Interim Use and Comment

U.S. NUCLEAR REGULATORY COMMISSION

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

9.5.6 EMERGENCY DIESEL ENGINE STARTING SYSTEM

REVIEW RESPONSIBILITIES

Primary - Organization responsible for the review of diesel generator support systems

Secondary - None

I. AREAS OF REVIEW

Nuclear power plants are required to have redundant onsite emergency power sources of sufficient capacity to permit functioning of structures, systems and components (SSCs) important to safety. In almost all cases, the onsite power sources include diesel-engine-driven generator sets. The emergency diesel engine (EDE) starting system (EDESS) performs the safety function of starting the EDE following an engine start signal to support its safety function for the required period of operation. Design Specific Review Standard (DSRS) Sections 9.5.4 through 9.5.8 cover the review of various essential elements of emergency diesel generator support systems.

The EDESS provides motive power for starting the station EDEs and is reviewed for compliance with the requirements of General Design Criteria (GDCs) 1, 2, 4, 5, and 17. The review covers EDESS portions external to the diesel engine skid that compress ambient air, store the compressed air, and deliver the compressed air to the EDE starting motor. The system includes all compressors, pressure vessels, valves, and piping up to the engine interface as defined by the engine manufacturer. The system components mounted directly on the diesel engine and its support structure are reviewed with the diesel generator in accordance with DSRS Section 8.3.1, “AC Power Systems (Onsite).”

Depending on the design and regulatory treatment of nonsafety-related system (RTNSS) analysis, the emergency diesel engine starting system for a passive plant design may be classified as:

1) Safety-related risk-significant
2) Safety-related nonrisk significant
3) Nonsafety-related risk-significant, which includes RTNSS Criterion B and RTNSS Criterion C
4) Nonsafety-related nonrisk-significant

The mPower^{TM} application will include the classification of SSCs, a list of risk-significant SSCs, and a list of RTNSS equipment. Based on this information, the staff will review according to

DSRS Section 3.2, SRP Sections 17.4 and 19.3 to confirm the determination of the safety-related and risk-significant SSCs. The current passive plant designs (AP1000, ESBWR, and mPower^{TM}) may include the following nonsafety-related risk-significant onsite AC power supplies:

A. Ancillary Diesel Generators – classified as RTNSS Criterion B and designed for seismic events and other natural phenomena.
B. Standby Diesel Generators – classified as RTNSS Criterion C

For these designs, the starting system for the onsite power supply driver may be subject to regulatory treatment of nonsafety-related system (RTNSS) considerations.

The specific areas of review for the safety-related EDESS are as listed below. All of the areas of review listed below apply to starting air systems classified as RTNSS Criterion B or Criterion C (RTNSS B and C), unless otherwise indicated. The RTNSS-specific review guidance, where different from that of a safety-related EDESS, will be presented in italics throughout this DSRS section. For nonsafety-related nonrisk-significant starting systems, nothing applies unless noted below.

For this area of review, the reviewer must evaluate the following:

1. Appropriate safety/risk-significant classification as discussed above.

2. Compliance with the requirements of GDCs 1, 2, 4, 5, and 17.

   RTNSS B and C: SRP Section 19.3 defines the applicability of the GDCs to RTNSS SSCs.

3. The capability of the EDESS to adequately start the EDE.

4. The functional performance requirements of the system, including the ability to withstand design-basis adverse operational and environmental occurrences, operability requirements for normal operation, and requirements for operation during and following postulated accidents.

5. Design, fabrication, erection and testing to appropriate codes and standards.

6. Appropriate design classification of structures housing portions of the system important to safety.

7. Consequences of a single active failure.

8. The effects of non-Seismic Category I component failures on the Seismic Category I portion of the system.

   RTNSS B: SSCs required to function following a seismic event should be reviewed for the effects of non-Seismic Category I component failures.

9. The provisions for detection and control of system leakage.

10. Appropriate boundary divisions between safety-related and nonsafety-related portions of the system.

11. The requirements for operational testing and inservice inspection of the system.

    RTNSS B and C: does not apply directly since RTNSS B SSCs are considered risk-significant and RTNSS C SSCs support cold shutdown conditions. Testing and inservice inspection are elements of the reliability assurance program (RAP). Also, surveillance testing is done for items in the Availability Controls Manual. Alternative criteria are addressed in DSRS Section 19.3 on the programmatic requirements for RTNSS with respect to inspection and testing.

12. Instrumentation and control features necessary to accomplish design functions, including isolation of components for leakage or malfunctions and actuation requirements for redundant equipment.

13. Space provided to permit inspection, cleaning, maintenance, and repair of the system.

14. <u>Inspections, Tests, Analyses, and Acceptance Criteria (ITAAC)</u>. For design certification (DC) and combined license (COL) reviews, the staff reviews the applicant's proposed ITAAC associated with the structures, systems, and components (SSCs) related to this DSRS section in accordance with SRP Section 14.3, "Inspections, Tests, Analyses, and Acceptance Criteria." The staff recognizes that the review of ITAAC cannot be completed until after the rest of this portion of the application has been reviewed against acceptance criteria contained in this 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.

15. <u>COL Action Items and Certification Requirements and Restrictions</u>. 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 items 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.

<u>Review Interfaces</u>

Other SRP or DSRS sections interface with this section for safety-related and nonsafety-related EDESS, as follows. The need for each of the following interface reviews for a RTNSS B and C starting air system should be based on the RTNSS B and C review guidance and acceptance criteria for the system included in this section and in SRP Section 19.3.

1. DSRS sections 3.2.1 and 3.2.2: review of the seismic and quality group classifications for EDESS components.

2. DSRS sections 3.3.1, 3.3.2, 3.5.3, 3.7.2and SRP sections 3.7.1, 3.7.3, 3.7.4, 3.8.4, and 3.8.5: review of the acceptability of the design analyses, procedures, and criteria establishing the capability of Seismic Category I structures housing the system and supporting systems to withstand the effects of natural phenomena like the safe shutdown earthquake, probable maximum flood, and tornado missiles.

   RTNSS B: corresponding review of structures that house system components that must perform their function following a seismic event.

3. DSRS section 3.4.1: review for flood protection.

4. DSRS section 3.5.1.1: review for protection against internally-generated missiles.

5. DSRS sections 3.5.1.4 and 3.5.2: review of SSC protection against the effects of externally-generated missiles.

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

7. DSRS sections 3.9.1and 3.9.2 and SRP section 3.9.3: review of EDESS SSCs for whether they are in accordance with the applicable codes and standards.

8. DSRS section 3.9.6: review of the adequacy of the inservice testing program for pressure vessels and valves.

9. DSRS section 6.6: review to verify whether system components meet inservice inspection requirements and the compatibility of the materials of construction with service conditions.

10. DSRS Chapter 7: review to determine the adequacy of the design, installation, inspection, and testing of all essential EDESS controls and instrumentation.

11. DSRS section 8.1: review to determine the adequacy of the design, installation, inspection, and testing of all essential electrical components required for proper operation.

12. DSRS section 8.3.1: review of the adequacy of the design, installation, inspection, and testing of the diesel generator and all electrical components (sensing, control, and power) required for proper operation of the system, including interlocks.

13. DSRS section 8.4: overall review of compliance with station blackout requirements.

14. SRP section 9.5.1: review for fire protection requirements.

15. DSRS sections 14.2 and 14.3.7: review for initial plant testing and plant systems ITAAC.

16. DSRS section 16.0: review of technical specifications.

17. SRP section 17.5: review of the quality assurance requirements.

18. SRP section 19.3: review for probabilistic risk assessment, for the applicable risk classification, and for the application of regulatory requirements to RTNSS SSCs.

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

II. ACCEPTANCE CRITERIA

Requirements

Acceptance criteria for the safety-related EDESS are based on meeting the relevant requirements of the following Commission regulations. The RTNSS-specific acceptance criteria for nonsafety-related risk-significant SSCs, including the application of GDCs, are addressed in SRP Section 19.3, System-specific acceptance criteria are addressed in this DSRS Section 9.5.6. For a nonsafety-related nonrisk-significant starting air system, no requirements other than those specifically identified in italics below apply.

1. GDC 1, "Quality Standards and Records," as it relates to quality standards commensurate with the importance of the safety functions.

2. GDC 2, "Design Bases for Protection Against Natural Phenomena," as it relates to capability of SSCs important to safety to withstand the effects of natural phenomena such as earthquakes, tornadoes, tsunamis, hurricanes, floods and seiches,without loss of capability to perform their safety function.

3. GDC 4, "Environmental and Dynamic Effects Design Bases," as it relates to capability of SSCs important to safety to withstand environmental conditions and dynamic effects of externally-generated and internally-generated missiles, pipe whip, and jet impingement forces of pipe breaks, during normal plant operation as well as upset and accident conditions.

4. GDC 5, "Sharing of Structures, Systems, and Components," provides that SSCs important to safety shall not be shared among nuclear power units unless it can be shown that such sharing will not significantly impair their ability to perform their safety functions, including, in the event of an accident at one unit, an orderly shutdown and cooldown of the remaining units.

5. GDC 17, "Electric Power Systems," as it relates to the capability of the EDESS to support the capability of the onsite emergency power system to perform its safety functions assuming a single failure, including the requirements for independence, redundancy, and testability.

6. 10 CFR 52.47(b)(1), which requires that a DC application contain the proposed 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, and the NRC's rules and regulations.

RTNSS B and C: applies using the guidance in DSRS Section 14.3.7, but moderated based on risk importance and the level of confidence that the design requirement will be met (e.g., a new and unique component design may warrant an ITAAC for an important function to confirm that the design requirement can be met). ITAAC are not necessarily required for RTNSS SSCs (see SRP section 19.3).

7. 10 CFR 52.80(a), which requires that a COL application contain the proposed inspections, tests, and analyses, including those applicable to emergency planning, that the licensee shall perform, and the acceptance criteria that are necessary and sufficient to provide reasonable assurance that, if the inspections, tests, and analyses are performed and the acceptance criteria met, the facility has been constructed and will operate in conformity with the combined license, the provisions of the Atomic Energy Act, and the NRC's rules and regulations.

   RTNSS B and C: applies using the guidance in DSRS Section 14.3.7, but moderated based on risk importance and the level of confidence that the design requirement will be met. ITAAC are not necessarily required for RTNSS SSCs (see SRP section 19.3).

DSRS Acceptance Criteria

Specific DSRS acceptance criteria acceptable to meet the relevant requirements of the NRC's regulations identified above are set forth below. 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 requirements in 10 CFR 52.47(a)(9), "Contents of applications; technical information." The same approach may be used to meet the requirements of 10 CFR 52.79(a)(41) for COL applications.

The acceptance criteria listed below apply to starting air systems classified as RTNSS Criterion B and Criterion C, unless otherwise indicated. The RTNSS-specific acceptance criteria, where different from that of a safety-related EDESS, are presented in italics. For a nonsafety-related nonrisk-significant starting system, nothing applies unless noted below.

1. Quality standards and records. Information that addresses the requirements of GDC 1 regarding the quality standards and records for SSCs important to safety will be considered acceptable if the guidance of Regulatory Guide (RG) 1.28, "Quality Assurance Program Criteria (Design and Construction)," are appropriately addressed. A quality assurance (QA) program shall be established and implemented. Appropriate records of the design, fabrication, erection, and testing of SSCs important to safety shall be maintained.

   RTNSS B and C: does not apply. The QA program, including documentation requirements, for RTNSS SSCs should be the manufacturer's standard program for non-nuclear safety SSCs

2. Protection against natural phenomena. Information that addresses the requirements of GDC 2 regarding the capability of structures housing the EDESS to withstand the effects of natural phenomena will be considered acceptable if the guidance of RG 1.29, Position C.1 for safety-related portions of the EDESS and Position C.2 for nonsafety-related portions of the EDESS are appropriately addressed. Comprehensive compliance with GDC 2 is reviewed under other DSRS sections as specified in Subsection I of this DSRS section.

   RTNSS B and C SSCs: applies to the effects of natural phenomena without loss of function, using a graded approach. SRP Section 19.3 provides further guidance related to the reliability and availability missions of RTNSS B and C SSCs.

3. Environmental and dynamic effects. Comprehensive compliance with GDC 4 is reviewed under other DSRS sections as specified in Subsection I of this DSRS section.

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

5. Independence, redundancy and testability. Information that addresses the requirements of GDC 17 regarding the capability of the EDESS to meet independence, redundancy, and testability criteria will be considered acceptable if each diesel generator has a separate and independent EDESS and the following criteria are met:

   A. NRC recommendations specified in NUREG/CR-0660, "Enhancement of Onsite Emergency Diesel Generator Reliability," are implemented, where applicable.

   B. Each diesel engine should have a dedicated air starting system consisting of an air compressor, an air dryer, one or more air receivers, piping, injection lines and valves, and devices to crank the engine as recommended by the engine manufacturer.

   C. At a minimum, the air starting system should be capable of cranking a cold diesel engine five times without recharging the receiver(s). The air starting system capacity should be determined as follows, whichever air start requirement is larger:

      i. Each cranking cycle duration should be approximately three seconds, or

      ii. Each cycle consists of two to three engine revolutions, or

      iii. Air start requirements per engine start are provided by the engine manufacturer.

The system capacity should be based on beginning the start cycles from the receiver low pressure alarm setpoint.

D. Alarms should alert operating personnel if the air receiver pressure falls below the minimum allowable value.

E. Provisions for the periodic or automatic blowdown of accumulated moisture and foreign material in the air receiver(s) and other system critical points.

F. Starting air should be dried to a dew point of not more than 10°C (50°F) at operating pressure when installed in a normally-controlled 21°C (70°F) environment; otherwise, the starting air dew point at operating pressure should be controlled to at least 5.5°C (10°F) less than the lowest expected ambient temperature.

RTNSS B and C: the acceptance should be based on the correlation between the associated risk and the supporting design for independence, redundancy, testability and single active failure. Compressed air storage capable of cranking a cold diesel engine three times without recharging the receiver(s) is acceptable.

III. REVIEW PROCEDURES

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

These review procedures are based on the identified 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.

The reviewer uses such input as required to complete this review procedure. For aspects of the EDESS design that must comply with regulatory requirements that are also applicable to other systems (e.g., ASME Section III, seismic design, ITAAC, and RTNSS).

Plant-to-plant variations in the design of the EDESS can occur due to multiple architect-engineering companies and engine-generator manufacturers having design responsibility in this area. Differences may occur in areas such as the method of air drying, piping configurations and component redundancy. The reviewer selects and emphasizes material from the following paragraphs and supplements that material as required to fit the particular design under review. The applicability of review procedures for RTNSS B and C starting air systems is described in italics. For nonsafety-related nonrisk-significant starting air systems, nothing applies unless noted below. Additional review guidance for RTNSS SSCs is provided in SRP Section 19.3.

1. Programmatic Requirements - 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 that include:

A. 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".
B. Quality Assurance Program SRP Sections 17.3 and 17.5 (DSRS Section 13.4, Table 13.4, Item 16).
C. 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.
D. Reliability Assurance Program (SRP Section 17.4).
E. Initial Plant Test Program (Regulatory Guide 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).
F. ITAAC (DSRS Chapter 14).

RTNSS B and C: applies; however, Technical Specifications may not apply and are replaced with Short Term Availability Controls, as required. RG 1.215 only applies if ITAAC are required.

2. For new reactor license applications submitted under Part 52, the applicant is required to (1) address the proposed technical resolution of unresolved safety issues (USIs) and medium- and high-priority generic safety issues (GSIs) that are identified in the version of NUREG-0933 current on the date 6 months before application and that 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). Reference: 10 CFR 52.47(a)(21), 10 CFR 52.47(a)(22) , and 10 CFR 52.47(a)(8), respectively. These cross-cutting review areas should be addressed by the reviewer for each technical subsection and relevant conclusions documented in the corresponding SER section.

3. The final safety analysis report (FSAR) is reviewed to verify whether the EDESS description and related diagrams clearly indicate the system functions for all modes of system operation, including the means for indicating, controlling, and monitoring the compressed starting air.

RTNSS B and C: applies.

4. The reviewer verifies whether essential portions of the system are protected from the effects of high-energy and moderate-energy line breaks. The system description and layout drawings are reviewed (if available) for whether no high-energy or moderate-energy piping systems are close to essential EDESS portions or for protection from the effects of failure. The means for such protection are in SAR Section 3.6, and the procedures for reviewing this information are in the corresponding DSRS sections.

   RTNSS B and C:applies.

5. The FSAR descriptive information, related system drawings, and results of failure modes and effects analyses are reviewed to verify whether minimum system requirements will be met following DBAs, assuming a concurrent single active component failure. For each case the design is acceptable if minimum system requirements are met.

   RTNSS B and C: applies, however failure modes and effects analyses are not performed.

6. The seismic design bases and the seismic and quality group classifications are reviewed by interfacing reviewers as indicated in Subsection I of this DSRS section. The primary reviewer verifies whether essential EDESS portions including the isolation valves separating essential and nonessential portions are classified Quality Group C and Seismic Category I. SAR component and system descriptions of mechanical and performance characteristics are reviewed to verify whether the appropriate seismic and quality group classifications are specified and whether the piping and instrumentation drawings correctly indicate any points of change at the system or system component interfaces.

   RTNSS B and C: applies as appropriate to the quality group and seismic classification of the SSCs, as determined by the guidance in SRP Section 19.3.

7. The reviewer establishes whether the EDESS description and P&IDs clearly delineate all modes of operation and include the means for monitoring, indicating, and controlling receiver air pressure as required by the engine starting service. The reviewer verifies the following:

   A. Provisions are made for inspection of components as shown on system layout drawings.

   B. A pressure gauge, relief valve, drain valve, automatic means of maintaining the receiver pressure within an allowable range, and suitable low pressure alarms are provided for the compressed air receiver(s).

   C. Failure in the piping interconnections between the dedicated air start systems can not lead to the loss of starting for more than one diesel engine.

   D. Each diesel engine air start system has its own compressor.

E. EDESS design precludes fouling of the air start valve or plugging of the air filter with moisture and contaminants like oil and rust carryover. Air dryers should be installed upstream of air receivers to remove entrained moisture.

RTNSS B and C: applies, however, the extent of the description provided in the SAR may be substantially less than that provided for a safety-related starting air system. A commitment to providing a starting air system in accordance with the diesel engine manufacturer's requirements and recommendations is acceptable.

8. The reviewer verifies whether the system function will be maintained as required in any failure of non-Seismic Category I SSCs near the system. Plant arrangement features and the protections obtained by location and the design of the system and structures are considered in determining the ability of the system to maintain functions in such failures.

   RTNSS B and C: does not apply directly since RTNSS B SSCs are considered risk-significant and RTNSS C SSCs support cold shutdown conditions. Testing and inservice inspection are elements of the reliability assurance program (RAP). Also, surveillance testing is done for items in the Availability Controls Manual. Alternative criteria are addressed in DSRS Section 19.3 on the programmatic requirements for RTNSS with respect to inspection and testing.

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

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

   RTNSS B and C: applies.

10. For review of both DC and COL applications, DSRS 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.

    RTNSS B and C: applies using a graded review approach for ITAAC, commensurate with the risk importance of the system functions and the level of confidence that the design requirement will be met. ITAAC are not necessarily required for RTNSS SSCs.

IV. <u>EVALUATION FINDINGS</u>

The reviewer verifies that the applicant has provided sufficient information and that the review and calculations (if applicable) support conclusions of the following type to be included in the staff's safety evaluation report. The reviewer also states the bases for those conclusions. The applicability of the evaluation findings to RTNSS B and RTNSS C starting air systems is described in italics. For nonsafety-related nonrisk-significant systems, nothing applies unless noted below.

The EDESS has an air compressor, air dryer(s), filters, valves, and all components and piping connecting to the engine interfaces necessary for the system to be available and capable of starting the diesel engine following a loss of offsite power. The scope of review of the system for the plant included layout drawings, flow diagrams, piping and instrumentation diagrams, and descriptive information for the EDESS and supporting systems essential to its operation. The essential EDESS portions necessary to shut down the reactor down safely or to mitigate the consequences of an accident are designed to comply with Seismic Category I and Quality Group C.

RTNSS B and C: applies. Seismic category and quality group classification are as required by SRP Section 19.3. The extent of the design information, including drawings, provided for RTNSS SSCs may be less than that provided for a safety-related EDESS.

The basis for EDESS acceptance in our review was compliance of the design criteria and bases with NRC regulations as stated in the GDCs of Appendix A to 10 CFR Part 50. The staff concludes that the design is acceptable and meets the requirements of GDCs 1, 2, 4, 5, and 17. This conclusion is based on the following findings *(the applicability of the GDCs and the corresponding findings that the design is acceptable and meets regulatory requirements should be in accordance with the general guidance in SRP Section 19.3 and the system-specific guidance in this DSRS Section 9.5.6)*:

1. The applicant meets the requirements of GDC 1, “Quality Standards and Records.” Acceptance is based on the SSCs important to safety as being designed, fabricated, erected, and tested to quality standards commensurate with the importance of the safety functions to be performed. Recognized codes and standards are identified and the staff evaluated them to determine their applicability, adequacy, and sufficiency. Appropriate records of the design, fabrication, erection, and testing of SSCs important to safety shall be maintained by or under the control of the nuclear power unit licensee throughout the life of the unit. The licensee quality assurance program is in accordance with the guidelines of Regulatory Guide (RG) 1.28, "Quality Assurance Program Requirements (Design and Construction)."

   RTNSS B and C: does not apply. The diesel starting air system should be in accordance with the manufacturers’ quality assurance programs for nonsafety-related nuclear plant SSCs. Revise the above paragraph to read:

   The applicant meets the regulatory requirements for the quality assurance program applied to the diesel starting air system SSCs. The system SSCs are designed, fabricated, erected, and tested to quality standards commensurate with the risk *importance of the system functions. Recognized codes and standards are identified and the staff evaluated them to determine their applicability, adequacy, and sufficiency.*

2. The applicant has met the requirements of GDC 2, "Design Bases for Protection Against Natural Phenomena," for the ability of structures housing the EDESS and the EDESS itself to withstand effects of natural phenomena like earthquakes, tornadoes, hurricanes, and floods, and GDC 4, "Environmental and Dynamic Effects Design Bases," for the ability of structures housing the system and the system itself to withstand the effects of externally- and internally-generated missiles, pipe whip, and jet impingement forces of pipe breaks. The EDESS is housed in a seismic Category I structure which protects against the effects of tornados, tornado missiles, turbine missiles, and floods. This protection meets the positions of RG 1.115, "Protection Against Low-Trajectory Turbine Missiles," Position C.1, and RG 1.117 "Tornado Design Classification," Appendix Position 13.

   RTNSS B and C: Designed to withstand the effects of external hazards should be as required by SRP Section 19.3 and the evaluation finding should be worded accordingly.

3. The applicant has met the requirements of GDC 5, "Sharing of Structures, Systems, and Components," for the capability of shared systems and components important to safety to perform required safety functions. Each unit of the plant has its own emergency diesel generators, each with an EDESS not shared between other diesel generators.

   RTNSS B and C: does not apply.

4. The applicant has met the requirements of GDC 17, "Electric Power Systems," for the ability of the air starting system to meet independence and redundancy criteria. Each EDESS is independent and physically separated from the other system serving the redundant diesel generator(s). A single failure in any one of the systems will affect only its own diesel generator. Each of the starting systems can crank a cold diesel engine five times without air receiver recharging. The applicant has also met the applicable positions of NUREG/CR-0660, "Enhancement of Onsite Emergency Diesel Generator Reliability."

   RTNSS B and C: applies to the extent that the system design ensures an appropriate level of performance, reliability and availability, assuming a single active failure. The number of times the system can crank a cold diesel engine may be reduced to three.

The staff concludes that the EDESS design complies with all applicable GDCs, regulatory guide positions cited, NUREG/CR-0660 as applicable, staff positions, and industry standards and is therefore acceptable.

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 design certification (DC), or combined license (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 (SMR) 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 Standard Review Plan (SRP) revision in effect 6 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, "Domestic Licensing of Production and Utilization Facilities.”

2. 10 CFR Part 52, “Early site permits; standard design certifications; and combined licenses for nuclear power plants.”

3. RG 1.28, "Quality Assurance Program Criteria (Design and Construction)."

4. RG 1.29, “Seismic Design Classification.”

5. RG 1.68, “Initial Test Programs for Water-Cooled Nuclear Power Plants.”

6. RG 1.115, "Protection Against Low-Trajectory Turbine Missiles."

7. RG 1.117, "Tornado Design Classification."

8. RG 1.160, “Monitoring the Effectiveness of Maintenance at Nuclear Power Plants.”

9. RG 1.182, “Assessing and Managing Risk Before Maintenance Activities at Nuclear Power Plants.”

10. RG 1.215, “Guidance for ITAAC Closure Under 10 CFR Part 52.”

11. NUREG/CR-0660, "Enhancement of Onsite Emergency Diesel Generator Reliability.," University of Dayton Research Institute; UDR-TR-79-07; February 1979.