C20 NIST Standard Reference Materials (SRMs) for Water Measurements and Analysis

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After attending this presentation, attendees will understand the availability and use of certified NIST Standard Reference Materials (SRMs) related to water measurements and analysis and criteria for data validation.

This presentation will impact the forensic community and/or humanity by discussing a range of Standard Reference Materials (SRMs) for water measurements and analysis of interest to the forensic community. The discussion will encompass precision, accuracy, and traceability considerations to be taken into account to validate data.

This paper discusses the application of certified NIST Standard Reference Materials (SRMs) in instrument calibrations for the measurement, identification, and assessment of a wide range of toxic substances in water, and for the comparison and evaluation of water samples. In these measurements, SRMs provide the benchmarks to assess the levels of precision, accuracy, and traceability required to validate the measurements and data.

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 and standardization 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 standards organizations methods and procedures, such as those promulgated by 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 traceability, which validate measurements and data.

The measurement of physical, optical, and chemical properties of samples is often employed to identify a type of material or substance. Measurements and analysis of water samples can be used identify chemicals or materials, and to track the original producer, the date or period of manufacture and the intended use or application for the material or product. For example, chemical or property measurements and/or the evaluation of samples can establish a link in the chain from producer, 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 samples, accuracy, and uncertainty terms and traceability 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 of Analysis 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 that characterizes the range of values within which the true value is asserted to lie within 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 and data. 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) Inter-laboratory 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 water analysis. Some employ basic chemistry procedures while others use very sophisticated techniques, which make use of atomic and radiation physics principles, and nuclear interactions that require complex and expensive apparatus. Fortunately, a number of SRMs of interest to the “water community” have been established for standardized laboratory evaluations. 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 SRMs for water measurements and analysis 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

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methodologies employed. This paper will also provide insights on the future needs for SRMs for forensic measurements and characterization.

Standards, Water, Calibrations

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