RG 1.70 2.3 Meteorology

Regional Climatology

2.3.1.1 General Climate. The general climate of the region should be described 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. Provide references that indicate the climatic atlases and regional climatic summaries used.

2.3.1.2 Regional Meteorological Conditions for Design and Operating Bases. Seasonal and annual frequencies of severe weather phenomena, including hurricanes, tornadoes and waterspouts, thunderstorms, lightning, hail, and high air pollution potential, should be provided. Provide the probable maximum annual frequency of occurrence and time duration of freezing rain (ice storms) and dust (sand) storms where applicable. Provide estimates of the weight of the 100-year return period snowpack and the weight of the 48-hour Probable Maximum Winter Precipitation for the site vicinity. Using the above estimates, provide the weight of snow and ice on the roof of each safety-related structure.

Provide the meteorological data used for evaluating the performance of the ultimate heat sink with respect to (1) maximum evaporation and drift loss and (2) minimum water cooling (see Regulatory Guide 1.27, "Ultimate Heat Sink for Nuclear Power Plants"). The period of record examined should be identified, and the bases and procedures used for selection of the critical meteorological data should be provided and justified.

Provide design basis tornado parameters, including translational speed, rotational speed, maximum pressure differential with its associated time interval (see guidance in Regulatory Guide 1.76, "Design Basis Tornado for Nuclear Power Plants"), and 100-year return period "fastest mile of wind," including vertical distribution of velocity and appropriate gust factor.

Provide all other regional meteorological and air quality conditions used for design and operating basis considerations and their bases. References to SAR sections in which these conditions are used should be included.

2.3.2 Local Meteorology

2.3.2.1 Normal and Extreme Values of Meteorological Parameters. Provide monthly and annual summaries (based on both long-term data from nearby reasonably representative locations and shorter-term onsite data) of:

1. Monthly and annual wind roses using the wind speed classes provided in Regulatory Guide 1.23 (Safety Guide 23), "Onsite Meteorological Programs," and wind direction persistence summaries at all heights at which wind characteristics data are applicable or have been measured.

2. Monthly and annual air temperature and dewpoint temperature summaries, including averages, measured extremes, and diurnal range.

3. Monthly and annual extremes of atmospheric water vapor (absolute and relative) including averages, measured extremes, and diurnal range.

4. Monthly and annual summaries of precipitation, including averages and measured extremes, number of hours with precipitation, rainfall rate distribution, (i.e., maximum 1 hr, 2 hr, ... , 24 hr) and monthly precipita tion wind roses with precipitation rate classes.

5. Monthly and annual summaries of fog (and smog), including expected values and extremes of frequency and duration.

6. Monthly and annual summaries of atmospheric stability defined by vertical temperature gradient or other well-documented parameters that have been substantiated by diffusion data.

7. Monthly mixing height data, including frequency and duration (persistence) of inversion conditions.

8. Hourly averages of wind speed and direction at all heights at which wind characteristics data are applicable or have been measured and hourly averages of atmospheric stability as defined by vertical temperature gradient or other well-documented parameters that have been substantiated by diffusion data. (These data should be presented as hour-by-hour data on magnetic tape or monthly and annual joint frequency distributions of wind speed and wind direction by atmospheric stability.)

This information should be fully documented and substantiated as to the validity of its representation of conditions at and near the site. References should be provided to the National Weather Service (NOAA) station summaries from nearby locations and to other meteorological data that were used to describe site characteristics.

2.3.2.2 Potential Influence of the Plant and Its Facilities on Local Meteorology. Discuss and provide an evaluation of the potential modification of the normal and extreme values of meteorological parameters described in Section 2.3.2.1 above as a result of the presence and operation of the plant (e.g. , the influence of cooling towers or water impoundment features on meteorological conditions). Provide a map showing the detailed topographic features (as modified by the plant) within a 5-mile (3.1 km) radius of the plant. Also provide a smaller scale map showing topography within a 50-mile (80 km) radius of the plant as well as a plot of maximum elevation versus distance from the center of the plant in each of the sixteen 22-1/2-degree compass point sectors (centered on true north, north northeast, northeast, etc.) radiating from the plant to a distance of 50 miles (80 km).

2.3.2.3 Local Meteorological Conditions for Design and Operating Bases. Provide all local meteorological and air quality conditions used for design and operating basis considerations and their bases, except for those conditions referred to in Sections 2.3.4 and 2.3.5. References should be included to SAR sections in which these conditions are used.

2.3.3 Onsite Meteorological Measurements Program

The preoperational and operational programs for meteorological measurements at the site, including offsite satellite facilities, should be described. This description should include measurements made, locations and elevations of measurements, exposure of instruments, descriptions of instruments used, instrument performance specifications, calibration and maintenance procedures, data output and recording systems and locations, and data analysis procedures. Additional sources of meteorological data for consideration in the description of airflow trajectories from the site to a distance of 80 km should be similarly described in as much detail as possible, particularly measurements made, locations and elevations of measurements, exposure of instruments, descriptions of instruments used, and instrument performance specifications. These additional sources of meteorological data may include National Weather Service stations and other meteorological programs that are well maintained and well exposed (e.g., other nuclear facilities, university and private meteorological programs). Guidance on acceptable onsite meteorological programs is presented in Regulatory Guide 1.23.

Provide joint frequency distributions of wind speed and direction by atmospheric stability class (derived from currently acceptable parameters), based on appropriate meteorological measurement heights and data reporting periods, in the format

described in Regulatory Guide 1.23. An hour-by-hour listing of hourly-averaged parameters should also be provided on magnetic tape.

For the PSAR, at least one annual cycle of onsite meteorological data should be provided at docketing. If adequate meteorological data are not available at docketing, the best available (onsite and offsite) data to describe atmospheric dispersion characteristics should be provided. Adequate onsite meteorological data must be provided prior to or with the scheduled response to the first set of staff requests for additional information.

For the FSAR, at least two consecutive annual cycles (and preferably three or more whole years), including the most recent one-year period, should be provided at docketing.

Evidence should be provided to show how well these data represent long-term conditions at the site.

2.3.4 Short-Term Diffusion Estimates

2.3.4.1 Objective. Provide conservative and realistic estimates of atmospheric diffusion (x/Q) at the site boundary (exclusion area) and at the outer boundary of the low population zone for appropriate time periods up to 30 days after an accident.

2.3.4.2 Calculations. Diffusion estimates should be based on the most representative meteorological data. Onsite data alone should be used as soon as a one-year period of record is completed.

Provide hourly cumulative frequency distributions of relative concentrations (x/Q), using onsite data at appropriate distances from the effluent release point(s), such as the minimum site boundary distance (exclusion area). The x/Q values from each of these distributions that are exceeded 5% and 50% (median value) of the time should be reported. For the outer boundary of the low population zone, provide cumulative frequency of x/Q estimates for (1) the 8-hour time period from 0 to 8 hours; (2) the 16-hour period from 8 to 24 hours; (3) the 3-day period from 1 to 4 days; and (4) the 26-day period from 4 to 30 days. Report the worst condition and the 5% and 50% probability level conditions. Guidance on appropriate diffusion models for estimating X/Q values is presented in Regulatory Guides 1.3, "Assumptions Used for Evaluating the Potential Radiological. Consequences of a Loss-of-Coolant Accident for Boiling Water Reactors," and 1.4, "Assumptions Used for Evaluating the Potential Radiological Con sequences of a Loss-of-Coolant Accident for Pressurized Water Reactors."

Evidence should be provided to show how well these diffusion estimates represent conditions that would be estimated from anticipated long-term conditions at the site. The effects of topography on short-term diffusion estimates should be discussed.

2.3.5 Long-Term Diffusion Estimates

2.3.5.1 Objective. Provide realistic estimates of annual average atmospheric transport and diffusion characteristics to a distance of 50 miles (80.5 km) from the plant for annual average release limit calculations and man-rem estimates.

2.3.5.2 Calculations. Provide a detailed description of the model used to calculate realistic annual average x/Q values. Discuss the accuracy and validity of the model, including the suitability of input parameters, source configuration, and topography. Provide the meteorological data summaries (onsite and regional) used as input to the models. Guidance on acceptable atmospheric transport and diffusion models is presented in Regulatory Guide 1.111, "Methods for Estimating Atmospheric Transport and Dispersion of Gaseous Effluents in Routine Releases from Light-Water-Cooled Reactors.""

Provide a calculation of the maximum annual average X/Q at or beyond the site boundary utilizing appropriate meteorological data for each routine venting location. Estimates of annual average X/Q values for 16 radial sectors to a distance of 50 miles (80.5 km) from the plant using appropriate meteorological data should be provided