

March 2016

Inside:

New SRMs/RMs

**SRM 1720 Northern
Continental Air**

**SRM 2373 Genomic DNA
Standards for *HER2*
Measurements**

**SRM 2378 Fatty Acids in
Frozen Human Serum**

**SRM 2445 Mercury in
Iodized Activated Carbon**

**SRM 2429 Flue Gas
Desulfurization Gypsum**

**SRM 2700 Hexavalent
Chromium in
Contaminated Soil (Low
Level)**

**SRM 3252 Protein Drink
Mix**

**SRM 3264 St. John's Wort
(*Hypericum perforatum* L.)**

SRM 3290 Dry Cat Food

Renewal SRMs

**SRM 1643f, SRM 1967a
SRM 2366a, SRM 2682c
SRM 2910b, SRM 2950a**

Revisions

**SRM 972a, SRM 1648a,
SRM 1849a, SRM 2383a,
SRM 2387, SRM 2781,
SRM 3950**

NIST SRM Exhibits

The identification of any commercial product or trade name does not imply endorsement or recommendation by the National Institute of Standards and Technology.

Editor: Regina R. Montgomery



NIST SRM 1720 Northern Continental Air (Ambient Nominal Amount-of-Substance Fraction: Carbon Dioxide, Methane, Nitrous Oxide)

Carbon dioxide (CO₂), methane (CH₄), and nitrous oxide (N₂O) are all greenhouse gases (GHGs) that make important contributions to climate change. A recent analysis from the Global Atmosphere Watch (GAW) Observations Program of the World Meteorological Organization (WMO) shows that the globally averaged molar fractions of GHGs reached new highs in 2013. These maxima include $(396.0 \pm 0.1) \mu\text{mol mol}^{-1}$ for CO₂, $(1824 \pm 2) \text{ nmol mol}^{-1}$ for CH₄, and $(325.9 \pm 0.1) \text{ nmol mol}^{-1}$ for N₂O. Compared to pre-industrial levels (prior to 1750), these are relative changes in concentration of 140%, 250%, and 120% respectively. A recent update by the National Oceanic and Atmospheric Administration (NOAA) reports the preliminary global CO₂ level at $400.83 \mu\text{mol mol}^{-1}$ as of March 2015. All three species are long-lived greenhouse gases (LLGHGs) which absorb electromagnetic radiation and which affect the budget of tropospheric and stratospheric ozone (O₃). Thus, these LLGHGs contribute significantly to atmospheric radiative forcing and have an important role in atmospheric chemistry. In order to accurately establish trends in gas concentration, assess the role of LLHGLs in atmospheric chemistry, and relate measurement records from many laboratories and researchers, it is essential to have a stable, accurate, and internationally recognized source of calibration standards or scales.

In 2009, the United States Congress tasked NIST to support climate change research. As part of this effort, NIST's Gas Sensing Metrology Group (GSMG) began developing gas standards required for accurate measurements of GHGs for ground-based and ambient atmosphere applications. As part of this initiative, the GSMG has completed development of SRM 1720 Northern Continental Air. The development of this SRM was a collaboration with the Global Monitoring Division (GMD), Earth System Research Laboratory at the National Oceanic and Atmospheric Administration in Boulder, Colorado. The GMD/NOAA prepared the SRM candidate samples from northern continental air taken in the Rocky Mountains at the Niwot Ridge, an alpine tundra and subalpine forest site 35 km west of Boulder. The prime conditions for pristine continental air in this region occur during the winter and early spring months. This development of this gaseous whole air sample SRM is unique, as related to gas SRMs, in that all samples were also analyzed by NOAA, which is the Central Calibration Laboratory (CCL) for the World Meteorological Organization for these key greenhouse gases. The GSMG has certified these SRM samples for ambient level CO₂, CH₄, and N₂O. The values assigned by the GSMG are the certified values for this SRM 1720. In addition, the NOAA values are also given on the SRM certificate for those users needing to submit data, linked to the CCL, to the WMO. This SRM is intended to be used by researchers measuring these GHG species in many types of atmospheres.

Technical Contact: George Rhoderick
Email: George.Rhoderic@nist.gov

NIST SRM 2373 Genomic DNA Standards for *HER2* Measurements



The amplification of the gene for human epidermal growth factor 2 (*HER2*) occurs in approximately 20% to 25% of breast cancers. The accurate measurement of this biomarker is important for the proper treatment with anti-*HER2* therapeutics. Clinical laboratories are beginning to utilize accurate and sensitive diagnostic tests based on measurements of DNA. SRM 2373 consists of genomic DNA extracted from five breast cancer cell lines with different amounts of amplification of the *HER2* gene. The copy numbers of the *HER2* gene and three reference genes (not amplified) were measured using quantitative PCR and digital PCR assays. The certified values of the components are

the ratios of the *HER2* gene copy number to the reference gene copy numbers. The PCR assays were validated and calibrated using NIST SRM 2372 component A (human genomic DNA). The stability of the components was shown by repeated measurements over several years. The DNA concentration determined from absorbance and the PCR assays was provided as an information value.

Technical Contact: Kenneth Cole
Email: Kenneth.Cole@nist.gov



NIST SRM 2378 Fatty Acids in Frozen Human Serum

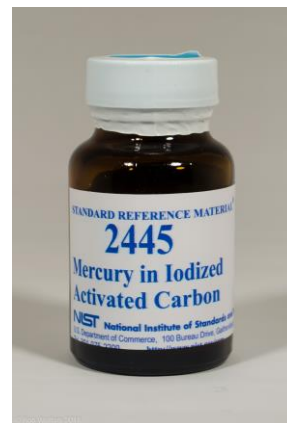
Healthcare providers, the Centers for Disease Control and Prevention (CDC), and other organizations monitor the fatty acid content of human plasma and serum as an indicator of health status and diet. A new Standard Reference Material® (SRM) 2378 Fatty Acids in Frozen Human Serum is now available for use as a quality assurance sample to support the measurement of fatty acids (FAs) in serum. SRM 2378 was produced in collaboration with the Office of Dietary Supplements at the National Institutes of Health in response to a need expressed by the CDC. Because certain FAs have been implicated in cardiovascular health, SRM 2378 will be of importance to the health care

community by providing better accuracy and metrological traceability of the levels of FAs measured in human populations. SRM 2378 consists of three different pools of serum from healthy donors who had taken fish oil dietary supplements (Serum 1 material), flaxseed oil dietary supplements (Serum 2 material), and no fish or flaxseed oil dietary supplements (Serum 3 material) for one month prior to donation. The FA profiles for the supplemented serum pools (Serum 1 and 2) show enrichments in the concentrations of specific FAs that reflect the type of supplementation used by the donors – fish oil or flaxseed oil. The Certificate of Analysis for SRM 2378 provides certified values for 12 FAs and reference values for another 17 FAs, as well as descriptions of the analytical methods employed for obtaining the different values.

Technical Contact: Bruce Benner
Email: Bruce.Benner@nist.gov

NIST SRM 2445 Mercury in Iodized Activated Carbon

SRM 2445 Mercury in Iodized Activated Carbon is a new matrix material for the measurement of gaseous mercury collected on halogenated activated carbon substrates. The material is a companion material to SRM 2448 which has a bromine substrate. SRM 2445 will provide NIST traceability and quality assurance for the measurements of mercury in support of environmental emissions regulations such as the EPA Air Toxics Standards for Portland Cement Manufacturing and the EPA Mercury and Air Toxics Standards (MATS) rule. The SRM will also provide quality assurance for mercury assessment and development of flue gas capture technologies at coal-fired electric utilities using activated carbon sorbent injection. Coal-fired power plants are currently the largest single source of anthropogenic mercury emissions in the United States. Halogen-impregnated substrates based on iodine and bromine significantly improve the capture efficiency of the mercury. SRM 2445 is an iodinated activated carbon material which has a certified value for mercury ($0.743 \text{ mg/kg} \pm 0.020 \text{ mg/kg}$) assigned using an isotope dilution inductively coupled plasma mass spectrometry (ID-ICP-MS) primary method.



Routine measurements of mercury in activated carbon typically consist of dissolution followed by cold vapor atomic fluorescence spectrometry (CVAFS) or cold vapor atomic absorption spectrometry (CVAAS), or, more recently, solid-phase combustion methods. These methods can be prone to interferences, especially in the presence of halogens. The availability of SRM 2445 should therefore be very useful as a quality assurance material and will provide critical traceability for environmental regulatory compliance monitoring.

Technical Contact: Stephen Long
Email: Stephen.Long@nist.gov

NIST SRM 2429 Flue Gas Desulfurization Gypsum



The combustion of pulverized coal in electric power utilities produces extensive sulfur dioxide (SO_2) emissions. These emissions can be reduced using wet scrubber flue gas desulfurization (FGD) systems. These systems are designed to introduce an alkaline sorbent consisting of lime or limestone in a spray form into the exhaust gas system. The alkali reacts with the SO_2 and is collected in a slurry form as calcium sulfite or calcium sulfate, which are frequently re-utilized in industrial products such as wall board, cement, and fertilizers.

With recent focus on the emissions of mercury from coal-fired power plants, there is now concern about the release of sequestered mercury during the various processing stages of these materials and the content of mercury and also other toxic metals in the finished products. The recycling of combustion by-products is a big industry and the potential release of mercury to the environment from both processing and disposal of such materials could be significant.

SRM 2429 is a highly homogeneous matrix prepared from gypsum derived from an FGD facility. The certified value for mercury is $0.778 \text{ mg/kg} \pm 0.024 \text{ mg/kg}$. Reference values for several major elements, as well as arsenic, barium, chromium, lead, selenium, and strontium, are also provided. The unit size for this material is relatively large at 200 g, which was chosen to support the development of leaching test methods for environmental assessments.

Technical Contact: Stephen Long
Email: Stephen.Long@nist.gov

NIST SRM 2700 Hexavalent Chromium in Contaminated Soil (Low Level)



A contaminated soil SRM, certified for hexavalent chromium, total chromium, iron, and manganese has been developed in a joint program with the New Jersey Department of Environmental Protection (NJDEP) and the United States Geological Survey (USGS). Over the last several decades, considerable environmental contamination has resulted from the terrestrial disposal of Chromite Ore Processing Residue (COPR). This waste material consists of a mixture of chromite (CrIII) and chromate (CrVI), otherwise known as hexavalent chromium, which is now widely recognized as a human carcinogen. Hexavalent chromium is relatively mobile and therefore the potential impact on environmental and human health is of great concern. The new SRM will provide quality assurance support for analytical measurements associated with environmental remediation activities, and was prepared from material collected from a waste site in

Hudson County, New Jersey. SRM 2700 contains hexavalent chromium at $14.9 \text{ mg/kg} \pm 1.2 \text{ mg/kg}$. A complementary material (SRM 2701), with a mass fraction of $551.2 \text{ mg/kg} \pm 34.5 \text{ mg/kg}$ hexavalent chromium, is also available.

Technical Contact: Stephen Long
Email: Stephen.Long@nist.gov

NIST SRM 3252 Protein Drink Mix

Sports nutrition is a \$24 billion industry, and protein supplements are becoming increasingly common beyond bodybuilding. Sales of protein powders are projected to top \$4.5 billion in 2015, as athletes look to increase protein intake to improve performance and non-athletes aim to improve overall health. Protein powder content can be regulated as either a food (under the Nutrition Labeling and Education Act) or a dietary supplement (under the Dietary Supplement Health and Education Act), depending on how the product is marketed and labeled. Consumers, however, expect that the nutrient content of a product is accurate and that known or suspected contaminants have been screened, regardless of the regulatory framework.



SRM 3252 Protein Drink Mix was developed to support both regulation and laboratory quality assurance for protein powders and drink mixes. This material fills a void in the AOAC food triangle with fat, protein, and carbohydrate content similar to foods in sector 9. A unit of SRM 3252 consists of 5 packets each containing 10 g of powder. The Certificate of Analysis for SRM 3252 contains 95 assigned values, including fatty acids, cholesterol, elements, vitamins, proximates, calories, amino acids, polyphenols, and xanthines.

Technical Contacts: Melissa Phillips and Laura Wood
Email: Melissa.Phillips@nist.gov and Laura.Wood@nist.gov

NIST SRM 3264 St. John's Wort (*Hypericum perforatum L.*) Methanol Extract



St. John's wort (*Hypericum perforatum L.*) is both cultivated and found in the wild and has been used as an herbal treatment for psychological disorders including depression, anxiety, and sleep disorders, as well as nerve pain and malaria. The flowering tops of St. John's wort are used to prepare supplement products rich in flavonoids and naphthodianthrone (hypericin and pseudohypericin). The St. John's wort plant is known to concentrate cadmium from the soil during plant maturation, thus analytical values for toxic elements are of particular interest in dietary supplements containing *Hypericum perforatum L.* Additionally, dietary supplements are often found to be inaccurately labeled, adulterated, or contaminated necessitating the use of Certified Reference

Materials (CRMs) during verification of label claims and quality control processes.

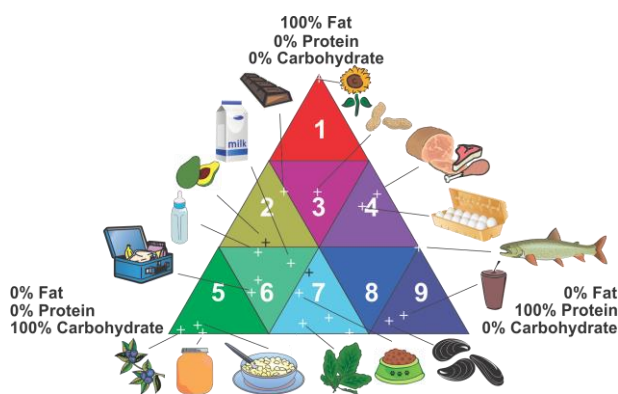
In association with the National Institutes of Health's Office of Dietary Supplements (NIH-ODS), NIST developed SRM 3264 St. John's Wort (*Hypericum perforatum L.*) Methanol Extract to continue work on the development of analytical methods and reference materials for dietary supplements. SRM 3264 will support manufacturers' measurement needs for a CRM to be used for method development, method validation, and as a quality assurance tool and when assigning organic and inorganic values to in-house control materials used for measurement of dietary supplements.

A unit of SRM 3264 consists of 5 packets each containing 1.6 g of powdered material. The Certificate of Analysis contains certified values for cadmium and lead and reference values for a number of flavonols, as well as the naphthodianthrone, hypericin, and pseudohypericin.

Technical Contacts: Kate Rimmer and Laura Wood

Email: Catherine.Rimmer@nist.gov and Laura.Wood@nist.gov

NIST SRM 3290 Dry Cat Food



The US pet food industry generated \$22 billion in spending in 2014, and Americans are increasingly concerned about the safety and nutrition of commercial pet food. Pet food labeling is regulated at the federal and state levels, and the Association of American Feed Control Officials (AAFCO) sets standards for the content of animal foods. The Food, Drug, and Cosmetic Act also requires that pet foods are free of harmful substances and that packaging is truthfully labeled, listing all ingredients and nutritional information.

SRM 3290 Dry Cat Food was developed to support regulation and laboratory quality assurance for pet foods. In addition to supporting pet food manufacturers and testing laboratories,

SRM 3290 is a suitable quality assurance material for food industry laboratories looking for such a material. This material fills a void in the AOAC food triangle with fat, protein, and carbohydrate content similar to foods in sector 7. A unit of SRM 3290 consists of 5 packets each containing 10 g of powder. The Certificate of Analysis for SRM 3290 contains 101 assigned values, including nutritional elements, vitamins, proximates, amino acids, and fatty acids.

Technical Contact: Melissa Phillips

Email: Melissa.Phillips@nist.gov

Renewal SRMs/RMs

NIST SRM 1643f Trace Elements in Water

SRM 1643f is a recently released water SRM with certified mass fraction and mass concentration values for 29 elements that are commonly regulated or monitored. Intended primarily for evaluating methods used to determine trace elements in fresh water, SRM 1643f can be useful to laboratories measuring contaminant elements in drinking water, as well as those assessing the efficacy of wastewater treatment. SRM 1643f serves an important function as a validation standard for millions of water analyses performed each year worldwide. It is therefore an efficient and effective means of transferring the chemical metrology expertise of NIST to nearly every water analysis sector. While use of SRM 1643f or its predecessor SRM 1643e is not required for compliance to documentary standards, there has been extensive use of these and similar materials to attain such compliance.

SRM 1643f was produced from deionized water first spiked with nitric acid, then spiked with matrix elements such as Ca, Mg, and Na, and lastly spiked with trace elements of interest such as Cr, As, and Pb. After thorough mixing, the material was then bottled in high-density polyethylene bottles sealed in aluminized Mylar bags to assist in maintaining stability. Certification measurements were conducted using inductively coupled plasma optical emission spectrometry and inductively coupled plasma mass spectrometry. Resulting mass fractions were calculated from these measurements and gravimetric preparation data with a conversion to mass concentration values to allow for easier comparison to limits such as the U.S. Environmental Protection Agency's maximum contaminant levels in drinking water.

Technical Contact: John Molloy
Email: John.Molloy@nist.gov



NIST SRM 1967a High-Purity Platinum Thermoelement

SRM 1967a is designed to replace the previous thermoelectric standard SRM 1967 or Pt-67 (which succeeded its predecessor Pt-27). As was the case for the previous standard, SRM 1967a is available in wire form of 1 meter length. This high-purity (approximately 99.999 % by mass), well-characterized lot of platinum wire will satisfy various needs of the thermometry community world-wide. It can be used by national metrology institutes, wire manufacturers, and calibration laboratories as well as other commercial laboratories to characterize all types of thermocouple wire below 1700 °C. As thermocouples (particularly base-metals) are not

defined by their composition but their temperature emf relationship, platinum serves as the de-facto reference for production control. Furthermore, it can serve as a reference standard for a laboratory's working platinum standards which undergo more intensive usage. In addition to thermoelectric voltages, SRM 1967a resistance ratio measurements are provided as supplemental information. Finally, this replacement SRM platinum is sufficiently pure and homogeneous that, within a specified uncertainty, the new SRM 1967a wire is thermoelectrically equivalent to the old SRM 1967 wire and no corrections will be necessary to reference new thermoelectric measurements to SRM 1967.

Technical Contact: Karen Garrity
Email: Karen.Garrity@nist.gov

NIST SRM 2366a Cytomegalovirus DNA (Towne_{Δ147} BAC) for DNA Measurements



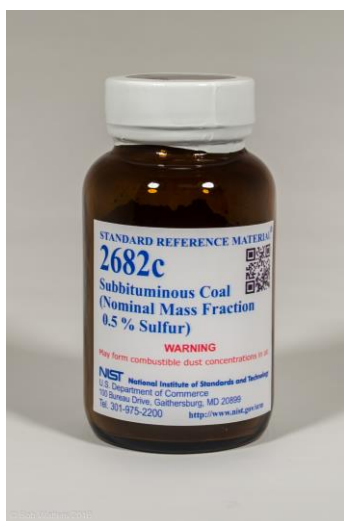
Cytomegalovirus (CMV) is a common virus that occurs widely throughout the population but rarely causes significant health problems. However, primary CMV infection may cause serious illness and complications in newborns and people with weakened immune systems, such as transplant recipients, cancer patients, people receiving immunosuppressive drugs, and people with HIV.

The viral DNA Standard Reference Material® (SRM) produced at the National Institute of Standards and Technology SRM 2366a Cytomegalovirus DNA (Towne_{Δ147} BAC) for DNA Measurements was re-released in 2015. The work preceding the release helped develop the model for future viral DNA SRMs; particularly, material production, packaging, and certification. The candidate material that subsequently became SRM 2366a was acquired as the entire Towne strain of CMV in a bacterial artificial chromosome (BAC) in *Escherichia coli*. At NIST the BAC was propagated and the DNA was isolated and purified. CMV DNA in buffer was packaged in perfluoroalkoxy fluoropolymer (PFA) tubes to minimize absorption of DNA onto tube walls.

The emerging technique of Digital PCR (dPCR) was used to certify the concentration of DNA. The use of dPCR allows the direct counting or enumeration of CMV genomes, so quantification can be achieved without the use of external DNA calibrants. In the past the number of replicate PCR reactions needed limited the accuracy and precision of digital PCR. However, new droplet-based and microfluidic technologies capable of analyzing thousands of replicates make the technique viable for measuring the concentration of DNA with reasonable measurement uncertainty. The SRM contains a single vial of CMV DNA at a concentration of 1,796,000 copies per microliter with a coefficient of variation (CV) of 1.5%. One of the intended uses of SRM 2366a is for clinical laboratories to calibrate their everyday CMV tests to further understand limits of detection and bias. Another use is to calibrate and monitor their own internal working CMV solutions.

Technical Contact: Peter Vallone
Email: Peter.Vallone@nist.gov

NIST SRM 2682c Subbituminous Coal (Nominal Mass Fraction 0.5 % Sulfur)



SRM 2682c Subbituminous Coal (Nominal Mass Fraction 0.5 % Sulfur) is a renewal SRM intended primarily for use in the evaluation of techniques used in the analysis of coals and materials of similar matrix. A unit of SRM 2682c consists of 50 g of subbituminous coal that was ground to pass a 250 µm sieve, homogenized, packaged in an amber glass bottle under argon atmosphere, and then sealed in an aluminized bag. SRM 2682c is the replacement for SRM 2682b. Like SRM 2682b, it is certified for the mass fractions of sulfur (S) and mercury (Hg) and has a reference value for the mass fraction of chlorine (Cl). SRM 2682c also has reference values for bromine, magnesium, and manganese mass fractions, and information values for particle size distribution.

Analysis of coals for Cl, Hg, and S has been important for monitoring pollutants, and the SRM 2682 series has helped to meet this need for nearly 30 years. In addition to SRM 2682c, NIST provides other coal SRMs with mass fraction values for Cl, Hg, S, and other elements (SRMs 1635a, 1632d, 2683c, 2684c, 2685c, 2692c, and 2693). With a nominal mass fraction of 0.5 %, SRM 2682c is an important standard for low-sulfur coals, with the suite of coal SRMs having nominal mass fractions of S that range from 0.5 % to 5 %. All of these SRMs also provide mass fraction values that are useful for

monitoring pollutants and trading commodities.

Technical Contact: Thomas Vetter
Email: Thomas.Vetter@nist.gov

NIST SRM 2910b Hydroxyapatite

NIST recently certified and released SRM 2910b Hydroxyapatite to meet high customer demand. Dental and orthopedic device manufacturers rely heavily on this SRM to demonstrate substantial equivalence to predicate devices in order to meet regulatory requirements for the approval of surgical implants with hydroxyapatite spray coatings. The production of this material utilized specialized NIST expertise in hydroxyapatite synthesis and characterization. It was performed through a partnership between NIST and the American Dental Association Foundation's Volpe Research Center (ADAF/VRC) with support from the National Institute of Dental and Craniofacial Research (NIH/NIDCR) through an Interagency Agreement. This SRM is the only well-characterized, non-geological hydroxyapatite reference material demonstrated to be homogenous, stable, highly crystalline, and stoichiometric with respect to Ca/P ratio. SRM 2910b is widely used and accepted, both in academia and industry, as a reference material and control for measurements of structural and physical properties of hydroxyapatite powders. In addition, SRM 2910b has been identified as the critical reference material requisite for several updated ISO (13779-3) and ASTM (F2024 – 10) standard methods related to measurement of phase purity of hydroxyapatite plasma coatings in surgical implants.



Technical Contact: Dongbo Wang

Email: Dongbo.Wang@nist.gov



NIST SRM 2950a Respirable Alpha Quartz on Filter Media

NIST has issued SRM 2950a Respirable Alpha Quartz on Filter Media to improve the measurement accuracy of the substance in the work environment. Occupational exposures to respirable crystalline silica are associated with the development of silicosis, lung cancer, pulmonary tuberculosis, and other airway diseases. To help safeguard the health of industrial workers against this deadly yet preventable occupational exposure in mining, quarrying, sandblasting operations, and other work environments the Occupational Safety and Health Administration (OSHA) enforces strict regulatory limits on the emission of respirable crystalline silica in the work place. For testing, air particulate matter is collected on filters and measured for crystalline silica. However, accurate determinations are difficult due to complexities in the calibration of the principal analysis technique X-ray diffraction (XRD). NIST

developed SRM 2950a Respirable Alpha Quartz on Filter Media to cover the typical range of quartz on field filter samples. The SRM is intended for calibration of XRD after ashing for redeposition and for calibration of infrared absorption spectrometry. SRM 2950a is recommended as the calibration standard for National Institute for Occupational Health and Safety (NIOSH) Methods 7500 (using SAMPLE PREPARATION 5 a-b), 7602, and 7603.

SRM 2950a was produced by depositing known amounts of SRM 1878a Respirable Alpha Quartz in slurry on 25 mm diameter polyvinyl chloride (PVC) filters. A unit of SRMs 2950a consists of 5 loaded PVC filters at each of the following nominal levels: 5 μg , 10 μg , 20 μg , 50 μg , 100 μg , 250 μg , and 500 μg . Thirty-five blank PVC filters containing no alpha quartz are also included. Blank filters and loaded filters are stored in separate, clear plastic Petri dishes with blue spacer sheets separating the individual filters.

Technical Contact: Lee Yu

Email: Lee.Yu@nist.gov

Renewal SRMs/RMs

SRM 80a	Soda-Lime Glass (Beads)
SRM 999c	Potassium Chloride Primary Standard (Dried at 500 °C)
SRM 1886b	White Portland Cement
SRM 2031b	Metal-on-Fused-Silica Neutral Density Filters (250nm-635nm))
SRM 3101a	Aluminum (Al) Standard Solution Lot #140903
SRM 3135a	Neodymium (Nd) Standard Solution Lot #140527
SRM 3140	Platinum (Pt) Standard Solution Lot #140930
SRM 3150	Silicon (Si) Standard Solution Lot #130912
SRM 3161a	Tin (Sn) Standard Solution Lot #140917
SRM 4326a	Polonium-209 Radioactivity Standard

Certificate Revisions

This is a list of our most recent certificate revisions. NIST updates certificates for a variety of reasons, such as to extend the expiration date or to include additional information gained from stability testing. Users of NIST Standard Reference Materials® should ensure that they have the current certificates. You can print or view a copy of the current certificate at our website at <http://www.nist.gov/srm> or contact the Office of Reference Materials at **phone** 301-975-2200, **fax** 301-926-4751, or **email** srminfo@nist.gov

NIST SRM 972a Vitamin D Metabolites in Frozen Human Serum



The prevalence of vitamin D deficiency or insufficiency in the general population is an issue of concern. Vitamin D deficiency is associated with rickets in children and weak muscles and bones in adults. Testing for vitamin D deficiency has increased dramatically in the past several years, with clinical laboratories performing hundreds of thousands of vitamin D tests per year. The most widely used indicator of vitamin D levels is the measurement of a metabolite known as 25-hydroxyvitamin D [25(OH)D] in either serum or plasma. A number of studies have reported inconsistencies between the results of different techniques used to

measure 25(OH)D. As a result, accurate diagnosis of vitamin D deficiency has remained problematic.

NIST, in collaboration with the National Institutes of Health (NIH) Office of Dietary Supplements (ODS), has developed SRM 972a Vitamin D Metabolites in Frozen Human Serum for use in evaluating the accuracy of procedures for the determination of 25(OH)D in human serum. SRM 972a is a replacement for SRM 972, which was introduced in 2009 and is no longer available. SRM 972a consists of frozen human serum with four different concentration levels of 25(OH)D that will address the needs of various measurement communities. In contrast to SRM 972, three of the four levels of SRM 972a were prepared from unmodified human serum. In addition to certified and reference values for the metabolites 25(OH)D₂, 25(OH)D₃, and 3-epi-25(OH)D₃, reference values were added for another metabolite 24R, 25-dihydroxyvitamin D₃, which is an important vitamin D metabolite used as a catabolism marker and indicator of kidney disease. SRM 972a will provide a mechanism for in-vitro diagnostic manufacturers and clinical laboratories to identify and address variations in 25(OH)D and 24R,25-dihydroxyvitamin D₃ measurements.

Technical Contact: Susan Tai
Email: Susan.Tai@nist.gov



NIST SRM 1648a Urban Particulate Matter

SRM 1648a is an atmospheric particulate material with a mean particle diameter of 5.85 μm . The material was originally collected from an industrialized urban area using a specially designed baghouse. The material is intended for use in the development of analytical methods and validation of data for the analysis of atmospheric particulate samples.

SRM 1648a was originally released in April 2008 as a replacement for SRM 1648 both of which were prepared from the same source of collected material. The

Certificate of Analysis for SRM 1648a has been recently updated to include additional values for selected polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), and organochlorine pesticides as well as the addition of a certified value for mercury, which was obtained using a primary method based on isotope dilution inductively coupled plasma mass spectrometry (ID-ICPMS).

Technical Contact: Stephen Long

Email: Stephen.Long@nist.gov



NIST SRM 1849a Infant/Adult Nutritional Formula

Infant formula is the most regulated food produced in the U.S. and worldwide, as it is often the sole source of nutrition for an infant. In the U.S., for example, the Infant Formula Act of 1980 requires that various nutrient levels fall within a specified range. Consequently, an SRM with values assigned for these nutrients is critical to allow manufacturers to monitor their products and ensure that their analytical methods are accurate. Official international dispute resolution methods for nutrients in infant formula products are being developed through an ongoing contract between AOAC INTERNATIONAL and the Infant Nutrition Council of America, named the Stakeholder Panel on Infant Formula

and Adult Nutritionals, or SPIFAN. Since inception in 2010, SPIFAN has generated methods for over 30 nutrients, and 8 have been approved for final action through AOAC and will become ISO/IDF and Codex official methods. Throughout this process, SRM 1849a has underpinned the evaluation of candidate methods and been used to distinguish well-performing methods from those with obvious biases.

The recent update to the Certificate of Analysis for SRM 1849a provided new data for fatty acids, including an upgrade of many values from reference values based on external data from collaborating laboratories to certified values upon combination with NIST data. Of interest are newly assigned certified values for arachidonic acid (ARA) and docosahexaenoic acid (DHA), omega-3 and -6 fatty acids that are fortified in infant formula specifically to improve visual function and neural development in the growing infant.

A unit of SRM 1849a consists of 10 packets each containing 10 g of powder. The Certificate of Analysis for SRM 1849a contains 91 assigned values, including fatty acids, cholesterol, elements, vitamins, proximates, calories, amino acids, and nucleotides.

Technical Contact: Melissa Phillips and Laura Wood

Email: Melissa.Phillips@nist.gov and Laura.Wood@nist.gov

NIST SRM 2383a Baby Food Composite



NIST food-matrix SRMs are used by food manufacturers, regulators, and testing laboratories to validate methods and as quality control materials in support of the Nutrition Labeling and Education Act of 1990, which requires that nutrition information be provided on all processed foods sold in the U.S. SRM 2383 Baby Food Composite was released in 1997 as one of the first food-matrix SRMs available from NIST, designed for use in the determination of carotenoids and fat-soluble vitamins in a mixed-diet matrix. The material was prepared by Gerber, following a recipe developed by NIST, combining commercially available baby foods in proportions that provided comparable levels of xanthophylls and carotenoids.

SRM 2383a Baby Food Composite was prepared by Gerber as a replacement for SRM 2383 using the main ingredients from the original recipe. Beef, infant formula, and additional minor ingredients (e.g., onion powder, oregano) were excluded from the new preparation based on suggestions from customers. SRM 2383a was released in 2012, and the recent update to the Certificate of Analysis provided new data for carotenoids, assigned using data from external collaborating laboratories as well as from two independent methods at NIST. The methods used for value assignment at NIST were liquid chromatography (LC) with absorbance detection and LC with mass spectrometry (MS) detection. The addition of these values is expected to increase interest in SRM 2383a, as this material was designed for use in evaluation of methods for carotenoids analysis.

A unit of SRM 2383a consists of 4 jars containing 70 g each. The Certificate of Analysis for SRM 2383a contains 50 assigned values, including carotenoids, elements, vitamins, proximates, and calories.

Technical Contact: Melissa Phillips
Email: Melissa.Phillips@nist.gov

NIST SRM 2387 Peanut Butter

NIST food-matrix SRMs are used by food manufacturers, regulators, and testing laboratories to validate methods and as quality control materials in support of the Nutrition Labeling and Education Act of 1990, which requires that nutrition information be provided on all processed foods sold in the U.S. SRM 2387 Peanut Butter was prepared by a commercial manufacturer as part of a larger production run. The material was designed for analysis of nutrients and contaminants, such as acrylamide and aflatoxins, in a high-fat food matrix. SRM 2387 was released in 2003.

The recent update to the Certificate of Analysis for SRM 2387 provided new data for water-soluble vitamins and α -tocopherol. The method used for value assignment of water-soluble vitamins at NIST was liquid chromatography (LC) with tandem mass spectrometry (MS/MS) detection. The addition of water-soluble vitamin values to the Certificate of Analysis for SRM 2387 is significant, as this is the first assignment of these values in a high-fat matrix. The α -tocopherol value was also updated based on new data collected at NIST using LC with fluorescence detection.



A unit of SRM 2387 consists of 3 jars containing 170 g each. The Certificate of Analysis for SRM 2387 contains 72 assigned values, including fatty acids, elements, vitamins, proximates, calories, amino acids, aflatoxins, and acrylamide.

Technical Contact: Melissa Phillips
Email: Melissa.Phillips@nist.gov



NIST SRM 2781 Domestic Sludge

NIST examines existing environmental matrix Standard Reference Materials® (SRMs) for compounds of emerging concern. Recently three groups of organic compounds of emerging concern, polycyclic musks, hexabromocyclododecanes (HBCDs), and perfluorinated alkyl acids (PFAAs) have been quantified in SRM 2781 Domestic Sludge. Polycyclic musks, HBCDs, and PFAAs are manufactured worldwide and have shown ubiquitous distribution in the environment. These compounds of emerging concern are used in a wide range of consumer products, including personal care products, textiles, home electronics, carpeting, and upholstery. With widespread consumer use in the home there is a great potential for these compounds to go down the drain and reach wastewater treatment plants. Wastewater sludge has been considered an important sink for organic pollutants and therefore a relevant matrix to examine compounds of emerging concern.

SRM 2781 was initially developed for evaluation of elements in the analysis of sludge and other material of similar matrix. Now with the additional organic values, this material can be used for method development and validation, as well as establishing traceability when assigning values, for polycyclic musks, HBCDs, and PFAAs.

Technical Contact: Jessica Reiner

Email: Jessica.Reiner@nist.gov



NIST SRM 3950 Vitamin B₆ in Frozen Human Serum

NIST has recently extended the expiration date (03/31/2023) for SRM 3950 Vitamin B₆ in Frozen Human Serum, which was first released in 2011, based on stability measurements. This SRM contains two levels of the clinically relevant vitamin B₆ metabolite, pyridoxal 5'-phosphate (PLP), in serum. Vitamin B₆ levels in serum are of clinical interest as they reflect dietary status and are associated with several disease states, including stroke, cardiovascular disease, and hypertension. The availability of this SRM allows laboratories to evaluate the accuracy of their measurement methods as well as to objectively compare results from multiple analytical methods and clinical laboratories. SRM 3950 Vitamin B₆ in Human Serum Level 1

is a human serum pool containing endogenous levels of PLP ($4.59 \text{ ng/mL} \pm 0.16 \text{ ng/mL}$). Level 2 contains a naturally lower level serum pool that has been fortified with PLP to achieve the desired higher level ($9.00 \text{ ng/mL} \pm 0.29 \text{ ng/mL}$). This material is NIST's first serum-based SRM containing multiple levels of vitamin B₆, which complements the existing clinical SRM selection.

Technical Contacts: Johanna Camara

Email: Johanna.Camara@nist.gov

SRM 92 Soda-Lime Glass, Low Boron (Powder)

Additional certified, reference and information values

Editorial changes

SRM 640e Line Position and Line Shape Standard for Powder Diffraction (Silicon Powder)

Editorial changes

SRM 660c Line Position and Line Shape Standard for Powder Diffraction (Lanthanum Hexaboride Powder)

Editorial changes

Revisions (continued)

SRM 663 Chromium-Vanadium Steel (Modified)

Editorial changes

SRM 676a Alumina Powder (Quantitative Analysis Powder Diffraction Standard)

Editorial changes

SRM 695 Trace Elements in Multi-Nutrient Fertilizer

New expiration date: 01 April 2026

Editorial changes

SRM 867 Ni-Fe-Cr Alloy UNS N08825 (chip form)

Editorial changes

SRM 909c Frozen Human Serum

New expiration date: 15 October 2025

Editorial changes

SRM 911c Cholesterol

Editorial changes

SRM 912a Urea

Editorial changes

SRM 914a Creatinine

Editorial changes

SRM 915b Calcium Carbonate

New expiration date: 01 March 2026

Editorial changes

SRM 920 D-Mannitol

Editorial changes

SRM 921 Cortisol (Hydrocortisone)

Editorial changes

SRM 929a Magnesium Gluconate

Editorial changes

SRM 956d Electrolytes in Frozen Human Serum

Editorial changes

SRM 967a Creatinine in Frozen Human Serum

Editorial changes

SRM 968e Fat-Soluble Vitamins, Carotenoids, and Cholesterol in Human Serum

Editorial changes

SRM 971 Hormones in Frozen Human Serum

Editorial changes

Revisions (continued)

SRM 998 Angiotensin I (Human)

Editorial changes

SRM 999b Potassium Chloride (Primary Chemical)

New expiration date: 31 October 2024

Editorial changes

SRM 1082 Cigarette Ignition Strength Standard

New expiration date: 31 December 2017

Editorial changes

SRM 1247 Ni-Fe-Cr Alloy UNS N08825 (disk form)

Editorial changes

SRM 1482a Polyethylene

New expiration date: 01 June 2020

Editorial changes

SRM 1483a Linear Polyethylene

New expiration date: 01 June 2020

Editorial changes

SRM 1508a Benzoylecgonine (Cocaine Metabolite) in Freeze-Dried Urine

Editorial changes

SRM 1548a Typical Diet

New expiration date: 30 April 2021

Editorial changes

SRM 1566b Oyster Tissue

Editorial changes

SRM 1577c Bovine Liver

Editorial changes

SRM 1588c Organics in Fish Oil

Editorial changes

SRM 1595 Tripalmitin

Editorial changes

SRM 1616b Sulfur in Kerosene (Low Level)

New expiration date: 31 December 2018

Editorial changes

SRM 1622e Sulfur in Residual Fuel Oil (Nominal Mass Fraction 2 %)

New expiration date: 31 August 2025

Editorial changes

Revisions (continued)

SRM 1649b Urban Dust

New expiration date: 31 July 2030

Editorial changes

SRM 1678c Carbon Monoxide in Nitrogen (Nominal Amount-of-Substance Fraction 50 $\mu\text{mol/mol}$) Lot4-K-XX

New expiration date: 4 February 2021

Editorial changes

SRM 1729 Tin Alloy (97 Sn - 3 Pb)

Editorial changes

SRM 1878b Respirable Alpha Quartz (Quantitative X-Ray Powder Diffraction Standard)

Editorial changes

SRM 1946 Lake Superior Fish Tissue

Editorial changes

SRM 1947 Lake Michigan Fish Tissue

Editorial changes

SRM 1951c Lipids in Frozen Human Serum

Editorial changes

SRM 1954 Organic Contaminants in Fortified Human Milk

Editorial changes

SRM 1955 Homocysteine and Folate in Frozen Human Serum

Editorial changes

SRM 1958 Organic Contaminants in Fortified Human Serum (Freeze-Dried)

Editorial changes

SRM 1974c Organics in Mussel Tissue (*Mytilus edulis*)

Editorial changes

SRM 1976b Instrument Response Standard for X-Ray Powder Diffraction

Editorial changes

SRM 1984 Thermal Spray Powder - Particle Size Distribution Tungsten Carbide/Cobalt (Acicular)

Editorial changes

SRM 2193a Calcium Carbonate pH Standard

New expiration date: 01 July 2020

Editorial changes

SRM 2235 Bismuth for Thermal Analysis

New expiration date: 01 August 2025

Editorial changes

SRM 2241 Relative Intensity Correction Standard for Raman Spectroscopy: 785 nm Excitation

New expiration date: 30 November 2020

Editorial changes

Revisions (continued)

SRM 2244 Relative Intensity Correction Standard for Raman Spectroscopy: 1064 nm Excitation

Editorial changes

SRM 2245 Relative Intensity Correction Standard for Raman Spectroscopy: 633 nm Excitation

Editorial changes

SRM 2246 Relative Intensity Correction Standard for Raman Spectroscopy: 830 nm Excitation

Editorial changes

SRM 2393 CAG Repeat Length Mutation in Huntington's Disease

New expiration date: 31 January 2021

Editorial changes

SRM 2492 Bingham Paste Mixture for Rheological Measurements

Editorial changes

SRM 2620 Carbon Dioxide in Nitrogen (Nominal Amount-of-Substance Fraction 1 % mol/mol)**Lot #31-G-xx**

New expiration date: 04 June 2023

SRM 2670a Toxic Elements

Editorial changes

SRM 2689 Coal Fly Ash

Editorial Changes

SRM 2690 Coal Fly Ash

Editorial Changes

SRM 2691a Coal Fly Ash

Editorial Changes

SRM 2717a Sulfur in Residual Fuel Oil (Nominal Mass Fraction 3%)

New expiration date: 31 August 2025

Editorial changes

SRM 2723b Sulfur in Diesel Fuel Oil (Nominal Mass Fraction 10 mg/kg)

Editorial changes

SRM 2782 Industrial Sludge

New expiration date: 01 October 2023

Editorial changes

SRM 2885 Polyethylene (M_w , 6 280 g/mol)

New expiration date: 01 June 2020

Editorial changes

SRM 2886 Polyethylene (M_w , 87 000 g/mol)

New expiration date: 01 June 2020

Editorial changes

Revisions (continued)

SRM 2887 Polyethylene (M_w , 196 400 g/mol)

New expiration date: 01 June 2020

Editorial changes

SRM 3120a Germanium (Ge) Standard Solution Lot #080429

New expiration date: 30 April 2017

SRM 3254 *Camellia sinensis* (Green Tea) Leaves

Editorial changes

SRM 3255 Green Tea (*Camellia sinensis*) Extract

Editorial changes

SRM 3256 Green Tea-Containing Solid Oral Dosage Form

New expiration date: 30 November 2021

Editorial changes

SRM 3669 Arsenic Species in Frozen Human Urine (Elevated Levels)

Editorial changes

SRM 3671 Nicotine Metabolites in Human Urine (Frozen)

Editorial changes

SRM 3672 Organic Contaminants in Smokers' Urine (Frozen)

Editorial changes

SRM 3673 Organic Contaminants in Non-Smokers' Urine (Frozen)

Editorial changes

SRM 4350b River Sediment Environmental Radioactivity Standard

Editorial changes

SRM 4351 Human Lung Environmental Radioactivity Standard

Editorial changes

RM 8011 Gold Nanoparticles, Nominal 10 nm Diameter

New expiration date: 25 October 2018

Editorial changes

RM 8012 Gold Nanoparticles, Nominal 30 nm Diameter

New expiration date: 25 October 2018

Editorial changes

RM 8013 Gold Nanoparticles, Nominal 60 nm Diameter

New expiration date: 25 October 2018

Editorial changes

RM 8040 Sodium Oxalate ($\text{Na}_2\text{C}_2\text{O}_4$) Reductometric Standard

New expiration date: 29 October 2020

Editorial changes

RM 8398 Human DNA for Whole-Genome Variant Assessment (Daughter of Utah/European Ancestry)

Editorial changes

NIST 2016 SRM EXHIBIT SCHEDULE

American Academy for Forensic Science
AAFS 68th Annual Scientific Meeting
February 22-27, 2016
Rio All-Suite Hotel, Las Vegas, NV

Clinical Lab Expo AACC
July 31- August 4, 2016
Pennsylvania Convention Center, Philadelphia, PA

Pittsburgh Conference PITTCON
March 6-10, 2016
Georgia World Congress Center, Atlanta, GA

American Chemical Society Fall Meeting ACS
August 21-25, 2016
Pennsylvania Convention Center, Philadelphia, PA

American Chemical Society Spring Meeting ACS
March 13-17, 2016
San Diego Convention Center, San Diego, CA

AOAC Annual Meeting and Expo
September 18-21, 2016
Sheraton Dallas Hotel, Dallas, TX

Materials Research Society Spring Meeting MRS
March 28 - April 1, 2016
Phoenix Convention Center, Phoenix, AZ

Materials Science & Technology Conference and Exhibition MS&T 16
October 24-27, 2016
Salt Palace Convention Center, Salt Lake, UT

The American Society of Crime Laboratories Directors ASCLD
April 24-28, 2016
Hyatt Regency Bellevue, Bellevue, WA

Material Research Society Fall Meeting MRS
November 27-December 2, 2016
Hynes Convention Center, Boston, MA

ORDER NIST SRMs ONLINE

You can order NIST SRMs through our online request system, which is continually updated. This system is efficient, user-friendly, and secure. Our improved search function finds keywords on SRM detail pages as well as words in titles. **PLEASE NOTE:** Purchase orders and credit cards may be used when ordering an SRM online. Also note that we are placing many historical archive certificates online for your convenience.

<https://www-s.nist.gov/srmors>

Please Register Your SRM Online!

Registering will ensure that you will be notified of technical updates or developments.

http://www.nist.gov/srm_reg

NIST Measurement Services Websites of Interest

Standard Reference Materials



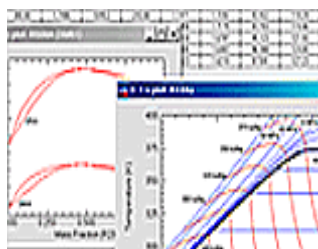
Standard Reference Materials®

<http://www.nist.gov/srm>

Historical Archived Certificates/Reports of Investigation

<https://www-s.nist.gov/srmors/certArchive.cfm>

Standard Reference Data



NIST Scientific and Technical Databases

<http://www.nist.gov/srd>

NIST Data Gateway

<http://srdata.nist.gov/gateway>

Calibrations



Calibrations Services

<http://www.nist.gov/calibrations>

Standard Reference Instruments



Standard Reference Instruments

<http://www.nist.gov/srm/standard-reference-instruments.cfm>

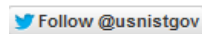
Please visit the NIST Facebook page

<http://www.facebook.com/usnistgov>



Follow NIST on Twitter

<http://twitter.com/usnistgov>



Visit us on YouTube

<http://www.youtube.com/usnistgov>



We appreciate your feedback!