U.S. NUCLEAR REGULATORY COMMISSION

DESIGN-SPECIFIC REVIEW STANDARD FOR NuScale SMR DESIGN

3.3.2 EXTREME WIND LOADS (TORNADO AND HURRICANE LOADS)

REVIEW RESPONSIBILITIES

Primary - Organization responsible for structural analysis reviews

Secondary - None

I. AREAS OF REVIEW

The following areas are related to the design of structures that must withstand the effects of the specified design-basis tornado and hurricane for the plant. These areas are reviewed to ensure conformance with Title 10 of the *Code of Federal Regulations* (10 CFR), Part 50, Appendix A, General Design Criterion (GDC) 2.

The specific areas of review are as follows:

1. The design parameters applicable to the tornado, including the tornado wind translational and rotational speeds; the tornado-generated atmospheric pressure change; and the spectrum of tornado-generated missiles, including their characteristics, from the standpoint of use in defining the input parameters for the structural design criteria appropriate to account for tornado loads.

2. The procedures that are used to transform tornado parameters into effective loads on structures, including the following:

   A. The transformation of tornado wind into equivalent loads applied to structures, taking into consideration the geometrical configuration and physical characteristics of the structures and the distribution of tornado wind pressure on structures.

   B. The transformation of tornado-generated atmospheric pressure changes into applied loads on structures.

   C. The transformation of tornado-generated missiles, which are impactive dynamic loads, into equivalent loads on structures.

   D. The combination of the above individual loads in a manner that will produce the most adverse total tornado effect on structures.

3. The design hurricane parameters, including maximum wind speed and the spectrum of hurricane-generated missiles, including their characteristics to be used in defining the hurricane loads as part of input to the structural design.

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4. The procedure used to transform hurricane parameters into effective loads on structures, including the following:

   A. The transformation of hurricane wind into equivalent pressure loads onto structures, taking into consideration the geometric configuration and physical characteristics of the structures and the distribution of hurricane wind pressure on structures.

   B. The transformation of hurricane-generated missiles induced impactive dynamic loads into equivalent loads on structures.

   C. The combination of the above individual loads in such a manner that will produce the most adverse total hurricane effect on structures.

5. The information provided to demonstrate that failure of any structure or component not designed for both tornado and hurricane loads will not affect the capability of other structures or components to perform necessary safety functions.

6. Regulatory treatment of non-safety systems (RTNSS) “B” structures, systems and components (SSCs) relied upon for maintaining key safety functions after 72 hours following the onset of postulated accidents should be protected from the effects of the design basis tornado and hurricane, which are addressed in this Design Specific Review Standard (DSRS) section. Selection of RTNSS “B” SSCs and compliance with other augmented design standards are reviewed under Standard Review Plan (SRP) Section 19.3 and other applicable DSRS sections.

7. 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 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.

8. 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.

9. Extreme Wind Loads and Associated Missile Impact Effects for NuScale Applications

   The specific areas of review items 1 through 8 discussed above are generally applicable provided that unique NuScale design features and containment configurations as described below are adequately accounted for in the review.

The NuScale light-water Small Modular Reactor (SMR) includes a small-size reactor inside a tightly conforming containment, underground in a below-grade water-filled reactor pool within the reactor building with up to 12 total reactor modules. A refueling bay and the spent fuel pool are also parts of the reactor pool structure and the reactor/containment modules are moved to this area for refueling and spent fuel storage. A reactor building and turbine generator building complex sits above the reactor pool. This DSRS section determines the extreme design basis wind loads and associated missile impact effects for all Seismic Category I structures.

Review Interfaces

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

1. The adequacy of the most severe regional and local meteorological data used to specify design basis tornado and design basis hurricane load parameters for SSCs that may be affected by weather phenomena is reviewed in accordance with SRP Sections 2.3.1 and 2.3.2.

2. The adequacy of the design-basis tornado and hurricane-generated missile spectrum is reviewed in according with DSRS Section 3.5.1.4.

3. Review of the description and results of the probabilistic risk assessment is performed under SRP 19.0 and RTNSS, for passive advanced light water reactors, is reviewed under SRP Section 19.3 and those DSRS sections that address specific non-safety SSCs within the scope of RTNSS.

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

The adequacy of procedures used to determine tornado-generated atmospheric pressure change effects on partially enclosed structures are reviewed on a case-by-case basis.

II. ACCEPTANCE CRITERIA

Requirements

1. 10 CFR 50, Appendix A, GDC 2 requires that SSCs important to safety shall be designed to withstand the effects of natural phenomena such as earthquakes, tornados, hurricanes, tsunami, floods, and seiches without loss of capability to perform their safety functions as it relates to natural phenomena. The design bases for these SSCs shall reflect appropriate combinations of the effects of normal and accident conditions with the effects of the natural phenomena.

2. 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 plant that incorporates the design certification is built and will operate in accordance with the design certification, the provisions of the Atomic Energy Act (AEA), and the U.S. Nuclear Regulatory Commission (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.

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. As an alternative, and as described in more detail below, an applicant may identify the differences between a DSRS section and the design features (DC and COL applications only), analytical techniques, and procedural measures proposed in an application and discuss how the proposed alternative provides an acceptable method of complying with the NRC regulations that underlie the DSRS acceptance criteria.

1. The tornado or hurricane wind and associated missiles generated by the tornado or hurricane wind used in the design should be the most severe tornado or hurricane wind that has been historically reported for the site and surrounding area with sufficient margin for the limited accuracy, quantity, and period of time in which historical data have been accumulated.

2. The acceptance criteria for the design basis tornado parameters (including maximum wind speed, translational speed, rotational speed, and atmospheric pressure change) and the design basis hurricane parameters and the bases for determining these parameters are defined in SRP Sections 2.3.1 and 2.3.2. Acceptance criteria for the spectrum of tornado and hurricane-generated missiles and their characteristics, as well as the bases for determining these parameters, are defined in DSRS Section 3.5.1.4. These parameters should serve as basic input to the review and evaluation for structural design.

3. The acceptance criteria for procedures used to translate tornado parameters and hurricane parameters into equivalent loads on structures are as follows (subparagraphs A through E apply to tornadoes and subparagraphs F through I apply to hurricanes):

   A. Tornado Characteristics and Effects

      Tornados are characterized, in Table 1 of Regulatory Guide (RG) 1.76 for the contiguous United States into three geographical regions and by (1) maximum wind speed, (2) translational speed, (3) maximum rotational speed, (4) radius of maximum rotational speed, (5) pressure drop, and (6) rate of pressure drop for each of the three regions. Tornado effects are subdivided into three groups:

      i. Tornado wind effects caused by the direct action of air flow on structures,

      ii. Atmospheric pressure change effects caused by the differential pressure between the interior and exterior of a structure during the passage of a tornado, and

      iii. Tornado-generated missile impact effects.

Tornado effects considered in design should include combinations of tornado wind effects, atmospheric pressure change effects, and tornado-generated missile impact effects.

B. Tornado Wind Effects

Procedures delineated in American Society of Civil Engineers/ Structural Engineering Institute (ASCE/SEI) 7-05,"Minimum Design Loads for Buildings and Other Structures," are acceptable for transforming tornado wind speed into pressure-induced forces applied to structures. In particular, the following shall apply:

i. The maximum velocity pressure, q_z, should be based on the applicable maximum tornado wind speed, V, using the following equation from ASCE/SEI 7-05, Section 6.5.10:

$$q_z = 0.00256\, K_z K_{zt} K_d V^2 I \ (lb/ft^2)$$

Where:

K_z = velocity pressure exposure coefficient equal to 0.87
K_{zt} = topographic factor equal to 1.0
K_d = wind directionality factor equal to 1.0
V = maximum tornado wind speed (mi/h)
I = importance factor equal to 1.15

The maximum tornado wind speed, V, is the resultant of the maximum rotational speed and the translational speed of the tornado.

ii. Wind speed is assumed not to vary with the height above ground.

iii. Design tornado wind loads should be determined in accordance with the following sections in ASCE/SEI 7-05, as applicable.

(1) 6.5.12 Design Loads on Enclosed and Partially Enclosed Buildings

(2) 6.5.13 Design Wind Loads on Open Buildings with Monoslope, Pitched, or Troughed Roofs

(3) 6.5.14 Design Wind Loads on Solid Freestanding Walls and Solid Signs

(4) 6.5.15 Design Wind Loads on Other Structures

C. Atmospheric Pressure Change Effects

RG 1.76 provides guidance for determining the pressure drop and the rate of pressure drop caused by the passage of a tornado. "Wind Effects on Structures: Fundamentals and Applications to Design," (Third Edition, John Wiley and Sons, Inc., New York, 1996.) by E. Simiu and R. H. Scanlan, provides methods for determining loads on structures due to atmospheric pressure changes during the passage of a tornado.

For a structure that is completely open subjected to a tornado, the internal and external pressures on the structure equalize rapidly during the passage of the tornado. Therefore, the atmospheric pressure change between the interior and the exterior of that structure approaches zero.

For a structure that is enclosed (unvented structure), the internal pressure remains equal to the atmospheric pressure before the passage of a tornado. The atmospheric pressure outside the structure changes during the passage of a tornado, which creates pressure differences between the interior and the exterior of that structure, and these differential pressures produce outward acting loads on the roof and walls of the enclosed structure.

For a structure that is partially enclosed (vented structure), the determination of loads on the structure due to atmospheric pressure changes during the passage of a tornado is more complicated. If venting is adopted as a way to reduce the atmospheric pressure change effect on a structure, the review will be performed on a case-by-case basis.

D. Tornado-Generated Missile Impact Effects

Tornado-generated missile characteristics and the design-basis tornado missile spectrum are provided in RG 1.76. The acceptance criteria for transforming tornado-generated missile impact into equivalent static loads on structures are delineated in DSRS Section 3.5.3, subsection II.

E. Combined Tornado Effects

After tornado-generated wind effects, W_w, atmospheric pressure change effects, W_p, and missile impact effects, W_m, are determined, the combination thereof should then be established in a conservative manner for structures. An acceptable method of combining these effects and establishing the total tornado load on a structure is as follows:

$$W_t = W_p \qquad \text{Eq. 1}$$

$$W_t = W_w + 0.5\, W_p + W_m \qquad \text{Eq. 2}$$

where:

W_t = total tornado load
W_w = load from tornado wind effect
W_p = load from tornado atmospheric pressure change effect

W_m = load from tornado missile impact effect

F. Hurricane Characteristics and Effects

Hurricanes are characterized in RG 1.221 for the contiguous United States (except for the Pacific coast). Hurricane effects are subdivided into two groups:

i. Hurricane wind effects caused by the direct action of air flow on structures, and

ii. Hurricane-generated missile impact effects.

Hurricane effects considered in design should include combinations of hurricane wind effects and hurricane-generated missile impact effects.

G. Hurricane Wind Effects

Procedures delineated in ASCE/SEI 7-05 similar to that for severe wind effects described in Acceptance Criteria II.3 in DSRS Section 3.3.1 are acceptable for transforming hurricane wind speed into an equivalent pressure to be applied to structures.

H. Hurricane-Generated Missile Impact Effects

Hurricane-generated missile characteristics and the design-basis hurricane missile spectrum are provided in RG 1.221. The acceptance criteria for transforming hurricane-generated missile impact into equivalent static loads on structures are delineated in DSRS Section 3.5.3, Subsection II.

I. Combined Hurricane Effects

After hurricane-generated wind effects, Wwh, and missile impact effects, Wmh, are determined, the combination thereof should then be established in a conservative manner for structures. An acceptable method of combining these effects and establishing the total hurricane load on a structure is as follows:

$$W_{th} = W_{wh} + W_{mh} \qquad \text{Eq. 3}$$

where:

W_{th} = total hurricane load
W_{wh} = load from hurricane wind effect
W_{mh} = load from hurricane missile impact effect

4. The information provided to demonstrate that failure of any structure or component not designed for tornado and hurricane loads will not affect the capability of other SSCs to perform necessary safety functions, is acceptable if found in accordance with either of the following:

   A. The postulated failure or collapse of structures and components not designed for tornado and hurricane loads, including missiles, can be shown not to result in any structural or other damage to safety-related structures, systems, or components.

   B. Safety-related structures are designed to resist the effects of the postulated structural failure, collapse, or generation of missiles from structures and components not designed for tornado and hurricane loads.

5. The staff will evaluate and verify that RTNSS "B" SSCs are protected from or designed to withstand the effects of the design-basis tornado and hurricane and associated tornado- and hurricane-borne missiles without loss of capability to perform their intended safety functions following guidance in RG 1.76 and RG 1.221 respectively.

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:

1. Compliance with GDC 2 requires that nuclear power plant SSCs and important to safety shall be designed to withstand the effects of natural phenomena such as earthquakes, tornadoes, hurricanes, floods, tsunami, and seiches without loss of capability to perform their intended safety functions.

2. The acceptance criteria outlined above include references to industry standards and data for evaluating tornado and hurricane loads on structures. These standards and data have been reviewed by the staff and found to be acceptable.

3. Meeting the requirements of GDC 2 provides assurance that and SSCs important to safety and subject to tornado and hurricane effects will be designed to withstand the extreme loads from the design basis tornado and design basis hurricane without loss of capability to perform their intended safety functions.

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.

1. Selected Programs and Guidance - In accordance with the guidance in NUREG-0800, "Introduction - Part 2: Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants: Integral Pressurized Water Reactor Edition" (NUREG-0800 Intro Part 2) as applied to this DSRS Section, the staff will review the information

proposed by the applicant to evaluate whether it meets the acceptance criteria described in Subsection II of this DSRS. As noted in NUREG-0800 Intro Part 2, the NRC requirements that must be met by an SSC do not change under the SMR framework. Using the graded approach described in NUREG-0800 Intro Part 2, the NRC staff may determine that, for certain structures, systems, and components (SSCs), the applicant's basis for compliance with other selected NRC requirements may help demonstrate satisfaction of the applicable acceptance criteria for that SSC in lieu of detailed independent analyses. The design-basis capabilities of specific SSCs would be verified where applicable as part of completion of the applicable ITAAC. The use of the selected programs to augment or replace traditional review procedures is described in Figure 1 of NUREG-0800, Introduction - Part 2. Examples of such programs that may be relevant to the graded approach for these SSCs include:

- 10 CFR Part 50, Appendix A, General Design Criteria (GDC), Overall Requirements, Criteria 1 through 5
- 10 CFR Part 50, Appendix B, Quality Assurance (QA) Program
- 10 CFR 50.49, Environmental Qualification of Electrical Equipment (EQ) Program
- 10 CFR 50.55a, Code Design, Inservice Inspection and Inservice Testing (ISI/IST) Programs
- 10 CFR 50.65, Maintenance Rule requirements
- Reliability Assurance Program (RAP)
- 10 CFR 50.36, Technical Specifications
- Availability Controls for SSCs Subject to Regulatory Treatment of Non-Safety Systems (RTNSS)
- Initial Test Program (ITP)
- Inspections, Tests, Analyses, and Acceptance Criteria (ITAAC)

This list of examples is not intended to be all-inclusive. It is the responsibility of the technical reviewers to determine whether the information in the application, including the degree to which the applicant seeks to rely on such selected programs and guidance, demonstrates that all acceptance criteria have been met to support the safety finding for a particular SSC.

2. In accordance with 10 CFR 52.47(a)(8),(21), and (22), and 10 CFR Part 52.79(a)(17), (20) and (37) 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 that are identified in the version of NUREG-0933 current on the date six 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). 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. Sections 2.3.1 and 2.3.2. The spectrum and characteristics of tornado and hurricane missiles described in Review Interfaces, Subsection 2, are reviewed in accordance with DSRS Section 3.5.1.4. Tornado-generated atmospheric pressure change effects for partially enclosed structures described in Review Interfaces, are reviewed on a case-by-case basis.

4. After the acceptability of the site-related parameters is established, the reviewer proceeds to review the structural aspects of tornado and hurricane design in the following manner:

   A. The procedures used by the applicant to transform tornado and hurricane wind effects into design loads for structures are reviewed and compared with the procedures delineated in ASCE/SEI 7-05 and, in particular, with the acceptance criteria delineated in this DSRS Acceptance Criteria, subsection 3.B through 3.E for tornadoes and 3.G through 3.I for hurricanes.

   B. The procedures used by the applicant to transform tornado-generated atmospheric pressure change effects into design loads for open and enclosed structures are reviewed and compared with the procedures described in this DSRS Acceptance Criteria, subsection 3.C. The procedures used by the applicant to transform tornado-generated atmospheric pressure change effects into loads for partially enclosed structures are reviewed on a case-by-case basis.

   C. The review procedures for missiles generated by tornadoes and hurricanes are described in DSRS Section 3.5.1.4. The review procedures for design of missile barriers are described in DSRS Section 3.5.3.

5. The information provided to demonstrate that failure of any structure or component not designed for tornado and hurricane loads will not affect the capability of other SSCs to perform necessary safety functions is reviewed.

6. 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).

   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.

IV. EVALUATION FINDINGS

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 applicant has met the requirements of GDC 2 with respect to the capability of structures to withstand design-basis tornado and design-basis hurricane wind effects, tornado-

generated atmospheric pressure change effects, and tornado and hurricane-generated missile impact effects so that their design reflects:

1. Appropriate consideration for the most severe tornado and hurricane recorded for the site with an appropriate margin;

2. Appropriate combinations of the effects of normal and accident conditions with the effects of the natural phenomena; and

3. The importance of the safety function to be performed.

The applicant has designed the plant structures with sufficient margin to prevent structural damage during the design-basis tornado and design-basis hurricane loadings predicted for the site so that the requirements in item 1 listed above are met. In addition, the design of seismic Category I structures, as required in item 2 listed above, has included load combinations of the extreme environmental loads resulting from the design-basis tornado and the design-basis hurricane and the loads resulting from normal and accident conditions.

The procedures used to determine the loadings on structures induced by the design-basis tornado and the design-basis hurricane specified for the plant are acceptable because these procedures have been used in the design of conventional structures and proven to provide a conservative basis which together with other engineering design considerations ensures that the structures can withstand such environmental forces.

The use of these procedures provides reasonable assurance that in the event of a design-basis tornado or design-basis hurricane, the structural integrity of the plant structures that have to be designed for tornadoes and hurricanes will not be impaired and, in consequence, safety-related systems and components located within these structures will be adequately protected and may be expected to perform necessary safety functions as required, thus satisfying the requirement in item 3 listed above.

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 regulations in 10 CFR 52.17(a)(1)(xii), 10 CFR 52.47(a)(9), and 10 CFR 52.79(a)(41) establish requirements for applications for ESPs, DCs, and COLs, respectively. These regulations require the application to include an evaluation of the site (ESP), standard plant design (DC), or facility (COL) against the Standard Review Plan (SRP) revision in effect six months before the docket date of the application. While the SRP provides generic guidance, the staff developed the SRP guidance based on the staff's experience in reviewing applications for construction permits and operating licenses for large light-water nuclear power reactors. The proposed small modular reactor (SMR) designs, however, differ significantly from large light-water nuclear reactor power plant designs.

In view of the differences between the designs of SMRs and the designs of large light-water power reactors, the Commission issued 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) (SRM). In the SRM, the Commission directed the staff to develop risk-informed licensing review plans for each of the SMR design reviews, including plans for the associated pre-application activities. Accordingly, the staff has developed the content of the DSRS as an alternative method for the evaluation of a NuScale-specific application submitted pursuant to 10 CFR Part 52, and the staff has determined that each application may address the DSRS in lieu of addressing the SRP, with specified exceptions. These exceptions include particular review areas in which the DSRS directs reviewers to consult the SRP and others in which the SRP is used for the review. If an applicant chooses to address the DSRS, the application should identify and describe all differences between the design features (DC and COL applications only), analytical techniques, and procedural measures proposed in an application and the guidance of the applicable DSRS section (or SRP section as specified in the DSRS), and discuss how the proposed alternative provides an acceptable method of complying with the regulations that underlie the DSRS acceptance criteria.

The staff has accepted the content of the DSRS as an alternative method for evaluating whether an application complies with NRC regulations for NuScale SMR applications, provided that the application does not deviate significantly from the design and siting assumptions made by the NRC staff while preparing the DSRS. If the design or siting assumptions in a NuScale application deviate significantly from the design and siting assumptions the staff used in preparing the DSRS, the staff will use the more general guidance in the SRP as specified in 10 CFR 52.17(a)(1)(xii), 10 CFR 52.47(a)(9), or 10 CFR 52.79(a)(41), depending on the type of application. Alternatively, the staff may supplement the DSRS section by adding appropriate criteria in order to address new design or siting assumptions.

VI. REFERENCES

1. 10 CFR Part 20, "Standards for Protection Against Radiation."

2. 10 CFR Part 50, "Domestic Licensing of Production and Utilization Facilities."

3. 10 CFR Part 52, "Early Site Permits; Standard Design Certifications; and Combined Licenses for Nuclear Power Plants."

4. GDC 61, "Fuel Storage and Handling and Radioactivity Control."

5. GDC 19, "Control Room."

6. GDC 4, "Environmental and Dynamic Effects Design Bases."

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

8. RG 1.112, "Calculations of Releases of Radioactive Materials in Gaseous and Liquid Effluents from Light-Water-Cooled Power Reactors."

9. RG 1.183, "Alternative Radiological Source Terms for Evaluating Design Basis Accidents at Nuclear Power Reactors."

10. ANSI/ANS Standard 18.1-1999, “Source Term Specification,” American National Standards Institute/American Nuclear Society.”

11. NUREG-0737, “Clarification of TMI Action Plan Requirements.”

12. 40 CFR Part 190, “Environmental Radiation Protection Standards For Nuclear Power Operations.”

13. RG 1.89, “Environmental Qualification of Certain Electric Equipment Important to Safety for Nuclear Power Plants.”

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

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

16. RG 1.29, “Seismic Design Classification.”

17. RG 1.117, “Tornado Design Classification.”

18. RG 1.206, “Combined License Applications for Nuclear Power Plants (LWR Edition).”

19. EPRI, “Pressurized Water Reactor Primary Water Chemistry Guidelines.”

20. EPRI, “Pressurized Water Reactor Primary Water Zinc Application Guidelines.”

21. EPRI, “Advanced Light Water Reactor Utility Requirements Document, Volume III, ALWR Passive Plant.”

22. NUREG-1242, “NRC Review of Electric Power Research Institute's Advanced Light Water Reactor Utility Requirements Document, Passive Plant Designs” Volume 3, Part 1 and Volume 3, Part 2 (ADAMS Accession Nos. ML070600372 and ML070600373).

23. EPRI, “Cobalt Reduction Guidelines.”

24. RG 8.8, “Information Relevant to Assuring that Occupational Radiation Exposures at Nuclear Power Stations Will Be as Low as is Reasonably Achievable.”