



Determining Meteorological Information at Nuclear Facilities

An American National Standard

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**American National Standard
Determining Meteorological
Information at Nuclear Facilities**

Secretariat
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American National Standard ANSI/ANS-3.11-2015

Foreword

(This foreword is not a part of American National Standard, "Determining Meteorological Information at Nuclear Facilities," ANSI/ANS-3.11-2015.)

Meteorological data collected at nuclear facilities play an important role in determining the effects of radiological and toxic chemical effluents on workers, facilities, the public, and the environment; and these data have many other useful applications, such as determining the effects of non-radiological/non-toxic water vapor releases (e.g., cooling tower plumes) and implementing emergency response plan Emergency Action Levels (e.g., in instances of high winds). Accordingly, meteorological program design should be based on the needs and objectives of the facility and the guiding principles for making accurate and valid meteorological measurements. ANSI/ANS-2.5-1984 (R1990) (withdrawn), "Determining Meteorological Information at Nuclear Power Sites," was issued in 1984 to address nuclear power facility meteorological data acquisition programs. ANSI/ANS-2.5-1984 (R1990) (withdrawn) was referenced by second proposed Revision 1 to Regulatory Guide 1.23, "Meteorological Measurement Program for Nuclear Power Plants." ANSI/ANS-2.5-1984 (R1990) (withdrawn) was, however, narrowly focused on commercial nuclear power plant siting considerations and did not provide adequate guidance on meteorological data application from startup to operations to decommissioning (i.e., life cycle).

In 1996, the Nuclear Utility Meteorological Data Users Group and the U.S. Department of Energy (DOE) Meteorological Coordinating Council jointly undertook comprehensive reviews of the applicability of ANSI/ANS-2.5-1984 (R1990) (withdrawn) and recommended major refinements in the following areas:

- (1) operational data applications (especially emergency preparedness) in addition to siting applications;
- (2) availability of guidance for both public and private sector entities;
- (3) life cycle considerations of meteorological monitoring systems;
- (4) the need to monitor multiple locations to acquire sufficient data for models to characterize three-dimensional flows in regions of complex terrain;
- (5) inclusion of state-of-the-art meteorological monitoring equipment, including remote sensing instrumentation.

The meteorological data that are acquired, according to ANSI/ANS-2.5-1984 (R1990) (withdrawn) principles, are primarily used in supporting licensing applications of commercial nuclear power plants. More common operational applications to support protection of the health and safety of site personnel and the public, such as emergency preparedness consequence assessments and environmental compliance analyses, were not addressed because these programs had not fully matured at that time. Meteorological data required to support consequence assessments associated with emergency response differ significantly from the archived data used for climate characterization, environmental impact assessment, and compliance analysis purposes in that data must be available in real time. Real-time meteorological data availability may require significant upgrades to existing monitoring systems to limit data loss and to focus attention on the diurnal and seasonal effects that complex terrain, if present, have on the meteorological wind fields (and therefore plume trajectory) in the region of transport.

Nuclear facilities in the public sector and non-regulatory domains of the DOE and the U.S. Department of Defense were not represented in ANSI/ANS-2.5-1984 (R1990) (withdrawn). Government agencies resorted to issuing their own technical guidance (such as "Environmental Radiological Effluent Monitoring and Environmental Surveillance Handbook," DOE-HDBK-1216-2015, in which Chapter 5 addressed meteorological measurements). The need to develop a standard that was also applicable to the public sector

was enhanced by the recent DOE initiative, through its Technical Standards Program, which set a goal of operating DOE facilities under voluntary standards by 2000, in compliance with the Federal guidance contained in the Office of Management and Budget's circular OMB-119A, "Federal Participation in the Development and Use of Voluntary Consensus Standards and in Conformity Assessment Activities."

Meteorological data monitored at public sector nuclear facilities are used for

- (1) routine radiological and chemical release consequence analyses;
- (2) operating procedures, with respect to severe weather;
- (3) operations and maintenance considerations for heat sinks (e.g., cooling towers, ponds);
- (4) real-time consequence assessments of accidental releases of radiological and chemical species;
- (5) potential environmental and control room habitability impacts resulting from design-basis accidents from projected new facilities or from modifications to existing facilities.

The use of meteorological data can also play an important role in various types of environmental, decontamination and decommissioning, air quality, wind loading, and engineering studies. Other uses of meteorological data include assessments of environmental remediation activities, industrial hygiene, construction, and waste management. Ideally, meteorological data needed to design or evaluate nuclear facilities complying with the requirements of ANSI/ANS-2.3-2011, "Estimating Tornado, Hurricane and Extreme Straight Line Wind Characteristics at Nuclear Facilities," and other applicable standards should be collected and analyzed in accordance with this standard. A comprehensive meteorological monitoring system requires instrumentation that will meet the programmatic purposes for which it is intended.

Meteorological measurements are most commonly taken with in situ sensors that are mounted on towers and are directly in contact with the atmosphere. Additionally, atmospheric properties can be inferred with "remote" sensors, which emit or propagate electromagnetic or acoustic waves into the atmosphere. The criteria for upgrading a sensor include improved accuracy, durability, and/or dependability, or a decrease in required maintenance that would increase the level of data recovery and cost-effectiveness of the measurement system while maintaining or improving appropriate measurement capabilities. When it becomes necessary to replace, upgrade, or supplement the meteorological monitoring system equipment, the most effective technology available that is appropriate to meet the objectives is normally employed. In the case where a new type of sensor replaces an existing sensor, a demonstration of the effectiveness of the new sensor is necessary before the replacement is completed (see ASTM D4430-96, "Standard Practice for Determining the Operational Comparability of Meteorological Measurements"). The following document provided useful information related to the subject of this standard: "National Technology Transfer and Advancement Act," PL 104-113; accessible online at http://gsi.nist.gov/global/docs/pubs/NISTIR_5967.pdf.

ANSI/ANS-3.11-2000 was developed to address life cycle issues associated with meteorological monitoring programs at nuclear facilities. This standard was also developed to address technological advances for in situ and remote sensing instrumentation to monitor meteorological parameters (e.g., sonic anemometers, lidar, Doppler sodar, radar wind profilers, etc.), modifications in analytical requirements, and other considerations. The aforementioned remote sensing systems provide the nuclear facility meteorologist

or meteorological program manager with additional means to acquire sufficient data to characterize the three-dimensional wind field in the vicinity of the facility and within the region of transport. ANSI/ANS-3.11-2000 also provides additional information on instrument siting and measurement issues, based on the results of wind tunnel studies, which have given insight into the aerodynamic effects of obstacles on a local wind field.

ANSI/ANS-3.11-2000 was designed with sufficient depth and breadth to address the needs of the entire meteorological monitoring community associated with all nuclear facilities nationwide, including commercial electric generating stations and nuclear installations at federal sites, ranges, and reservations. It does not attempt to define the exact monitoring criteria for every possible type of facility or site environment. It does identify the minimum information that comprises a successful monitoring program and requires that the details of such programs be delegated to subject matter expert meteorologists who analyze each particular site and application in order to arrive at an acceptable program for that particular application.

The ANS-3.11 Working Group was reconstituted in February 2003 to evaluate the currency of the three-year-old standard and to determine whether it should be simply reaffirmed on its February 18, 2005, sunset or it needed to be updated to account for new reference standards, advances in ex situ and in situ instrumentation, advances in data management equipment and techniques, advances in meteorological program management, integration with facility programs (e.g., configuration management), and other considerations. The Working Group unanimously determined to update the standard, and ANSI/ANS-3.11-2005 is a result of this work. In 2008, the ANS-3.11 Working Group again reevaluated the actions to be taken on the standard prior to its five-year sunset in December 2010. The Working Group unanimously determined to reaffirm the standard, and ANSI/ANS-3.11-2005 (R2010) is a result of this work.

The ANS-3.11 Working Group was reconstituted in August 2012 to revise ANSI/ANS-3.11-2005 (R2010). The revision is needed to account for new reference standards, advances in ex situ and in situ instrumentation, advances in data management equipment and techniques, advances in meteorological program management, improvements in integration with facility programs (e.g., configuration management), cyber security, software quality assurance, and other programmatic considerations. The appendices provide supplemental information needed for the design and implementation of a meteorological monitoring program.

This standard does not incorporate the concepts of generating risk-informed insights, performance-based requirements, or a graded approach to quality assurance. The user is advised that one or more of these techniques could enhance the application of this standard.

This standard might reference documents and other standards that have been superseded or withdrawn at the time the standard is applied. A statement has been included in the references section that provides guidance on the use of references.

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Determining Meteorological Information at Nuclear Facilities

1 Scope

This consensus standard provides criteria for gathering, assembling, processing, storing, and disseminating meteorological information at commercial nuclear electric generating stations, U.S. Department of Energy / National Nuclear Security Administration nuclear facilities, and other national or international nuclear facilities. While well-established monitoring and analysis methods are adequately addressed, this revision provides information on newer systems, both hardware and software, and more modern methods to keep up with the state of the science.

Meteorological data collected, processed, stored, and disseminated through implementation of this standard are utilized to support the full life cycle (i.e., siting, construction, operation, and decommissioning) of nuclear facilities. The meteorological data are employed in a large number of applications associated with determining environmental impacts, enabling consequence assessments in routine release and design-basis accident evaluations, supporting emergency preparedness and response programs, and other important applications, such as evaluating beyond design-basis events.

2 Acronyms and definitions

2.1 Acronyms

ABL:	atmospheric boundary layer
QA:	quality assurance
DQOs:	data quality objectives
FAA:	Federal Aviation Administration
HVAC:	heating, ventilating, and air conditioning
lidar:	<u>l</u> ight <u>d</u> etection <u>a</u> nd <u>r</u> anging
MADIS:	Meteorological Assimilation Data Ingest System
NIST:	National Institute of Standards and Technology
NOAA:	National Oceanic and Atmospheric Administration
NEXRAD:	next-generation weather radar
NWS:	National Weather Service
radar:	<u>r</u> adio <u>d</u> etection <u>a</u> nd <u>r</u> anging
RASS:	radio acoustic sounding system
SA:	system accuracy
sodar:	<u>s</u> ound <u>d</u> etection <u>a</u> nd <u>r</u> anging
SRDT:	solar radiation/delta-T
TIBL:	thermal internal boundary layer
TKE:	turbulence kinetic energy