



Engineering Sciences Section – 2005

C58 NIST Standard Reference Materials® (SRMs) for Environmental Measurements and Analysis

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After attending this presentation, attendees will understand the use of NIST Certified Standard Reference Materials® (SRMs) to validate environmental measurements and data and related NIST SRMs Web presence and navigation techniques.

This presentation will impact the forensic community and/or humanity by presenting to the forensic community the availability and use of NIST Certified Standard Reference Materials to establish validity for environmental measurements and data.

This paper discusses physical and chemical properties of certified NIST Standard Reference Materials (SRMs) related to environmental measurements on the identification and/or comparison of specimens to be linked to forensic data. Environmental SRMs provide the measurement benchmarks to assess the levels of a range of toxic chemicals and the movement of such potentially harmful substances through ecosystems and food webs.

NIST supports accurate and compatible measurements by providing over 1300 Certified SRMs with well-characterized composition and/or properties. These SRMs are used to perform instrument calibrations in situ as part of overall quality assurance programs, to verify the accuracy of specific measurements and to support the development of new measurement methods. NIST SRMs are currently available for use in areas such as industrial materials production and analysis, environmental analysis, food and agriculture, radioactivity, health measurements and basic measurements in science and metrology. Each SRM is supplied with a Certificate of Analysis. Along with other standardization organizations methods and procedures, such as ASTM and ANSI. NIST has published many articles and practice guides that describe the development, analysis and use of SRMs. NIST SRMs provide the benchmarks of precision, accuracy, and trace ability, which validate the measurements and data.

The measurement of physical, optical and chemical properties of environmental samples is often employed to identify the type of material and/or application. Measurements of material properties can be used to track and identify the original producer, the date or period of manufacture and the intended use or application for the material or product. For example, property or chemical measurements and/or the evaluation of environmental samples or product characteristics, in addition to visual markings if present, can establish a link in the chain from producer, fabricator, distributor, vendor, end-use or application, down to a specific geographical area or sample origin.

In the measurement of properties, chemical composition, or characteristics of environmental samples, accuracy and uncertainty terms and trace ability statements are of paramount importance in forensic investigations for the validation of data. These concepts must be used correctly to avoid possible confusion and inadmissibility of evidence. SRMs and the associated Certificate or Certificate of Analysis documentation state the intended purpose and application of a particular SRM, its certified property value(s) with associated uncertainty (ies), and present technical information deemed necessary for its proper use. The uncertainty attached to a certified value is especially important as it represents a quantity, which characterizes the range of values within which the true value is asserted to lie with a stated level of confidence. A NIST SRM certificate bears the logo of the U.S. Department of Commerce, the name of NIST as certifying body, and the name and title of the NIST officer authorized to accept responsibility for its contents. In addition to the certified values, the SRM certificate may contain references and/or other pertinent information and data. SRMs certified values with their associated uncertainties, in applicable situations insure the integrity and the validation of forensic measurements. NIST certified values are obtained by one or more of the following measurement modes: 1) A definitive (or primary) method using specialized instrumentation capable of high accuracy and precision and whose errors have been thoroughly investigated and corrected; or, 2) Two or more independent methods at NIST using commercial instrumentation that is calibration based and with differing sources of systematic errors; or, 3) Interlaboratory data from selected laboratories using multiple methods and SRMs as controls. However, the sources of error with the latter mode will generally result in uncertainties greater than those for the other two modes.

There are a number of measurement methodologies related to the determination of materials properties and /or chemical composition. For instance chemical composition methods cover basic "wet chemistry" procedures and other very sophisticated techniques, which utilize atomic and radiation physics principles, and nuclear interactions that require complex and expensive apparatus. Fortunately, a number of SRMs having components comparable with those of the materials to be evaluated have been established.



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These SRMs and associated methods or standard procedures are available for equipment calibrations.

This paper will discuss and illustrate the use of a number of environmental SRMs of interest to the forensic community. The discussion will encompass measurement practices, methods, standards, and precision and accuracy considerations to be taken into account for the measurement methodologies employed. This paper will also provide insights on the future needs for SRMs for environmental measurements and characterization.

Standards , Certified Reference Materials, Forensic Science