# 3. METEOROLOGICAL MONITORING

## 3.1 INTRODUCTION

Meteorological monitoring acquires information on atmospheric weather phenomena that can be used to analyze atmospheric dispersion of normal operational releases, unplanned releases, or any other events causing environmental concerns. This section describes the types of weather information that must be acquired to support environmental protection activities. It also presents the elements of the meteorological monitoring program at ORR and explains the purpose and the regulatory bases for the selection of these specific program components and activities.

## 3.2 RATIONALE

Meteorological information representative of conditions at each facility on the reservation is essential for assessing the transport, diffusion, and deposition of materials released to the atmosphere by ETTP, ORNL, and Y-12. The establishment and documentation of a meteorological monitoring program to collect such information are mandated by DOE Order 5400.1 and elaborated in the *Regulatory Guide*. The data provided by a meteorological monitoring program are used in routine dispersion modeling to predict impacts from facility operations and as input to emergency response atmospheric models used in the event of accidental releases from a facility. Various plant organizations also use the monitoring data as input to research projects, engineering and permitting decisions, and site-monitoring activities. The meteorological monitoring network on ORR is depicted in Fig. 3.1.

## 3.3 ORR SYSTEM DESCRIPTION

The nine meteorological towers, depicted in Fig. 3.1, consist of one 100-m (330-ft) tower (MT5) and one 60-m (200-ft) tower (MT6) at Y-12, one 330-ft tower (MT2) and two 100-ft towers (MT3 and MT4) at ORNL, and one 200-ft tower (MT1) and one 30-m (100-ft) tower (MT7) at ETTP. Additionally, ETTP has two satellite towers 208A and 208B, both 10-m high.

Data are collected at different levels to determine the vertical structure of the atmosphere and the possible effects of vertical variations on releases from facilities. At the towers, data are collected at the 10-m (32.8-ft) level and at the top of the tower. Additionally, selected towers collect data at 30-m, 60-m, and 100-m levels. At each measurement level temperature, wind speed, and wind direction are measured. Y-12's MT6 has an additional temperature measurement at 20 m (65 ft).

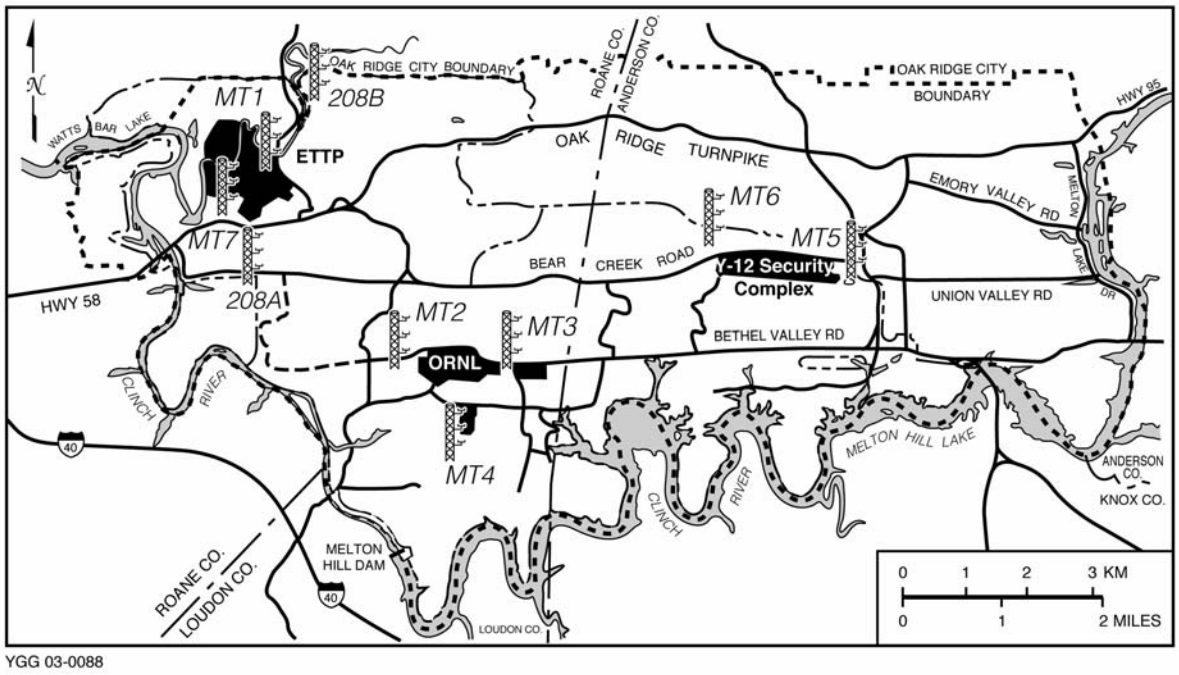


**Fig. 3.1. Oak Ridge Reservation meteorological monitoring network.**

Humidity and data needed to determine atmospheric stability (a measure of the dispersive capability of the atmosphere) are also measured at each tower. Barometric pressure is measured at one or more towers at each facility (MT1, MT2, MT5, and MT7). Precipitation is measured at MT5 and MT6 at Y-12, at MT1 and MT7 at ETTP, and at MT2 at ORNL; solar radiation is measured at MT2 at ORNL, MT1 and MT7 at ETTP, and MT5 and MT6 at Y-12.

## 3.4 DATA ANALYSIS

Fifteen-minute and hourly data are used directly at each site for emergency response purposes such as input to dispersion models. Annual dose estimates are calculated from archived data (either hourly values or summary tables of atmospheric conditions). Data quality is checked continuously against predetermined data constraints, and out-of-range parameters are marked invalid and are not input to the dispersion models.

The meteorological monitoring data from ORNL are summarized monthly as wind roses and data tables. Quarterly calibrations of the instruments are conducted for each site on ORR by an outside subcontractor.

## 3.5 REPORTS AND RECORDS

Data from the towers at each site are collected by a dedicated control computer. The towers are polled, and the data are archived on disk. One-minute, 15-min and hourly values are automatically stored at two locations (ETTP for Y-12 and ETTP, and ORNL for ORNL). Long-term archives are kept of 1-min data at ORNL and ETTP (MT1 tower only) and for all sites for 15-min and hourly data.

## 3.6 *REGULATORY GUIDE* PERFORMANCE CRITERIA

**a. Each DOE site *should** establish a meteorological monitoring program that is appropriate to the activities at the site, the topographical characteristics of the site, and the distances to critical receptors.**

A meteorological monitoring program has been in operation on ORR since 1982. Within this program, the major components of the meteorological data acquisition program were developed between 1982 and 1985. The monitoring towers have been sited to best depict a representative picture of wind conditions over the topographic features of the site at ORR. Special attention was also given during placement of the meteorological towers to the proximity to potential or routine release sites of airborne emissions from the facilities.

**b. The scope of the program *should** be based on an evaluation of the regulatory requirements, the meteorological data needed for impact assessments, environmental surveillance activities, and emergency response, considering the mathematical procedures, models, and input data requirements necessary for computing atmospheric transport and diffusion computations and performing dose assessments.**

Present guidelines for the program are based on EPA-450/4-87-013, *On-Site Meteorological Program Guidance for Regulatory Modeling Applications*. The required DOE measurements of wind direction, wind speed, and atmospheric stability (parameters) are made at each tower for computing atmospheric transport and diffusion computations and performing dose assessments. Additional measurements are made for other modeling needs and/or surveillance.

**c. The program *should** be documented in a meteorological monitoring section of the EMP in compliance with DOE 5400.1.**

This section of the EMP documents the meteorological monitoring program in compliance with DOE Order 5400.1.

**d. For data from an off-site source to be acceptable, the data *should** be representative of conditions at the DOE facility and provide statistically valid data consistent with on-site monitoring requirements.**

N/A

Each site on ORR has at least one meteorological tower that was sited by a qualified meteorologist and is representative of site conditions.

**e. Specific meteorological information requirements for each facility *should** be based on the magnitude of potential source terms, the nature of potential releases from the facility, possible pathways to the atmosphere, distances from release points to critical receptors, and the proximity of the site to other DOE facilities.**

The specific meteorological information required and archived at ORR is used in conjunction with predefined base maps and receptor (calculational) grids established at all three facilities on ORR. Any airborne release, whether routine or accidental, can be sited as a source on a calculational grid. Then, the most appropriate and representative meteorological data are used to calculate the dose at predefined critical receptors, including the other ORR facilities, on the grid.

**f. Meteorological information requirements for facilities *should** be sufficient to support environmental monitoring and surveillance programs.**

The meteorological information requirements at ORR are broad enough to support the specified environmental and surveillance programs. Details of each meteorological element measurement are contained in the subcontractor's written procedures.

**g. The meteorological monitoring program for each DOE site *should** provide the data for use in atmospheric transport and diffusion computations that are appropriate for the site and application.**

The meteorological information requirements at ORR satisfy DOE requirements for the evaluation of atmospheric dispersion as well as the requirements found in EPA-450/ 4-87-013.

**h. Before any model is deemed appropriate for a specific application, the assumptions upon which the model is based *should** be evaluated and the evaluation results documented.**

Only EPA-approved models [i.e., AIRDOS-EPA, Industrial Source Complex (ISC3)] are used for compliance modeling at ORR.

**i**. **Meteorological programs for sites where on-site meteorological measurements are not required *should** include a description of climatology in the vicinity of the site and *should** provide ready access to representative meteorological data.**

N/A

**j. Potential release modes, distances from release points to receptors, and meteorological conditions *should** be considered in assessments for DOE facilities required to take on-site measurements.**

See response to criterion "e."

**k. Meteorological measurements *should** be made in locations that, to the extent practicable, provide data representative of the atmospheric conditions into which material will be released and transported.**

The locations selected for making meteorological measurements at ORR represent valley floors as well as ridge tops, and the data are obtained at various potential release heights.

**l. The instruments used in the monitoring program *should** be capable of continuous operation in the normal range of atmospheric conditions at the facility.**

Instruments are calibrated quarterly and certified to work within a normal range of atmospheric conditions for this area.

**m. Wind measurements *should** be made at a sufficient number of altitudes to adequately characterize the wind at potential release heights.**

The altitudes at which wind measurements are made on the seven monitoring towers are intended to provide appropriate data to adequately characterize the wind at potential release heights.

**n. If instruments are mounted on booms extending to the side of a tower, the booms *should** be oriented in directions that minimize the potential effects of the tower on the measurements. The instruments *should** be at least two tower diameters from the tower, but *should* be three to four tower diameters from the tower.**

The booms extend in directions that minimize tower effects on the meteorological measurements and are, in all cases, at least two tower diameters from the tower.

**o., p. The meteorological monitoring program *should** provide for routine inspection of the data and scheduled maintenance and calibration of the meteorological instrumentation and data-acquisition system at a minimum, based on the**

**calibration frequency recommendations of the manufacturers. Inspections, maintenance, and calibrations *should** be conducted in accordance with written procedures, and logs of the inspections, maintenance, and calibrations *should** be kept and maintained as permanent records.**

The meteorological data are visually inspected. ORNL's Environmental Protection group routinely inspects wind roses and statistics to validate the data. Instruments are routinely inspected and calibrated in accordance with written procedures under a maintenance contract with a subcontractor. These activities are documented in permanent records.

**q. The instrument system *should** provide data recovery of at least 90% on an annual basis for wind direction, wind speed, those parameters necessary to classify atmospheric stability, and other meteorological elements required for dose assessment.**

A minimum of 90% monthly data recovery is currently the goal of the meteorological data acquisition system, and every effort is made to reach this objective.

**r., s. The topographic setting of a facility and the distances from the facility to points of public access *should** be considered when evaluating the need for supplementary instrumentation. If meteorological measurements at a single location cannot adequately represent atmospheric conditions for transport and diffusion computations, supplementary measurements *should** be made.**

Several studies concerning meteorological measurements have been made at ORR. Considerable confidence is held, however, in the value of the data currently being obtained for transport and diffusion calculations.

**t. A site-wide meteorological monitoring program *should** be established at each multi-facility site to provide a comprehensive database that can be used for all facilities located within the site.**

A database of hourly meteorological data has been maintained at ORNL for all three ORR facilities. Data are periodically supplied to various organizations at all three facilities as well as to outside organizations that request the information from time to time.

**u. As they apply to meteorological monitoring, the general QA program provisions of Chapter 10 of this guide *should** be followed.**

The relevant QA program elements of Chap. 10 of the *Regulatory Guide* are followed in the conduct of the meteorological monitoring program at ORR.