



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

## 2.3.2 LOCAL METEOROLOGY

### REVIEW RESPONSIBILITIES

**Primary** - Organization responsible for the review of meteorology

**Secondary** - None

#### I. AREAS OF REVIEW

Chapter 2 of the 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 the local (site) meteorological parameters, the assessment of the potential influence of the proposed plant and its facilities on local meteorological conditions, and a topographical description of the site and its environs. This SRP section applies to reviews performed for each of these types of applications. The review covers the following specific areas:

1. Summaries of the local (site) meteorology in terms of airflow, temperature, atmospheric water vapor (e.g., wet-bulb temperature, dew point temperature, or relative humidity), precipitation, fog, atmospheric stability, and air quality.
2. An assessment of the construction and operation impacts of the plant and its facilities on the local meteorological parameters listed in (1). These impacts should include the effects of plant structures, terrain modification, and heat and moisture sources due to plant operation.

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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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3. A topographical description of the site and its environs, as modified by the plant structures, including the site boundary, exclusion zone, and low population zone.
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.

## Review Interfaces

Other SRP sections interface with this section as follows:

1. The reviewer provides findings on the assessment of the construction and operation impacts of the plant and its facilities on meteorological site characteristics or parameters to the reviewers of the appropriate subsections within SRP Chapter 3, as necessary, to ensure structures, systems, and components (SSCs) important to safety are adequately designed.
2. The reviewer provides findings on local meteorological conditions that could affect the atmospheric dispersion and deposition estimates to the reviewers of SRP Sections 2.3.4 and 2.3.5.
3. 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>1</sup> submitted by the applicant is performed under SRP Section 2.0, “Site Characteristics / 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

Local meteorological and topographic descriptions of the site area, both before construction and during operation of the plant that might be constructed on the proposed site, should be presented. Meteorological impacts on plant design and operation, as well as the impact on local meteorological conditions from the nuclear power plant or plants and its facilities, should be discussed. The information should be fully documented and substantiated as to its representativeness of conditions at and near the site.

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

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

1. 10 CFR Part 50, Appendix A, General Design Criterion 2 (GDC 2), "Design Bases for Protection Against Natural Phenomena," as it relates to consideration of the most severe local weather 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 and that are reflected in the design bases for structures, systems, and components important to safety.
2. 10 CFR 100.10(c)(2), 100.20(c)(2), and 100.21(d) with respect to the consideration that has been given to the local meteorological and air quality characteristics of the site and other physical characteristics of the site that can influence the local meteorology.
3. For ESP applications, GDC are not applicable. The GDC 2 requirement to identify climatic site characteristics that consider 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 is specifically identified in 10 CFR 52.17(a)(1)(vi).

#### 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.

1. Local summaries of meteorological data based on onsite measurements in accordance with Regulatory Guide 1.23 and National Weather Service station summaries or other standard installation summaries from appropriate nearby locations (e.g., within 80km (50 miles)) should be presented as specified in Regulatory Guide 1.70, Section 2.3.2, and RG 1.206, Section 2.3.2.1.
2. A complete topographical description of the site and environs out to a distance of 80 kilometers (50 mi) from the plant, as described in Regulatory Guide 1.70, Section 2.3.2.2, and RG 1.206, Section 2.3.2.2, should be provided.
3. A discussion and evaluation of the influence of the plant and its facilities on the local meteorological and air quality conditions should be provided. Applicants should also identify potential changes in the normal and extreme values as presented in the safety analysis report (FSAR), resulting from plant construction and operation. The acceptability of the information is determined through comparison with standard assessments.
4. The description of local site airflow should include wind roses and annual joint frequency distributions of wind speed and wind direction by atmospheric stability for all measurement levels using the criteria provided in Regulatory Guide 1.23.

## 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 paragraph:

GDC 2, or 10 CFR 52.17(a)(1)(vi) for ESP applications, require consideration of the most severe of the natural phenomena. 10 CFR 100.10(c)(2) and 100.20(c)(2) require meteorological characteristics of the site that are necessary for safety analysis or that may have an impact upon plant design (such as maximum probable wind speed and precipitation) to be identified and characterized, so that they may be taken into consideration in determining the acceptability of the site. 10 CFR 100.21(d) requires physical characteristics of the site, including meteorology, to be evaluated and site parameters established such that potential threats from such physical characteristics will pose no undue risk to the type of facility proposed to be located at the site. Application of GDC 2 (or 10 CFR 52.17(a)(1)(vi) for ESP applications), 10 CFR 100.10(c)(2), 100.20(c)(2), and 10 CFR 100.21(d) provide assurance that the most severe meteorological conditions at the chosen plant site have been identified.

### 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 local meteorology is 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. The summaries listed in Section 2.3.2.1 of Regulatory Guide 1.70 and Section 2.3.2.1 of RG 1.206 are reviewed for completeness and adequacy of basic data. The wind and atmospheric stability data should be based on onsite data, because airflow and vertical temperature structure, which can vary substantially from one location to another, are necessary for assessment of atmospheric diffusion conditions at the site. The other summaries should be based on data from nearby representative stations (e.g., within 80 km (50 miles)) with long periods of record because the locally measured values are not likely to provide reliable estimates of the intensity or frequency of extremes. Extreme values are compared to design basis values presented in the safety assessment and are used by other branches to determine whether the meteorological conditions are limiting conditions for design and emergency procedures. When offsite data are used, a determination is made of how well the data represent site conditions and whether more representative data are available. Determinations should be based on distance from the site, surrounding topography, elevation, land use (e.g., urban versus rural), nearby

bodies of water, and data collection procedures. National Oceanic and Atmospheric Administration (NOAA) National Climatic Data Center summaries (Refs. 7 and 8) and other standard climatological summaries related to structural design (e.g., Refs. 9 and 10) are used by the reviewer to evaluate the representativeness of stations and periods of record. The reviewer should be familiar with all primary meteorological data collection locations. The applicant should provide all references to the National Oceanic and Atmospheric Administration (NOAA), National Weather Service, station summaries from nearby locations, and to other meteorological data that were used to describe site characteristics.

The reviewer considers potential deviations from regional to local meteorological conditions caused by local topography, nearby bodies of water, or other unique site characteristics that should be identified by the applicant.

2. The reviewer ensures that all topographic maps and topographic cross sections presented by the applicant are legible and well labeled so that the information needed during the review can be readily extracted. Reference points and the direction of true north should be checked carefully. Points of interest such as structures of the plant, site boundary, and exclusion zone should be marked on the maps and diagrams.

The reviewer compares the applicant's assessment of the effect of topography on local meteorological conditions to standard assessments such as those presented in "Atmospheric Science and Power Production" (Ref. 11) and decides whether the standard regulatory atmospheric diffusion models (discussed in Sections 2.3.4 and 2.3.5 of this review standard) are appropriate for the proposed site.

3. The reviewer evaluates the contents of Section 2.3.2 of the Safety Analysis Report as follows:
  - a. Determine the terrain modifications that are likely to occur as a result of construction of a nuclear power plant, such as removal of trees, leveling of ground, and installation of lakes and ponds. The applicant should provide a map showing the detailed topographic features as modified by the plant.
  - b. Determine the location, size, and materials used for plant structures, including buildings, cooling towers, switchyard gear, parking lots, and roads.
  - c. Determine and quantify the heat and moisture sources that would be expected to result from operations.
  - d. Relate the input information in items a, b, and c, above, to modification of local meteorology so that the impact of the modifications on plant design and operation can be determined.
  - e. Determine air quality conditions used for design and operating basis considerations.
  - f. Compare the reviewer's assessment with that of the applicant.

#### 4. 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 early site permit 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), the 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, NRC staff reviews that application to ensure that sufficient information is 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 should 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 provides 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 FSEER to ensure that any early site permit conditions, restrictions to the DC, or COL action items identified in the FSEERs are appropriately handled in the COL application.

#### IV. EVALUATION FINDINGS

The review should document the staff's evaluation of site characteristics with respect 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 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 local meteorological, air quality, and topographic characteristics important to the design and siting of this plant. The staff has reviewed the information provided and, for the reasons given above, concludes that the identification and consideration of the meteorological, air quality, and topographical characteristics of the site and the surrounding area are acceptable and meet the requirements of 10 CFR 100.10(c) [for stationary power reactor site applications before January 10, 1997] or 10 CFR 100.20(c) and 10 CFR 100.21(d) [for stationary power reactor site applications on or after January 10, 1997], 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. Specifically, the staff has generally accepted the methodologies used to determine the meteorological, air quality, and topographic characteristics reflected in these design bases, as documented in safety evaluation reports for previous licensing actions. Because the applicant has correctly implemented these methodologies, as described above, the staff has determined that the use of these methodologies results in design basis 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 of 10 CFR Part 50, Appendix A, General Design Criterion 2, "Design Bases for Protection Against Natural Phenomena," 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 ESP site:

As set forth above, the applicant has presented and substantiated information on local meteorological, air quality, and topographic characteristics of importance to the safe design and operation of a nuclear power plant or plants falling within the applicant's Plant Parameter Envelope (PPE) that might be constructed on the proposed site. The staff has reviewed the information provided and, for the reasons given, concludes that the applicant's identification and consideration of the meteorological, air quality, and topographical characteristics of the site and the surrounding area meet the requirements of 10 CFR 52.17(a)(1)(vi), 10 CFR 100.20(c), and 10 CFR 100.21(d) and are sufficient to determine the acceptability of the site.

The staff also reviewed available information relative to severe local weather phenomena at the site and in the surrounding area. As set forth above, the staff concludes that the applicant has identified the most severe local weather phenomena at the site and surrounding area.

### 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. Technical specifications and emergency operations 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, 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."
4. Regulatory Guide 1.23, "Onsite Meteorological Programs."
5. Regulatory Guide 1.70, "Standard Format and Content of Safety Analysis Reports for Nuclear Power Plants."
6. Regulatory Guide 1.206, "Combined License Applications for Nuclear Power Plants (LWR Edition)."
7. U.S. Department of Commerce, "State Climatological Summary," Environmental Data Service, NOAA, published annually by state.
8. U.S. Department of Commerce, "Local Climatological Data - Annual Summary with Comparative Data," Environmental Data Service, NOAA, published annually for all first-order NWS stations.

9. ASCE Standard No. 7-05, "Minimum Design Loads for Buildings and Other Structures," ASCE/SEI 7-05, American Society of Civil Engineers," 2006.
10. U.S. Department of Commerce, "Engineering Weather Data," National Climatic Data Center, NOAA. CD-ROM
11. Darryl Randerson (ed.), "Atmospheric Science and Power Production," DOE/TIC-27601, U.S. Department of Energy (1984).

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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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