



**U.S. NUCLEAR REGULATORY COMMISSION**  
**STANDARD REVIEW PLAN**

## 2.4.5 PROBABLE MAXIMUM SURGE AND SEICHE FLOODING

### REVIEW RESPONSIBILITIES

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

**Secondary** - None

### I. AREAS OF REVIEW

Chapter 2 of the Standard Review Plan (SRP) 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 construction permit (CP), operating license (OL), design certification (DC), early site permit (ESP), or combined license (COL) concerning hydrological setting of the site as they relate to safety-related structures, systems, and components (SSC). This SRP section applies to reviews performed for each of these types of applications. The staff's review and findings are described in the appropriate section of the safety evaluation report (SER).

In this section of the safety analysis report (SAR), the hydrometeorological design basis is developed to ensure that any potential hazard to the safety-related facilities due to the effects of probable maximum surge and seiche are considered in plant design. The staff's review of the SAR covers the following specific areas:

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### USNRC STANDARD REVIEW PLAN

This Standard Review Plan, NUREG-0800, has been prepared to establish criteria that the U.S. Nuclear Regulatory Commission staff responsible for the review of applications to construct and operate nuclear power plants intends to use in evaluating whether an applicant/licensee meets the NRC's regulations. The Standard Review Plan is not a substitute for the NRC's regulations, and compliance with it is not required. However, an applicant is required to identify differences between the design features, analytical techniques, and procedural measures proposed for its facility and the SRP acceptance criteria and evaluate how the proposed alternatives to the SRP acceptance criteria provide an acceptable method of complying with the NRC regulations.

The standard review plan sections are numbered in accordance with corresponding sections in Regulatory Guide 1.70, "Standard Format and Content of Safety Analysis Reports for Nuclear Power Plants (LWR Edition)." Not all sections of Regulatory Guide 1.70 have a corresponding review plan section. The SRP sections applicable to a combined license application for a new light-water reactor (LWR) are based on Regulatory Guide 1.206, "Combined License Applications for Nuclear Power Plants (LWR Edition)."

These documents are made available to the public as part of the NRC's policy to inform the nuclear industry and the general public of regulatory procedures and policies. Individual sections of NUREG-0800 will be revised periodically, as appropriate, to accommodate comments and to reflect new information and experience. Comments may be submitted electronically by email to [NRR\\_SRP@nrc.gov](mailto:NRR_SRP@nrc.gov).

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1. Probable Maximum Hurricane. Probable maximum hurricane<sup>1</sup> (PMH) that causes the probable maximum surge<sup>2</sup> as it approaches the site along a critical path at an optimum rate of movement.
2. Probable Maximum Wind Storm. Probable maximum wind storm<sup>3</sup> (PMWS) from a hypothetical extratropical cyclone or a moving squall line that approaches the site along a critical path at an optimum rate of movement.
3. Seiche and Resonance. Seiche<sup>4</sup> 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 safety-related water supplies.
4. Wave Runup. Wind-induced wave runup under PMH or PMWS winds.
5. 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 SSC important to safety.
6. Consideration of Other Site-Related Evaluation Criteria. The potential effects of seismic 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.
7. Additional Information for 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.

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<sup>1</sup> As defined by National Oceanic and Atmospheric Administration National Weather Service Report 23, the PMH is a hypothetical steady state hurricane having a combination of values of meteorological parameters that will give the highest sustained wind speed that can probably occur at a specified coastal location.

<sup>2</sup> A probable maximum storm surge is that surge that results from a combination of meteorological parameters of a probable maximum hurricane, a probable maximum wind storm, or a moving squall line and has virtually no probability of being exceeded in the region involved.

<sup>3</sup> As defined by ANSI/ANS-2.8-1992, the probable maximum wind storm is a hypothetical extratropical cyclone that might result from the most severe combination of meteorological storm parameters that is considered reasonably possible in the region involved.

<sup>4</sup> 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).

## Review Interfaces

Other SRP sections interface with this section as follows:

1. Tsunamis, which may cause seiching, are reviewed in SRP Section 2.4.6.
2. Flooding protection measures, if required for SSC important to safety, are reviewed in SRP Section 2.4.10.
3. 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 function of the ultimate heat sink is performed under SRP Section 9.2.5, "Ultimate Heat Sink."
4. 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.
5. 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<sup>5</sup> 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 Section 2.0.

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

## II. ACCEPTANCE CRITERIA

### Requirements

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

1. 10 CFR Part 100, as it relates to identifying and evaluating hydrological features of the site. The requirements to consider physical site characteristics in site evaluations are specified in 10 CFR 100.10(c) for applications before January 10, 1997, and in 10 CFR 100.20(c) for applications on or after January 10, 1997.
2. 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 the site.
3. 10 CFR Part 50, Appendix A, General Design Criterion (GDC) 2, for CP and OL applications, 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

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<sup>5</sup> Additional supporting information of prior DC rules may be found in DCD Tier 2 Section 14.3.

margin for the limited accuracy, quantity, and period of time in which the historical data have been accumulated.

4. 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.
5. 10 CFR 50, Appendix A, General Design Criterion (GDC) 44, for CP and OL applications, as it relates to providing an ultimate heat sink for normal operating and accident conditions.

### SRP Acceptance Criteria

Specific SRP acceptance criteria acceptable to meet the relevant requirements of the NRC's regulations identified above are as follows for the review described in this SRP section. The SRP is not a substitute for the NRC's regulations, and compliance with it is not required. However, an applicant is required to identify differences between the design features, analytical techniques, and procedural measures proposed for its facility and the SRP acceptance criteria and evaluate how the proposed alternatives to the SRP acceptance criteria provide acceptable methods of compliance with the NRC regulations.

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

Regulatory Guide 1.27 describes the applicable ultimate heat sink capabilities.

Regulatory Guide 1.29 identifies seismic design bases for safety-related structures, systems, and components.

Regulatory Guide 1.59, as supplemented by best current practices, provides guidance for developing the hydrometeorological design bases.

Regulatory Guide 1.102 describes acceptable flood protection to prevent the safety-related facilities from being adversely affected.

1. Probable Maximum Hurricane. To meet the requirements of GDC 2, 10 CFR 52.17, and 10 CFR Part 100, estimates of the probable maximum hurricane and the probable maximum storm surge, i.e., the storm surge induced by the PMH, are needed. The PMH, as defined by NOAA NWS Report 23, should be estimated for coastal locations that may be exposed to these events. If a PMH is not considered a design basis for the proposed site, documentation of the reasons should be provided. The storm surge induced by the PMH should be estimated as recommended by Regulatory Guide 1.59, supplemented by current best practices.
2. Probable Maximum Wind Storm. To meet the requirements of GDC 2, 10 CFR 52.17, and 10 CFR Part 100, estimates of the probable maximum wind storm and the storm surge induced by the PMWS are needed. The PMWS should be considered for

locations along the Pacific and North Atlantic Coasts, and near large bodies of water such as the Great Lakes. The storm surge induced by the PMWS should be estimated as recommended by Regulatory Guide 1.59, supplemented by current best practices.

3. 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 safety-related water supply to the plant may be affected.
4. 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 PMH or PMWS winds is needed. The PMH or PMWS winds should be used to estimate wave runup as recommended by the U.S. Army Corps of Engineers (USACE) Coastal Engineering Manual.
5. 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 functionality of safety-related water supply to the plant caused by blockages due to sediment deposition or erosion during the storm surge or seicheing is needed. If a hazard to SSC important to safety exists from sediment erosion and deposition, it should be documented and included in the design bases of these SSC.
6. Consideration of Other Site-Related Evaluation Criteria. The potential effects of site-related proximity, seismic, and non-seismic information as they relate to flooding and loss of safety-related water supply 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 SRP section is discussed in the following paragraphs:

1. Compliance with GDC 2 requires that nuclear power plant SSC 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 structures, systems, and components 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 SRP 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 floods and low-water events for the purpose of determining the design bases for SSC important to safety.

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 SRP sections.

2. Sections 100.10(c) and 100.20(c) of 10 CFR Part 100 require 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 SAR 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 SSC important to safety.

Meeting this requirement provides a level of assurance that plant SSC important to safety have been designed to withstand the most severe flooding likely to occur as a result of storm surges or seiches.

### 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 CP applications, 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 SRP section. For reviews of OL applications, these procedures are used to verify that the data and analyses remain valid and that the facility's design specifications are consistent with these data. As applicable, reviews of OLs and 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 SRP 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. Probable Maximum Hurricane. This section of the SAR may also state with justification that storm surge estimates are not necessary to identify the flood design basis (e.g., the site is not near a large body of water).

All reasonable combinations of probable maximum 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 use data and methods recommended by National Oceanic and Atmospheric Administration (NOAA) National Hurricane Center to evaluate an applicant's analysis of the PMH near the site, as described by NOAA National Weather Service Report 23 for the U.S. Gulf and East coasts. A PMH is specified in terms of several meteorological parameters that vary with location: central pressure, peripheral pressure, radius of maximum winds, forward speed, track direction, and inflow angle. Methods for estimating these parameters for the PMH are described in NOAA NWS Report 23.

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 anomalies, are estimated using NOAA, U.S. Army Corps of Engineers (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% exceedence" monthly spring high tide, plus a sea level anomaly 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.

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.

2. Probable Maximum Wind Storm. The approaches and criteria for development of probable maximum hurricanes for east and Gulf Coast sites, squall lines for the Great Lakes, and severe cyclonic wind storms for all lake 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.

3. Seiche and Resonance. Models such as Platzmann's (1963) or other verified models may be used to estimate the maximum surge or seiche stillwater elevation for Great Lakes sites. Some two-dimensional models (e.g., Longuet-Higgins and Stewart, 1963; Reid and Bodine, 1968; Tsai and Chang, 1974) 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 required period for resonance is satisfactory to discuss the possibility of damaging seiching. Similarly, seismically induced seiching is if the natural period of oscillation of the water body is dissimilar from the period of precluded 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.

4. Wave Runup. Detailed descriptions of shoreline protection and safety-related facilities 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 ANSI/ANS-2.8-1992. Similar combinations of factors are also used to assess the low water surface elevation that may affect safety-related plant water supply.

5. Effects of Sediment Erosion and Deposition. Sediment deposition during the storm surge and seiche is estimated to ensure that safety-related functioning of all SSC is not impaired. Erosion caused by high velocity of flood waters or wave action is estimated and its effect on foundations of SSC important to safety is examined. Any potential erosion and sediment deposition should not affect the safety-related functioning of SSC.
6. Consideration of Other Site-Related Evaluation Criteria. 10 CFR Part 100 describes site-related proximity, seismic, and non-seismic evaluation criteria for power reactor applications. Subpart A to 10 CFR Part 100 addresses the requirements for applications before January 10, 1997, and Subpart B is for applications on or after January 10, 1997. 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.

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

- A. Early Site Permit 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. The scope and level of detail of review of data parallel that used for a CP review.

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 SSCs important to safety are reflected in the site characteristics, design parameters, or terms and conditions of the early site permit.

- B. Standard Design Certification 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 SRP 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. Combined License 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 SRP section and if the above condition for these parameters has not been met (ie. 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 early site permit as applicable to this SRP 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 early site permit 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 early site permit 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 safety analysis report. 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 safety evaluation report. The reviewer also states the bases for those conclusions.

1. Construction Permit, Operating License, and Combined License 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, General Design Criterion 2 and 10 CFR 100.10(c) or 10 CFR 100.20(c), as applicable], 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 important to safety. 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 safety evaluation reports 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, General Design Criterion 2 and 10 CFR 100.10(c) [or 10 CFR 100.20(c)], with respect to establishing the design basis for SSCs important to safety.

2. Early Site Permit 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, "Probable Maximum Surge and Seiche Flooding," of NUREG-0800, Standard Review Plan, provides that the site safety analysis report 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 safety evaluation reports 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 important to safety, as may be proposed in a COL or CP 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 SRP section in performing safety evaluations of DC applications and license applications submitted by applicants pursuant to 10 CFR Part 50 or 10 CFR Part 52. Except when the applicant proposes an acceptable alternative method for complying with specified portions of the Commission's regulations, the staff will use the method described herein to evaluate conformance with Commission regulations.

The provisions of this SRP section apply to reviews of applications submitted six months or more after the date of issuance of this SRP section, unless superseded by a later revision.

## 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.
7. "Coastal Engineering Manual," Report Number EM 1110-2-1100, U.S. Army Corps of Engineers, Coastal and Hydraulics Laboratory - Engineer Research and Development Center, Waterways Experiment Station - Vicksburg, Mississippi (2006).
8. G. W. Platzmann, "The Dynamical Prediction of Wind Tides on Lake Erie," Technical Rpt. No. 7, Contr. CWB-9768, Dept. of Geophysical Sciences, University of Chicago (1963).
9. M. S. Longuet-Higgins and R. W. Stewart, "A Note on Wave Set-Up," Jour. of Marine Research, Vol. 21, pp. 4-10 (1963).

10. Regulatory Guide 1.27, "Ultimate Heat Sink for Nuclear Power Plants."
11. Regulatory Guide 1.29, "Seismic Design Classification."
12. Regulatory Guide 1.59, "Design Basis Floods for Nuclear Power Plants."
13. Regulatory Guide 1.70, "Standard Format and Content of Safety Analysis Reports for Nuclear Power Plants."
14. Regulatory Guide 1.102, "Flood Protection for Nuclear Power Plants."
15. Regulatory Guide 1.206, "Combined License Applications for Nuclear Power Plants." (LWR Edition)
16. R. O. Reid and B. R. Bodine, "Numerical Model for Storm Surges in Galveston Bay," Jour. Waterways and Harbors Division, Proc. Am. Soc. Civil Engineers, Vol. 94, No. WW1, pp. 33-57 (1968).
17. Y. J. Tsai and Y. C. Chang, "Prediction and Verification of Storm Surges in Lake Ontario and Lake Erie," 17th Conference on Great Lakes Research, International Association for Great Lakes Research, August 12-14, 1974, Hamilton, Ontario.

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**PAPERWORK REDUCTION ACT STATEMENT**

The information collections contained in the Standard Review Plan are covered by the requirements of 10 CFR Part 50 and 10 CFR Part 52, and were approved by the Office of Management and Budget, approval number 3150-0011 and 3150-0151.

**PUBLIC PROTECTION NOTIFICATION**

The NRC may not conduct or sponsor, and a person is not required to respond to, a request for information or an information collection requirement unless the requesting document displays a currently valid OMB control number.

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