



U.S. NUCLEAR REGULATORY COMMISSION
STANDARD REVIEW PLAN
OFFICE OF NUCLEAR REACTOR REGULATION

SECTION 3.3.1

WIND LOADINGS

REVIEW RESPONSIBILITIES

Primary - Structural Engineering Branch (SEB)

Secondary - Site Analysis Branch (SAB)

I. AREAS OF REVIEW

The following areas relating to the design of seismic Category I structures to withstand the effects of the design wind specified for the plant are reviewed.

1. The design wind velocity and its recurrence interval, the velocity vertical profiles, and the applicable gust factors are reviewed from the standpoint of use in defining the input parameters for the structural design criteria appropriate to account for wind loadings. The bases for the selection and the values of these parameters are within the review responsibility of the Site Analysis Branch (SAB) as stated in Standard Review Plans 2.3.1 and 2.3.2.
2. The procedures that are utilized to transform the design wind velocity into an effective pressure applied to exposed surfaces of seismic Category I structures are reviewed with particular emphasis on the shape coefficients and distribution of the wind pressure on rectangular flat surfaces and on circular structures such as containments.

II. ACCEPTANCE CRITERIA

The acceptance criteria for the areas of review are as follows:

1. The acceptance criteria for the design wind velocity and its recurrence interval, the velocity vertical profiles, the applicable gust factors, and the bases for determining these site-related parameters, are established by the Site Analysis Branch (SAB) and are contained in Standard Review Plans 2.3.1 and 2.3.2. The approved values of these parameters should serve as basic input to the review and evaluation of the structural design procedures.
2. For the procedures utilized to transform the wind velocity into an effective pressure applied to exposed surfaces of structures, the procedures delineated in either the American Society of Civil Engineers (ASCE) Paper No. 3269, "Wind Forces on Structures"

USNRC STANDARD REVIEW PLAN

Standard review plans are prepared for the guidance of the Office of Nuclear Reactor Regulation staff responsible for the review of applications to construct and operate nuclear power plants. These documents are made available to the public as part of the Commission's policy to inform the nuclear industry and the general public of regulatory procedures and policies. Standard review plans are not substitutes for regulatory guides or the Commission's regulations and compliance with them is not required. The standard review plan sections are keyed to Revision 2 of the Standard Format and Content of Safety Analysis Reports for Nuclear Power Plants. Not all sections of the Standard Format have a corresponding review plan.

Published standard review plans will be revised periodically, as appropriate, to accommodate comments and to reflect new information and experience.

Comments and suggestions for improvement will be considered and should be sent to the U.S. Nuclear Regulatory Commission, Office of Nuclear Reactor Regulation, Washington, D.C. 20545

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(Ref. 1), or in ANSI A58.1-1972, "Building Code Requirements for Minimum Design Loads in Building and Other Structures" (Ref. 2), are acceptable. In particular, the procedures utilized are acceptable if found in accordance with the following:

- a. If the ASCE Paper No. 3269 is selected:

For a design wind velocity of v mph, the dynamic pressure q is given by:

$$q = 0.00256 v^2 \text{ psf}$$

To arrive at the equivalent uniform pressure acting on a particular structure, the dynamic pressure q should be modified by a shape or drag coefficient which is primarily dependent on the geometry and physical configuration of the structure. Shape or drag coefficients for a variety of structures are given in Table 4 of ASCE Paper No. 3269 (Ref. 1). Geometrical shapes that are not specifically covered in the ASCE Paper No. 3269 case reviewers on a case-by-case basis.

- b. If the ANSI A58.1-1972 document is selected:

For a design wind velocity of V_{30} mph specified at a height of 30 ft above the ground, the velocity pressure, q_{30} , is given by:

$$q_{30} = 0.00256 V_{30}^2 \text{ psf}$$

The effective pressure for structures, q_F , and for portions thereof, q_p , at various heights above the ground should be in accordance with Table 5 and Table 6 of ANSI A58.1-1972, respectively. Since most nuclear power plants are located in relatively open country, Exposure C, as defined in ANSI A58.1-1972, should be selected for both tables.

Depending on the structure geometry and physical configuration, pressure coefficients may be selected in accordance with Section 6.4 of ANSI A58.1-1972. Geometrical shapes that are not covered in this document are reviewed on a case-by-case basis.

III. REVIEW PROCEDURES

The reviewer selects and emphasizes material from the review procedures described below as may be appropriate for a particular case.

1. The site-related parameters described in Section I. 1. of this plan are reviewed by the Site Analysis Branch (SAB) and are covered by Standard Review Plans 2.3.1 and 2.3.2. The structural reviewer examines the approved values of these parameters to assure himself that the procedures utilized in designing the structures to withstand the specified wind loadings are appropriate and applicable.
2. After the applicability of the site-related parameters is established, the reviewer proceeds with his review of the structural aspects of wind design. The procedures utilized by the applicant to transform wind velocities into applied pressures are reviewed and compared with those procedures delineated in either ASCE Paper No. 3269 or in ANSI A58.1-1972 document, whichever has been selected. In particular, the pressures and shape coefficients utilized for rectangular buildings and circular structures are reviewed and compared with those referenced in Section II.2 of this plan.

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IV. EVALUATION FINDINGS

The reviewer verifies that sufficient information has been provided to satisfy the requirements of this review plan, and concludes that his evaluation is sufficiently complete and adequate to support the following type of conclusive statement to be included in the staff's Safety Evaluation report:

"The procedures utilized to determine the loadings on seismic Category I structures induced by the design wind specified for the plant are acceptable since these procedures provide a conservative basis for engineering design to assure that the structures will withstand such environmental forces.

"The use of these procedures provides reasonable assurance that in the event of design basis winds, the structural integrity of the plant seismic Category I structures will not be impaired and, in consequence, seismic Category I systems and components located within these structures are adequately protected and will perform their intended safety functions if needed. Conformance with these procedures is an acceptable basis for satisfying, in part, the requirements of General Design Criterion 2."

V. REFERENCES

1. ASCE Paper No. 3269, "Wind Forces on Structures," Transactions of the American Society of Civil Engineers, Vol. 126, Part II (1961).
2. ANSI A58.1-1972, "Building Code Requirements for Minimum Design Loads in Buildings and Other Structures," Committee A58.1, American National Standards Institute (1972).
3. 10 CFR Part 50, Appendix A, General Design Criterion 2, "Design Bases for Protection Against Natural Phenomena."

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