall classification process is reviewed to ensure that appropriate codes and standards for fluid systems are identified in the FSAR and supplemented by QA programs, reliability assurance programs consistent with DC/COL-ISG-018 and the RTNSS process or similar process to ensure reliability consistent with the PRA. Reference documents, such as NUREG/CR-5973 (Reference 21) lists various codes and standards referenced in regulatory documents that may support the application of codes and standards. The following fluid systems important to safety for pressurized water reactor (PWR) are examples of those that are reviewed by the staff with regard to quality group classification. Typical PWR system names are provided below, based on historical staff reviews of prior applications. It should be noted that systems whose function is important to safety in accordance with RG 1.26 and that are used in passive system light water reactor (LWR) designs or non-LWR designs may not be identified by these names. NRC risk insight documents typically define which systems are risk-significant for each type of reactor design.

FLUID SYSTEMS IMPORTANT TO SAFETY FOR PWR PLANTS

Auxiliary Feedwater System

Boron Thermal Regeneration System[1,2]

Boron Recycle System[1,2]

Chemical and Volume Control System

Combustible Gas Control System[1,6]

Compressed Air System[1,2,6]

Condensate Storage System[1]

Containment Cooling System

Containment Isolation System[6]

Containment Purge System

Containment Spray System

Emergency Core Cooling System

Emergency Diesel Engine Fuel Oil Storage and Transfer System[6]

Emergency Diesel Engine Cooling Water System

Emergency Diesel Engine Starting System

Emergency Diesel Engine Lubrication System

Emergency Diesel Engine Combustion Air Intake and Exhaust System

Equipment and Floor Drainage System[2,6]

Feedwater System[3]

Main Steam System[3]

Pressurizer Power-Operated Relief Valves (PORVs) (including associated components and block valves)[6]

Process and Post-Accident Sampling Systems[3]

Reactor Auxiliary Cooling Water Systems (e.g., Component Cooling Water and Essential Chilled WaterSystems)[2]

Reactor Coolant System

Refueling Water Storage System[2]

Residual Heat Removal System

Spent Fuel Pool Cooling and Cleanup System[2,4]

Station Service Water System[2]

Steam Generator Blowdown System[3]

Ultimate Heat Sink and Supporting Systems[6]

Ventilation Systems for Areas such as Control Room and Engineered Safety Features Rooms[6]

---

1 For some plants this system may be non safety-related, providing it is quality group classified consistent with the positions of RG 1.26.
2 Portions of the system that perform a safety-related function.
3 Portions of the system to outermost containment isolation valve.
4 Includes makeup water systems as described in DSRS Section 9.1.3.
5 Refers to the relief valves providing RCPB overpressure protection.
6 See Appendix A for supplemental classification guidance.

Clarification of the quality group classification provided in RG 1.26 and applicable to those portions of BWR main steam and feedwater systems (other than the reactor coolant pressure boundary) on the turbine side of the containment isolation valves, is provided in Branch Technical Position (BTP) 3-1 and BTP 3-2.

Additional guidance on the quality group classification of systems and components important to safety for typical plant designs is provided in Appendix A attached to this DSRS section.

Appendix A identifies quality group classifications and related references supplemental to the guidance of RG 1.26 for the classification of system components.

Table 3.2.2-1 provides a summary of the construction Codes and Standards for components of water-cooled nuclear power plants and is based on the NRC quality group classification system in RG 1.26. Appendix A identifies additional guidance regarding the construction of certain systems and components.

In the event an applicant intends to take exception to RG 1.26 it should be supported with adequate justification for the proposed quality group classification or an analysis to establish an acceptable basis for the proposed quality group classification. Staff comments may also be prepared requesting clarification, in order to ensure a clear understanding of the quality group classifications assigned to a system by the applicant.

Exceptions and alternatives to the specified quality group classifications of RG 1.26 or the guidance identified in Appendix A are acceptable only if application of an "equivalent quality level" is justified. In such cases, justification can be demonstrated if: the component is classified to meet the criteria of a higher group classification than specified in RG 1.26 or alternative design rules are based on the use of a more conservative design; the extent of component nondestructive examination is equal to or greater than the provisions of the specified code; and the quality assurance requirements of Appendix B, 10 CFR Part 50 are met.

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

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

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

10 CFR 52.47 also states that the Commission will require, before design certification, that information normally contained in certain procurement specifications and construction and installation specifications be completed and available for audit if the information is necessary for the Commission to make its safety determination. The staff may elect to credit an ITAAC or audit available design documents such as design specifications, system description and schematics or P&IDs, if applicable, QA lists, and procurement documents associated with the quality group classification of risk-significant systems and mechanical components. An audit should be scheduled based on the availability of design documents and prior to the design certification and/or COL application. The staff review may include an assessment of the degree of completeness of design information supporting classifications and how quality group classification and/or code class identified in the licensing basis are translated into design documents. The audit may also be used to support resolution of quality group open items identified during the review of the application. Depending on the audit plan, the scope may be limited to a review of the design classification process and a sampling of risk-significant systems

and mechanical components to validate that the applicant has an appropriate classification process in place.

IV. EVALUATION FINDINGS

The reviewer determines that the applicant has provided sufficient information and, on the basis of the review, ITAAC (if applicable), or audit (if applicable), that the information provided supports conclusions of the following type to be included in the staff's safety evaluation report. The reviewer also states the bases for those conclusions.

1. The application includes a classification process and specific classification criteria consistent with regulatory guidance in RG 1.26 or an acceptable alternative. Pressure-retaining components of fluid systems important to safety and their supports such as pressure vessels, heat exchangers, storage tanks, pumps, piping and valves have been classified Quality Group A, B, C, or D and have been identified in an acceptable manner in Table 3.X.X and on system piping and instrumentation diagrams in the SAR. Appropriate quality group classification consistent with RG 1.26 ensures that these components will be constructed to quality standards commensurate with the importance of the safety function to be performed. The review of Quality Group A and B (ASME Section III, Class 1 and 2) RCPB components is discussed in Section 5.2.1.1 of the SER. Other Quality Group B components of systems identified in Position C.1.a through C.1.e of RG 1.26 are constructed to ASME Section III, Class 2. Components in systems identified in Position C.2.a through C.2.d of RG 1.26 are constructed to Quality Group C standards, ASME Section III, Class 3. Components in systems identified in Position C.3 of RG 1.26 are constructed to Quality Group D standards such as ASME Section VIII and American National Standard Institute (ANSI)/ASME B31.1.

2. The staff concludes that there is reasonable assurance that pressure-retaining components of fluid systems important to safety have been properly classified as Quality Group A, B, C, or D items and meets the requirements of General Design Criterion 1, "Quality Standards and Records." This conclusion is based on the applicant having defined an appropriate classification process and design process to meet the requirements of GDC 1 by having properly classified these pressure-retaining components important to safety as Quality Group A, B, C, or D in accordance with the positions of RG 1.26, "Quality Group Classifications and Standards for Water-, Steam-, and Radioactive-Waste-Containing Components of Nuclear Power Plants," or an acceptable alternative. The staff further concludes that the identified pressure-retaining components include major components that, in part, provide assurance that the facility can be operated with adequate protection to the health and safety of the public and those necessary (1) to prevent or mitigate the consequences of accidents and malfunctions originating within the reactor coolant pressure boundary, (2) to permit shutdown of the reactor and maintain it in a safe shutdown condition, and (3) to contain radioactive materials.

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

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

V. IMPLEMENTATION

The staff will use this DSRS section in performing safety evaluations of mPower^{TM}-specific DC, or COL, applications submitted by applicants pursuant to 10 CFR Part 52. The staff will use the method described herein to evaluate conformance with Commission regulations.

Because of the numerous design differences between the mPower^{TM} and large light-water nuclear reactor power plants, and in accordance with the direction given by the Commission in SRM- COMGBJ-10-0004/COMGEA-10-0001, "Use of Risk Insights to Enhance the Safety Focus of Small Modular Reactor Reviews," dated August 31, 2010 (ML102510405), to develop risk-informed licensing review plans for each of the small modular reactor reviews including the associated pre-application activities, the staff has developed the content of this DSRS section as an alternative method for mPower^{TM} -specific DC, or COL submitted pursuant to 10 CFR Part 52 to comply with 10 CFR 52.47(a)(9), "Contents of applications; technical information."

This regulation states, in part, that the application must contain "an evaluation of the standard plant design against the SRP revision in effect SIX months before the docket date of the application." The content of this DSRS section has been accepted as an alternative method for complying with 10 CFR 52.47(a)(9) as long as the mPower^{TM} DCD FSAR does not deviate significantly from the design assumptions made by the NRC staff while preparing this DSRS section. The application must identify and describe all differences between the standard plant design and this DSRS section, and discuss how the proposed alternative provides an acceptable method of complying with the regulations that underlie the DSRS acceptance criteria. If the design assumptions in the DC application deviate significantly from the DSRS, the staff will use the SRP as specified in 10 CFR 52.47(a)(9). Alternatively, the staff may supplement the DSRS section by adding appropriate criteria in order to address new design assumptions. The same approach may be used to meet the requirements of 10 CFR 52.79(a)(41) for COL applications.

VI. REFERENCES

1. 10 CFR Part 50.55a, "Codes and Standards."

2. 10 CFR Part 50, Appendix A, GDC 1, "Quality Standards and Records."

3. 10 CFR Part 50, Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants."

4. RG 1.26, "Quality Group Classifications and Standards for Water-, Steam, and Radioactive-Waste-Containing Components of Nuclear Power Plants."

5. RG 1.84, "Design and Fabrication Code Case Acceptability ASME Section III Division 1."

6. RG 1.85, "Materials Code Case Acceptability ASME Section III Division 1."

7. ANSI/ASME B16.34, "Valves - Flanged, Threaded, and Welding End," American National Standards Institute.

8. ANSI/ASME B31.1, "Power Piping," American National Standards Institute.

9. ANSI B96.1, "Specification for Welded Aluminum-Alloy Field-Erected Storage Tanks," American National Standards Institute.

10. API Standard 620, Sixth Edition, "Recommended Rules for Design and Construction of Large, Welded, Low-Pressure Storage Tanks," American Petroleum Institute.

11. API Standard 650, Sixth Edition, Revision 1, "Welded Steel Tanks for Oil Storage," American Petroleum Institute.

12. Boiler and Pressure Vessel Code, “Section III, Division I, Nuclear Power Plant Components," American Society of Mechanical Engineers.

13. Boiler and Pressure Vessel Code, “Section VIII, Division 1, Pressure Vessels," American Society of Mechanical Engineers.

14. AWWA D100, "AWWA Standard for Steel Tanks-Standpipes, Reservoirs, and Elevated Tanks for Water Storage," American Water Works Association.

15. NRC Generic Letter GL 84-01, “NRC Use Of The Terms "Important To Safety" and "Safety Related" (ADAMS Accession No. ML031150515).

16. RG 1.201, “Guidelines for Categorizing Structures, Systems and Components in Nuclear Power Plants, According to their Safety Significance.”

17. 10 CFR 50.69, “Risk-informed categorization and treatment of structures, systems and components for nuclear power reactors.”

18. SRM July 21, 1993, SECY 93-087, "Policy, Technical, and Licensing Issues Pertaining to Evolutionary and Advanced Light Water Reactor (ALWR) Designs," April 4, 1993.

19. BTP 3-1, “Classification of Main Steam Components Other than the Reactor Coolant Pressure Boundary for BWR Plants.”

20. BTP 3-2, “Classification of BWR/6 Main Steam and Feedwater Components Other than the Reactor Coolant Pressure Boundary.”

21. NUREG/CR-5973 Codes and Standards and Other Guidance Cited in NRC Documents

22. DC/COL-ISG-018 “Interim Staff Guidance on Standard Review Plan, Section 17.4, Reliability Assurance Program” (delete once included in SRP 17.4)

23. RG 1.186, “Guidance and Examples for Identifying 10 CFR 50.2 Design Bases”

24. NEI 97-04 Revised Appendix B, Guidance and Examples for Identifying 10 CFR 50.2 Design Bases, November 2000

25. RG 1.206, “Combined License Applications for Nuclear power Plants”

26. Applying Risk Insights to the Review of Safety Analysis Reports Using the Standard Review Plan: Framework and Basis, Rev. 0, 7/9/07 (NRC Agencywide Documents Access and Management System (ADAMS) Accession No. ML072040352).

27. SECY-11-0024, “Use of Risk Insights to Enhance the Safety Focus of Small Modular Reactor Reviews”

TABLE 3.2.2-1

SUMMARY OF CONSTRUCTION[1] CODES AND STANDARDS FOR COMPONENTS OF WATER-COOLED NUCLEAR POWER PLANTS BY NRC QUALITY CLASSIFICATION SYSTEM[2]

	NRC Quality Classification System			
Component	**Quality Group A**	**Quality Group B**	**Quality Group C**	**Quality Group D**
Pressure Vessels	ASME Boiler and Pressure Vessel Code, Section III, Division 1, Subsection NB -Class 1, Nuclear Power Plant Components [3,4]	ASME Boiler and Pressure Vessel Code, Section III, Division 1, Subsection NC -Class 2, Nuclear Power Plant Components[3,4]	ASME Boiler and Pressure Vessel Code, Section III, Division 1, Subsection ND -Class 3, Nuclear Power Plant Components [3,4]	ASME Boiler and Pressure Vessel Code, Section VIII, Division 1.
Piping	As above	As above	As above	ANSI B31.1 Power Piping
Pumps	As above	As above	As above	Manufacturer's standards.
Valves	As above	As above	As above	ANSI B31.1 Power Piping and ANSI B16.34
Atmospheric Storage Tanks	Not applicable	As above	As above	API-650, AWWA D100, or ANSI B96.1
0-15 psig Storage Tanks	Not applicable	As above	As above	API-620
Supports	As above except Subsection NF	As above except Subsection NF	As above except Subsection NF	Manufacturers standards
Metal Containment Components	Not applicable	As above except Subsection NE, Class MC	Not applicable	Not applicable
Core Support Structures	Not applicable	As above except Subsection NG	Not applicable	Not applicable

NOTES:

1 As defined in Sub-subarticle NCA-1110 of Section III, of the ASME Boiler and Pressure Vessel Code, construction is an all-inclusive term comprising materials, design, fabrication, examination, testing, inspection, and certification necessary in the manufacture and installation of components.

2 As defined in Regulatory Guide 1.26, the NRC Quality Classification System identifies, on a functional basis, components of fluid systems by Quality Groups A, B, C, and D.

3 See Section 50.55a, "Codes and Standards," of 10 CFR Part 50 for requirements with regard to the Code Edition and Addenda to be applied.

4 The specific applicability of ASME Code Cases is covered separately in DSRS Section 5.2.1.2, Regulatory Guides 1.84 and 1.85, or in Commission regulations, where appropriate.

Applicants proposing the use of ASME Code Cases not covered by these DSRS and Regulatory Guides should receive approval from the Commission prior to their use and should demonstrate that an acceptable level of quality and safety would be achieved.

APPPENDIX A

Additional Guidance for Classification of Systems and Components and Application of Quality Standards

This appendix summarizes guidance supplemental to the guidance provided in RG 1.26 for the quality group classification of components of fluid systems important to safety.

REFERENCES

1. RG 1.7, "Control of Combustible Gas Concentrations in Containment Following a Loss-of-Coolant-Accident."

2. RG 1.11, "Instrument Lines Penetrating Primary Reactor Containment."

3. RG 1.26, "Quality Group Classification and Standards for Water-, Steam-, and Radioactive-Waste-Containing Components of Nuclear Power Plants."

4. RG 1.72, "Spray Pond Piping Made from Fiberglass- Reinforced Thermosetting Resin."

5. RG 1.96, "Design of Main Steam Isolation Valve Leakage Control Systems for Boiling Water Reactor Nuclear Power Plants."

6. RG 1.137, "Fuel Oil Systems for Standby Diesel Generators."

7. RG 1.141, "Containment Isolation Provisions for Fluid Systems."

8. RG 1.143, "Design Guidance for Radioactive Waste Management Systems, Structures, and Components Installed in Light-Water-Cooled Nuclear Power Plants."

9. RG 1.151, "Instrument Sensing Lines."

10. BTP 6-3, "Determination of Bypass Leakage Paths in Dual Containment Plants."

11. NRC Letter to All Pressurized Water Reactor Licensees and Construction Permit Holders, "Resolution of Generic Issue 70, "Power-Operated Relief-Valve and Block Valve Reliability," and Generic Issue 94, "Additional Low-Temperature Overpressure Protection for Light-Water Reactors," (NRC Generic Letter No. 90-06)," June 25, 1990.

12. NRC Memorandum from E. S. Beckjord for F. P. Gillespie, "Resolutions of Generic Issue 70, "Power Operated Relief Valve and Block Valve Reliability," and Generic Issue 94, "Additional Low-Temperature Overpressure Protection for Light Water Reactors,"" November 16, 1989.

13. Boiler and Pressure Vessel Code, "Section III, Nuclear Power Plant Components," and "Section XI, Rules for Inservice Inspection of Nuclear Power Plant Components," American Society of Mechanical Engineers.

Table A-1

Added Guidance for Classification and Application of Quality Standards

	System or Component	Quality Group	References
1.	Combustible Gas Control System	B (1)	DSRS 6.2.5, RG 1.7
2.	Compressed Air Systems required to perform a safety function	C	SRP 9.3.1
3.	Containment Isolation System:	A/B (2)	DSRS 6.2.4
	a. Penetrations including associated piping and isolation valves	A/B (2)	RG 1.141
	b. Instrument lines penetrating containment	B (3)	RG 1.11
	c. Isolation barriers comprised of closed systems inside containment	B (2)	DSRS 6.2.4
	d. Isolation barriers comprised of closed systems outside containment	B (2)	DSRS 6.2.4
	e. Closed systems in secondary containment proposed as boundaries to preclude bypass leakage	B (4)	Branch Technical Position 6-3
4.	Emergency Diesel Engine:		
	a. Fuel Oil Storage and Transfer System	C (5)	DSRS 9.5.4, RG 1.137
	b. Cooling Water System	C	DSRS 9.5.5
	c. Starting System	C	DSRS 9.5.6
	d. Lubrication System	C	DSRS 9.5.7
	e. Combustion Air Intake and Exhaust System	C	DSRS 9.5.8
5.	Equipment and Floor Drainage System	C (6)	DSRS 9.3.3
6.	Gas Treatment Systems which are considered as engineered safeguards systems	B	

	System or Component	Quality Group	References
7.	BWR Main Steam Isolation Valve Leakage Control System and necessary subsystems	B/A (7)	RG 1.96
8.	Plant Ventilation Systems for areas such as the control room and engineered safety features rooms	C	
9.	PWR Pressurizer PORVs, associated components, and Block Valves	(8)	Generic Letter 90-06
10.	Radioactive Waste Management Systems	(9)	RG 1.143
11.	Safety-Related Instrument Sensing Lines	B,C (10)	RG 1.151
12.	Ultimate Heat Sink and Supporting Systems	C (11)	DSRS 9.2.5, RG 1.72
13.	Main Steam, essential portions	B	DSRS 10.3
14.	Circulating Water System	D	DSRS 10.4.5
15.	PWR Safety related Steam Generator Blowdown	B	SRP 10.4.8

NOTES:

(1) RG 1.7 describes acceptable methods for the control of combustible gas in containment, with consideration of 10 CFR 50.44, "Standards for Combustible Gas Control Systems in Light-Water-Cooled Power Reactors."

(2) DSRS Section 6.2.4 contains guidance related to classification of containment isolation systems. Containment isolation system components (e.g., isolation barriers) are normally classified as Quality Group B unless their service function dictates that Quality Group A standards be applied. RGs 1.11 and 1.141 are cited in DSRS Section 6.2.4 and describe methods acceptable to the NRC staff for complying with the Commission's requirements with respect to containment isolation of fluid systems.

(3) RG 1.11 describes a suitable basis which may be used to implement containment isolation design criteria for instrument lines. Position C.1.c indicates that protection system sensing lines penetrating or connected to primary reactor containment should be provided with an isolation valve capable of automatic operation or remote operation, and should be located in the line outside the containment as close to the containment as practical. Position C.1.d indicates that such lines should be conservatively designed up to and including the isolation valve and of a quality at least equivalent to the containment [generally Group B per NOTE (2) above]. Position C.2 indicates that sensing lines for instruments that are not part of the protection system should meet the above provisions or should be provided with one automatic isolation valve inside and one automatic valve outside containment as close to containment as practical.

(4) Branch Technical Position 6-3, describes methods for determining bypass leakage paths in dual containment plants. Position B.9.b indicates that closed systems proposed as a leakage boundary to preclude bypass leakage should be designed in accordance with

Quality Group B standards, as defined by RG 1.26, but that systems designed to Quality Group C or D standards that qualify as closed systems to preclude bypass leakage will be considered on a case-by-case basis.

(5) RG 1.137 describes a method acceptable for complying with regulations regarding fuel-oil systems for standby diesel generators. The Regulatory Guide describes positions with respect to the design and fabrication of diesel fuel oil systems which are supplemental to those indicated by the Quality Group C classification including the application of additional standards.

(6) DSRS Section 9.3.3 provides criteria used to determine the safety-related portions of the equipment and floor drainage system and indicates that the safety-related portions of the system should be verified to be classified Quality Group C or higher.

(7) RG 1.96 describes an acceptable basis for evaluating the need for, and design of, leakage control systems for BWR main steam isolation valves. Position C.1 of the Regulatory Guide describes the appropriate classification for leakage control systems as Quality Group B, with the exception of the unisolable portion of the system connected to the RCPB, which should be classified as Quality Group A. Appendix A of the Regulatory Guide describes measures supplemental to the ASME Code to be applied for Quality Group A portions of the system.

(8) Components of the reactor coolant system, including those comprising the RCPB, should be quality group classified accordingly. PORVs and associated components should be classified as safety-related where necessary to perform a safety-related function (e.g., mitigation of a design-basis steam generator tube rupture accident, low temperature overpressure protection of the reactor vessel, and/or plant cooldown as described in Generic Letter 90-06). As described in Reference 12, the safety-related classification should address redundant and diverse control systems designed to Seismic Category I criteria and those improvements that were imposed subsequent to the TMI-2 accident, such as criteria to be powered from Class 1E buses and to provide valve position indication in the control room. The PORVs and block valves should be included within a quality assurance program that is in compliance with 10 CFR Part 50, Appendix B.

For PWR plants licensed prior to the revision date of this DSRS section and whose PORVs were not constructed as safety-grade components, these components should be addressed in accordance with the positions specified in Generic Letter 90-06, Enclosure A, Section 3.1.

(9) RG 1.143 describes a method acceptable for complying with regulations regarding radwaste management systems, including guidance for classification and quality assurance measures. Position C.1.1 and Table 1 of the Regulatory Guide describe codes and industry standards applicable to the design and fabrication of radwaste management systems. In addition, the Regulatory Guide describes positions with regard to the design and fabrication of these systems that are supplemental to those established by the codes and standards cited. RG 1.143 does not explicitly specify classifications for radwaste management system components in terms of the quality groups (A-D) described in RG 1.26.

(10) RG 1.151 describes an acceptable method for the design and installation of safety-related instrument sensing lines, including the application of another standard in addition to the

ASME Code. The Regulatory Guide describes an acceptable method for classifying instrument sensing lines by providing classification guidance for instrument sensing lines in terms of the ASME Boiler and Pressure Vessel Code, Section III code classes, which correspond to RG 1.26 Quality Groups.

(11) DSRS Section 9.2.5 provides review procedures and findings that verify that the ultimate heat sink and its supporting systems meet Quality Group C criteria. RG 1.72 describes an acceptable method for the design, fabrication, and testing of fiberglass-reinforced thermosetting resin piping for spray pond applications, which includes the application of a code case as supplemented by the regulatory positions. RG 1.72 position C.7.b indicates that ASME Code, Section XI inservice inspection criteria for Class 3 systems should be applied for such piping.