

Proposed - For Interim Use and Comment



U.S. NUCLEAR REGULATORY COMMISSION DESIGN-SPECIFIC REVIEW STANDARD FOR mPOWER™ iPWR DESIGN

2.4.2 FLOOD AND SITE DRAINAGE

REVIEW RESPONSIBILITIES

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

Secondary - None

I. AREAS OF REVIEW

This section of the Design-Specific Review Standard (DSRS) identifies historical flooding (defined as occurrences of abnormally high water stage or overflow from a stream, floodway, lake, or coastal area) at the proposed site or in the region of the site. It identifies the potential effects of local intense precipitation considered in establishing the flood design bases for structures, systems, and components (SSCs) important to safety and site drainage analysis.

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 U.S. Nuclear Regulatory Commission (NRC) staff reviews information presented by the applicant for a design certification (DC), early site permit (ESP), or combined license (COL) concerning the hydrologic setting of the site as it relates to SSCs Important to safety. 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 safety evaluation report (SER).

The flood history and the potential for flooding are reviewed for the sources and events listed below. Factors affecting potential runoff (such as urbanization, forest fire, or change in agricultural use), erosion, and sediment deposition are considered in the review. In addition to describing flood history, this section of the FSAR also determines the local intense precipitation on the site to estimate local flooding. Local intense precipitation is reported as a site characteristic used in site grading design. The review covers the following specific areas:

1. Design Bases for Site Drainage

The staff reviews flooding of the site produced by local intense precipitation including the following:

- A. The staff reviews local intense precipitation, which may be estimated from relevant National Oceanic and Atmospheric Administration (NOAA) hydrometeorological reports (HMR).
- B. The staff reviews the design of the site drainage system, including grading to drain runoff from local intense precipitation away from SSCs important to safety.

- C. The staff reviews estimates of local intense precipitation runoff for site drainage and drainage areas adjacent to the plant site, including the roofs of structures important to safety. Additionally, cold region hydrologic processes of rain-on-snow, rain-on-frozen-soils, permafrost melting, and combinations of these processes need to be considered.
- D. The staff reviews modeling of hydrologic and hydraulic processes to estimate the flood water surface elevations adjacent to and on the plant site that may affect design bases for SSCs important to safety.
- E. The staff's review considers the potential effects of erosion and sedimentation from runoff produced by local intense precipitation, as well as from other hydrologic and geophysical phenomena.
- F. The staff review considers the potential effects of changes in the hydrologic process for sites located in the permafrost region. Possible effects of thawing and their impact on site drainage conditions will also be considered. Additional information is provided in the section 2.4 and 2.4.1 of this DSRS.

Review Interfaces

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

1. Sections 2.4.0 and 2.4.3 - 2.4.9 address specific flood-producing phenomena. The types of events considered in these sections and the controlling flooding event are described in this section.
2. Flooding protection measures, including dynamic effects (hydrodynamic forces and impact forces from debris and projectiles), if required for safety-related or risk-significant SSCs, are described in Section 2.4.10.
3. Consideration of the effects of design basis flood elevation on subsurface hydraulic heads is covered in DSRS Section 2.4.12.
4. The organization responsible for review of issues related to hydrology also reviews, under SRP Section 2.0 (Appendix A), the adequacy of the site parameter envelope specified in standard DC applications.
5. The seismic design basis that includes seismically-induced land subsidence information is performed under SRP Section 2.5.1, "Basic Geologic and Seismic Information."
6. 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 2¹ 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.

¹ Additional supporting information of prior DC rules may be found in DCD Tier 2 Section 14.3.

II. ACCEPTANCE CRITERIA

Requirements

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

1. Title 10 of the *Code of Federal Regulations* (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)(vi), for ESP applications, and 10 CFR 52.79 (a)(1)(iii), for COL applications, as they relate to the hydrologic characteristics of the proposed site 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 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 100.10(c).

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 SSCs that are important to safety. In the case of mPower™, risk-significant SSCs would be included under the review of SSCs important to safety.

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

RG 1.102 describes acceptable flood protection to prevent the facilities important to safety from being adversely affected.

1. Design Bases for Site Drainage: To meet the requirements of GDC 2, 10 CFR 52.17 and 10 CFR Part 100, estimates of the local site drainage characteristics are needed. The application should include an estimate of local intense precipitation or local probable maximum precipitation (PMP) and a determination of the capacity of site drainage facilities (including drainage from the roofs of buildings and site ponding). The application should provide an estimate of the runoff from the immediate site area and the drainage from areas adjacent to the site, including the roofs of structures important to safety. Flood response characteristics to hydrologic and hydraulic processes should be identified to estimate flood elevations adjacent to and on the plant site. The effects of erosion and sedimentation during flooding, or other hydrologic and geophysical phenomena, should be identified and their effects on SSCs important to safety should be determined. If a potential hazard to SSCs important to safety exists, the applicant should document and justify the design bases of affected facilities. Conclusions relating to the potential for any adverse effects of blockage of site drainage facilities by debris, ice, or snow should be based upon conservative assumptions of storm and vegetation conditions likely to exist during storm periods. If a potential hazard does exist (e.g., the elevation of ponding exceeds the elevation of plant access openings), the applicant should document and justify the design bases of affected facilities.
2. Combined Events Criteria: The application should include information concerning design basis flooding at the plant site, including consideration of appropriate combinations of individual flooding phenomena in addition to the most severe effects from individual phenomena themselves. The highest flood water surface elevation should be determined based on consideration of the worst combination of flooding phenomena and is reported as a site characteristic in the staff's SER.
3. Consideration of Other Site-Related Evaluation Criteria: The application should demonstrate that the potential effects of site-related proximity, seismic (including the effects of possible land subsidence), and non-seismic information as they relate to hydrologic description in the vicinity of the proposed plant site and site regions are appropriately taken into account.

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. Pursuant to GDC 2, 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 relevant to DSRS Section 2.4.2 in that it specifies the hydrologic phenomenon (i.e., flooding) addressed in this section. In general terms, it also specifies the level of conservatism that should be used to assess the severity of the flood for the purpose of determining the design bases for the SSCs important to safety. This is a similar standard as that applied in reviewing ESPs or COLs.

Meeting the requirements of this criterion provides a level of assurance that SSCs important to safety have been designed to withstand the most severe flood likely to occur.

- 2. Section 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 these sections, the applicant's FSAR should contain a description of the surface and subsurface hydrologic characteristics of the site and region and an analysis of the PMF. This description should be sufficient to assess the acceptability of the site and to assess the potential for those characteristics to influence the design of plant SSCs important to safety.

Meeting this requirement provides a level of assurance that SSCs important to safety are designed to withstand appropriately severe hydrologic phenomena.

III. REVIEW PROCEDURES

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 of COLs include a determination on whether the content of technical specifications related to is acceptable and whether the technical specifications reflect consideration of any identified unique conditions.

These review procedures are based on 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 SER section.

2. Local Flooding on the Site and Drainage Design: Flooding on the plant site is reviewed to determine if SSCs important to safety are adequately protected. Local intense precipitation is a measure of the extreme amount of water falling in the immediate vicinity of the site, usually taken as the one-square-mile PMP. In response to local intense precipitation, immediate flooding by ponding at the site may occur due to inadequate infiltration capacity and a lack of an efficient drainage system. In cold regions, flooding from rain-on-snow event can produce higher runoff volume than from precipitation alone. The staff's estimates of flooding potential are based on PMP estimates from the appropriate HMRs published by NOAA. The staff's estimates are compared with the applicant's estimates to determine conformity to acceptance criteria in Subsection II of this DSRS section. The local intense precipitation is reported as a site characteristic in the staff's SER.

Runoff models, such as the unit hydrograph if applicable, or other runoff discharge estimates presented in standard texts or engineering manuals, are used to estimate discharge on the site drainage system under local intense precipitation. Where generalized runoff models are used, coefficients used for the site and region are compared to information available at documented locations to evaluate hydrologic conditions used in determining the PMF for the site drainage system.

The staff review should also determine the appropriateness of the runoff model used and the assumptions involved. For example, if the watershed has sufficiently diverse hydrologic characteristics that justify the use of a distributed model, then the use of such a model is encouraged as compared to a lumped model. In its review of flooding of site drainage, the staff may verify the applicant's estimate or perform its own independent analysis using currently accepted runoff generation and flood routing methods. The staff's estimates are compared with the applicant's estimates to determine their acceptability according to the acceptance criteria in Subsection II of this DSRS section

Protection from flooding caused by local intense precipitation cannot be mitigated by siting changes. Flooding from local intense precipitation should be mitigated by an effective and efficient site drainage system. The staff reviews site drainage design and any appropriate flooding protection required for SSCs important to safety in this section of the SER. Flooding protection requirements are described in detail in SER Section 2.4.10.

3. Combined Events Criteria: The staff reviews the combinations of individual flooding phenomena that are reasonably possible. It is possible that a combination of two or more flooding phenomena that individually result in floods less severe than their respective worst-case occurrences may combine due to dependence among themselves and result in a more severe flood than the worst case of any one of the phenomena occurring in isolation. American National Standard Institute/American Nuclear Society

(ANSI/ANS)-2.8-1992 provides guidance for determination of appropriate combinations of flooding phenomena along with their relative severity within the combined events.

The staff uses the recommendations of ANSI/ANS-2.8-1992, supplemented with best current practices, to review the applicant's submittal in order to ensure that the most severe flood at the plant site has been determined. The highest flood water surface elevation is reported as a site characteristic in the staff's SER. The staff may choose to accept the applicant's estimate of the highest water surface elevation if it is no more than 5% less conservative² than the corresponding staff's assessment.

All SSCs important to safety should be protected against flooding by siting them above the highest flood water surface elevation or providing adequate flooding protection. Details of flooding protection measures are reviewed in SER Section 2.4.10.

4. Consideration of Other Site-Related Evaluation Criteria: The staff reviews the potential effects of site-related proximity, seismic (including the effects of possible land subsidence), and non-seismic information as they relate to floods in the vicinity of the proposed plant site and site regions and verifies that plant design bases appropriately account for these effects.

Subpart B of 10 CFR Part 100 describes site-related proximity, seismic and non-seismic evaluation criteria for power reactor applications. The staff's review will include evaluation of pertinent information to determine if these criteria are appropriately used in postulation of worst-case flooding scenario at the proposed plant site. The effects of these criteria on individual flooding phenomena are reviewed in the respective DSRS sections.

5. 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 NRC'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 for reviewing data parallel those used for a COL 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 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

² The staff may accept site characteristics values presented in the FSAR if the values are no more than 5% less conservative compared to the staff's independent estimates. For absolute values, e.g., accumulated freezing degree-days and local intense precipitation rates, the value itself will be used as the baseline. For relative measures, e.g., elevations measured above a datum, the location of the datum has a significant effect on the difference expressed as a percentage. The staff will use the site grade as the datum for elevation-based site characteristics. The above rule will only be applied to compare final values of site characteristics and will not be used to assess agreement with parameters or results of intermediate calculations.

by the COL applicant. However, pursuant to 10 CFR Part 52.47(a)(1), a DC applicant must provide site parameters postulated for the design. The reviewer verifies 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. Should the actual site characteristics 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 final safety evaluation report (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.

For a COL application referencing either an ESP or DC or both, the staff has issued additional guidance for review of COL items that cannot be resolved prior to issuance of the license in Interim Staff Guidance 015 (ISG-015). A COL applicant must provide all information in the COL application that is necessary for the staff to make the findings required to issue the license. Therefore, it may be necessary for the staff to partially close certain COL action or information items noted in an ESP or a DC, or both. The staff should identify the remaining portion of the COL items associated with information that is not necessary to issue the license as post-licensing commitments.

IV. EVALUATION FINDINGS

The review should document the staff's evaluation of site characteristics with regard to 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 submittal. The staff's evaluation may include verification that the applicant followed applicable regulatory guidance, performance of independent calculations, and/or validation that the appropriate assumptions were made. 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 SER. The reviewer also states the bases for those conclusions.

1. COL Reviews

The following statements in the SER 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 local intense precipitation, flooding phenomena, and the controlling flooding phenomenon 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 local intense precipitation and flooding 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, or 10 CFR 52.79, as applicable] and 10 CFR Part 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 for establishing the site characteristics for SSCs important to safety. The staff has generally accepted the methodologies used to determine the local intense precipitation, flooding phenomena, and controlling flooding phenomenon reflected in these site characteristics, as documented in SERs for previous licensing actions. Accordingly, the staff concludes that the use of these methodologies results in site characteristics 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 or 10 CFR 52.79, as applicable] and or 10 CFR 100.20(c), with respect to establishing the design basis for SSCs important to safety.

2. ESP Reviews

The following statements in the SER 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 local intense precipitation, flooding phenomena, and the controlling flooding phenomenon at the proposed site. Section 2.4.2, "Floods," of the Design-Specific Review Standard for mPower™ Integral Pressurized Water Reactor (iPWR) Design, provides that the site FSAR report should address the requirements of 10 CFR Parts 52 and 100 as they relate to identifying and evaluating the local intense precipitation, flooding phenomena, and the controlling flooding phenomenon in the vicinity of the site and site regions. Further, the applicant considered the most severe natural phenomena that have been historically reported for the site and surrounding area and reasonable combination of these phenomena in establishing design-basis information pertaining to the local intense precipitation, flooding phenomena, and the controlling flooding phenomenon, 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 SERs 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 application.

Therefore, the staff concludes that the identification and consideration of the local intense precipitation, flooding phenomena, and the controlling flooding phenomenon set forth above are acceptable and meet the requirements of 10 CFR Part 52.17(a)(1)(vi), 10 CFR Part 100.20(c), and 10 CFR Part 100.21(d).

In view of the above, the staff finds the applicant's proposed site characteristics related to the local intense precipitation, flooding phenomena, and the controlling flooding phenomenon for inclusion in an ESP for the applicant's site, should one be issued, to be acceptable.

3. DC Reviews

The following statement in the SER 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. The local intense precipitation, flooding phenomena, and the controlling flooding phenomenon 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.

For DC and COL reviews, the findings will also summarize (to the extent that the review is not discussed in other SER sections) the staff's evaluation of the ITAAC, including design acceptance criteria, as applicable, and interface requirements and COL action items relevant to this DSRS section.

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™ 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. REFERENCES³

1. 10 CFR Part 50, Appendix A, General Design Criterion 2, "Design Bases for Protection Against Natural Phenomena."
2. 10 CFR Part 52, "Early Site Permits; Standard Design Certifications; and Combined Licenses for Nuclear Power Plants."
3. 10 CFR Part 100, Reactor Site Criteria.

³ References for PMP estimates, time distribution, etc., are in SRP Section 2.4.3.

4. ANSI/ANS-2.8-1992, "Determining Design Basis Flooding at Power Reactor Sites." Historical Technical Reference.
5. "Application of Probable Maximum Precipitation Estimates, United States East of the 105th Meridian," Hydrometeorological Report No. 52, U.S. Department of Commerce National Oceanic and Atmospheric Administration and U.S. Department of Army Corps of Engineers, August 1982.
6. Final Interim Staff Guidance ESP/DC/COL-ISG-015, "Post-Combined License Commitments." January 21, 2010. Accession Number: ML093561416.
7. "Meteorological Criteria for Extreme Floods for Four Basins in the Tennessee and Cumberland River Watersheds," Hydrometeorological Report No. 47, U.S. Department of Commerce National Oceanic and Atmospheric Administration and Tennessee Valley Authority, May 1973.
8. "Meteorology of Important Rainstorms in the Colorado River and Great Basin Drainages," Hydrometeorological Report No. 50, U.S. Department of Commerce National Oceanic and Atmospheric Administration and U.S. Department of Army Corps of Engineers, December 1981.
9. "Probable Maximum Precipitation for California – Calculation Procedures," Hydrometeorological Report No. 58, U.S. Department of Commerce National Oceanic and Atmospheric Administration and U.S. Department of Army Corps of Engineers, October 1998.
10. "Probable Maximum Precipitation for California," Hydrometeorological Report No. 59, U.S. Department of Commerce National Oceanic and Atmospheric Administration and U.S. Department of Army Corps of Engineers, February 1999.
11. "Probable Maximum Precipitation Estimates, Colorado River and Great Basin Drainages," Hydrometeorological Report No. 49, U.S. Department of Commerce National Oceanic and Atmospheric Administration and U.S. Department of Army Corps of Engineers, Reprinted 1984.
12. "Probable Maximum Precipitation – Pacific Northwest States, Columbia River (including portions of Canada), Snake River and Pacific Coastal Drainages," Hydrometeorological Report No. 57, U.S. Department of Commerce National Oceanic and Atmospheric Administration, U.S. Department of Interior Bureau of Reclamation, and U.S. Department of Army Corps of Engineers, October 1994.
13. "Probable Maximum Precipitation Estimates, - United States Between the Continental Divide and the 103rd Meridian," Hydrometeorological Report No. 55A, U.S. Department of Commerce National Oceanic and Atmospheric Administration, (U.S. Department of Army Corps of Engineers and U.S. Department of Interior Bureau of Reclamation), June 1988.
14. "Probable Maximum Precipitation Estimates, United States East of the 105th Meridian," Hydrometeorological Report No. 51, U.S. Department of Commerce National Oceanic and Atmospheric Administration and U.S. Department of Army Corps of Engineers, June 1978.

15. "Probable Maximum Precipitation in the Hawaiian Islands," Hydrometeorological Report No. 39, U.S. Department of Commerce Weather Bureau, May 1963.
16. "Probable Maximum Precipitation and Snowmelt Criteria For Red River of the North Above Pembina, and Souris River Above Minot, North Dakota," Hydrometeorological Report No. 48, U.S. Department of Commerce National Oceanic and Atmospheric Administration and U.S. Department of Army Corps of Engineers, May 1973.
17. "Probable Maximum Precipitation and Snowmelt Criteria for Southeast Alaska," Hydrometeorological Report No. 54, U.S. Department of Commerce National Oceanic and Atmospheric Administration and U.S. Department of Army Corps of Engineers, September 1983.
18. "Probable Maximum and TVA Precipitation Estimates With Areal Distribution for Tennessee River Drainages Less Than 3,000 Mi² in Area," Hydrometeorological Report No. 56, U.S. Department of Commerce National Oceanic and Atmospheric Administration and Tennessee Valley Authority, October 1986.
19. Reports of Great Lakes levels by National Ocean Survey, National Oceanic and Atmospheric Administration.
20. RG 1.27, "Ultimate Heat Sink for Nuclear Power Plants.
21. RG 1.29, "Seismic Design Classification."
22. RG 1.59, "Design Basis Floods for Nuclear Power Plants."
23. RG 1.70, Standard Format and Content of Safety Analysis Reports for Nuclear Power Plants.
24. RG 1.102, "Flood Protection for Nuclear Power Plants."
25. RG 1.206, "Combined License Applications for Nuclear Power Plants." (LWR Edition)
26. "Seasonal Variation of 10-Square-Mile Probable Maximum Precipitation Estimates, - United States East of the 105th Meridian," Hydrometeorological Report No. 53, U.S. Department of Commerce National Oceanic and Atmospheric Administration and U.S. Nuclear Regulatory Commission NUREG/CR-1486, April 1980.
27. "Surface Water Supply of the United States,"⁴ U.S. Geological Survey.
28. "Tide Tables," National Oceanic and Atmospheric Administration (similar situation as identified in footnote 3).
29. U.S. Army Corps of Engineers records maintained in District and Division Offices, Coastal Engineering Research Center, and Waterways Experiment Station.

⁴ "Surface Water Supply" is a continuing series of water discharge measurements by the USGS and others. It is not practical to list all the volumes (called "Water-Supply Papers") that are not available. Numerous State and local authorities maintain river discharge, lake level, and tide data.

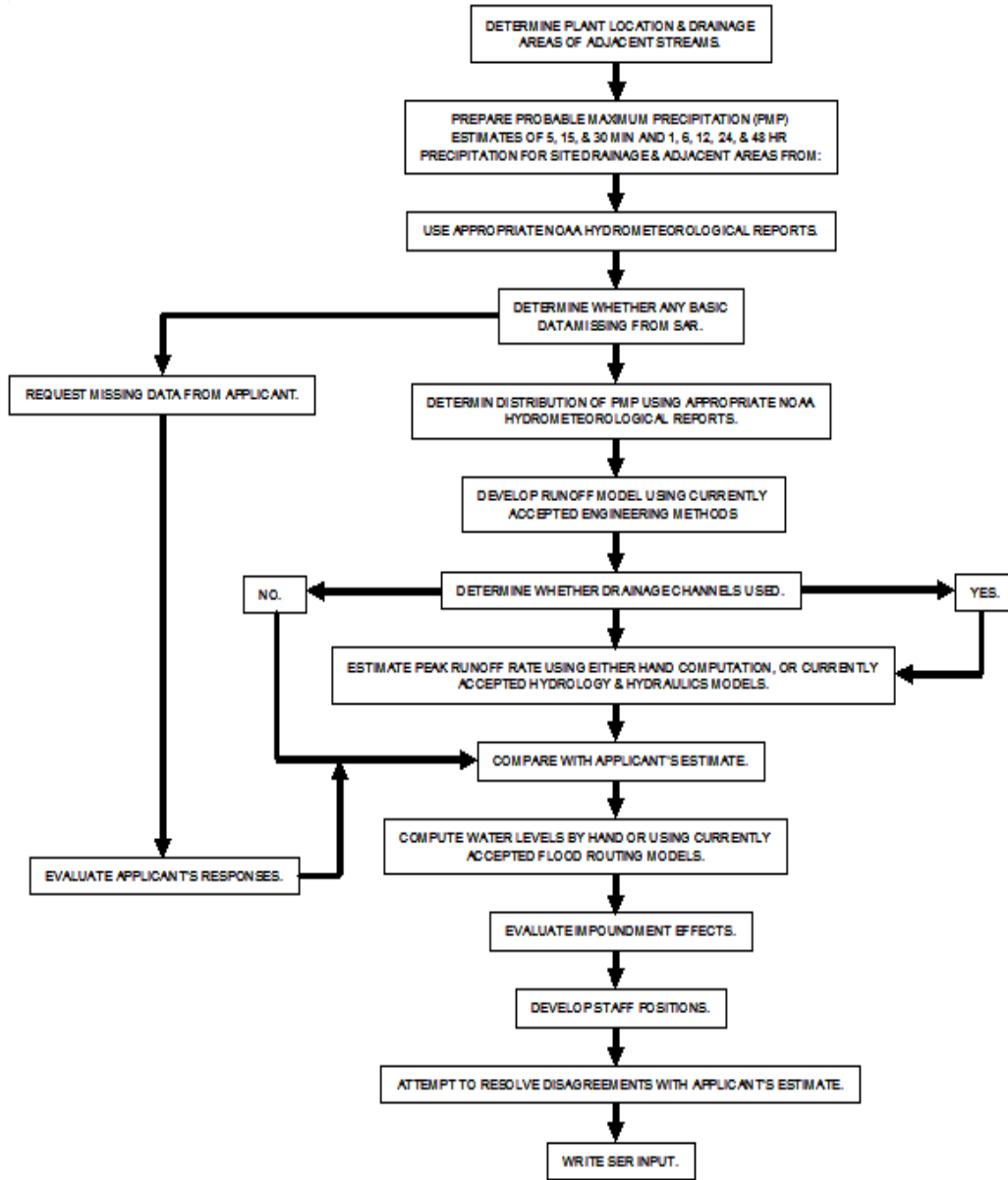


Figure 2.4.2-1: Standard Review Plan Section 2.4.2 Site Drainage and Adjacent Drainage