

## RS-002, "PROCESSING APPLICATIONS FOR EARLY SITE PERMITS"

### ATTACHMENT 2

#### 2.3.1 REGIONAL CLIMATOLOGY

##### REVIEW RESPONSIBILITIES

Primary - Probabilistic Safety Assessment Branch (SPSB)

Secondary - None

##### I. AREAS OF REVIEW

This section of the site safety assessment for an early site permit (ESP) application concerns averages and extremes of climatic conditions and regional meteorological phenomena which affect the safe design and siting of a nuclear power plant or plants of specified type (or falling within a plant parameter envelope [PPE]) that might be constructed on the proposed site. The review covers the following specific areas:

1. A description of the general climate of the region with respect to types of air masses, synoptic features (high- and low-pressure systems and frontal systems), general airflow patterns (wind direction and speed), temperature and humidity, precipitation (rain, snow, and sleet), and relationships between synoptic-scale atmospheric processes and local (site) meteorological conditions.
2. Seasonal and annual frequencies of severe weather phenomena, including tornadoes, waterspouts, thunderstorms, lightning, hail (including probable maximum size), and high air pollution potential.
3. Meteorological conditions used as design and operating bases, including:
  - a. The maximum snow and ice load (water equivalent) that the roofs of safety-related structures must be capable of withstanding during plant operation.
  - b. Ultimate heat sink meteorological conditions resulting in the maximum evaporation and drift loss of water and minimum water cooling.
  - c. Tornado parameters, including translational speed, rotational speed, and the maximum pressure differential with the associated time interval.
  - d. 100-year return period "straight-line winds," including vertical profiles and gust factors.
  - e. Probable maximum frequency of occurrence and time duration of freezing rain (ice storms) and, where applicable, dust (sand) storms.

- f. Other meteorological and air quality conditions used for design and operating basis considerations.

## II. ACCEPTANCE CRITERIA

The information regarding the regional meteorological conditions and phenomena which would affect the safe design and siting of a nuclear power plant or plants of specified type (or falling within a PPE) that might be constructed at the proposed site is acceptable if it meets the requirements of the following regulations:

1. 10 CFR Part 50, Appendix A, General Design Criterion (GDC) 2, "Design Bases for Protection Against Natural Phenomena" (Ref. 1), with respect to information on severe regional weather phenomena that have historically been reported for the region and that are reflected in the design bases for structures, systems, and components important to safety,
2. 10 CFR Part 50, Appendix A, GDC 4, "Environmental and Dynamic Effects Design Bases" (Ref. 2), with respect to information on tornadoes that could generate missiles, and
3. 10 CFR Part 100, §100.20(c) and §100.21(d) (Ref. 3), with respect to the consideration that has been given to the regional meteorological characteristics of the site.

The information should be presented in accordance with accepted practice.

Regulatory positions and specific criteria necessary to meet the Commission's regulations identified above are as follows:

1. The description of the general climate of the region should be based on standard climatic summaries compiled by NOAA (Refs. 4, 5). Consideration of the relationships between regional synoptic-scale atmospheric processes and local (site) meteorological conditions should be based on appropriate meteorological data (Refs. 5, 6).
2. Data on severe weather phenomena should be based on standard meteorological records from nearby representative National Weather Service (NWS), military, or other stations recognized as standard installations which have long periods on record. The applicability of these data to represent site conditions during the expected period of reactor operation should be substantiated (Refs. 5, 6, 7).
3. Design basis tornado parameters may be based on Regulatory Guide 1.76 (Ref. 8) or the staff's interim position on design basis tornado characteristics (Ref. 9). ESP applicants may use any design-basis tornado wind speeds that are appropriately justified, but must conduct a technical evaluation of site-specific data.
4. Design basis straight-line wind velocity should be based on appropriate standards, with suitable corrections for local conditions (Refs. 10, 11).
5. The ultimate heat sink meteorological data, as stated in Regulatory Guide 1.27 (Ref. 12), should be based on long-period regional records which represent site conditions.

Suitable information may be found in climatological summaries (e.g. Refs. 10 or 11 or similar publications) for evaluation of wind, temperature, humidity, and other meteorological data used for ultimate heat sink design.

6. Freezing rain estimates should be based on representative NWS station data.
7. High air pollution potential information should be based on U.S. Environmental Protection Agency (EPA) studies (Refs. 13, 14).
8. All other meteorological and air quality data used for safety-related plant design and operating bases should be documented and substantiated.

### III. REVIEW PROCEDURES

#### 1. General Climate

The general climatic description of the region in which the site is located is reviewed for completeness and authenticity. Climatic parameters such as air masses, general airflow, pressure patterns, frontal systems, and temperature and humidity conditions reported by the applicant are checked against standard references (Refs. 4 and 5) for appropriateness.

The applicant's description of the role of synoptic-scale atmospheric processes on local (site) meteorological conditions is checked against the descriptions provided in References 5 and 6.

#### 2. Regional Meteorological Averages and Extremes

Estimates of meteorological averages and extremes can only be obtained from stations that have long periods of record. It is not likely that meteorological stations used to describe the regional climatology will be near the proposed site, with the possible exception of stations at existing nuclear power plants near which an ESP site might be located. Therefore, one of the primary concerns of this review is a determination of the representativeness of the available data for the site. The adequacy of the stations and their data is also evaluated.

Meteorological averages and extremes are checked against standard publications to determine if the design-basis meteorological data presented are reasonable. Climatological data summaries suitable for review of the applicant's values are published by organizations such as the American Society of Civil Engineers (e.g., Ref. 10); the American Society of Heating, Refrigerating, and Air-Conditioning Engineers; and the American National Standards Institute. Climatological data suitable for use in this review are available from the National Climatic Data Center. For example, the Engineering Weather Data CDROM (Ref. 11) contains data summaries prepared by the U.S. Air Force Combat Climatology Center.

#### IV. EVALUATION FINDINGS

The reviewer verifies that sufficient information has been provided and that the staff's evaluation supports concluding statements of the following type to be included in the staff's safety evaluation report:

As set forth above, the applicant has presented and substantiated information relative to the regional meteorological conditions of importance to the safe design and siting of a nuclear power plant of type specified by the applicant that might be constructed on the proposed site. The staff has reviewed the available information provided. Based on [summarize bases for conclusion], the staff concludes that the identification and consideration of the regional and site meteorological characteristics meet the requirements of 10 CFR 100.20(c) and 10 CFR 100.21(d).

The applicant has presented and substantiated information regarding severe regional weather phenomena. The staff has reviewed the information provided and, based on [summarize bases for conclusion], concludes that the identification and consideration of the severe weather phenomena at the site and the surrounding area meet the requirements of 10 CFR Part 50, Appendix A, General Design Criterion 2, "Design Bases for Protection Against Natural Phenomena," with respect to establishing the design bases for structures, systems, and components important to safety.

The applicant has conformed with the position set forth in the staff's interim position on design basis tornado characteristics [or with Regulatory Guide 1.76] or has conducted a technical evaluation of site-specific tornado data sufficient to justify that values that deviate from the interim position [or from Regulatory Guide 1.76] are appropriate for the site. Therefore, the staff concludes that the identification and consideration of tornadoes are acceptable and meet the requirements of 10 CFR Part 50, Appendix A, General Design Criterion 4, "Environmental and Dynamic Effects Design Bases," with respect to determining the design basis tornado for the generation of missiles.

These statements should be preceded by a resume of the general climate and the meteorological design parameters used for the plant.

#### V. IMPLEMENTATION

The following is intended to provide guidance to applicants and licensees regarding the NRC staff's plans for using this section of this review standard.

This section will be used by the staff when performing safety evaluations of ESP applications submitted by applicants pursuant to 10 CFR Part 52. Except in those cases in which the applicant proposes an acceptable alternative method for complying with specified portions of the Commission's regulations, the method described herein will be used by the staff in its evaluation of conformance with Commission regulations.

Implementation schedules for conformance to parts of the method discussed herein are contained in the referenced regulatory guides.

VI. REFERENCES

1. 10 CFR Part 50, Appendix A, General Design Criterion 2, "Design Bases for Protection Against Natural Phenomena."
2. 10 CFR Part 50, Appendix A, General Design Criterion 4, "Environmental and Dynamic Effects Design Bases."
3. 10 CFR Part 100, "Reactor Site Criteria."
4. U.S. Department of Commerce, "Climate Atlas of the United States, "National Climatic Data Center, NOAA. CD-ROM.
5. U.S. Department of Commerce, "Local Climatological Data - Annual Summary with Comparative Data," National Climatic Data Center, NOAA, published annually for all first-order NWS stations.
6. U.S. Department of Commerce, "State Climatological Summary," National Climatic Data Center, NOAA, published annually by State.
7. U.S. Department of Commerce, "Storm Data," National Climatic Data Center, NOAA, published monthly.
8. Regulatory Guide 1.76, "Design Basis Tornado for Nuclear Power Plants."
9. Interim staff position on tornadoes, letter dated March 25, 1988, from NRC to the Advanced Light Water Reactor (ALWR) Utility Steering Committee, Subject: ALWR Design Basis Tornado.
10. ASCE Standard No. 7-98, " Minimum Design Loads for Buildings and Other Structures," American Society of Civil Engineers, 2000.
11. U.S. Department of Commerce, "Engineering Weather Data," National Climatic Data Center, NOAA. CD-ROM.
12. Regulatory Guide 1.27, "Ultimate Heat Sink for Nuclear Power Plants."
13. G. C. Holzworth, "Mixing Heights, Wind Speeds, and Potential for Urban Air Pollution Throughout the Contiguous United States," AP-101, Office of Air Programs, USEPA, January 1972.
14. J. Korshover, "Climatology of Stagnating Anticyclones East of the Rocky Mountains, 1936-1970," Publication No. 99-AP-34, Public Health Service, October 1971.