U.S. NUCLEAR REGULATORY COMMISSION

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

2.4.5 SURGE AND SEICHE FLOODING

REVIEW RESPONSIBILITIES

Primary - Organization responsible for the review of issues related to hydrology

Secondary - None

I. AREAS OF REVIEW

In this section of the Design-Specific Review Standard (DSRS), the geophysical and hydraulic design basis is developed to ensure that any potential hazard to the safety-related or risk-significant structures, systems, and components (SSCs) due to the effects of surge and seiche are considered in plant design.

This section is part of Chapter 2 of the DSRS, which discusses the site characteristics that could affect the safe design and siting of the plant. The staff reviews information presented by the applicant for a design certification (DC), early site permit (ESP), or combined license (COL) concerning hydrologic setting of the site as they relate to safety-related or risk-significant SSCs. This DSRS section applies to reviews performed for each of these types of applications. These reviews are based on information and analysis presented in the applicant's final safety analysis report (FSAR). The staff's review and findings are described in the appropriate section of the final safety evaluation report (FSER).

The U.S Nuclear Regulatory Commission (NRC) staff's review of the FSAR covers the following specific areas:

1. Simulated Hurricane (SH). A hypothetical tropical cyclone (Hurricane) generated by a combination of meteorological storm parameters considered reasonably possible for the region involved. The simulated hurricanes approach the nuclear power plant site along multiple paths and rates of movement.

2. Simulated Wind Storm (SWS). A hypothetical extratropical cyclone or a moving squall line generated using a combination of meteorological parameters considered reasonably possible for the region involved. The SWS approaches the nuclear power plant site along multiple paths and rates of movement.

3. Design Basis Storm Surge (DBSS). The most adverse storm surge flooding at the nuclear power plant site caused by a SWS or SH due to a combination of severe meteorological storm parameters, critical paths, and rates of movement[1].

[1] DBSS was referred to as Probable Maximum Storm Surge (PMSS) in NUREG/CR 7046.

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4. Seiche and Resonance. Seiche[2] near the site and the potential for seiche wave oscillations at natural periodicity of a water body that may affect flood water surface elevation near the site or cause low water surface elevation affecting water supplies to SSCs that are safety-related or risk-significant.

5. Wave Runup. Wind-induced wave runup under DBSS wind conditions.

6. Effects of Sediment Erosion and Deposition. Effects of sediment erosion and deposition during storm surge and seiche-induced waves that may result in blockage or loss of function of SSCs that are safety-related or risk-significant. The potential effects of sediment erosion and deposition on the site drainage system and its conveyance capacity should be considered. Effects of erosion on local groundwater recharge properties need to be addressed depending on the duration and extent of flooding and erosion.

7. Consideration of Other Site-Related Evaluation Criteria. The potential effects of seismic (including the effects of potential land subsidence) and non-seismic information on the postulated design bases and how they relate to surge and seiche in the vicinity of the site and the site region.

8. Additional Information for Title 10 of the *Code of Federal Regulations* (10 CFR), Part 52 Applications. Additional information will be presented dependent on the type of application. For a COL application, the additional information is dependent on whether the application references an ESP, a DC, both, or neither. Information requirements are prescribed within the "Contents of Application" sections of the applicable Subparts to 10 CFR Part 52.

Review Interfaces

Other DSRS or Standard Review Plan (SRP) sections interface with this section as follows:

1. Sections 2.4.0, 2.4.2 – 2.4.4 and 2.4.6 – 2.4.9 address the flood-producing phenomena individually and in combination to determine the design-basis flood.

2. Tsunamis, which may cause seiching, are reviewed in DSRS Section 2.4.6.

3. Flooding protection measures, if required for SSCs that are safety-related or risk-significant, are reviewed in DSRS Section 2.4.10.

4. DSRS Section 2.4.12 "Groundwater" considers the effects of design basis flood elevation and erosion/deposition on subsurface hydraulic heads.

5. The review to ensure that adverse environmental conditions, including those from loss of water due to seiching or blockage from sedimentation, will not preclude the safety

[4] Seiche is an extreme sloshing of an enclosed or partially enclosed body of water excited by meteorological causes (e.g., barometric fluctuations, storm surges, and variable winds), interaction of wave trains with geometry and bathymetry of the water body (e.g., from tsunamis), and seismic causes (e.g., a local seismic displacement resulting in sloshing of the water body).

function of the ultimate heat sink is performed under DSRS Section 9.2.5, "Ultimate Heat Sink."

6. The organization responsible for issues related to geoscience and geotechnical engineering provides information regarding local seismic displacement that may result in sloshing of an entire water body and causing a seiche accompanied by potential land subsidence.

7. For DC applications and COL applications referencing a DC rule or DC application, review of the site parameters in the Design Control Document (DCD) Tier 1 and Chapter 2 of the DCD Tier 2[3] submitted by the applicant is performed under SRP Section 2.0, "Site Characteristics and Site Parameters." Review of site characteristics and site-related design parameters in ESP applications or in COL applications referencing an ESP is also performed under SRP Section 2.0.

The specific acceptance criteria and review procedures are contained in the referenced DSRS or SRP 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) 2, as it relates to consideration of the most severe of the natural phenomena that have been historically reported for the site and surrounding area, with sufficient margin for the limited accuracy, quantity, and period of time in which the historical data have been accumulated.

2. 10 CFR Part 50, Appendix A, GDC 4, as it relates to the effect of events and conditions outside the nuclear power unit on SSCs important to safety. For mPower™ reactors, GDC 4 is also assumed to include risk-significant SSCs as identified in DSRS Section 3.2.2.

3. 10 CFR 52.17(a)(1)(vi), for ESP applications, and 10 CFR 52.79(a)(1)(iii), for COL applications, as they relate to identifying hydrologic site characteristics with appropriate consideration of the most severe of the natural phenomena that have been historically reported for the site and surrounding area and with sufficient margin for the limited accuracy, quantity, and period of time in which the historical data have been accumulated.

4. 10 CFR 50, Appendix A, GDC 44, as it relates to providing an ultimate heat sink for normal operating and accident conditions.

5. 10 CFR Part 100, as it relates to identifying and evaluating hydrologic features of the site. The requirements to consider physical site characteristics in site evaluations are specified in 10 CFR 100.20(c).

[5] Additional supporting information of prior DC rules may be found in DCD Tier 2 Section 14.3.

6. 10 CFR 100.23(d) sets forth the criteria to determine the siting factors for plant design bases with respect to seismically-induced floods and water waves at the site.

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 intent of 10 CFR 52.47(a)(9), "Contents of applications; technical information." The same approach may be used to meet the requirements of 10 CFR 52.17(a)(1)(xii) and 10 CFR 52.79(a)(41), for ESP and COL applications, respectively.

Appropriate sections of the following Regulatory Guides (RGs) are used by the staff for the identified acceptance criteria.

RG 1.27 describes the applicable ultimate heat sink capabilities.

RG 1.29 identifies seismic design bases for safety-related or risk-significant SSCs.

RG 1.59, as supplemented by best current practices, provides guidance for developing the flood design bases.

RG 1.102 describes acceptable flood protection to prevent the safety-related or risk-significant facilities from being adversely affected.

1. Design Basis Storm Surge. To meet the requirements of General Design Criterion (GDC) 2, 10 CFR 52.17, and 10 CFR Part 100, estimates of the most adverse storm surge induced by hurricanes, extratropical and squall lines is needed. The storm surge induced by the hurricanes, extratropical cyclones and squall lines should be estimated as recommended by RG 1.59, supplemented by current best practices.

2. Seiche and Resonance. To meet the requirements of GDC 2, 10 CFR 52.17, and 10 CFR Part 100, estimates of seiche and resonance in water bodies induced by meteorological causes, tsunamis, and seismic causes are needed. An analysis of the interaction of seiche waves with the geometry of the water body should be carried out to determine if an amplification of wave heights due to oscillations at the natural periodicity of the water body is possible. An estimate of the minimum water surface elevation during the seiche activity should be provided to evaluate if water supply to safety-related or risk-significant SSCs may be affected.

3. Wave Runup. To meet the requirements of GDC 2, 10 CFR 52.17, and 10 CFR Part 100, an estimate of wind-induced wave runup under DBSS wind conditions is needed. Wave runup can be estimated directly from some numerical surge models or by a method recommended by the U.S. Army Corps of Engineers (USACE) Coastal Engineering Manual.

4. Effects of Sediment Erosion and Deposition. To meet the requirements of GDC 2, 10 CFR 52.17, and 10 CFR Part 100, an assessment of loss of safety-related or

risk-significant functionality of SSCs caused by blockages or damage due to sediment deposition or erosion during the storm surge or seiching is needed. If a hazard to SSCs that are safety-related or risk-significant exists from sediment erosion and deposition, it should be documented and included in the design bases of these SSCs.

5. Consideration of Other Site-Related Evaluation Criteria. The potential effects of site-related proximity, seismic (including the effects of potential land subsidence), and non-seismic information as they relate to flooding and loss of water supply to safety-related or risk-significant SSCs due to surge and seiche adjacent to the plant site and site regions are needed to meet the requirements of GDC 2, 10 CFR 52.17, and 10 CFR Part 100.

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 important to safety be designed to withstand the effects of natural phenomena such as earthquake, tornado, hurricane, flood, tsunami, and seiche without loss of capability to perform their safety functions. The criterion further specifies that the design bases for these SSCs shall reflect the following:

   A. Appropriate consideration of the most severe natural phenomena historically reported for the site and surrounding area, with sufficient margin for the limited accuracy, quantity, and time period in which the historical data have been accumulated;

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

   C. The importance of the safety functions to be performed.

   The first specification was adopted in recognition of the relatively short history available for severe natural phenomena (e.g., floods) on the North American continent and, when based on probabilistic considerations only, the potential for underestimating the severity of such events. This problem can be avoided by using a deterministic approach to assess design basis events. Such an approach will account for the practical physical limitations of natural phenomena that contribute to the severity of a given event.

   This criterion is applicable to DSRS Section 2.4.5 in that it specifies the hydrologic phenomenon (i.e., surge and seiche flooding) addressed in this section. In general terms, it also specifies the level of conservatism that should be used to assess the severity of PMS and seiche flooding for the purpose of determining the design bases for SSCs that are safety-related or risk-significant.

   For applications pursuant to 10 CFR Part 52, meeting the applicable requirements of 10 CFR 52.17 and 10 CFR 52.79 that correspond to GDC 2 provides a level of assurance that the most severe hydrologic site characteristics have been identified; whether GDC 2 is met with respect to the adequacy of the associated design bases will be evaluated pursuant to other DSRS sections.

2. Sections 100.20(c) of 10 CFR Part 100 requires that the site's physical characteristics (including seismology, meteorology, geology, and hydrology) be taken into account when determining its acceptability for a nuclear power reactor.

   To satisfy the hydrologic requirements of 10 CFR Part 100, the applicant's FSAR should contain a description of the surface and subsurface hydrologic characteristics of the region and an analysis of the potential for flooding due to surges or seiches. This description should be sufficient to assess the acceptability of the site and the potential for a surge or seiche to influence the design of plant SSCs that are safety-related or risk-significant.

   Meeting this requirement provides a level of assurance that safety-related or risk-significant plant SSCs have been designed to withstand the most severe flooding likely to occur as a result of storm surges or seiches[4].

III. REVIEW PROCEDURES

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

The procedures outlined below are used to review ESP applications, and COL applications that do not reference an ESP to determine whether data and analyses for the proposed site meet the acceptance criteria given in Subsection II of this DSRS section. As applicable, reviews COLs include a determination on whether the content of technical specifications related to hydrology-related site characteristics are acceptable and whether the technical specifications reflect consideration of any identified unique conditions.

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. In accordance with 10 CFR 52.47(a)(8),(21), and (22), 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). These cross-cutting review areas should be addressed by the reviewer for each technical subsection and relevant conclusions documented in the corresponding FSER section.

2. Design Basis Storm Surge. This section of the FSAR may also state with justification that storm surge estimates are not necessary to identify the design basis flood (e.g., the site is not near a large body of water).

[4] As and when it becomes available, additional guidance related to surge and seiche flooding analysis is to be used

All reasonable combinations of severe hurricane, moving squall line, or other cyclonic wind storm parameters are investigated, and the most critical combination is selected for use in estimating a water level. The staff uses data and methods recommended by the USACE and the National Oceanic and Atmospheric Administration (NOAA) to evaluate an applicant's analysis of the wind parameters and storm surge near the site. Methods for estimating these parameters are provided in Section VI (References).

Detailed descriptions of bottom profiles are used in the staff's independent estimate of surge levels. Models used to estimate surge hydrographs should have been previously peer-reviewed and published in the relevant technical literature.

Ambient water levels, including tides and sea level rise, are estimated using NOAA, USACE, and other publications. Data from publications of NOAA, USACE, and other sources (such as tide tables, tide records, and historical lake level records) are used to substantiate antecedent water levels. These antecedent water levels should be as high as the "10 percent exceedance" monthly spring high tide, plus an initial rise based on the maximum difference between recorded and predicted average water levels for durations of 2 weeks or longer for coastal locations or the 100-yr recurrence interval high water for the Great Lakes. The initial water surface elevation should also consider future sea-level change based on the current understanding of sea level rise processes and the scientific data used to arrive at that understanding.

Instead of an independent analysis, the staff's review may verify an applicant's assumptions and methodologies or may require consultation with State and Federal agencies that have the authority and the responsibility to carry out similar analyses in the vicinity of the site.

3. Hurricanes, Extratropical Cyclones and Squall Lines. The approaches and criteria for development of severe hurricanes, squall lines and severe cyclonic wind storms for all sites followed by USACE, NOAA, other state and federal agencies, and the staff are used for evaluating the conservatism of the applicant's estimates of severe windstorm conditions. The USACE and NOAA criteria require variation of the basic meteorological parameters within given limits to determine the most severe combination that could result. The applicant's hydrometeorological analysis should be based on the most critical combination of these parameters.

   Instead of an independent analysis, the staff's review may verify an applicant's assumptions and methodology or may require consultation with State and Federal agencies that have the authority and the responsibility to carry out similar analyses.

4. Seiche and Resonance. Verified standard models may be used to estimate the maximum surge or seiche stillwater elevation for Great Lakes sites. Some two-dimensional models include seiching effects. Seiching potential may be evaluated using one-dimensional models by comparing the natural period of oscillation (resonance) of the water body with the estimated meteorologically-induced wave periods. Resonance of a water body may be calculated by the methods presented in the USACE Coastal Engineering Manual or standard texts. Generally, a demonstration that the water body cannot generate or sustain waves of the resonant period is a satisfactory approach in evaluating the possibility of damaging seiching. Similarly, seismically-induced seiching may be precluded if the natural period of oscillation of the water body is considerably dissimilar from the period of seismic excitation. If resonance is possible,

the maximum and minimum seiche water surface elevations should be considered in the selection of the critical flood design bases or design low water conditions that affect the functioning of safety-related or risk-significant SSCs.

5. Wave Runup. Detailed descriptions of shoreline protection and safety-related or risk-significant SSCs are used in staff's independent estimate of wind-generated wave runup. Criteria and methods of the USACE, as generally summarized in USACE Coastal Engineering Manual, are used as a standard to evaluate the applicant's estimate of coincident wind-generated wave action and runup. These criteria are also used to evaluate flooding, including the static and dynamic effects of broken, breaking, and nonbreaking waves.

   The controlling flood water surface elevations are estimated based on the combination of appropriate ambient water surface elevations, critical storm surge or seiche water surface elevations, and coincident wind-wave action as described in American National Standard Institute/American Nuclear Society (ANSI/ANS)-2.8-1992. Similar combinations of factors are also used to assess the low water surface elevation that may affect safety-related or risk-significant plant water supply.

6. Effects of Sediment Erosion and Deposition. Sediment deposition during the storm surge and seiche is estimated to ensure that safety-related or risk-significant functioning of all SSCs is not impaired. Erosion caused by high velocity of flood waters or wave action is estimated and its effect on foundations of safety-related or risk-significant SSCs or subsurface safety-related or risk-significant SSCs is examined. Any potential erosion and sediment deposition should not affect the safety-related or risk-significant functioning of SSCs. The potential effects of sediment erosion and deposition on the site drainage system and its conveyance capacity should be considered.

7. Consideration of Other Site-Related Evaluation Criteria. Subpart B of 10 CFR Part 100 describes site-related proximity, seismic (including the effects of potential land subsidence), and non-seismic evaluation criteria for power reactor applications. The staff's review should include evaluation of pertinent information to determine if these criteria are appropriately used in the postulation of worst-case storm surge and seiching scenarios.

8. Review Procedures Specific to 10 CFR Part 52 Application Type

   A. ESP Reviews. Subpart A to 10 CFR Part 52 specifies the requirements and procedures applicable to the Commission's review of an ESP application for approval of a proposed site. Information required in an ESP application includes a description of the site characteristics and design parameters of the proposed site.

      In the absence of certain circumstances, such as a compliance or adequate protection issue, 10 CFR 52.39 precludes the staff from imposing new site characteristics, design parameters, or terms and conditions on the ESP at the COL stage. Accordingly, the reviewer should ensure that all physical attributes of the site that could affect the design basis of safety-related or risk-significant SSCs are reflected in the site characteristics, design parameters, or terms and conditions of the ESP.

B. Standard DC Reviews. DC applications do not contain general descriptions of site characteristics because this information is site-specific and will be addressed by the COL applicant. However, pursuant to 10 CFR 52.47(a)(1), a DC applicant must provide site parameters postulated for the design. Site parameters associated with this DSRS section are reviewed, as applicable, to verify that:

i. The postulated site parameters are representative of a reasonable number of sites that have been or may be considered for a COL application;

ii. The appropriate site parameters are included as Tier 1 information. This convention has been used by previous DC applicants. Additional guidance on site parameters is provided in SRP Section 2.0;

iii. Pertinent parameters are stated in a site parameters summary table; and

iv. The applicant has provided a basis for each of the site parameters.

C. COL Reviews. For a COL application referencing a certified standard design, the NRC staff reviews that application to ensure sufficient information was presented to demonstrate that the characteristics of the site fall within the site parameters specified in the DC rule. If there are site parameters associated with this DSRS section and if the above condition for these parameters has not been met (i.e. the actual site characteristics do not fall within the certified standard design site parameters), the COL applicant will need to demonstrate by some other means that the proposed facility is acceptable at the proposed site. This might be done by re-analyzing or redesigning the proposed facility.

For a COL application referencing an ESP, NRC staff reviews the application to ensure the applicant provided sufficient information to demonstrate that the design of the facility falls within the site characteristics and design parameters specified in the ESP as applicable to this DSRS section. In accordance with 10 CFR 52.79(b)(2), should the design of the facility not fall within the site characteristics and design parameters, the application shall include a request for a variance from the ESP that complies with the requirements of 10 CFR 52.39 and 10 CFR 52.93.

In addition, long-term environmental changes and changes to the region resulting from human or natural causes may have introduced changes to the site characteristics that could be relevant to the design basis. In the absence of certain circumstances, such as a compliance or adequate protection issue, 10 CFR 52.39 precludes the staff from imposing new site characteristics, design parameters, or terms and conditions on the ESP at the COL stage. Consequently, a COL application referencing an ESP need not include a re-investigation of the site characteristics that have previously been accepted in the referenced ESP. However, in accordance with 10 CFR 52.6, “Completeness and Accuracy of Information,” the applicant or licensee is responsible for identifying changes of which it is aware, that would satisfy the criteria specified in 10 CFR 52.39. Information provided by the applicant in accordance with 10 CFR 52.6(b) will be addressed by the staff during the review of a COL application referencing an ESP or a DC.

For a COL application referencing either an ESP or DC or both, the staff should review the corresponding sections of the ESP and DC FSER to ensure that any ESP conditions, restrictions to the DC, or COL action items identified in the FSERs are appropriately handled in the COL application.

IV. EVALUATION FINDINGS

The review should document the staff's evaluation of site characteristics against the relevant regulatory criteria. The evaluation should support the staff's conclusions as to whether the regulations are met. The reviewer should state what was done to evaluate the applicant's FSAR. The staff's evaluation may include verification that the applicant followed applicable regulatory guidance, performance of independent calculations, and/or validation of appropriate assumptions. The reviewer may state that certain information provided by the applicant was not considered essential to the staff's review and was not reviewed by the staff. While the reviewer may summarize or quote the information offered by the applicant in support of its application, the reviewer should clearly articulate the bases for the staff's conclusions.

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 FSER. The reviewer also states the bases for those conclusions.

1. COL Reviews. The following statements should be preceded by a summary of the site characteristics and parameters used for the plant:

   As set forth above, the applicant has presented and substantiated information relative to the effects of storm surge and seiche important to the design and siting of this plant. The staff has reviewed the available information provided and, for the reasons given above, concludes that the identification and consideration of the effects of storm surge and seiche at the site and in the surrounding area are acceptable and meet the requirements of 10 CFR Part 50, Appendix A, GDC 2 and 10 CFR 100.20(c), with respect to determining the acceptability of the site.

   The staff finds that the applicant has considered the appropriate site phenomena in establishing the design bases for SSCs that are safety-related or risk-significant. The staff has generally accepted the methodologies used to determine the effects of storm surge and seiche reflected in these design bases, as documented in FSERs for previous licensing actions. Accordingly, the staff concludes that the use of these methodologies results in design bases containing margin sufficient for the limited accuracy, quantity, and period of time in which the data have been accumulated. The staff concludes that the identified design bases meet the requirement(s) of 10 CFR Part 50, Appendix A, GDC 2 and 10 CFR 100.20(c), with respect to establishing the design basis for SSCs that are safety-related or risk-significant.

2. ESP Reviews. The following statements should be preceded by a summary of the site characteristics and design parameters to be included in any ESP that might be issued for the proposed site:

   As set forth above, the applicant has presented and substantiated sufficient information pertaining to the effects of storm surge and seiche at the proposed site. Section 2.4.5, "Surge and Seiche Flooding," of the Design-Specific Review Standard for mPower™

Integral Pressurized Water Reactor (iPWR) Design, provides that the site FSAR should address the requirements of 10 CFR Parts 52 and 100 as they relate to identifying and evaluating the effects of storm surge and seiche. Further, the applicant considered the most severe natural phenomena that have been historically reported for the site and surrounding area while describing the effects of surge and seiche near the site, with sufficient margin for the limited accuracy, quantity, and period of time in which the historical data have been accumulated. The staff has generally accepted the methodologies used to determine the severity of the phenomena reflected in these site characteristics, as documented in FSERs for previous licensing actions. Accordingly, the staff concludes that the use of these methodologies results in site characteristics containing sufficient margin for the limited accuracy, quantity, and period of time in which the data have been accumulated. In view of the above, the site characteristics previously identified are acceptable for use in establishing the design bases for SSCs that are safety-related or risk-significant, as may be proposed in a COL application.

Therefore, the staff concludes that the identification and consideration surge and seiche site characteristics set forth above are acceptable and meet the requirements of 10 CFR 52.17(a)(1)(vi), 10 CFR 100.20(c), and 10 CFR 100.21(d).

In view of the above, the staff finds the applicant's proposed site characteristics related to surge and seiche for inclusion in an ESP for the applicant's site, should one be issued, acceptable.

3. Design Certification Reviews. The following statement should be preceded by a list of the applicable site parameters used for the plant:

   The NRC staff acknowledges that the applicant has selected the site parameters referenced above for plant design inputs (a subset of which is included as Tier 1 information) and agrees that they are representative of a reasonable number of sites that have been or may be considered for a COL application. Surge and seiche are site-specific and will be addressed by the COL applicant. This should include the provision of information sufficient to demonstrate that the design of the plant falls within the site parameters specified by the siting review.

V. IMPLEMENTATION

The staff will use this DSRS section in performing safety evaluations of mPower™-specific DC, COL, or ESP 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™ 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 (Agencywide Documents Access and Management System Accession (ADAMS) No. 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™-specific DC, COL, or ESP applications 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 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 52.17 (a)(1)(xii) and 10 CFR 52.79 (a)(41), for ESP and COL applications, respectively.

VI. REFERENCES

1. 10 CFR Part 50, "Domestic Licensing of Production and Utilization Facilities."

2. 10 CFR Part 50, Appendix A, General Design Criterion 2, "Design Bases for Protection Against Natural Phenomena."

3. 10 CFR Part 50, Appendix A, General Design Criteria 44, "Cooling Water."

4. 10 CFR Part 52, "Early Site Permits; Standard Design Certifications; and Combined Licenses for Nuclear Power Plants."

5. 10 CFR Part 100, "Reactor Site Criteria."

6. ANSI/ANS-2.8-1992, "Determining Design Basis Flooding at Power Reactor Sites." Historical Technical Reference.

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9. RG 1.27, "Ultimate Heat Sink for Nuclear Power Plants."

10. RG 1.29, "Seismic Design Classification."

11. RG 1.59, "Design Basis Floods for Nuclear Power Plants."

12. RG 1.70, "Standard Format and Content of Safety Analysis Reports for Nuclear Power Plants."

13. RG 1.102, "Flood Protection for Nuclear Power Plants."

14. RG 1.206, "Combined License Applications for Nuclear Power Plants."

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