



U.S. NUCLEAR REGULATORY COMMISSION

STANDARD REVIEW PLAN

2.4.8 COOLING WATER CANALS AND RESERVOIRS

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 a 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 applicant's safety analysis report (SAR), the hydraulic design basis is developed for canal and reservoirs used to transport and impound water supplied to the SSC important to safety.

The specific areas of review are as follows:

1. Hydraulic Design Bases for Protection of Structures: The staff review the design bases postulated and used by the applicant for protection of structures such as riprap inasmuch as they apply to safety-related water supply.

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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.

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Hydraulic Design Bases of Canals: The staff review design bases of canals pertaining to capacity, protection against wind waves, erosion, sedimentation, and freeboard, and the ability to withstand a probable maximum flood (PMF), surges, etc. inasmuch as they apply to safety-related water supply.

2. Hydraulic Design Bases of Reservoirs: The staff review design bases of reservoirs pertaining to capacity, PMF design basis, wind wave and runup protection, discharge facilities (e.g., low-level outlet, spillways, etc.), outlet protection, freeboard, and erosion and sedimentation processes inasmuch as they apply to safety-related water supply.
3. Consideration of Other Site-Related Evaluation Criteria: The potential effects of seismic and non-seismic information on the postulated hydraulic design bases of canals and reservoirs for the proposed plant site.
4. 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.
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.

Review Interfaces

Other SRP sections interface with this section as follows:

1. 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, Chapter 2 of the DCD Tier 2, and the supporting information in DCD Tier 2, Section 14.3, submitted by the applicant is performed under SRP Section 2.0, "Site Characteristics and Site Parameters."
2. The identification of safety-related structures and equipment that should be protected against the effects of flooding is performed under SRP Section 3.4.1, "Flood Protection."
3. The review of the design of seismic Category I structures that may affect the design bases of canals and reservoirs is performed under SRP Section 3.4.2, "Analysis Procedures."
4. The review to ensure that adverse environmental conditions will not preclude the safety function of the ultimate heat sink is performed under SRP Section 9.2.5, "Ultimate Heat Sink."
5. The staff's review related to flooding from local probable maximum precipitation is described in SRP Section 2.4.2, that related to PMF in streams and rivers is described in SRP Section 2.4.3, that related to dam failure scenarios is described in SRP Section 2.4.4, that related to effects of storm surges and seiches including probable maximum windstorm is described in SRP Section 2.4.5, that related to tsunami hazards

is described in SRP Section 2.4.6, that related to ice hazards is described in SRP Section 2.4.7, that related to channel diversions is described in SRP Section 2.4.9, and that related to low water is described in SRP Section 2.4.11.

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 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 SSC important to safety.

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.

Regulatory Guide 1.125 provides guidance in the use and evaluation of physical models for design and operation of hydraulic structures and systems for nuclear power plants.

1. Hydraulic Design Bases for Protection of Structures: To meet the requirements of GDC 1, GDC 2, 10 CFR 52.17, and 10 CFR Part 100, a complete description of the hydraulic design bases for protection of structures is needed. These design bases should be consistent with site characteristics identified by staff during review of other SAR sections with respect to the flood water surface elevations, hydrodynamic forces, wind-induced waves and runup, erosion, and sedimentation.
2. Hydraulic Design Bases of Canals: To meet the requirements of GDC 1, GDC 2, GDC 44, 10 CFR 52.17, and 10 CFR Part 100, a complete description of the hydraulic design bases related to the capacity, protection against wind waves, erosion, sedimentation, and freeboard, and the ability to withstand a probable maximum flood (PMF), surges, etc., is needed. These design bases should be consistent with the site characteristics identified in other hydrology sections of the SAR and with the proposed plant requirements.
3. Hydraulic Design Bases of Reservoirs: To meet the requirements of GDC 1, GDC 2, 10 CFR 52.17, and 10 CFR Part 100, a complete description of the design bases of safety-related reservoirs related to their capacity, PMF design basis, wind wave and runup protection, discharge facilities (e.g., low-level outlet, spillways, etc.), outlet protection, freeboard, and erosion and sedimentation processes is needed. These design bases should be consistent with the site characteristics identified in other hydrology sections of the SAR and with the proposed plant requirements.
4. Consideration of Other Site-Related Evaluation Criteria: To meet the requirements of GDC 1, GDC 2, 10 CFR 52.17, and 10 CFR Part 100, a complete description of the potential effects of site-related proximity, seismic, and non-seismic information on the postulated design bases of safety-related canals and reservoirs is needed. This description should be sufficient to demonstrate that the applicant's design bases appropriately account for these effects.

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 1 requires that SSC important to safety be designed, fabricated, erected, and tested to quality standards commensurate with the importance of the safety functions to be performed.

GDC 1 applies to this SRP section because canals and reservoirs supply cooling water to SSC important to safety for use during normal operations, anticipated operational occurrences, and accident conditions.

Meeting the requirements of GDC 1 provides assurance that SSC important to safety requiring cooling water will not lose the capability to perform their intended safety functions during the most severe credible natural phenomena in combination with normal operations, anticipated operational occurrences, or accident conditions.

2. Compliance with GDC 2 requires that nuclear power plant SSC important to safety be designed to withstand the effects of natural phenomena such as hurricanes, floods, tsunamis, and seiches without loss of capability to perform their safety functions. This criterion further specifies that the design bases for these SSC 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 period of time in which the historical data have been accumulated;
- B. Appropriate combinations of the effects of normal and accident conditions with those of the natural phenomena; and
- C. The importance of the safety functions to be performed.

The design function of cooling water canals and reservoirs is to provide adequate cooling water to safety-related components of the emergency core cooling system and to reactor auxiliary equipment during normal operations, anticipated operational occurrences, and accident conditions. Compliance with GDC 2 ensures that cooling water canals and reservoirs will perform their design safety functions while withstanding the effects of the most severe natural phenomena likely to occur (including floods and droughts) in combination with normal operations, anticipated operational occurrences, or accident conditions.

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 is to be evaluated pursuant to other SRP sections.

3. Compliance with GDC 44 requires a system for transferring heat from SSC important to safety to an ultimate heat sink during normal operations, anticipated operational occurrences, and accident conditions.

GDC 44 applies to this SRP section because the ultimate heat sink for the cooling water system consists of complex water sources, including canals and reservoirs necessary to transport and impound plant cooling water. The design function of cooling water canals

and reservoirs is to provide adequate cooling water to service or component cooling water systems so that plant components required to maintain adequate core cooling remain functional during normal operations, anticipated operational occurrences, and accident conditions.

Meeting the requirements of GDC 44 provides assurance that cooling water canals and reservoirs will be designed to supply adequate cooling water during normal operations, anticipated operational occurrences, and accident conditions, thereby protecting against loss of core cooling.

4. 10 CFR 100.23(d) and Appendix A to 10 CFR Part 100 require that geologic and seismic factors include a determination of site suitability and acceptability of the nuclear power plant design. Paragraph V(d) in Appendix A describes the investigation required for determination of other design conditions, including that of the cooling water supply. It addresses the need to consider an adequate cooling water supply for emergency and shutdown decay heat removal in the design of a nuclear power plant. The evaluation should include consideration of river blockage or diversion, tsunami runup or drawdown, and failure of dams and intake structures, as appropriate.

These requirements are applicable to SRP Section 2.4.8 because it requires investigation of hydraulic design bases for canals and reservoirs used to transport and impound water supplied to the SSC important to safety. These requirements guide the Commission in its consideration of the suitability of proposed sites for nuclear power plants. In accordance with 10 CFR Part 100, Appendix A, cooling water canals and reservoirs should be designed to withstand the effects of the most severe hydrological phenomena noted in the previous paragraph. The function of the canal and reservoir is to provide adequate cooling water to safety-related components of the emergency core cooling system and to reactor auxiliary equipment during normal operations, anticipated operational occurrences, and accident conditions. More detailed guidance on the investigation of ultimate heat sinks is provided by Regulatory Guide 1.27.

Meeting the requirements of 10 CFR Part 100 provides assurance that canals and reservoirs will be designed to withstand appropriately severe phenomena and remain capable of providing an adequate supply of cooling water to those structures, systems, and components important to safety during normal operations, anticipated operational occurrences, and accident conditions.

5. 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.

10 CFR Part 100 is applicable to SRP Section 2.4.8 because it addresses the physical characteristics, including hydrology, considered by the Commission when determining the acceptability of a site for a power reactor. To satisfy the hydrologic requirements of 10 CFR Part 100, the applicant's SAR should contain a description of the hydrological and seismic characteristics of the region and a description of the design bases of safety-related canals and reservoirs. The description should be sufficient to assess the acceptability of the site and the potential for those characteristics to influence the design of SSC important to safety.

Meeting this requirement provides a level of assurance that canals and reservoirs important to safety have been designed to withstand the effects of the site's physical characteristics and that the safety-related water supply to the proposed plant is adequate.

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. Hydraulic Design Bases for Protection of Structures: The staff review protection of structures such as riprap from wave and runoff action coincident with the highest flood water elevation that may result from one or a reasonable combination of flooding mechanisms evaluated separately in SRP Sections 2.4.2, 2.4.3, 2.4.4, 2.4.5, 2.4.6, and 2.4.7. If the protection is provided for a structure that is safety-related, requirements of GDC 1 and GDC 2 apply. Protection of SSC important to safety from flooding is reviewed under SER Section 2.4.10.

If the staff's review disagrees with the applicant's estimates of these design bases, the applicant should fully document and justify its estimates or accept the staff's estimates and redesign protection of the SSC important to safety.

2. Hydraulic Design Bases of Canals: The staff reviews design bases of canals pertaining to the capacity, protection against wind waves, erosion, sedimentation, and freeboard, and the ability to withstand a probable maximum flood (PMF), surges, etc. The staff also reviews the adequacy of the safety-related canals under drought conditions. Low flow scenarios, estimated in the applicant's SAR Section 2.4.11, are used. The criteria of Regulatory Guide 1.27 should be used if the canals are a part of the ultimate heat sink. Erosion and sedimentation during floods that may lead to loss of functionality of the canals, if it is part of the ultimate heat sink, are also reviewed as required by GDC 1 and GDC 2.

If the staff's review disagrees with the applicant's estimates of these design bases, the applicant should fully document and justify its estimates or accept the staff's estimates and redesign the safety-related canals. The suggested criteria of Regulatory

Guide 1.27 should be applied when the water supply comprises part of the ultimate heat sink.

3. Hydraulic Design Bases of Reservoirs: The staff reviews the design bases of reservoirs pertaining to wind wave and runup coincident with the highest flood water surface elevation from one or a reasonable combination of flooding mechanisms evaluated separately in the applicant's SAR Sections 2.4.2, 2.4.3, 2.4.4, 2.4.5, 2.4.6, and 2.4.7. The staff uses U.S. Army Corps of Engineers (USACE) criteria and methods for review of the design bases of embankment protection such as riprap, grass, soil cement, tetrapods, dolosse, etc. Input from the review of SAR Section 2.4.7 is considered for ice-induced hazards, including flooding, forces on structures and components, ice blockages, and interruptions of safety-related cooling water supply.

The staff review of the design bases will also consider design conditions that ensure stability of the embankment. More specifically, the review will consider, as appropriate, the following:

- 1) Stability analysis during and at the end of construction,
- 2) Stability analysis for conditions of steady state seepage,
- 3) Stability analysis during conditions of sudden drawdown, and
- 4) Stability analysis for earthquake loading.

The spillway design is reviewed with respect to its ability to safely discharge the PMF or another controlling design-basis flood, with antecedent conditions, as discussed in Regulatory Guide 1.59, without endangering safety-related facilities or increasing the hazard to downstream residents. Regulatory Guide 1.125 provides guidance in the use and evaluation of physical models for design and operation of hydraulic structures and systems for nuclear power plants. The staff also reviews the necessity of a low-level outlet to assist in emergency discharge of floods.

The lowest water surface elevation in reservoirs is determined by routing the flow during the design basis drought, determined during review of SAR Section 2.4.11, through the reservoir using standard methods suggested by the USACE. If the reservoir storage is the sole source of water supply, the antecedent reservoir levels during the routing should be the lowest reasonably possible, considering regional conditions at the beginning of the drought and water demands including plant requirements. Staff will not use an antecedent reservoir level greater than the established normal operating level.

If reservoirs comprise a part of the ultimate heat sink, the staff reviews the design bases of these reservoirs, as recommended by Regulatory Guide 1.27. The volume of liquid water stored in a reservoir that comprises part of the ultimate heat sink should be sufficient to meet all safety-related water-supply requirements after accounting for loss in storage capacity due to seepage, sedimentation, evaporation, ice-sheet formation, and other causes.

If the staff's review disagrees with the applicant's estimates of these design bases, the applicant should fully document and justify its estimates or accept the staff's estimates and redesign safety-related reservoirs. The suggested criteria of Regulatory Guide 1.27 should be applied when the water supply comprises part of the ultimate heat sink.

4. 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 postulation of design bases of safety-related canals and reservoirs at the proposed plant site.

5. 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 a compliance or adequate protection issue, or a modification necessary based on updating early site permit-emergency preparedness information, or a variance, 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 on the ESP.

- 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. The reviewer verifies that:

1. The postulated site parameters should be representative of a reasonable number of sites that may be considered within a COL application;
2. The appropriate site parameters are included as Tier 1 information per SRP Section 14.3.1; and
3. Pertinent parameters are stated in a site parameters summary table.
4. The applicant has provided a technical basis for each of the site parameters.

- C. Combined License Reviews: For a COL application referencing a certified standard design, 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 early site permit as applicable to this SRP section. Should the design of the facility not fall within the site characteristics and design parameters, the application should include a request for a variance from the ESP that complies with the requirements of §§ 52.39 and 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. The requirements of 10 CFR 52.39 preclude the Commission from changing or imposing new site characteristics, design parameters, or terms and conditions on an ESP, unless the change is: necessary to assure adequate protection of the public health and safety; necessary to bring the permit or site into compliance with the Commission's regulatory requirements in effect when the permit was issued; necessary based on an update to early site permit-emergency preparedness information, or based on a variance. Consequently, the staff's review of a COL application referencing an ESP should 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 unresolved items, commitments, assumptions, and deferred issues 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 design bases of canals and reservoirs 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 design bases of canals and reservoirs is acceptable and meets the requirements of 10 CFR Part 50, Appendix A, General Design Criteria 1 and 2 and 10 CFR Part 100 [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 design bases of canals and reservoirs, 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 Criteria 1 and 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 to be included in any ESP that might be issued for the proposed site:

As set forth above, the applicant has presented and substantiated information to establish [state the site characteristic]. The staff has reviewed the information provided and, for the reasons given above, concludes that the applicant has established site characteristics and design parameters acceptable to meet the requirements of 10 CFR Part 100 and 10 CFR Part 52.

Therefore, the staff concludes that the identification and consideration of the safety-related canals and reservoirs 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 canals and reservoirs 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), but does not claim that they are representative of any particular percentile of possible sites in the United States, and does not assert the acceptability of the basis for the choice of values with respect to siting. The [identify applicable site parameter] is 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 values of the actual site characteristics specified in a COL or CP application.

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 docketed six months or more after the date of issuance of this SRP section.

VI. REFERENCES

1. 10 CFR Part 50, Appendix A, General Design Criterion 1, "Quality Standards and Records."
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 Criterion 44, "Cooling Water."
4. 10 CFR Part 100, "Reactor Site Criteria."
5. Am. Soc. Civil Engineers, "Hydraulic Models," Manual of Engineering Practice No. 25 (1963).
6. ANSI/ANS-2.8-1992, "Determining Design Basis Flooding at Power Reactor Sites." Historical Technical Reference.
7. C. V. Davis (ed.), "Handbook of Applied Hydraulics," McGraw-Hill Book Company, New York (1964).
8. "Design of Small Dams," Third Edition, Bureau of Reclamation, U.S. Department of the Interior (1987).
9. "Design Standards No. 3, Canals and Related Structures," "Chapter 2 of "General Design Information for Structures," Bureau of Reclamation, U.S. Department of the Interior, April 1962.

10. E. F. Brater and H. W. King, "Handbook of Hydraulics for the Solution of Hydrostatic and Fluid-Flow Problems," McGraw-Hill Book Company, New York (1963).
11. EM 1110-2-1100, "Coastal Engineering Manual," U.S. Army Corps of Engineers, Coastal and Hydraulics Laboratory - Engineer Research and Development Center, Waterways Experiment Station - Vicksburg, Mississippi (2006).
12. EM 1110-2-1601, "Hydraulic Design of Flood Control Channels," U.S. Army Corps of Engineers, June 30, 1994.
13. EM 1110-2-1603, "Hydraulic Design of Spillways," U.S. Army Corps of Engineers, March 31, 1965.
14. EM 1110-2-3600, "Management of Water Control Systems," U.S. Army Corps of Engineers, November 1987.
15. G. A. Hathaway, "Determination of Spillway Requirements for High Dams," Proc. Fourth International Conference on Large Dams, New Delhi, Vol. 2, pp. 301-347 (1951).
16. G. W. Fair, J. C. Geyer, and D. A. Okien, "Water Supply and Waste Water Removal," John Wiley & Son, Inc., New York (1966).
17. H. Rouse (ed.), "Engineering Hydraulics," John Wiley & Son, Inc., New York (1951).
18. H. W. King and E. F. Brater, "Handbook of Hydraulics," McGraw-Hill Book Company, New York (1963).
19. "Hydrologic Engineering Methods for Water Resources Development," Volumes 1 through 12, U.S. Army Corps of Engineers Hydrologic Engineering Center, Davis, California (1971).
20. "Hydraulic Model Studies" of the Bureau of Reclamation, U.S. Department of the Interior.
21. "Hydraulic Model Studies" of the Dept. of Water Resources, State of California.
22. Leo R. Beard, "Flood Control Operation of Reservoirs," Jour. Hydraulic Division, Proc. Am. Soc. Civil Engineers, Vol. 88, No. HY1, pp. 1-25 (1963).
23. Leo R. Beard, "Methods for Determination of Safe Yield and Compensation Water from Storage," Seventh International Water Supply Conference, Barcelona, Spain (1966).
24. R. K. Linsley, J. B. Franzini, D. L. Freyburg, and G. Tchobanoglous, "Water-Resources Engineering," Fourth Ed., McGraw-Hill Book Company, New York (1992).
25. Regulatory Guide 1.27, "Ultimate Heat Sink for Nuclear Power Plants."
26. Regulatory Guide 1.29, "Seismic Design Classification."
27. Regulatory Guide 1.59, "Flood Design Basis for Nuclear Power Plants."

28. Regulatory Guide 1.102, "Flood Protection for Nuclear Power Plants."
29. Regulatory Guide 1.125, "Physical Models for Design and Operation of Hydraulic Structures and Systems for Nuclear Power Plants."
30. "Reservoir Storage-Yield Procedures," Corps of Engineers Hydrologic Engineering Center, Davis, CA (1967).
31. U.S. Army Corps of Engineers, "Engineering and Design - Slope Stability," Publication Number: EM 1110-2-1902, 2003.
32. V. T. Chow (ed.), "Handbook of Applied Hydrology," McGraw-Hill Book Company, New York (1964).
33. V. T. Chow (ed.), "Open Channel Hydraulics," McGraw-Hill Book Company, New York (1959).
34. Waterways Experiment Station, "Hydraulic Design Criteria," U.S. Army Corps of Engineers, continuously updated.

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.

SRP Section 2.4.8

Description of Changes

This SRP section affirms the technical accuracy and adequacy of the guidance previously provided in Draft Revision 3, dated April 1996 of this SRP. See ADAMS accession number ML052070250.

In addition, this SRP section was administratively updated in accordance with NRR Office Instruction, LIC-200, Revision 1, "Standard Review Plan (SRP) Process." The revision also adds standard paragraphs to extend application of the updated SRP section to prospective submittals by applicants pursuant to 10 CFR Part 52.

The technical changes are incorporated in Revision 3, dated 2007:

REVIEW RESPONSIBILITIES - Reflects changes in review branches resulting from reorganization and branch consolidation. Change is reflected throughout the SRP.

I. AREAS OF REVIEW

1. An introductory paragraph was added at the beginning of this section.
2. Added review of consideration of seismic and non-seismic criteria during determination of design bases for canals and reservoirs.
3. Review Interfaces subsection was added in this section. A list of other SRP sections which interface with the review in this section was added to this subsection.
4. A statement that review of site parameters for DC applications and COL applications that reference a DC is performed in SRP Section 14.3 was added to the Review Interfaces subsection.
5. A statement that identification of safety-related structures and equipment is performed under SRP Section 3.4.1 was added to the Review Interfaces subsection.
6. A statement that review of design of seismic category I structures that may affect the design bases of canals and reservoirs is performed in SRP Section 3.4.2 was added to the Review Interfaces subsection.
7. A statement that review of the effects of adverse environmental conditions on the safety function of the ultimate heat sink is performed in SRP Section 9.2.5 was added to the Review Interfaces subsection.

II. ACCEPTANCE CRITERIA

1. Specific acceptance criteria for each item in an area of review was rewritten to realign with the Commission's regulations.

2. This section was updated to include requirements of 10 CFR Part 100.23(d) as it applies to determination of plant design bases with respect to seismic site characteristics.
3. This section was updated to include requirements of 10 CFR Part 100 as it relates to site evaluations in 10 CFR 100.10(c) for applications before January 10, 1997, and 10 CFR 100.20(c) for applications on or after January 10, 1997, in Acceptance Criteria.
4. This section was updated to include currently available best practices to supplement recommendations of Regulatory Guide 1.59.

III. REVIEW PROCEDURES

1. Introductory paragraphs were added at the beginning of this section to provide guidance related to application of the procedures described therein to different types of applications.
2. This section was rewritten to provide specific guidance related to each area of review.

IV. EVALUATION FINDINGS

1. This section was rewritten to provide specific guidance related to each type of application. Sample statements addressing evaluation findings for each application type was also rewritten.

V. IMPLEMENTATION

1. This section was revised to indicate that this SRP section will also be used in reviews of design certification applications.

VI. REFERENCES

1. The References list was updated.