U.S. NUCLEAR REGULATORY COMMISSION
OFFICE OF STANDARDS DEVELOPMENT
DRAFT REGULATORY GUIDE AND VALUE/IMPACT STATEMENT

September 1980
Division 1
Task SS 926-4

Contact: L. Brown (301) 443-5976

PROPOSED REVISION 1* TO REGULATORY GUIDE 1.23

METEOROLOGICAL PROGRAMS IN SUPPORT OF NUCLEAR POWER PLANTS

A. INTRODUCTION

Paragraph 100.10(c)(2) of 10 CFR Part 100, "Reactor Site Criteria," states that, in determining the acceptability of a site for a power or test reactor, the Nuclear Regulatory Commission (NRC) will take into consideration meteorological conditions at the site and in the surrounding area.

Paragraph 50.36a(a)(2) of 10 CFR Part 50, "Domestic Licensing of Production and Utilization Facilities," requires nuclear power plant licensees to submit semiannual reports specifying the quantity of each of the principal radionuclides released to unrestricted areas in liquid and gaseous effluents and such other information as may be required by the NRC to estimate maximum potential annual radiation doses to the public resulting from effluent releases. A knowledge of meteorological conditions in the vicinity of the reactor is important in providing a basis for estimating annual radiation doses resulting from radioactive materials released in gaseous effluents.

In order for the NRC to fulfill its responsibilities under the National Environmental Policy Act of 1969 and in accordance with the requirements of 10 CFR Part 51, "Licensing and Regulatory Policy and Procedures for Environmental Protection," and Appendix I, "Numerical Guides for Design Objectives

*This revised guide sets forth essentially the same considerations for preoperational programs for new facilities as the previous edition of this guide though with reorganization of content and clarification and additional details in the discussions. The major change relates to the addition of special considerations for emergency preparedness (regulatory position 8). The substantial number of changes in this proposed revision has made it impractical to indicate the changes with lines in the margin.

and Limiting Conditions for Operation To Meet the Criterion 'As Low As Is Reasonably Achievable' for Radioactive Material in Light-Water-Cooled Nuclear Power Reactor Effluents," to 10 CFR Part 50, basic meteorological information must be available for use in assessing potentially adverse environmental effects of a radiological and nonradiological nature resulting from the construction or operation of a nuclear power plant.

In addition to the requirements for determining meteorological conditions at nuclear power plants in order to assess siting, licensing, and environmental factors, detailed meteorological information is necessary for dealing with radiological emergencies. Appendix E, "Emergency Plans for Production and Utilization Facilities," to 10 CFR Part 50 requires each applicant for an operating license to include in its final safety analysis report, required by paragraph 50.34(b) of 10 CFR Part 50, plans for coping with radiological emergencies. The plans must include criteria for determining when protective measures should be considered within and outside the site boundary to protect health and safety and prevent damage to property. In this regard, it is necessary for the applicant or licensee to establish and maintain a meteorological program capable of rapidly assessing critical meteorological parameters.

Thus, at each nuclear power plant site, there are multiple needs for programs that will adequately measure and document basic meteorological data. These data can be used to develop atmospheric diffusion parameters that, with an appropriate dispersion model, can be used to estimate potential radiation doses to the public resulting from actual routine or accidental releases of radioactive materials to the atmosphere or to evaluate the potential dose to the public as a result of hypothetical reactor accidents. This regulatory guide describes meteorological measurement programs acceptable to the NRC staff for providing meteorological data needed to estimate these potential radiation doses.

B. DISCUSSION

Meteorological measurement programs at a nuclear power plant site should be capable of providing the meteorological information required to make the following assessments:

1. A conservative assessment by the applicant or licensee and the NRC staff of the potential dispersion of radioactive material from and the radiological consequences of design basis accidents to aid in evaluating the

acceptability of a site and the adequacy of engineered safety features for a nuclear power plant in accordance with the requirements of 10 CFR Part 100.

2. An assessment by the applicant or licensee and the NRC staff of the maximum potential annual radiation dose to the public resulting from the routine release of radioactive materials in gaseous effluents. These assessments assist in demonstrating that operations will be or are being conducted within the limits of 10 CFR Part 20, "Standards for Protection Against Radiation," and in ensuring that effluent control equipment design objectives and proposed operating procedures meet the requirements of Appendix I to 10 CFR Part 50.

3. A realistic assessment by the applicant or licensee and the NRC staff of the potential dispersion of radioactive materials from and the radiological consequences of a spectrum of accidents to aid in evaluating the environmental risk posed by a nuclear power plant in accordance with 10 CFR Part 51.

4. A realistic assessment by the applicant or licensee and the NRC staff of such nonradiological environmental effects as fogging, icing, and salt drift from cooling towers to aid in evaluating the environmental impact of a nuclear power plant in accordance with 10 CFR Part 51.

5. An assessment by the licensee and other appropriate persons of the radiological consequences of an accidental release of radioactive material to the atmosphere. The assessments should be used to provide guidance to persons assigned to the licensee's emergency organization and to appropriate local, State, and Federal agencies with responsibilities for coping with emergencies for use in determining (a) the need for notification and participation of local and State agencies and the NRC and other Federal agencies and (b) when appropriate measures should be taken to protect public health and safety and prevent damage to property in accordance with Appendix E to 10 CFR Part 50. Meteorological measurement programs should provide an adequate basis for short distance (less than 16 km) atmospheric dispersion calculations. Other regional meteorological data are necessary to make dispersion estimates for long distances. To ensure that the required data are readily available, it is important that the applicant or licensee establish and maintain contact with the Meteorologist-In-Charge at appropriate National Weather Service Offices[1] and inventory and

[1]The name and address of the Meteorologist-In-Charge may be obtained by contacting the Chief, Meteorological Services Division, National Weather Service, National Oceanic and Atmospheric Administration, Silver Spring, Maryland 20910.

make available to emergency response organizations and appropriate local, State, and Federal agencies meteorological data from other well-maintained meteorological systems in the plant vicinity.

Specific guidance concerning the dispersion models to be used for evaluating the potential radiological consequences of design basis reactor accidents is given in Regulatory Guide 1.145, "Atmospheric Dispersion Models for Potential Accident Consequence Assessments at Nuclear Power Plants." Guidance concerning use of site-specific meteorological information by the NRC staff is being developed for probabilistic assessment of consequences of a spectrum of accidents to aid in evaluating risks of operation of the nuclear power plant consistent with the requirements of 10 CFR Part 51. Guidance concerning the dispersion models to be used for evaluating the potential effects of routine releases of radioactive effluents into the atmosphere is given in Regulatory Guide 1.111, "Methods for Estimating Atmospheric Transport and Dispersion of Gaseous Effluents in Routine Releases from Light-Water-Cooled Reactors." Additional guidance concerning the dispersion models to be used for evaluating the potential radiological consequences for incident response is given in NUREG-0654, "Criteria for Preparation and Evaluation of Radiological Emergency Response Plans and Preparedness in Support of Nuclear Power Plants."

When establishing a meteorological program for an initial site survey, it is essential that care be taken to locate the stations at positions where the measurements will accurately represent the overall site vicinity meteorology and, if possible, where wind patterns will not be significantly influenced by singular topographic features or by construction of plant structures at a later date.

The number of locations in the site vicinity at which meteorological measurements are necessary will depend largely on the complexity of the terrain in the vicinity of the site. For example, a site in a valley or a site near a large body of water may require multiple measuring points to determine airflow patterns and spatial variations of atmospheric stability.

C. REGULATORY POSITION

This section describes suitable meteorological measurement programs to provide the data needed to determine meteorological conditions in the vicinity of nuclear power plants in order to assess safety and environmental factors

prior to plant operation and the data needed to determine when measures should be considered to protect health, safety, and property during the operational phase of the nuclear power plant.

1. METEOROLOGICAL PARAMETERS

To obtain the basic meteorological information required for estimates of atmospheric transport and diffusion and plant impact on the environment at a particular site, instrumentation that is capable of measuring wind direction and wind speed at a minimum of two levels and air temperature difference between a minimum of two levels should be provided on one tower or mast. Precipitation should be measured at or near this tower. Instrumentation should be provided for measuring air temperature on at least one level of the tower or mast corresponding to at least the measurement height of the lower level of the primary air temperature difference measurement. Instrumentation should be provided for measuring ambient moisture (relative humidity, dew point, or wet bulb temperature) on at least one level of the tower or mast. Visibility and solar radiation measurements may be necessary in conjunction with cooling system assessments.

Temperature difference with height may be used to define both the horizontal and vertical standard deviations of material distribution (σ_y and σ_z). The classification of stability parameters that define these standard deviations are delineated in Table 1. Other estimators of stability parameters such as the standard deviation of vertical wind direction (σ_ϕ) in conjunction with minimum wind speed criteria, the standard deviation of horizontal wind direction (σ_θ) in conjunction with minimum wind speed criteria, or Richardson Number may be considered (Ref. 1). However, use of and classification by alternative estimators other than temperature difference with height should be justified and may also require modification of the models described in Regulatory Guides 1.111 and 1.145 with appropriate justification.

The use of σ_ϵ values is not restricted to that of an indicator of diffusion. During plant operation and in the context of real-time diffusion assessments for emergency conditions, the wind direction variability is an essential element in describing the extent of the plume exposure pathway and estimating potential radiological doses.

Sites with unusual air quality characteristics (e.g., high concentrations of airborne particulates due to ambient conditions or plant operation) may require additional instrumentation (e.g., atmospheric sampling equipment). Additional wind, temperature, humidity, and precipitation instrumentation may be required to document site vicinity meteorological conditions due to complex mesoscale features (e.g., nonuniform terrain, coastal effects).

A particular site may warrant use of special meteorological instrumentation, data analysis techniques, or field studies. Proposed activities of this nature and the rationale for performing them should be discussed with the NRC staff prior to installation of special meteorological instrumentation or performance of special studies.

For making estimates of atmospheric transport and diffusion to a distance of 80 kilometers (50 mi) from the plant site, additional information may be needed. If so, it may be obtained, at least in part, from stations with well-maintained meteorological systems (e.g., National Weather Service, military stations, and any other micro-meteorological stations) if these existing stations are in locations that will aid in the description of regional airflow patterns.

2. SITING OF METEOROLOGICAL INSTRUMENTS

The meteorological tower site should represent as closely as possible the same meteorological characteristics as the region into which any airborne material will be released. Whenever possible, the base of the tower or mast should be sited at approximately the same elevation as the finished plant grade. The tower should be located in an area where singular natural or man-made obstructions or the heat dissipation system to be used during plant operation will have little or no influence on the meteorological measurements. The height of natural or man-made obstructions to air movement should ideally be lower than the measuring level to a horizontal distance of 10 times the measuring level height. Whenever possible, locating the tower or mast directly downwind of the obstructions or heat dissipation system under the prevailing downwind wind directions should be avoided. Instrumentation should be located on booms oriented into the prevailing wind direction at a minimum distance of two tower widths from the tower to preclude substantial influence of the tower upon the measurements (Ref. 2). The aspirated temperature shields should either be pointed downward or laterally toward the north.

On the primary tower, wind speed and direction should be monitored at approximately 10 and 60 meters and at a representative higher level for stack releases. The 10-meter level has been generally accepted throughout the world as a standard meteorological reference measurement level. The 60-meter level generally coincides with the routine release level for LWRs. Ambient temperature should be monitored at approximately 10 meters, and ambient moisture should be monitored at approximately 10 meters and also at a height where the measurements will represent the resultant atmospheric moisture content if cooling towers are to be used for heat dissipation. Temperature difference should be measured between the 10- and 60-meter levels and between the 10-meter and a higher level that is representative of diffusion conditions from stack release points.

If supplementary instrumented towers or masts are used to better define atmospheric conditions in the site vicinity, they should have locations and exposures that are indicative of meteorological conditions in the region of the plant site for which better definition is needed (e.g., emergency planning zones).

At coastal sites, the primary meteorological tower should be in such a location that the upper measuring level is within the thermal internal boundary layer during onshore flow conditions. Heights of the internal boundary layer should be confirmed experimentally before the tower or mast site is chosen. For a site with a simple coastline, a secondary tower or mast should be placed at a location where measurements representative of conditions in the unmodified marine air can be determined. When measurements are made to define the meteorological conditions in the vicinity of a nuclear power plant site with a neighboring area of land across a body of water, one secondary tower should be located in the water or two secondary towers or masts should be located on opposite shores. Instrument heights should be selected on the primary tower so that measurements representative of conditions within the internal boundary layer are obtained while the 50-meter separation between levels is maintained. On secondary towers or masts, instrument heights should meet the same criteria for the internal boundary layer over the shoreline.

At a valley site, the primary meteorological tower should be located so that the meteorological measurements are representative of conditions at the potential points of release. All levels at which measurements are made should be within the same thermal internal boundary layer. Drainage conditions and inversion depths should be confirmed experimentally before the tower site is

chosen. For a site with a simple nonmeandering valley that is relatively uniform in depth, a secondary tower or mast should be placed at a location where measurements representative of meteorological conditions outside the valley can be determined. For a site with complex terrain, additional secondary towers or masts should be located to represent complex flow conditions.

3. DATA RECORDERS

For data acquisition on the primary tower, a dual recording system consisting of one digital and one auxiliary analog system should be used. Both system accuracies should be within the specifications presented in regulatory position 4. The wind speed and direction analog recorders should be of the continuous strip chart recording type. Multipoint strip chart recorders are considered to be sufficient for recording all other parameters. All digital records except precipitation should consist of data sampled at intervals no longer than 60 seconds. Precipitation should be recorded on a cumulative basis at least once per hour. The standard deviation of horizontal wind direction fluctuations, σ_θ, should be determined from no less than 180 instantaneous values of lateral wind direction during the recording period (e.g., if the record period is 15 minutes, values sampled at intervals of 5 seconds or less are acceptable; likewise, if the record period is 1 hour, sampling intervals of 20 seconds or less are acceptable).

The data from the primary meteorological system (backup system when necessary) should be displayed in the control room for use during plant operation. These data should also be displayed in the onsite technical support center and nearsite emergency operations facility as needed (e.g., emergency situations, training exercises, demonstrations). These data should include wind direction and speed and an indicator of atmospheric stability for the past 12-hour period representative of each potential release level. Fifteen minutes is the maximum acceptable averaging period for these data. This display should be easily accessible and should be labeled so that the information is clearly understood (e.g., direction from which the wind is blowing, Pasquill stability class).

4. SYSTEM ACCURACY

Parameter accuracy for a system refers to the composite accuracy reflecting the errors introduced by sensor, cable, signal conditioner, humidity, temperature environment for signal conditioning and recording, recorders, and data reduction process. The errors introduced by each of the separate components of the system should be determined by statistical methods (Ref. 3). All sensors should have appropriate accuracies to meet the digital system accuracies specified below over the range of environmental conditions expected to occur during the lifetime of the plant. For individual samples, all components from the sensors to the recording systems that contribute to measurement error are collectively defined by the root sum of the squares (RSS) method as the system accuracy. The RSS is calculated by squaring each error, summing the squared errors, and taking the square root of the sum. For time-averaged values, those parts of the error budget that are truly random may be decreased from their instantaneous value by dividing by the square root of the number of samples used to define the average value. Then the RSS calculation can be made.

a. For digital systems, specific accuracies of time-averaged values by parameter should be:

(1) Wind direction: ±5° of azimuth, with a starting threshold of less than 0.45 m/s (1 mph). If the wind direction sensor is to be used for the collection of σ_θ data, the damping ratio must be 0.4 to 0.6, inclusive, with a deflection of 15 degrees and delay distance not to exceed 2 meters.

(2) Wind speed: ±0.22 m/s (0.5 mph) for speeds less than 11.13 m/s (25 mph), with a starting threshold of less than 0.45 m/s (1 mph).

(3) Temperature: ±0.5°C (0.9°F).

(4) Temperature difference: ±0.15°C (0.27°F) per 50-meter height interval.

(5) Dew point: ±1.5°C (2.7°F) or an equivalent accuracy for relative humidity or wet bulb temperature. These accuracies are applicable for conditions where relative humidity is in excess of 60 percent and temperature is between -30° and 30°C (-22° and 86°F), which is the region of concern for evaluation.

(6) Precipitation: by a recording rain gauge with a resolution of 0.25 mm (0.01 in.). The accuracy of the recorded value must be within ±10 percent of the total accumulated catch.

(7) Time: within 5 minutes of actual time for all recording systems.

All parameters not covered above should be consistent with the current state of the art for the measurement of these parameters.

b. For analog systems, specific accuracies of time-averaged values by parameter should be the same as those above except that the accuracies for wind speed and direction records should be not more than 1.5 times those stated in regulatory position 4a. The system accuracies should include the reduction of data from the strip chart recorder to digital form.

5. INSTRUMENT MAINTENANCE, SERVICING SCHEDULES, AND DATA AVAILABILITY

The system should be protected against lightning and other severe environmental conditions (e.g., icing, blowing sand, salt deposition, air pollution) that may occur at the site. The meteorological measurement system and associated controlled environment housing system for the equipment should be connected to a power system that is supplied from redundant power sources. Meteorological instruments should be inspected and serviced at a frequency that will minimize extended periods of outage and ensure at least an annual 90 percent joint data recovery for atmospheric stability, wind speed, and wind direction at the level that represents each effluent release point. It is essential to maintain an adequate spare parts inventory to minimize extended periods of system outage. Annual data recovery for other individual parameters should be at least 90 percent for each parameter. Redundant sensors and recorders at appropriate locations may also be used to achieve the required data recovery. For the operational meteorological measurement program, the gap that could exist because of failure of the primary system may be filled by a backup system to ensure continuous data availability (see regulatory position 8 for additional guidance for emergency preparedness). The systems should be calibrated at least semiannually to ensure meeting the system accuracies presented in this guide; the calibration results should be reflected in the compiled data base. In areas with high ambient aerosol or particulate loadings in the atmosphere (e.g., sea coastal sites, deserts), calibrations should be performed on a more frequent basis as required to maintain system accuracies. Procedures and a log of inspection, maintenance, and calibrations should be maintained at the tower site as a controlled document and a permanent record to be made available for

review. Any major modification of the system or environs should be documented and discussed with the NRC staff.

6. DATA REDUCTION AND COMPILATION

The basic reduced data should be averaged over a period of 1 hour. At least 15 consecutive minutes of continuous data during each hour should be used to represent a 1-hour average. Precipitation should be totaled hourly. The basic reduced data should be compiled into monthly and annual joint frequency distributions of wind speed and wind direction by atmospheric stability class. An example of a suitable format for data compilation and reporting purposes is shown in Table 2. The table may be modified for specific situations. For example, sites with a high occurrence of low or high wind speeds should include additional wind speed classes. Atmospheric stability should be classified as described in Table 1.

A listing should be prepared of hourly average measurements used in the evaluation, and a magnetic tape containing these parameters should be prepared in the format presented in Appendix A to this guide. An accounting of all hours should be made, with any missing data appropriately designated.

Minimum data requirements with respect to length of data record for various licensing actions are given in Section 2.3 of Regulatory Guide 1.70, "Standard Format and Content of Safety Analysis Reports for Nuclear Power Plants - LWR Edition." Certain computational schemes used by the staff for probabilistic assessment of consequences of a spectrum of accidents to aid in evaluating risks of operation of the nuclear power plant require site-specific hour-by-hour meteorological data over a period of a whole year. To aid in assessing the impact of plant operation on the environment, joint frequency distribution data summaries of wind direction and speed, atmospheric stability class, and relative humidity that will permit the description of the frequency and extent of fogging and icing conditions caused by plant operation should be compiled.

7. QUALITY ASSURANCE

A quality assurance program that is consistent with the provisions of Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants," to 10 CFR Part 50 should be established for both the meteorological

measurement program prior to nuclear power plant operation and for the meteorological measurement program in support of the operation of the nuclear power plant. Chapter 17 of NUREG 75-087, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants, LWR Edition," and Regulatory Guide 1.33, "Quality Assurance Program Requirements (Operation)," provide further guidance.

8. SPECIAL CONSIDERATIONS FOR EMERGENCY PREPAREDNESS

Provisions should be made for remote interrogation of all utility-maintained meteorological systems during emergency situations. These systems should have the capability of being remotely interrogated simultaneously by the licensee, emergency response organizations, and the NRC without interruption of the data-gathering process. This capability may be acquired by the installation of a dial-up connection for an 80-column ASCII terminal via telephone lines (e.g., output format of RS-232-C in FSK). The transmission rate(s) should be compatible with receiving system(s) of the appropriate state(s) and counties and of the NRC. The system should have the capability of recalling 15-minute averages of meteorological parameters from at least the previous 12-hour period. The resolution of the data should meet the system accuracy specifications given in regulatory position 4. An example of a suitable format for the meteorological data is given in Appendix B to this guide.

All sites with operating nuclear power plants should have a viable backup system to obtain real-time local meteorological data. Such a system would provide meteorological information when the primary system is out of service, thus providing assurance that basic meteorological information is available during and immediately following an accidental airborne release. An independent system[2] (e.g., mobile meteorological equipment) should be established for obtaining measurements of wind direction and speed representative of the 10-meter level and a seven-category (classes A through G) estimator of atmospheric stability (e.g., temperature difference with height, wind direction fluctuations as

[2]An independent system can be a system installed and maintained by the licensee specifically for the purpose of providing redundant site-specific meteorological information. This system can be an existing system to which the licensee can access and should be capable of providing the designated continuous information representative of the site environs.

categorized in Table 3). This information should be representative of the site environs and should include data from multiple locations when necessary. The backup system should provide information in a real-time mode in the event necessary parameters from the primary system are not available. Changeover from the primary system to the backup system should occur within 5 minutes.[3] Such information should be presented in place of the lost record as outlined in Appendix B. A functional backup communications link should also be established to ensure interrogation capability. NUREG-0654, "Criteria for Preparation and Evaluation of Radiological Emergency Response Plans and Preparedness in Support of Nuclear Power Plants," provides further guidance on special considerations for the meteorological program during the operational phase of the nuclear power plant.

D. IMPLEMENTATION

The purpose of this section is to provide information to applicants and licensees regarding the NRC staff's plans for using this regulatory guide.

This proposed revision has been released to encourage public participation in its development. Except in those cases in which an applicant proposes an acceptable alternative method for complying with specified portions of the Commission's regulations, the method to be described in the active guide reflecting public comments will be used in the evaluation of all applications that are docketed after, or are in review at, issuance of this guide.

This guide will also be used in staff reviews conducted in accordance with emergency planning schedules as delineated in the amendments to the regulations published in the Federal Register on August 19, 1980. Paragraph 50.54(s) of 10 CFR establishes an implementation date of April 1, 1981, for emergency response plans to be upgraded and specifies April 1, 1982, as the date by which emergency support facilities, including meteorological systems, are expected to be fully operational.

[3]The unavailability goals should be less than 0.001 for each individual parameter as outlined in NUREG-0696, "Functional Requirements for Emergency Response Facilities." Planned outages and preventative maintenance schedules should not be coincident for the primary and backup meteorological systems. The availability goals should be applied to unplanned outages, e.g., resulting from a lightning strike.

REFERENCES

1. S. R. Hanna, G. A. Briggs, et al., "AMS Workshop on Stability Classification Schemes and Sigma Curves--Summary and Recommendations," Bulletin of American Meteorological Society, Vol. 58, No. 12, p. 1305-1309, December 1977.

2. R. C. Hilfiker, "Exposure of Instruments," chapter in Air Pollution Meteorology, USEPA Air Pollution Training Institute, Research Triangle Park, North Carolina (September 1975).

3. CEP Brooks and N. Carruthers, Handbook of Statistical Methods in Meteorology, M.O. 538, Her Majesty's Stationery Office, London (1953), Chapter 5.

TABLE 1

CLASSIFICATION OF ATMOSPHERIC STABILITY
BY TEMPERATURE CHANGE WITH HEIGHT

Stability Classification	Pasquill Categories	Temperature Change with Height (°C/100 m)
Extremely unstable	A	$\Delta T/\Delta z \leq -1.9$
Moderately unstable	B	$-1.9 < \Delta T/\Delta z \leq -1.7$
Slightly unstable	C	$-1.7 < \Delta T/\Delta z \leq -1.5$
Neutral	D	$-1.5 < \Delta T/\Delta z \leq -0.5$
Slightly stable	E	$-0.5 < \Delta T/\Delta z \leq 1.5$
Moderately stable	F	$1.5 < \Delta T/\Delta z \leq 4.0$
Extremely stable	G	$4.0 < \Delta T/\Delta z$

TABLE 2

EXTREMELY STABLE ($\Delta T/\Delta z$ exceeds 4.0°C/100 m) PERIOD OF RECORD:
PASQUILL G

WIND SPEED (m/s) AT 10-m LEVEL

Wind Direction	.22-.50	.51-.75	.76-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-5.0	5.1-7.0	7.1-10.0	10.1-13.0	13.1-18.0	>18.0	Total
N													
NNE													
NE													
ENE													
E													
ESE													
SE													
SSE													
S													
SSW													
SW													
WSW													
W													
WNW													
NW													
NNW													
Total													
Number of Calms													
Number of Invalid Hours													
Number of Valid Hours													

TABLE 3

CLASSIFICATION OF ATMOSPHERIC STABILITY
BY SIGMA THETA

Stability Classification	Pasquill Categories	σ_θ* (degrees)
Extremely unstable	A	$\sigma_\theta \geq 22.5$
Moderately unstable	B	$22.5 > \sigma_\theta \geq 17.5$
Slightly unstable	C	$17.5 > \sigma_\theta \geq 12.5$
Neutral	D	$12.5 > \sigma_\theta \geq 7.5$
Slightly stable	E	$7.5 > \sigma_\theta \geq 3.8$
Moderately stable	F	$3.8 > \sigma_\theta \geq 2.1$
Extremely stable	G	$2.1 > \sigma_\theta$

*Standard deviation of horizontal wind direction fluctuation over a period of 15 minutes to 1 hour.

APPENDIX A

FORMAT FOR HOURLY METEOROLOGICAL DATA TO BE PLACED ON MAGNETIC TAPE

Use: 9 track tape (7 will be acceptable)
Standard Label, which would include
Record Length = 160 characters
Block Size = 3200 characters (fixed block size)
Density = 1600 BPI preferred (800 BPI will be accepted)

Do not Use: Magnetic tapes with unformatted or spanned records.

(For guidance on tape formatting and a description of tape attributes, see Tables A-1 and A-2.)

At the beginning of each tape, use the first five records (which is the equivalent of ten cards) to give a tape description. Include plant name and location (latitude, longitude), dates of data, information explaining data contained in the "other" fields if they are used, height of measurements, and any additional information pertinent to identification of the tape. Make sure all five records are included, even if some are blank. Format for the first five records will be 160A1. Meteorological data format is (I6, I2, I3, I4, 25F5.1, F5.2, 3F5.1). Decimal points should not be included when copying data onto the tape.

All data should be given to a tenth of a unit except solar radiation, which should be given to a hundredth of a unit. This does not necessarily indicate the accuracy of the data (e.g., wind direction is usually given to the nearest degree, but record it with a zero in the tenth's place; therefore, 275 degrees would be 275.0 degrees and placed on the tape as 2750.) All nines in any field should indicate a lost record (99999). All sevens in a wind direction field should indicate calm (77777). If only two levels of data are monitored, use the upper and lower level fields. If only one level of data is monitored, use the upper level field.

TABLE A-1

MAGNETIC TAPE METEOROLOGICAL DATA

LOCATION:

DATE OF DATA RECORD:

I6	Identifier (can be anything)	
I2	Year	
I3	Julian Day	
I4	Hour (on 24-hr clock)	
		ACCURACY
F5.1	Upper Measurements: Level = _____ meters	
F5.1	Wind Direction (degrees)	_____
F5.1	Wind Speed (m/s)	_____
F5.1	Sigma Theta (degrees)	_____
F5.1	Ambient Temperature (°C)	_____
F5.1	Moisture: _____	_____
F5.1	Other: _____	_____
F5.1	Intermediate Measurements: Level = _____ meters	
F5.1	Wind Direction (degrees)	_____
F5.1	Wind Speed (m/s)	_____
F5.1	Sigma Theta (degrees)	_____
F5.1	Ambient Temperature (°C)	_____
F5.1	Moisture: _____	_____
F5.1	Other: _____	_____
F5.1	Lower Measurements: Level = _____ meters	
F5.1	Wind Direction (degrees)	_____
F5.1	Wind Speed (m/s)	_____
F5.1	Sigma Theta (degrees)	_____
F5.1	Ambient Temperature (°C)	_____
F5.1	Moisture: _____	_____
F5.1	Other: _____	_____

TABLE A-1 (Continued)

F5.1	Temp Diff (Upper-Lower) (°C/100 meters)	
F5.1	Temp Diff (Upper-Intermediate) (°C/100 meters)	
F5.1	Temp Diff (Intermediate-Lower) (°C/100 meters)	
F5.1	Precipitation (mm)	
F5.2	Solar Radiation (cal/cm^2/min)	
F5.1	Visibility (km)	
F5.1	Other: _____	
F5.1	Other: _____	

TABLE A-2

DATA TAPE ATTRIBUTES

USE		KEYWORDS	
		IBM	CDC
Mode:	9-track, 1600bpi, EBCDIC[1]	UNIT = TAPE9, DEN = 3	NT, PE, EB, S, CM = Yes
Internal Labels:	none[2]	LABEL = (;NL)	
Record Format:	fixed length/blocked	RECFM = FB	RT = F, BT = K
Record Length:	160 characters	LRECL = 160	FL = 160
Blocking:	3200 characters/block	BLKSIZE = 3200	RB = 20

DO NOT USE

Variable length or unformatted records or records that span tape blocks, e.g.:

IBM's RECFR = U or VBS.
CDC SCOPE standard tape data format (use the S parameter on the REQUEST to avoid this).

OTHER SYSTEMS

For systems other than IBM or CDC, the above information should be used as a guideline to produce tapes with similar characteristics.

[1] 9-track, 800 bpi, EBCDIC or 7-track, 800 or 556 bpi, BCD are also acceptable.

[2] IBM standard labels are also acceptable.

APPENDIX B

FORMAT FOR DATA INTERROGATION FROM METEOROLOGICAL SYSTEMS

To facilitate the remote interrogation requirements and the ability of

The meteorological information should be preceded by a 3-record block that provides a descriptor for each field of data. This 3-record block should be repeated for every 6-hour block of meteorological data, i.e., every 24 records. The format for the meteorological data field descriptor is given in Table B-2.

The meteorological data considered critical in emergency situations for initial estimation purposes should be provided by transmission. The list of parameters to be transmitted, which could be altered as procedures for evaluating the consequences of radioactive release change, should include 15-minute-averaged wind speed and direction at all measured levels, standard deviation of the horizontal wind direction fluctuations (σ_θ) at all measured levels, vertical temperature difference for all measured layers, ambient and dew point temperature at the 10-meter level, and the precipitation total for the 15-minute period.

All nines in any field should indicate a lost record or a parameter not monitored. All eights in any field should indicate the sensor is in place and recording, but, the information is deemed suspect. All sevens in the wind direction field should indicate calm. If only two levels of data are monitored, the upper and lower level fields should be used. If only one level of data is monitored, use the upper level field. The format for presentation of the meteorological data record is given in Table B-3.

TABLE B-1

SITE DESCRIPTOR DATA FORMAT
(8 Mandatory Records)

Record	Format	Content
1	80A1	Organization/Utility Name
2	80A1	Plant Name/Tower Identification
3	80A1	See Coding Form (Figure B-1)
4	F10.5	Latitude of Containment (degrees North)
	F10.5	Longitude of Containment (degrees West)
	F10.0	Elevation of Base of Meteorological Tower (feet above MSL)
	5X	Blank
	A10	Current Date
	A10	Current Time (session log on)
5	80A1	See Coding Form (Figure B-1)
6	F5.1	Height of Wind Sensor Upper Level (meters)
	F5.1	Height of Wind Sensor Intermediate Level (meters)
	F5.1	Height of Wind Sensor Lower Level (meters)
	5X	Blank
	F5.1	Upper Level Height of Temperature Difference (upper to lower measurement) (meters)
	F5.1	Lower Level Height of Temperature Difference (upper to lower measurement) (meters)
	5X	Blank
	F5.1	Upper Level Height of Temperature Difference (upper to intermediate measurement) (meters)
	F5.1	Intermediate Level Height of Temperature Difference (upper to intermediate measurement) (meters)
	5X	Blank
	F5.1	Intermediate Level Height of Temperature Difference (intermediate to lower measurement) (meters)
	F5.1	Lower Level Height of Temperature Difference (intermediate to lower measurement) (meters)
	5X	Blank
	F5.1	Height of Ambient Temperature Lower Level (meters)
	F5.1	Height of Dew Point Temperature Lower Level (meters)
	F5.1	Precipitation Gauge Height (meters)
7-10	80A1	Comment Section

TABLE B-2

METEOROLOGICAL DATA FIELD DESCRIPTOR
(3 Records for Every 6 Hours of Data)

Record	Format	Content
1	80X	Blank
2	80A1	See Coding Form (Figure B-2)
3	80X	Blank

TABLE B-3

METEOROLOGICAL DATA FORMAT
(1 Record Per 15-Minute-Averaged Data Set)

Format	Content
I2	YEAR
I3	JULIAN DATE
I2	HOUR (on 24-hour clock)
I2	MINUTE (ending observation)
F4.0	WIND DIRECTION (degrees)* UPPER LEVEL
F4.0	WIND DIRECTION (degrees)* INTERMEDIATE LEVEL
F4.0	WIND DIRECTION (degrees)* LOWER LEVEL
1X	BLANK COLUMN
F4.1	WIND SPEED (m/s) UPPER LEVEL
F4.1	WIND SPEED (m/s) INTERMEDIATE LEVEL
F4.1	WIND SPEED (m/s) LOWER LEVEL
1X	BLANK COLUMN
F3.0	SIGMA THETA (degrees) UPPER LEVEL
F3.0	SIGMA THETA (degrees) INTERMEDIATE LEVEL
F3.0	SIGMA THETA (degrees) LOWER LEVEL
1X	BLANK COLUMN
F5.1	TEMPERATURE DIFFERENCE (°C/100 m) UPPER-LOWER
F5.1	TEMPERATURE DIFFERENCE (°C/100 m) UPPER-INTERMEDIATE
F5.1	TEMPERATURE DIFFERENCE (°C/100 m) INTERMEDIATE-LOWER
1X	BLANK COLUMN
F5.1	AMBIENT TEMPERATURE (°C) LOWER LEVEL
1X	BLANK COLUMN
F5.1	DEW POINT TEMPERATURE (°C) LOWER LEVEL
1X	BLANK COLUMN
F5.1	PRECIPITATION TOTAL (mm) GROUND LEVEL
1X	BLANK COLUMN
I1	PASQUILL STABILITY CLASS OR EQUIVALENT TO BE ASSUMED FOR DIFFUSION ESTIMATES (1 = A, 2 = B, 3 = C, ..., 7 = G)

*Wind direction indicates the direction from which the wind is coming.

NRC FORM 53A
(12-75)

U.S. NUCLEAR REGULATORY COMMISSION

ADP TRANSCRIPTION SHEET

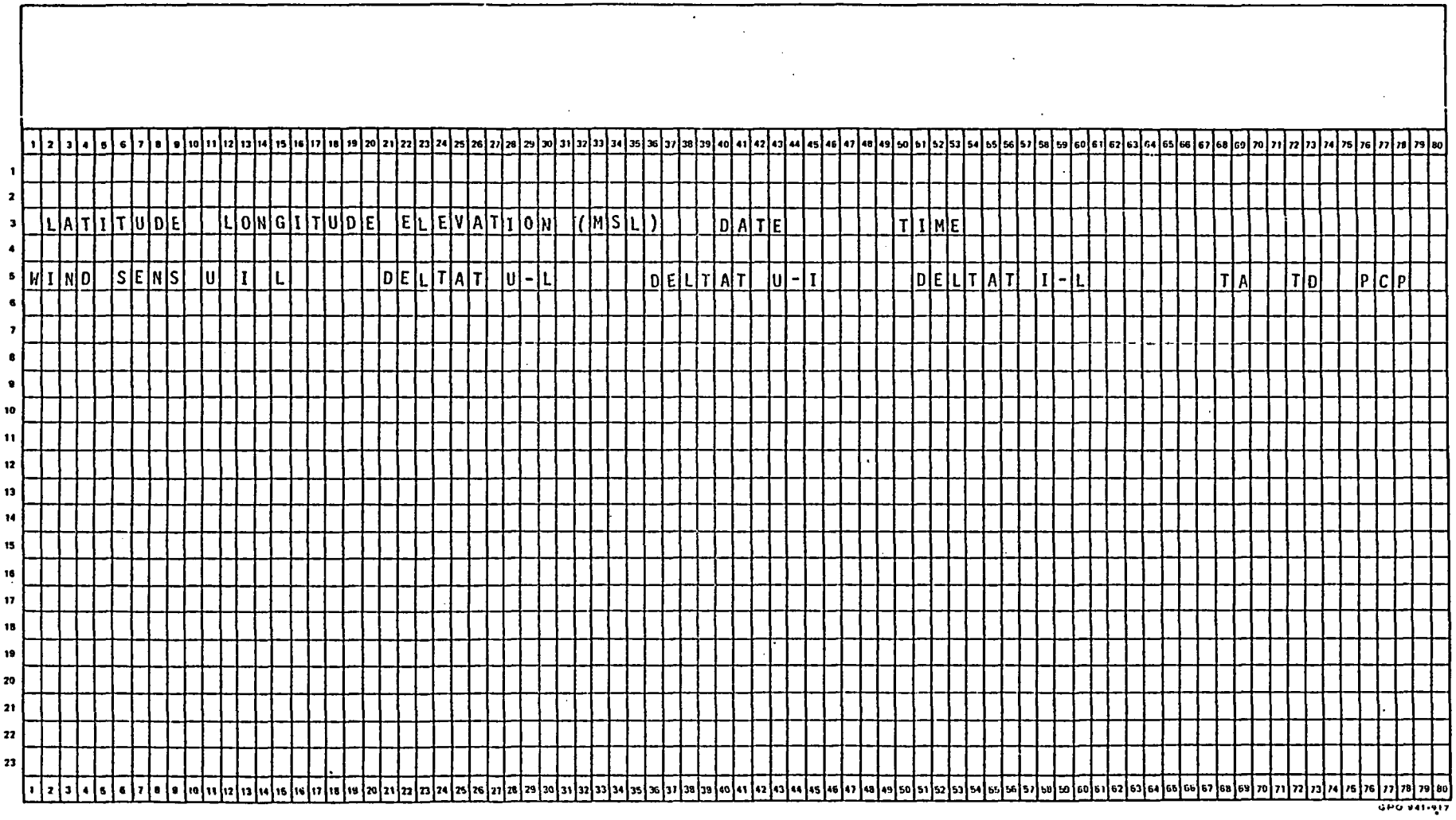
JOB TITLE _____

OFFICE _____

PAGE _____ OF _____

DATE _____

PREPARED BY _____



GPO 941-917

FIGURE B-1. SITE DATA DESCRIPTOR FORMAT

NRC FORM 53A
(12-75)

U.S. NUCLEAR REGULATORY COMMISSION

ADP TRANSCRIPTION SHEET

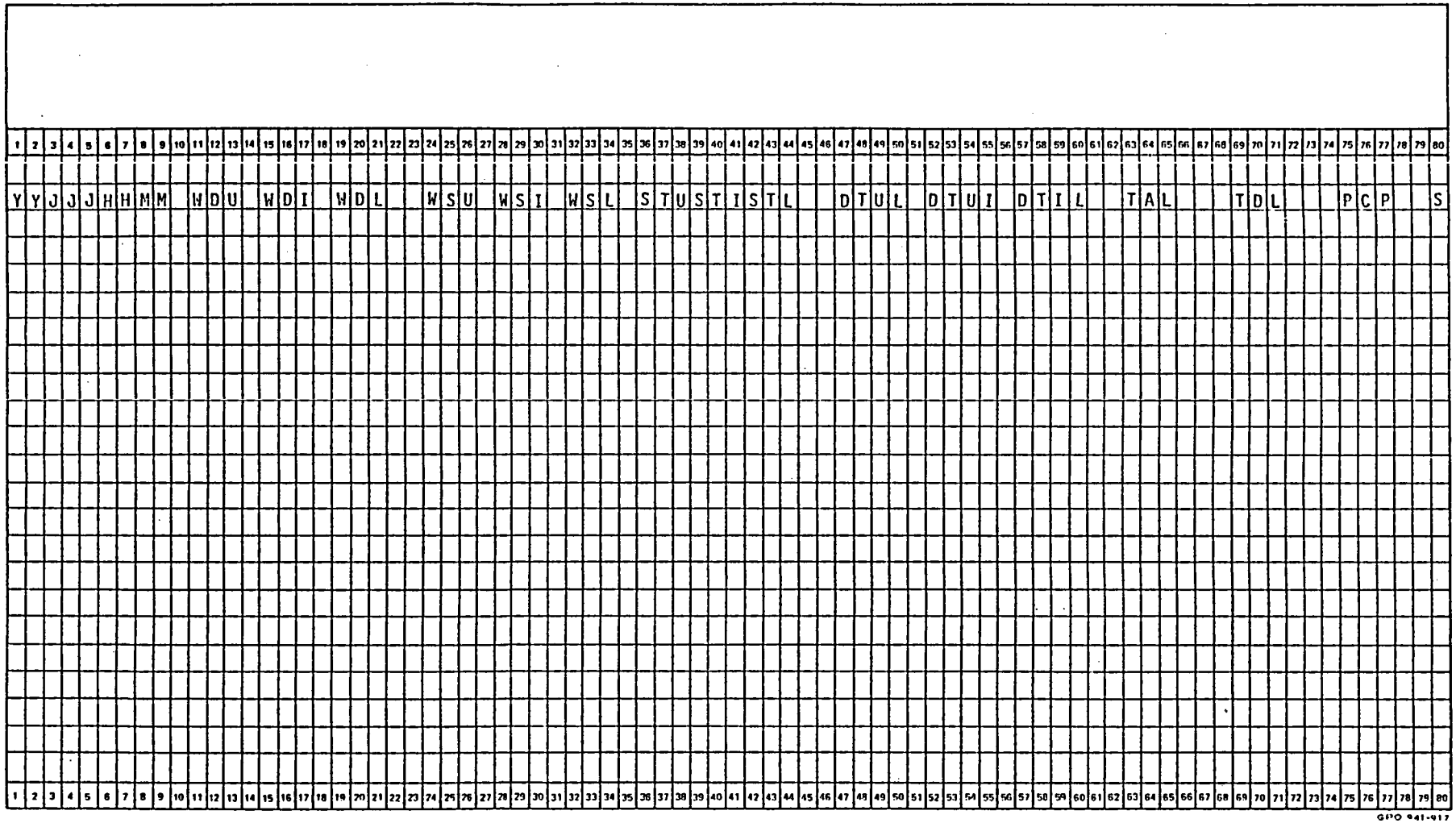
JOB TITLE _____

OFFICE _____

PAGE _____ OF _____

DATE _____

PREPARED BY _____



GPO 841-017

FIGURE B-2. METEOROLOGICAL DATA FIELD DESCRIPTOR FORMAT

DRAFT VALUE/IMPACT STATEMENT

1. PROPOSED ACTION

1.1 Description

The proposed action consists of the revision of Regulatory Guide 1.23 (Safety Guide 23) to update the recommendations for establishing and operating the meteorological programs at nuclear power plant sites. The meteorological programs are necessary to measure and collect meteorological information that is used in estimating potential radiation doses to the public resulting from actual routine releases of radioactive materials into the atmosphere and to estimate either potential doses to the public as a result of a hypothetical reactor accident or actual doses in the case of a real accident.

1.2 Need for Proposed Action

Regulatory Guide 1.23, "Onsite Meteorological Programs," was originally issued as Safety Guide 23 in February 1972. This guide has never been revised. Consequently, much of the information provided in the guide is obsolete, having been made so by changes in the state of the art in meteorological measurement technology and by changes discussed in the guide in the meteorological evaluation procedures in which the meteorological data are to be used. In addition, recent staff experience during the accident at Three Mile Island has shown that a capability to access the meteorological data remotely should be an integral part of the operational meteorological measurement program. The present version of the guide does not include such a recommendation. A revision of this guide is deemed necessary, therefore, to strengthen the guidance in an area shown to be weak as a result of the Three Mile Island experience and to update other areas that are obsolete and of little or no value to users.

1.3 Value/Impact of Proposed Action

1.3.1 NRC

Completion of the proposed action is estimated to require from 0.5 to 1.0 man-year of effort. Associated costs include printing and copying costs

and costs for normal office supplies. No additional research or technical assistance contract costs in support of this effort are anticipated. However, the possibility exists that unanticipated future developments may indicate the advisability of efforts that would incur additional manpower, contract, and travel costs. The primary benefit to the NRC would be a reduction in the number of inquiries that arise because of the obsolete information in the unrevised guide, which does not adequately describe the present recommendations for meteorological programs. Finally, if the recommendation in the proposed revision concerning the remote-access capability for meteorological data is implemented, the NRC will have the potential to acquire real-time meteorological data if needed in the event of an emergency.

1.3.2 Other Government Agencies

Applicant agencies (e.g., TVA) would be affected as discussed in Section 1.3.3. Additional workload would accrue at other agencies (e.g., NOAA, EPA) that may participate in terms of review and comment services. Upon completion of the proposed action, other agencies will have a current reference document describing the NRC's recommendations concerning meteorological measurement programs at nuclear power plant sites. Should the remote-access capability recommendation be implemented, agencies (Federal, State, and local) that may be involved in an emergency situation because of an accident at a nuclear power plant will be assured of access to meteorological data representative of the site in the event that data-recording instruments become inaccessible by conventional means.

1.3.3 Industry

Industry will benefit by having available a current source of information concerning NRC recommendations for establishing and operating an onsite meteorological program at nuclear power plant sites. Costs to industry will result from having to become familiar with the product document and in review and comment efforts. It is anticipated that studies will cost approximately $100,000 to $200,000 at those coastal sites where it is necessary to experimentally confirm the heights of the internal boundary layer. The total estimated cost of purchasing and installing the necessary equipment for a

remote-access capability to archive meteorological data for emergency response purposes, should this recommendation be implemented, is $10,000 to $20,000 per site. This equipment is expected to be part of a larger system for making atmospheric dispersion calculations and dose assessments. Annual operating costs are estimated to be less than $2,000. In some cases, the cost may be offset because this equipment can also be used as part of the meteorological data reduction system. The benefit to industry resulting from the installation of such a capability will be the ability to provide emergency response groups involved in an accident situation with meteorological data representative of the site, even if the onsite recorders are inaccessible.

1.3.4 Public

The public will bear the monetary costs of completing and implementing the proposed action. In addition, the costs incurred by the utilities from the installation and operation of the remote-access capability, if implemented, would be expected to be passed on to the consumers of electric power in the form of higher rates. In return, the public will benefit by an increased assurance that meteorological information representative of the site, which might prove crucial in an emergency situation, will be available to emergency response groups. The public will also benefit from the availability of a current reference document that presents the NRC's recommendations concerning meteorological measurement programs at nuclear power plant sites.

1.4 Decision on Proposed Action

The proposed action should be accomplished on a priority basis.

2. TECHNICAL APPROACH

The alternative methods of accomplishing the proposed action are to perform the work in-house or initiate a technical assistance contract with an independent contractor.

2.1 Discussion and Comparison of Technical Alternatives

The information and expertise needed to revise the guide is currently available within the NRC. The amount of work necessary to accomplish the proposed action is of limited extent and can be performed in-house within the anticipated time frame without adversely impacting on other task requirements. Considerable time would be expended on the initiation and completion of a technical assistance contract with an independent contractor. Although staff time expended on direct work on the proposed action would be eliminated by contracting the task, additional staff time would be required to prepare and issue a contract and monitor contractor performance.

2.2 Decision on Technical Alternatives

Since the information and expertise to accomplish the proposed action exists within the NRC, the completion of the task in-house is the most beneficial technical alternative.

3. PROCEDURAL APPROACH

Since the proposed action is an update of information contained in an existing regulatory guide, the only appropriate procedural approach is a revision to the existing guide.

4. STATUTORY CONSIDERATIONS

4.1 NRC Authority

Authority for this guide would be derived from the safety requirements of the Atomic Energy Act through the Commission's regulations. In particular, paragraph 100.10(c)(2) of 10 CFR Part 100 states that, in determining the acceptability of a site for a power or test reactor, the Commission will take into consideration meteorological conditions at the site and in the surrounding area. Appendix E, "Emergency Plans for Production and Utilization Facilities," to 10 CFR Part 50 requires that applicants for an operating license develop plans for coping with radiological emergencies. The plans must include criteria for

determining when protective measures should be considered within and outside the site boundary to protect health, safety, and property. In this regard, it is necessary for the applicant to establish and maintain a meteorological program capable of rapidly assessing critical meteorological parameters. Further, paragraph 50.36a(a)(2) of 10 CFR Part 50 requires nuclear power plant licensees to submit semiannual reports specifying the quantity of each of the principal radionuclides released to unrestricted areas in gaseous effluents and such other information as may be required by the Commission to estimate maximum potential doses to the public resulting from these releases to ensure compliance with the requirements of 10 CFR Part 20. A knowledge of meteorological conditions in the vicinity of the plant is necessary to make these estimates. Finally, in order for the Commission to fulfill its responsibilities under NEPA and in accordance with the requirements of Appendix I to 10 CFR Part 50 and of 10 CFR Part 51, meteorological information must be available for use in assessing potentially adverse environmental effects resulting from the construction or operation of a nuclear power plant.

4.2 Need for NEPA Assessment

The proposed action is not a major action as defined by paragraph 51.5(a)(10) of 10 CFR Part 51 and does not require an environmental impact statement.

5. RELATIONSHIP TO OTHER EXISTING OR PROPOSED REGULATIONS OR POLICIES

No potential conflicts with other agencies have been identified. The product document will be used in the implementation of 10 CFR Part 20, 10 CFR Part 50, 10 CFR Part 51, and 10 CFR Part 100 as described above. The guidance in the proposed revision will be consistent with that in Regulatory Guide 1.70, "Standard Format and Content of Safety Analysis Reports for Nuclear Power Plants - LWR Edition," Regulatory Guide 4.2, "Preparation of Environmental Reports for Nuclear Power Stations," Regulatory Guide 1.21, "Measuring, Evaluating, and Reporting Radioactivity in Solid Wastes and Releases of Radioactive Materials in Liquid and Gaseous Effluents from Light-Water-Cooled Nuclear Power Plants," Regulatory Guide 1.111, "Methods for Estimating Atmospheric Transport and Dispersion of Gaseous Effluents in Routine Releases from Light-Water-Cooled

Reactors," and Regulatory Guide 1.145, "Atmospheric Dispersion Models for Potential Accident Consequence Assessments at Nuclear Power Plants."

Regulatory Guide 3.8, "Preparation of Environmental Reports for Uranium Mills," references the meteorological measurement program and data format presented in Regulatory Guide 1.23. Since the revised meteorological measurement programs described in proposed Revision 1 to Regulatory Guide 1.23 may not be appropriate for most uranium mills, a further revision of Regulatory Guide 3.8 may be needed. Additional expenditure of manpower to make changes is expected to be small because Regulatory Guide 3.8 is currently in the final process of comment resolution.

Backfitting requirements will result from the implementation of the remote-access capability at those installations where the data reduction systems do not presently have such a capability. Potential backfitting costs are discussed above.

6. SUMMARY AND CONCLUSIONS

A revision to Regulatory Guide 1.23, "Onsite Meteorological Programs," should be prepared. This revision should be done in-house.