NISTIR 6451

NIST Standard Reference Materials® Program

FY 2000 SRM® Project Plans

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U.S. DEPARTMENT OF COMMERCE
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U.S. DEPARTMENT OF COMMERCE
William M. Daley, Secretary

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Dr. Cheryl L. Shavers, Under Secretary of Commerce for Technology

NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY
Raymond G. Kammer, Director

Foreword

A Standard Reference Material® (SRM®) is a certified reference material (CRM)[1] produced in quantity and issued by the National Institute of Standards and Technology (NIST). It is well-characterized for specific physical or chemical properties using state-of-the-art measurement methods and is accompanied by a certificate that reports the results of the characterization and the intended use of the material.

SRMs are among the most widely recognized and sought after metrologic products provided by NIST. They are needed by industry, academia, and government to develop methods of analysis, to calibrate measurement systems, to facilitate the exchange of goods, to control measurement assurance programs, to demonstrate measurement competence, and to validate research. Their greatest value is, however, in what they represent as part of the national measurement infrastructure of the United States for which NIST is constitutionally responsible. SRMs provide one of only a few acceptable paths by which traceability to national and international standards of measurement can be achieved and demonstrated. While first and foremost a technical concept, the requirement for measurement traceability has recently been integrated into international trade and conformity assessment policies giving it added economic relevance. This has resulted in demands for even more NIST SRMs. Through collaborations with the private and governmental sectors, NIST has been uniquely successful in addressing critical SRM requirements. However, the challenge to maintain existing SRMs and concurrently produce new SRMs has long since taxed the capacities of NIST Laboratories. The SRM projects they have submitted for funding in this fiscal year have thus been carefully chosen to maximize utilization of NIST Laboratory resources while expeditiously responding to the most critical of measurement demands.

SRM Coordinators

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[1] Defined by the International Organization for Standardization (ISO) in Guide 30:1992 (E/F) *Terms and definitions used in connection with reference materials.*

Summary and Key Words

The SRM project plans for FY 2000 are summarized by Laboratory (Operating Unit – OU) in the following pages of this report. [NOTE – this report can be viewed electronically by accessing the SRM Program web site, http://ts.nist.gov/srm .] Some 89 production projects (40 for new SRMs, 49 for renewal SRMs) and 44 SRM development projects were submitted by the OUs to the Budget Office for funding. The SRM Program requested that the OUs consider 17 additional renewal SRM projects, mostly under the aegis of the NIST/ASTM Collaborative Agreement for Metals.

The plans are grouped by funding requirement – those designated for Working Capital Funds (WCF) and those designated for Service Development Support Funds (SDS). ***Within a funding group, the title of each plan is preceded by a number indicating its priority as established by the OU.*** [NOTE – several project plans were reprioritized after this report was begun. For those plans affected, the new numbers have been added and the old numbers placed in parentheses.] The status, impact, technical work objective, and duration of work for each plan are then briefly described. Detailed information about each SRM can be found in the project plans prepared by each OU. Copies of individual plans are available from the OU, the Budget Office, or from the SRM Program.

Key Words: calibration, certified reference material (CRM), characterization, composition, material, measurement, physical and/or chemical property, quality assurance, Standard Reference Material® (SRM®), traceability.

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Electronics and Electrical Engineering Laboratory

□ Production Plans – SRM Projects submitted for Working Capital (WC) Funding

1. SRM 2520 Optical Fiber Cladding Diameter

Status: Renewal SRM

Impact: In fiber optic systems, minimization of signal loss is a high priority and requires that fibers and components be connected with the best possible alignment. This places the restriction on fibers that their cladding (outer) diameter be well known and repeatable, with an accuracy below 1 μm. To meet this need, NIST has been producing SRM 2520, a fiber specimen whose cladding diameter is certified to approximately 35 nm.

Technical Work Objective: Manufacture and certify additional optical fiber cladding diameter units.

Project Duration: 0.5 year; Expected Completion - Mid FY 00.

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2. SRM 2517 Wavelength Reference Absorption Cell, Acetylene
3. SRM 2519 Wavelength Reference Absorption Cell, Hydrogen Cyanide
5. SRM 2515 Wavelength Reference Absorption Cell, Acetylene

Status: Renewal/New SRMs

Impact: Recent requirements in optical fiber communication to extend the bandwidth of existing optical fibers have dramatically increased the need for wavelength calibration in the 1500 nm to 1600 nm wavelength region. Work instituted by NIST and supported by the U.S. Navy and Air Force have led to certification of 'moderate accuracy' SRMs that represent wavelength division multiplexed (WDM) systems, incorporating multiple channels at different wavelengths. These SRMs are used to calibrate optical spectrum analyzers and tunable lasers.

Technical Work Objective: Produce and certify wavelength reference absorption cells in the 1513 nm to 1541 nm and 1525 nm to 1565 nm bands.

Project Duration: 0.5 year; Expected Completion - Mid FY 00.

4. SRM 2544 Silicon Resistivity Standard

Status: Renewal SRM

Impact: Electrical resistivity, expressed in ohm-centimeters, Ω•cm, is a critical material parameter in the production and operation of semiconductors. SEMATECH, an industrial consortium of semiconductor manufacturers, had identified a need for standardization and traceability in the measurement of resistivity. NIST has developed a suite of seven SRMs for resistivity that range from 0.01 Ω•cm to 200 Ω•cm for use by test equipment manufacturers and silicon wafer suppliers. This work will replenish the stock of SRM 2544, the highest demand SRM from the suite.

Technical Work Objective: Provide additional silicon resistivity standard units to stock.

Project Duration: 0.5 year; Expected Completion - Mid FY 00.

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6. SRM 2538 Polarization Mode Dispersion (Non-Mode-Coupled) Standard

Status: New SRM

Impact: In long distance telecommunication, the ultimate measure of performance is data rate (bandwidth). Polarization mode dispersion (PMD) in optical fibers and components is a major bandwidth-limiting factor faced by optical fiber and test equipment manufacturers and users. However, PMD is a statistical quantity that makes its measurement a confusing subject and its accuracy often difficult to determine. SRM 2538, to simulate PMD in optical components (non-mode-coupled), is part of a two-step solution to the problem. SRM 2538 will supplement SRM 2518 Polarization Mode Dispersion Standard in that it will simulate measurements on non-fiber components and support common measurement techniques (interferometry and wavelength scanning) that cannot be calibrated with SRM 2518.

Technical Work Objective: Assemble, certify, and deliver 15 non-mode-coupled PMD SRMs.

Project Duration: 0.5 year; Expected Completion - Mid FY 00.

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7. SRM 2537 Polarization Dependent Loss Reference Standard [See also SD Project 2.]

Status: New SRM

Impact: The most severe noise sources experienced by fiber optic communication systems are related to a combination of optical polarization effects that change signal intensity with time. NIST has been conducting research on one aspect of these polarization effects known as polarization dependent loss (PDL). The immediate need is for a reference material to calibrate instruments that measure PDL, either directly or indirectly, through its effect on system noise in the 1528 nm to 1565 nm wavelength range. NIST will produce an artifact, SRM 2537, with a known amount of PDL characterized as a function of wavelength.

Technical Work Objective: Assemble, certify, and deliver 15 non-mode-coupled PMD SRMs.

Project Duration: 1 year; Expected Completion - End FY 00.

□ Development Plans – SRM Projects submitted for Service Development (SD) Funding

1. SRM 2516 Wavelength Reference Absorption Cell

Status: New SRM

Impact: Recent requirements in optical fiber communication to extend the bandwidth of existing optical fibers have dramatically increased the need for wavelength calibration in the 1500 nm to 1600 nm wavelength region. This need is expanding into other wavelength regions, and will likely extend from 1300 nm to 1620 nm. Work on 'moderate accuracy' standards by NIST and supported by the U.S. Navy and Air Force has led directly to certification of SRMs that will calibrate wavelength division multiplexed (WDM) systems that incorporate multiple channels at different wavelengths and are used to calibrate optical spectrum analyzers and tunable lasers.

Technical Work Objective: Develop SRM 2516 for use in the 1570 nm to 1620 nm wavelength region. Investigate two candidate materials in this region: hydrogen iodide and carbon monoxide. Select one for SRM development.

Project Duration: 1 year; Expected Completion - End FY 00.

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2. SRM 2537 Polarization Dependent Loss Reference Standard [See also WCF Project 7.]

Status: New SRM

Impact: The most severe noise sources experienced by fiber optic communication systems are related to a combination of optical polarization effects that change signal intensity with time. NIST has been conducting research on one aspect of these polarization effects known as polarization dependent loss (PDL). The immediate need is for reference materials to calibrate instruments that measure this effect either directly or indirectly through its effect on system noise in the 1528 nm to 1565 nm wavelength range. SRM 2537 will meet this need by offering an artifact with certified PDL.

Technical Work Objective: Complete the development and documentation of the SRM artifact at 0.1 dB PDL (characterized over a range of wavelengths). Produce 10 SRM units upon completion of development.

Project Duration: 0.5 year; Expected Completion - Mid FY 00.

3. Magnetic Thin Film Reference Standard

Status: New SRM

Impact: A longstanding problem for the data storage industry is the determination of absolute atomic moments. Because the relevant devices are dominated by interfaces that are affected by reduced atomic coordination, intermixing and alloying, pinholes, and quantum well effects; bulk material properties are not applicable. Therefore, it is necessary to measure the actual magnetic flux of samples as-deposited in order to correlate useful properties (e.g., magneto-resistance, coercivity, anisotropy) with magnetic moments. SRMs for magnetometers are critical to solving the problem, and will make possible higher yields and reduced processing times.

Technical Work Objective: Measure the total flux inside a magnetic film using a superconducting pickup loop of wire surrounding a thin film/multilayer sample.

Project Duration: 1 year; Expected Completion - End FY 01.

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Manufacturing Engineering Laboratory

□ Production Plans – SRM Projects submitted for Working Capital (WC) Funding

1. SRM 2800 Optical Microscope Magnification Standard

Status: New SRM

Impact: Optical and scanning probe microscopes are widely used in such areas as semiconductor manufacture, pharmaceutical production, and biological research, not only to image features but to make length and size measurements. This SRM will satisfy the historical demand for a high-accuracy NIST-certified standard in the 1 μm to 1 cm range to calibrate the length scale (pitch) of this type of equipment. Units of this SRM will be made available quickly and be of higher accuracy than artifacts that are commercially acquired and sent to NIST to be calibrated through the NIST Calibration Program.

Technical Work Objective: Develop software and calibration protocol for NIST UV microscope for calibration of SRM 2800; measure, evaluate uncertainty, and provide units.

Project Duration: 0.5 year; Expected Completion - Mid FY 00.

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2. SRM 2059 Optical Photomask Linewidth Standard

Status: New SRM

Impact: Photomasks are used in semiconductor manufacture to photographically transfer patterns onto resist-covered silicon wafers. The resist is then chemically removed leaving a layer of finished features. Performance is affected by the accurate sizing and placement of these features, hence the demand from photomask and semiconductor manufacturers for SRMs to provide traceability to pitch linewidth, and registration measurements. This SRM is designed to calibrate one-dimensional linewidth measurements and edge location on optical microscopes and in-line metrology systems. NIST photomask linewidth standards are the subject of a current BIPM international comparison to assess the degree of equivalence between national measurement institutes with respect to linewidth.

Technical Work Objective: Develop software and calibration protocol for NIST UV microscope for calibration of SRM 2059; measure, evaluate uncertainty, and provide units.

Project Duration: 1.5 year; Expected Completion - Mid FY 01.

3. **SRM 5001 Two-Dimensional Grid Standard**

Status: New SRM

Impact: As semiconductor features get smaller and chips and wafers become larger, the accurate placement of features on the chip becomes more challenging. Current industry metrology depends on very accurate and repeatable state-of-the-art two-dimensional measuring machines (that cost in excess of $ 2M each) with traceability problems. The increasing need is for high accuracy artifacts to map and test field distortions, scale factors, and orthogonality. To meet this need, NIST proposes a new SRM that consists of a 100 μm × 100 μm grid consisting of a 13 × 13 array of features with accurately measured pitch. This SRM will complement SRM 2059.

Technical Work Objective: Acquire custom-made two dimensional grids; calibrate pitch, orthogonality, and distortion of a two dimensional prototype grid using industrial two-dimensional measuring machines and the NIST Linescale Interferometer.

Project Duration: 0.5 year; Expected Completion - Mid FY 00.

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4. **SRM 2089 AFM Pitch/Height Standard**

Status: New SRM

Impact: Atomic Force Microscopes (AFMs) are becoming widely used in a variety of industrial applications. Because AFMs are capable of generating three dimensional images with nanometer level resolution, they are increasingly used by the semiconductor, data storage, and related micro-fabrication industries as metrology tools. Current standards used in the calibration of these machines employ stylus instruments or optical measurement techniques, and have limitations due to differing sensitivities.

Technical Work Objective: Procure AFM artifacts from the Naval Research Laboratory and calibrate artifacts using instrumentation traceable to the wavelength of light for all 3 axes.

Project Duration: 2 years; Expected Completion - End FY 01.

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5. **SRM Gage Block Standards** [See also SD Project 3.]

Status: New SRMs

Impact: Machine shops and related manufacturing industries use gage blocks to calibrate their metrology tools. This SRM will facilitate the dissemination of traceable length measurements to these industries by providing gage blocks of various materials (steel, chrome carbide, and tungsten) with better efficiency and lower measurement uncertainty. Use of these blocks will reduce the number of master blocks a shop needs to maintain while virtually eliminating systematic errors from differential deformation between materials.

Technical Work Objective: Acquire and calibrate SRM gage block sets.

Project Duration: 1.5 year; Expected Completion - Mid FY 01.

6. SRM 2071c Sinusoidal Roughness Block

Status: New SRM

Impact: Machine shops and many manufacturing industries use stylus instruments that measure roughness as a specification for surface finish of machined parts. This SRM will facilitate the dissemination of traceable roughness measurements to these industries by providing calibrated sinusoidal roughness blocks. These blocks constitute the only source of measurement traceability for roughness available in the United States.

Technical Work Objective: Evaluate prototype specimens and perform experimental design to develop an economical certification plan for FY 01.

Project Duration: 2 years; Expected Completion - End FY 01.

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7. SRM 2091 SEM Sharpness Standard

Status: New SRM

Impact: SRM 2091 is intended for use in checking the sharpness of scanning electron microscopes (SEMs) used in the semiconductor and other industries. Sharpness is an important aspect of quality control for these instruments. This standard would allow automated SEM tools to perform periodic quality checks of sharpness without human objectivity or intervention, and can also serve as a good check for contamination deposition. This SRM will be used with the SEM Monitor program - winner of the 1998 R&D 100 Magazine Award.

Technical Work Objective: Donated materials have already been obtained. Materials are to be diced and packaged and supporting documentation written.

Project Duration: 0.5 year; Expected Completion - Mid FY 00.

□ Development Plans – SRM Projects submitted for Service Development (SD) Funding

1. SRM 5000 Standard Overlay Artifact

Status: New SRM

Impact: As integrated circuit densities increase and electronic device dimensions are miniaturized, the accuracy of registration of one mask level (overlay) relative to another mask level is of increasing importance. Currently, control of overlay error is required at the 25 nm level with repeatability of 3 nm. There is immediate need for standards that support these measurements. The primary users will be manufacturers of semiconductor devices.

Technical Work Objective: Design and oversee the manufacture of a series of overlay target structures to be calibrated with the NIST overlay metrology tool (a scanning electron microscope that measures features on a silicon wafer).

Project Duration: 1 year; Expected Completion - End FY 00.

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2. SRM 2081 Bullets and Casings Standard for Forensics

Status: New SRM

Impact: Firearms, like fingerprints, have characteristics that leave unique signatures on fired bullets and casings. By analyzing these ballistic signatures, examiners can connect a firearm to a violent crime. The Integrated Ballistics Identification System, sponsored by the FBI and BATF, automate tools for this process using optical imaging techniques. To demonstrate system reliability, a daily check standard is required.

Technical Work Objective: Design manufacturing procedure for standard bullets and fabricate prototypes.

Project Duration: 2.5 years; Expected Completion - Mid FY 02.

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3. SRM Gage Block Standards [See also WCF Project 5.]

Status: New SRMs

Impact: Machine shops and related manufacturing industries use gage blocks to calibrate their metrology tools. This SRM will facilitate the dissemination of traceable length measurements to these industries by providing gage blocks of various materials (steel, chrome carbide, and tungsten) with better efficiency and lower measurement uncertainty. Use of these blocks will reduce the number of master blocks a shop needs to maintain while virtually eliminating systematic errors from differential deformation between materials.

Technical Work Objective: Develop and calibrate prototype SRM gage blocks.

Project Duration: 1.5 years; Expected Completion - Mid FY 01.

4. Scanning Electron Microscope Linewidth SRM

Status: New SRM

Impact: In integrated circuit design, linewidth is a critical parameter that determines the performance of a printed circuit. The Semiconductor Industry Association (SIA) has determined that a traceable Critical-Dimension Scanning Electron Microscope (CD-SEM) linewidth standard supporting these measurements is a critical step to the SIA National Technology Roadmap for Semiconductors. Until recently, the need for an electron beam interaction model was the limiting factor in the development of the standard. Recent modeling work at NIST has developed to the point where edge location can now be accurately determined.

Technical Work Objective: Provide prototype in whole wafer size and as diced chips.

Project Duration: 1 year; Expected Completion - End FY 00 (for prototype).

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5. NIST Traceable Stage Micrometer

Status: New SRM

Impact: Stage micrometers are widely used throughout industry to calibrate optical instruments, commonly optical microscopes. Optical microscopes are used in hospitals, schools, scientific laboratories, semiconductor manufacturing, and anywhere where the human eye needs aid to see and measure distances in the range of a fraction of a millimeter. This project will develop a new technique that will produce individually measured high-accuracy stage micrometers at low cost.

Technical Work Objective: Develop new technique to produce stage micrometers with patterns whose pitch is capable of being measured electrically.

Project Duration: 1 year; Expected Completion - End FY 00 (for prototype).

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6. Scanning Probe Microscopy Organic Crystal

Status: New SRM

Impact: Scanning Probe Microscopy (SPM) is gaining importance as a metrology tool in the semiconductor and data storage manufacturing industries. SPMs are being used in research and development laboratories for setup and process control, and for off-line defect inspection. SPM-based devices are also being investigated as advanced data storage devices. For all these and other applications, accurate scale calibration is necessary.

Technical Work Objective: Obtain materials with lattice spacings and step heights of 1 nm and 1.7 nm, respectively, from Argonne National Laboratory and investigate for suitability. Explore the applicability of organic conducting crystals as 'atom-based' pitch and step height standards for SPM.

Project Duration: 1 year; Expected Completion - End FY 00 (for prototype).

7. Transmission Electron Microscope (TEM) Magnification Standard

Status: New SRM

Impact: TEMs find use in many areas of materials science in the imaging of very thin or very small electron transparent samples. Current industry standards for TEM calibration consist of specimens made from single crystal semiconductor wafers. When viewed in a TEM, these specimens exhibit light and dark silicon/silicon germanium layers whose distance is known based on the crystalline lattice spacing of the layers. However, the accuracy of these materials is unknown. NIST proposes to develop methods to measure these layer spacings.

Technical Work Objective: Investigate methods to accurately measure interlayer spacing.

Project Duration: 1 year; Expected Completion - End FY 00.

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Chemical Science and Technology Laboratory

□ Production Plans – SRM Projects submitted for Working Capital (WC) Funding

1. **SRM 1930 Glass Filters for Spectrophotometry (Extended Visible)**
2. **SRM 2030a Glass Filter for Transmittance Measurement (Spice Filter)**
3. **SRM 2031a Metal-on-Fused-Silica Filters for Spectrophotometry (UV/Visible)**
7. **SRM 930e Glass Filters for Spectrophotometry (Visible)**

Status: Renewal/Continuous SRMs

Impact: Spectrophotometric measurements play a key role in materials identification for chemical and pharmaceutical production and in on-line process control. Reference materials are needed to ensure the quality control of absorbance measurements in the ultraviolet and visible regions. The U.S. Pharmacopoeia also recommends the use of these materials. SRMs 930e, 1930, and 2031a are certified for a range of transmittances over different wavelength regions. SRM 2030a has a certified transmittance value at a wavelength of 465.0 nm, which meets a specific need of the spice industry.

Technical Work Objective: Continually produce a series of optical filters certified as SRMs to be used as calibrants for spectrophotometers in the UV and visible light wavelength regions.

Project Duration: Ongoing

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4. **SRMs 3181 and 3186 Anion Standard Solutions**
5. **SRMs 3190 through 3199 Aqueous Electrolytic Conductivity Standard Solutions**
6. **SRMs 3101a through 3169 Single Element Standard Solutions**

Status: Renewal/Continuous SRMs

Impact: These SRMs are required for regulatory compliance purposes, environmental monitoring and control, analytical method or instrument calibration, measurement traceability validation, and measurement system quality assurance. SRM users (national and international) include governmental and commercial testing laboratories, nuclear power generation utilities, and a variety of manufacturing industries for such products as electronic hardware, drugs and medical devices, pharmaceuticals, processed foods, water purification, and secondary reference materials.

Technical Work Objective: Continually provide solution units in most stable packaging available and certify element or property of interest by appropriate analytical methods.

Project Duration: Ongoing

8. SRM 1662a 1000 μmol/mol Sulfur Dioxide in Nitrogen

Status: Renewal SRM

Impact: This SRM is used by the specialty gas industry to produce gas NIST-Traceable Reference Materials (NTRMs) and Environmental Protection Agency (EPA) protocol gases. This gas standard supports the EPA stack gas program and pollution credits program.

Technical Work Objective: To provide well-characterized gas standards that will be certified by using state-of-the-art analytical methods.

Project Duration: 0.5 year; Expected Completion - Mid FY 00.

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9. SRM 1666b 10 μmol/mol Propane in Air
10. SRM 1667b 50 μmol/mol Propane in Air
11. SRM 1668b 100 μmol/mol Propane in Air
12. SRM 1669b 500 μmol/mol Propane in Air

Status: Renewal SRMs

Impact: These SRMs are used by the specialty gas industry to produce gas NTRMs. This series of gas standards supports the automotive industry in the analysis of automobile exhaust gases and environmental analysis of atmospheric carbon.

Technical Work Objective: To provide well-characterized gas standards that will be certified by using state-of-the-art analytical methods.

Project Duration: 1 year; Expected Completion - Mid through End FY 00.

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13. SRM 1676 362 μmol/mol Carbon Dioxide in Air

Status: Renewal SRM

Impact: This SRM is used by the ambient carbon dioxide monitoring community. The concentration of this SRM mimics the present concentration of carbon dioxide in the atmosphere.

Technical Work Objective: To provide a well-characterized gas standard that will be certified by using state-of-the-art analytical methods.

Project Duration: 0.5 year; Expected Completion - Mid FY 00.

14. SRM 1683b 50 μmol/mol Nitric Oxide in Nitrogen
15. SRM 1684b 100 μmol/mol Nitric Oxide in Nitrogen
19. SRM 2629a 20 μmol/mol Nitric Oxide in Nitrogen

Status: Renewal SRMs

Impact: These SRMs are used by the specialty gas industry to produce gas NTRMs. This series of gas standards supports the automotive industry in the analysis of automobile exhaust gases.

Technical Work Objective: To provide well-characterized gas standards that will be certified by using state-of-the-art analytical methods.

Project Duration: 1 year; Expected Completion - Mid through End FY 00.

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16. SRM 1693a 50 μmol/mol Sulfur Dioxide in Nitrogen
17. SRM 1694a 100 μmol/mol Sulfur Dioxide in Nitrogen

Status: Renewal SRMs

Impact: These SRMs are used by the specialty gas industry to produce gas NTRMs and EPA protocol gases. This series of gas standards supports the EPA stack gas program and pollution credits program.

Technical Work Objective: To provide well-characterized gas standards that will be certified by using state-of-the-art analytical methods.

Project Duration: 1 year; Expected Completion - End FY 00.

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18. SRM 1941b Organics in Marine Sediment

Status: Renewal-In Progress SRM

Impact: This material has been used extensively by laboratories involved in National Oceanic and Atmospheric Administration (NOAA) and Environmental Protection Agency (EPA) projects, as well as other marine monitoring activities.

Technical Work Objective: Certified concentrations will be determined for approximately 25 polycyclic aromatic hydrocarbons (PAHs), 20 polychlorinated biphenyl (PCB) congeners and 10 pesticides by combining the results obtained at NIST from liquid chromatography with fluorescence detection (LC-FL) and gas chromatography with mass spectrometric detection (GC/MS) methods for the determination of PAHs, and by combining results from GC with electron capture detection (GC-ECD) and GC/MS methods for the determination of chlorinated compounds (PCBs and pesticides). Results from the NIST/NOAA National Status and Trends (NS&T) Quality Assurance (QA) Organics Program will be used as an additional data set.

Project Duration: 1 year; Expected Completion - End FY 00.

20. SRM 2644 250 μmol/mol Propane in Nitrogen

Status: Renewal SRM

Impact: This gas standard is used by the specialty gas industry to produce gas NTRMs. This gas standard is one of a series that supports the automotive industry in the analysis of automobile exhaust gasses and environmental analysis of atmospheric carbon.

Technical Work Objective: To provide well-characterized gas standards that will be certified by using state-of-the-art analytical methods.

Project Duration: 1 year; Expected Completion - Mid through End FY 00.

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21. SRM 913b Uric Acid

Status: Renewal SRM

Impact: Uric acid is one of the most commonly measured analytes in the clinical laboratory and is used to test for gout and other conditions related to protein metabolism. SRMs are required in this area for regulatory compliance purposes, analytical method or instrument calibration, and measurement traceability validation. SRM 913 and its renewals are produced to provide measurement traceability for these purposes.

Technical Work Objective: Provide a well-characterized high purity chemical and certify purity using a variety of chromatographic and spectroscopic approaches. Characterization will include ash content, weight loss on drying, liquid chromatography - mass spectrometry (LC/MS) and UV spectrophotometry.

Project Duration: 1 year; Expected Completion - End FY 00.

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44. (22.) SRM 1545 Antibiotics in Milk

Status: New SRM

Impact: State regulatory agencies screen 5 to 6 million milk samples per year for antibiotic residues using test kits that can generate a significant number of false positives and false negatives. When a test kit finds a milk sample to contain an antibiotic residue, as is the case for 50,000 to 60,000 samples per year, the sample is retested. Positive samples are verified with positive and negative controls, repeat analyses, and independent verification. There are significant legal and economic impacts when antibiotic residue is present. This SRM will provide traceability for the test kit manufacturers' control materials.

Technical Work Objective: Certify a milk-based material that has been treated with penicillin (and possibly tetracycline) and will be certified for the concentration of the antibiotic residue by liquid chromatography (LC) and gas chromatography mass spectrometry (GC/MS). Collaborate with the Food and Drug Administration (FDA) Center for Veterinary Medicine.

Project Duration: 2 years; Expected Completion - End FY 01.

22. (23.) SRM 1946 Lake Superior Fish Tissue (for Organics)

Status: New-In Progress SRM

Impact: An SRM made from Lake Superior trout tissue, with contaminant concentrations of organics indicative of typical urban levels, is being certified for analytical method validation purposes. It will be beneficial to the environmental and food analytical communities who currently use SRM 2976 Mussel Tissue and SRM 1941a Organics in Marine Sediment.

Technical Work Objective: Certify a fresh-frozen fish homogenate material for organic contaminants such as PCB congeners and chlorinated pesticides, total mercury, methylmercury, proximates, and fatty acids by state-of-the-art analytical methods.

Project Duration: 1 year; Expected Completion - End FY 00.

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23. (24.) SRM 2036 Combination Transmittance/Diffuse Reflectance Near Infrared Standard

Status: New SRM

Impact: Near infrared (NIR) measurements are used for food and agriculture authentication and nutrient assessment, pharmaceutical identification, and environmental monitoring. SRM 2035 is a rare earth glass material used as a transfer standard for the wavelength scale of spectrophotometers. However, another SRM is needed for the many NIR applications that involve double-pass "transflectance" or diffuse reflectance measurements.

Technical Work Objective: Prepare an SRM that is a borate matrix glass certified as a wavelength standard for NIR reflectance and transmission that simulates diffusely reflecting material.

Project Duration: 1 year; Expected Completion - End FY 00.

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24. (25.) SRM 2037 Red Diesel Dye

Status: New SRM

Impact: Federal Excise Tax regulation 26 CFR 48.4802-1(b) mandates that all high-sulfur and tax-exempt non-highway diesel fuels shall contain Solvent Red 164 at a concentration that is spectrally equivalent to 3.9 pounds per thousand barrels (11.1 mg/L) of solid dye standard Solvent Red 26. This is required by the Internal Revenue Service and state tax agencies as a means of differentiating between taxable and tax-exempt fuels. To support this regulatory activity, NIST is certifying the pure solvent dye powder. Other SRMs, consisting of stable solutions of Red 26 in normal hydrocarbons, may be needed in the future.

Technical Work Objective: Certify this material for dye purity and the molar extinction coefficient at two wavelengths in the UV-visible spectrum using methods such as liquid chromatography and nuclear magnetic resonance spectroscopy.

Project Duration: 1 year; Expected Completion - End FY 00.

25. (26.) SRM 2384 Baking Chocolate

Status: New-In Progress SRM

Impact: The Nutrition Labeling and Education Act of 1990 requires that information be provided on product packaging for selected nutrients in all processed foods. To support the regulation, NIST is producing a series of food-based materials primarily for validation of analytical methods for the measurement of nutrients in foods of similar fat, protein, and carbohydrate composition by commercial and federal food testing laboratories and producers of processed foods.

Technical Work Objective: Certify a food based material for nutrition composition, e.g., individual fatty acids, total dietary fiber, vitamins, minerals, caffeine, etc. by appropriate analytical methods. Include measurements by performed by external laboratories.

Project Duration: 1.5 years; Expected Completion - Mid FY 01.

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45. (27.) SRM 2385 Spinach

Status: New SRM

Impact: The Nutrition Labeling and Education Act of 1990 requires that information be provided on product packaging for selected nutrients in all processed foods. To help support this regulatory requirement, NIST is developing a series of food-based materials that that are intended primarily for validation of analytical methods for the measurement of nutrients in foods of similar fat, protein, and carbohydrate composition. The SRM users will be commercial and federal food testing laboratories and producers of processed foods.

Technical Work Objective: Provide a canned vegetable-based reference material characterized for persistent pesticides, nutrition composition, total dietary fiber, folate, carotenoids, vitamins, and mineral concentrations by chromatographic methods and external laboratory analyses.

Project Duration: 2 years; Expected Completion - End FY 01.

26. (28.) SRM 2721 Moisture and Sulfur in Crude Oil
27. (29.) SRM 2722 Moisture and Sulfur in Crude Oil

Status: New SRMs

Impact: Moisture and sulfur concentrations are two of the most important specifications measured in crude oils. Moisture content plays a large part in determining the value of the product, which is sold on a dry barrel basis, while sulfur content is the focus of environmental regulations. Industry round robin testing has demonstrated biases in moisture measurement of up to 40% while sulfur determinations performed by x-ray fluorescence (XRF) spectrometry (the most commonly used industrial technique) are known to be highly matrix dependent. NIST will meet the need for well-characterized standards in a crude oil matrix by producing SRMs 2721 and 2722, whose sulfur contents will be 0.2% and 1.7%, representative of the range found in commerce.

Technical Work Objective: Certify moisture by volumetric and coulometric methods. Certify sulfur by thermal ionization mass spectrometry (TIMS).

Project Duration: 1 year; Expected Completion - End FY 00.

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28. (30.) SRM 2783 Urban Air Particulate Matter (APM) Filter for Trace Elements
33. (31.) SRM 2784 Baltimore Urban Air Particulate Matter on Filter for Carbonaceous Species

Status: New SRMs

Impact: These SRMs are designed to specifically characterize filter samples containing the air particulate matter (APM) fraction targeted by the new Environmental Protection Agency (EPA) Clean Air Standard. They will provide calibration checks of instrumentation used to measure particulate contamination in air. The EPA has identified these SRMs as among their highest priority items.

Technical Work Objective: The certification campaign will utilize a variety of techniques for about 30 critical elements, selected anions and cations, total carbon, inorganic carbon, and organic carbon.

Project Duration: 1 year; Expected Completion - End FY 00.

34. (32.) SRM 2921 Cardiac Troponin I

Status: New-In Progress SRM

Impact: In 1997, the Standards Committee of the American Association for Clinical Chemistry (AACC) identified the measurement of the heart protein cardiac troponin I (cTnI) as the most significant measurement problem for clinical laboratories. This protein is released into the blood when a heart attack occurs and thus, is one of the best diagnostic markers for such an event. However, different immunoassays for cTnI provide vastly different results for the same specimen. NIST has agreed to work with the AACC on the development of a reference material that manufacturers of cTnI immunoassays would use to calibrate their systems. Various materials will be evaluated by a variety of immunoassays under the guidance of the Standards Committee.

Technical Work Objective: Provide a well-characterized material that will be used as a standard for manufacturers of clinical diagnostic tests for cardiac troponin I in human serum/plasma. Techniques developed at NIST will be used in the characterization of this material.

Project Duration: 2 years; Expected Completion - End FY 01.

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38. (33.) SRMs 2452, 2453, and 2454 Hydrogen in Titanium Alloy (ASTM/NIST Cooperative Agreement Activity)

Status: New SRMs

Impact: Hydrogen embrittlement in a metal is a phenomenon whereby the presence of hydrogen within the microstructure of the metal, even in quantities of less than 10 mg/kg, can adversely affect such properties as strength, hardness, and fracture toughness. The control and accurate measurement of hydrogen content is therefore an important issue for all industries that manufacture or use ferrous and nonferrous metal products. It is especially critical for those that are involved in such activities as the manufacture of steel nuclear pressure vessels and jet engine components from superalloys.

Technical Work Objective: Produce a new series of titanium alloy matrix standards with known hydrogen concentrations ranging from >10 mg/kg to 300 mg/kg; develop reliable methods to 'dope' and measure predetermined amounts in a Ti-6Al-4V titanium alloy.

Project Duration: 1 year; Expected Completion - End FY 00 (production of two levels).

39. (34.) Microhomogeneity Sediment (Small Sample Solid Sampling Techniques)

Status: New SRM

Impact: A high degree of homogeneity is a critical prerequisite for SRMs used in the analysis of small subsamples. Many environmental samples, such as plant and tissue materials, typically consist of several different solid phases that have characteristic physical properties (grain size, particle geometry, density, etc.) as well as widely varying concentrations of trace elements. The certification of a candidate material consisting of small representative particles (<10 μm) with a small size distribution (≤ 50 % of the size) is necessary to allow calibration of the newer instrumentation used to characterize such samples of environmental interest.

Technical Work Objective: NIST will use of a portion of the excess collection of SRM 1941b Marine Sediment, the same material that is being considered for the "bulk" trace element analysis. The material will be jet-milled to reduce the particle size to yield a material with the same elemental composition as the "bulk" inorganic sediment SRM but with a higher degree of homogeneity. NIST will confirm value assignment of the "bulk" material by direct analysis techniques and collaborators using alternate direct analysis techniques will supply data to verify value assignment. If observed concentrations in the processed material are indistinguishable from the bulk inorganic sediment SRM, no additional analytical measurements should be required for certification. If observed concentrations are different, additional measurements will be planned for FY 01.

Project Duration: 2 years; Expected Completion - End FY 01.

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40. (35.) SRM 2371 Isotopically Depleted Proteins for Use as Mass Spectrometry Calibration Standard

Status: New SRM

Impact: New techniques in mass spectrometry are permitting the characterization and measurement of molecules far beyond what could be done ten years ago, significantly changing approaches to the study of large biopolymers. The most fundamental structural determination performed for these large molecules is molecular weight. Traditionally, calibration of mass spectrometers is performed using small proteins (< 20 kDa) that can be obtained in reasonably high purity but there are significant problems when such calibrations are extrapolated for larger proteins (30 kDa to100 kDa). To overcome the various limitations, a collaborative project has been established between two CSTL divisions to engineer a set of highly pure, homogenous large proteins. The work of academic, research, and biotechnology laboratories that use mass spectrometric instrumentation for molecular weight determination of proteins will significantly benefit from the availability of this SRM.

Technical Work Objective: To provide a set of highly pure, homogenous proteins depleted in the natural abundance isotopes of carbon-13 and nitrogen-15 for use as mass spectrometry calibrants ranging in molecular weight from 18 kDa to 120 kDa. Use fourier transform ion cyclotron resonance mass spectrometry (FT-ICR/MS) as the method of protein characterization.

Project Duration: 1 year; Expected Completion - End FY 00.

41. (36.) SRM 3000 series Semi-Volatile Organic Compounds (VOCs)
43. (38.) SRM 3000 series VOCs in Methanol [See also SD Project 11.]
48. (41.) SRM 3000 series PCBs in Oil

Status: New SRMs

Impact: As part of the externalization of EPA's Water Supply and Water Pollution Performance Evaluation (PE) studies program, NIST is preparing solution SRMs of a variety of organics in appropriate water-soluble solvents and in the case of PCBs in transformer oil (SRMs 3075 through 3080 will replace SRM 1581). In many cases distribution will be limited to qualified secondary producers only.

Technical Work Objective: Certify by gravimetry with comparison of gravimetric data to the concentrations determined from at least one suitable analytical technique (e.g., gas chromatography).

Project Duration: 1 year; Expected Completion - End FY 00.

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42. (37.) Ultraviolet Solution Absorbance Standard (Potassium Dichromate in Sulfuric Acid)

Status: New SRM

Impact: Spectrophotometric measurements play a key role in materials identification for chemical and pharmaceutical production and in on-line process control. Reference materials are needed to ensure the quality control of absorbance measurements in the ultraviolet region.

Technical Work Objective: Produce a series of optical filters certified as SRMs to be used as calibrants for spectrophotometers in the UV wavelength region.

Project Duration: 1 year; Expected Completion - End of FY 00.

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46. (39.) SRM 154b Titanium Oxide

Status: Renewal SRM

Impact: Titanium oxide (TiO_2) is used as a whitener in a number of applications including food, paint, and ceramics. SRM 154a continues to be a benchmark for TiO_2 analysis in these industries.

Technical Work Objective: Certify the next renewal lot of titanium oxide by one or more of the following candidate assay methods: controlled-potential coulometry, titrimetry, controlled-current coulometry, and/or gravimetry.

Project Duration: 1 year; Expected Completion - End FY 00.

47. (40.) SRM 1575a Pine Needles

Status: Renewal SRM

Impact: Plant matrix SRMs are required for environmental monitoring and control, analytical method development and instrument calibration, measurement traceability, validation, and quality assurance. The original issue of this SRM was popular and used by the lumber industry, governmental and commercial testing laboratories, agronomists, and secondary reference materials producers. One key application was for the calibration of instrumentation used in analyzing plant leaf composition to determine proper fertilization for maximum growth.

Technical Work Objective: Provide a homogeneous pine needle material that will be characterized for trace elements by a variety of appropriate state-of-the-art analytical techniques such as prompt gamma activation analysis (PGAA) and graphite furnace atomic absorption spectrometry (GFAAS).

Project Duration: 2 years; Expected Completion - End FY 01.

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49. (42.) SRM 1643d Trace Elements in Water

Status: Renewal SRM

Impact: SRM 1643, and its renewal lots, remains the benchmark SRM for traceability of inorganic water analysis. It continues to be a critical part of international measurement evaluation programs and is integral to many domestic quality assurance programs. Inductively-coupled plasma mass spectroscopy (ICP/MS) manufacturers routinely use it to demonstrate the capabilities and validate operation of their instruments.

Technical Work Objective: Prepare and acceptance test the fourth renewal issue of this material using in a high-precision ICP/MS comparison mode of measurement. The material will be certified after the information obtained from the FY 00 acceptance testing, from collaborating laboratories, and from independent NIST analytical methods have been evaluated.

Project Duration: 2 years; Expected Completion - End FY 01.

50. (43.) SRM 2670a Toxic Elements in Urine

Status: Renewal SRM

Impact: One of the routine screening methods (by a clinical laboratory) for unhealthful exposure to toxic elements is the analysis of urine. This certified urine material is required by the clinical laboratory to benchmark these critical measurements.

Technical Work Objective: Provide a lyophilized urine material certified for metals such as aluminum, arsenic, cadmium, lead, and mercury. The renewal lot of this material has been developed in collaboration with the Centers for Disease Control and Prevention. The original certification consisted of two levels - a "normal" level and a level spiked with toxic elements at or above the action levels. In the original certification of the normal urine, 8 out of 10 of the toxic elements had information values or less-than values assigned rather than certified values. Given increased national concerns about exposure to toxic elements and the improved analytical ability to quantify such elements at lower levels, the goal of this activity is to certify additional toxic elements in both levels of this renewal material.

Project Duration: 2 years; Expected Completion - End FY 01.

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37. (44.) SRMs 2709a, 2710a, 2711a, Soils (Trace Elements)
51. (45.) SRM 2712 Inorganic Sediment SRM (renewal for SRM 2704 and RM 8704)

Status: Renewal SRMs

Impact: Each material has been used extensively by scientists in the mining, agriculture, and geology fields. The materials are particularly valuable to laboratories involved in Environmental Protection Agency (EPA) quality assurance, acid mine drainage monitoring, and land-use abatement projects.

Technical Work Objective: The NIST certification campaign will utilize direct analysis and dissolution techniques for more than 25 critical elements and include complementary analyses from several cooperating laboratories. For SRMs 2709, 2710, and 2711 the plan is to determine biologically active elements such as arsenic, selenium, mercury, chloride, zinc, iron, and others by instrumental neutron activation analysis (INAA) in randomly selected bottles of each of the new materials. If the concentrations are the same as for the original materials, no additional analytical measurements will be necessary. If the measurements of the new materials are different from the original materials, more analytical work will be needed in FY01.

Project Duration: 2 years; Expected Completion - End FY 01.

52. (46.) SRM 2380 Drugs of Abuse in Human Hair Segments

Status: Renewal SRM

Impact: Test accuracy is critical to companies that evaluate current and prospective employees for long term use of drugs of abuse. The use of human hair to detect drug use is growing rapidly. Reference materials are needed to assure that state and federal laboratories are performing accurate measurements of drugs of abuse in hair samples.

Technical Work Objective: NIST will produce a human hair standard certified for cocaine, benzoylecgonine, phencyclidine, amphetamine, methamphetamine, morphine, codeine, monoacetylmorphine, and tetrahydrocannabinol. The analytical techniques to be used by NIST are gas chromatography/mass spectrometry (GC/MS) and liquid chromatography/ mass spectrometry (LC/MS). Measurements by external laboratories will also be included.

Project Duration: 1 year; Expected Completion - End FY 00.

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53. (47.) RM 8559, RM 8560, and RM 8561 Natural Gas Isotopic Reference Materials

Status: New RMs

Impact: Through collaboration with the Chevron Oil Company, the Azienda Generale Italiana Petroli (AGIP), the University of Groningen, and the International Atomic Energy Agency (IAEA), a series of a light hydrocarbons and associated gases from distinct sources were identified for intercomparability of isotopic composition measurements. These standards have important research and environmental applications such as the measurement of greenhouse gases and volatile organic compounds that are precursors of tropospheric ozone. In 1992, NIST was asked to administer the distribution of the materials and now seeks to produce them more efficiently as reference material (RM) units that can be maintained and issued by the SRM Program.

Technical Work objective: Stage 1, evaluate and modify (if necessary) the IAEA-recommended protocol test procedure for homogeneously filling small gas cylinders. Stage 2, produce three gas mixtures and fill ≈40 cylinders of each.

Project Duration: 2 years; Expected Completion - End FY 00 (Stage 1).
Expected Completion - End FY 01 (Stage 2).

54. (48.) SRMs 2298 and 2299 Low Sulfur in Gasoline

Status: New SRMs

Impact: The Environmental Protection Agency's (EPA) Tier 2 plan of the 1990 Clean Air Act Amendments calls for lowering the sulfur content of gasoline by almost 90%, down to 30 mg/kg (ppm). The Association of International Automobile Manufacturers (AIAM) believes the quality of commercial gasoline has become the limiting factor in designing cleaner and more efficient vehicles and would like to see a 5 mg/kg specification. The reduction in sulfur in gasoline will also be necessary to overcome technical barriers in the development of gasoline-based electric fuel cells. A key component in a fuel cell is the catalyst, which is degraded by sulfur compounds.

Technical Work Objective: Perform homogeneity testing by x-ray fluorescence and certify the low sulfur content by isotope dilution thermal ionization mass spectrometry (ID-TIMS).

Project Duration: 1 year; Expected Completion - End FY 00.

Not rated. SRM 217d 2,2,4-Trimethylpentane (*Iso*-octane)

Status: Renewal SRM

Impact: SRM 217d - 2,2,4-Trimethylpentane has been certified as a combustion calorimetry standard for volatile liquid fuels. It is necessary for checking calorimetric procedures of those working with jet fuel and other types of volatile fuels.

Technical Work Objective: A surplus of SRM 1816a that is bottled in 100 mL ampoules for octane testing will be re-ampouled into 2.5 mL ampoules by the SRM Program. This will create ≈600 units of five 2.5 mL ampoules to be identified as SRM 217d 2,2,4-Trimethyl-pentane. Measurements will be made in the NIST high-precision bomb calorimeter to verify the new sample results with the SRM 217c sample. Additional measurements will be carried out in the NIST commercial bomb calorimeter.

Project Duration: 1 year; Expected Completion - End FY 00.

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29. (Not rated.) SRM 2426 Galvalume™ (ASTM/NIST Cooperative Agreement Activity)

Status: New SRM

Impact: This type of coated sheet steel is one of the most widely used products in the world for pre-engineered buildings, steel roofing and siding, and ductwork. First produced in the 1960s, Galvalume™ has enjoyed the fastest growth rate of any steel material produced in the U.S. and yet there is no reference material available to accurately monitor the compositional chemistry of the molten metal portion of the manufacturing process.

Technical work Objective: Characterize and certify the chemical composition of the molten metal coating material selected to serve as a benchmark SRM for Galvalume™.

Project Duration: 2 years; Expected Completion - End of FY 01.

36. (Not rated.) SRMs 853a and 1240c Aluminum Alloy 3004
SRMs 854a and 1241c Aluminum Alloy 5182
SRMs 1255a and 1256a Aluminum Alloys 356 and 380
(all ASTM/NIST Cooperative Agreement Activities)

Status: Renewal SRMs

Impact: The first four SRMs represent the basic aluminum alloy materials used in the beverage and food industries to contain soft and alcoholic drinks and to process and contain sterilized foods of all kinds. The last two SRMs represent the types of aluminum alloys used in the automotive industry to produce car components.

Technical Work Objective: Homogeneity testing was completed in FY 99. Certify the major and minor elements of these benchmark SRMs using analytical techniques such as inductively coupled plasma mass spectrometry (ICPMS), isotope dilution mass spectrometry (IDMS), and x-ray fluorescence (XRF).

Project Duration: 1 year; Expected Completion - End FY 00.

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36. (Not rated.) SRM 173c 6Al-4V Titanium Alloy (ASTM/NIST Cooperative Agreement Activity)

Status: Renewal

Impact: This material has long been an important benchmark for this specific class of titanium alloy and is of particular relevance to the aerospace industry.

Technical Work Objective: Certify the major, minor, and trace elements in this material using analytical techniques such as inductively coupled plasma mass spectrometry (ICPMS), isotope dilution mass spectrometry (IDMS), and x-ray fluorescence (XRF).

Project Duration: 2 years; Expected Completion - End FY 01.

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70. (Not rated.) SRM 1649b Air Particulate (Organics)
SRM 1650b Diesel Particulate (Organics)

Status: Renewal SRMs

Impact: Ambient air particulates, especially diesel particulates, are important components targeted for investigation by the Particulate Matter (PM) 2.5 μm size fraction initiative of the Clean Air Act. There is an increased interest in the impact of diesel emissions on human health, in particular the mutagenic and carcinogenic potential of the particles.

Technical Work Objective: For SRM 1649b, use analytical methods for the determination of selected PAHs, PCB congeners, and chlorinated pesticides. Provide reference values for selected inorganic constituents, total organic carbon, etc. For SRM 1650, determine PAHs and various mutagenic and carcinogenic parameters.

Project Duration: 2 years; Expected Completion - End FY 01.

1. Thermal Analysis Standard Set

Status: New SRM

Impact: Applications for thermal analysis instruments range from routine quality control to production of research quality thermodynamic data. Due to the design of differential scanning calorimeters (DSCs), a subset of thermal analysis instruments, neither the temperature nor the heat flux of a sample is measured directly. Therefore, thermal analysis requires calibration protocols and standard materials for accurate establishment of the two principle variables: temperature and heat measurements. This work, ongoing in ASTM, is critical to American industries. The PTB in Germany has assigned a research group to specifically work on DSC protocols as well.

Technical Work Objective: Produce a set of SRMs composed of four standard materials, gallium, cyclopentane, bismuth, and lead or zinc, that will allow accurate calibration of DSCs over the temperature range of 120 K to >700 K.

Project Duration: 2 years; Expected Completion - End FY 01.

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2. (6.) SRM 3000 series Anion Solutions
Not rated. (11.) SRM 3000 series Very Volatile Organic Compounds in Methanol
[See also WCF Project 43. (38.)]

Status: New SRMs

Impact: As part of the externalization of EPA's Water Supply and Water Pollution Performance Evaluation (PE) studies program, NIST is preparing solution SRMs of a variety of organics in appropriate water-soluble solvents. Distribution may be limited to qualified secondary producers only.

Technical Work Objective: Certify the solutions by gravimetry with comparison of gravimetric data to the concentrations determined by at least one suitable analytical technique (e.g., gas chromatography).

Project Duration: Two years; Expected Completion - End FY 01.

3. (2.) Organic and Elemental Carbon Particle Reference Materials on Filter Substrates

Status: New SRMs

Impact: These SRMs are designed to specifically characterize filter samples containing the air particulate matter (APM) fraction targeted by the new Environmental Protection Agency (EPA) Clean Air Standard. They will provide calibration checks of instrumentation used to measure particulate contamination in air. The EPA has identified these SRMs as among their highest priority items.

Technical Work Objective: The certification project will target the determination of total carbon, inorganic carbon, and organic carbon.

Project Duration: 1 year; Expected Completion - End FY 00.

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4. (3.) SRM 2394 Heteroplasmic Mitochrondrial DNA

Status: New SRM

Impact: Forensic, biomedical research, environmental monitoring, and toxicology measurement techniques will greatly benefit from the release of SRM 2394. The SRM will be useful for medical diagnosis, mutation detection, and forensic identification and may even be helpful in the area of disease prevention.

Technical Work Objective: Develop a human heteroplasmic mitochondrial DNA (mtDNA) SRM to provide quality control for the detection of low-frequency mutations and endogenous heteroplasmy.

Project Duration: 2 years; Expected Completion - End FY 01.

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5. (4.) SRM 2395 Y Chromosome Microsatellites

Status: New SRM

Impact: The Y chromosome has defined regions with specific short tandem repeat (STR) polymorphisms (multiple markers on a chromosome) that are amenable to polymerase chain reaction (PCR) amplification methods. Y-STRs are found only on the Y chromosome and the technology to amplify these loci provides a method of identifying male DNA. Y-STRs are already being used by population geneticists who are studying historical aspects of human evolution. The forensic community's interest in these same markers is for amplification of specific Y-STRs without the interference of associated high background female DNA.

Technical Work Objective: Develop a SRM containing a minimum of 100 ng of DNA to assay the Y-STRs that are currently known in the field. Appropriate state-of-the art DNA methodologies will be used.

Project Duration: 2 years; Expected Completion - End FY 01.

6. (5.) SRM 2396 Oxidatively Modified DNA Base Biomarker

Status: New SRM

Impact: This SRM will provide diagnostic and research laboratories with a reference material measurement kit consisting of key biomarkers required for instrument calibration and accurately monitoring oxidative DNA damage. The SRM will also permit clinicians and scientists to offer a complete profile of a patient's cellular damage attributed to oxidative stress and allow diagnostic laboratories to perform accurate Oxidative Stress profiles. Such an SRM of oxidatively modified DNA bases will ensure the accuracy, traceability, and comparability of measurement results among laboratories.

Technical Work Objective: Synthesize a total of 12 stable isotope labeled modified DNA bases and characterize them by such techniques as nuclear magnetic resonance (NMR) and gas chromatography/mass spectrometry (GC/MS).

Project Duration: 3 years; Expected Completion - End FY 02.

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7. Fluorescein Fluorescence Intensity Standard

Status: New SRM

Impact: The clinical, medical, and biotechnology communities have a pressing need for fluorescence intensity standard to calibrate flow cytometers (cell counters). Fluorescein has been chosen for the initial standard because it is available in a reasonably pure form, has been well studied as a fluorescent material, and is representative of the commonly used fluorescent tagging/labeling reagent fluorescein isothiocyanate (FITC) and other fluorescein-labeled tools such as microspheres, antibodies, and derivatizing agents.

Technical Work Objective: Prepare an SRM of fluorescein dissolved in a suitable buffer solution that can be used volumetrically. Each SRM unit will consist of five 5 mL aliquots of the fluorescein standard solution.

Project Duration: 2 years; Expected Completion - End FY 01.

Not rated. (8.) Elemental Primary Standard SRMs

Status: New SRMs

Impact: These SRMs would be used for establishing the traceability of commercially produced elemental solutions standards to NIST. They would consist of weighed aliquots of single element solutions of quantitatively dissolved *NIST Primary Materials* weighed into an appropriate container. Each container would have a unique individual certified value based on the mass of the aliquot and the concentration of the prepared solution.

Technical Work Objective: Install and test an automatic weighing station; prepare prototype standards of 10 elements.

Project Duration: 1 year; Expected Completion - End FY 00.

8. (9.) SRMs 1704-1709 Low Concentration Nitric Oxide Gas Standards

Status: New SRMs

Impact: The push for cleaner emission automobiles has heightened the need for low concentration nitric oxide gas standards. These gas standards are particularly difficult to prepare due to the requirement for very low oxygen levels in the nitrogen balance gas, and the control of very low leak levels during preparation. Because of these difficulties, these gas standards may never be integrated into the NTRM program and will have to be produced as new SRMs.

Technical Work Objective: Provide several low concentration nitric oxide gas standards.

Project Duration: 2 years; Expected Completion - End FY 01.

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9. (10.) Raman Intensity SRMs for 785 nm Excitation

Status: New SRMs

Impact: Raman spectroscopy is a nondestructive analytical method that has many qualitative and quantitative analytical applications in the bulk chemical, pharmaceutical, and biotechnology industries. Its major advantage over infra-red (IR) spectroscopy as an analytical tool is that it may be used with little or no sample preparation.

Technical Work Objective: Develop a suite of Raman standards for use in the frequency and intensity calibration of conventional analytical Raman instrumentation. Identify candidate glasses for the calibration of the intensity axis of Raman spectrometers. Organize and implement a round robin exercise with ASTM to evaluate the efficacy of the chromium-doped borate glass for the correction of several commercial spectrometers.

Project Duration: 1 year; Expected Completion - End FY 00.

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10. (12.) SRM 2427 Anode Tin (ASTM/NIST Cooperative Agreement Activity)

Status: New SRM

Impact: A high volume commodity used by the U.S. (and foreign) producers of steel coated materials, anode tin is used to manufacture some 3 million tons of tinplate for such applications as food and beverage cans, paint cans, and automotive oil filter cans. The material contains few impurities but there are potential health risks associated with trace elements such as lead. Thus the producers of the tinplated steel and the food industry users of tinplated cans must be able to measure the lead impurity content of the tin (in its anode form and in its plated form) as accurately as possible.

Technical Work Objective: Produce the first known anode tin reference material; assess metal purity and homogeneity by x-ray fluorescence spectrometry (XRF) and certify lead content by isotope dilution mass spectrometry (TIMS).

Project Duration: 2 years; Expected Completion - End FY 01.

11. (13.) SRM 1928 Additives in Smokeless Gunpowder

Status: New SRM

Impact: State and federal forensic laboratories require standards in order to provide measurements to accurately identify gunpowder residues from handguns and explosives involved in the execution of criminal and terrorist activities.

Technical Work Objective: Develop a test material to validate methods supporting the quality of forensic and military measurements. Three major additives in smokeless powder representing two major types of gunpowder, ball and extruded, will be certified by using appropriate analytical methodologies such as gas chromatography/mass spectrometry (GC/MS), possibly with a separate extraction protocol.

Project Duration: 1 year; Expected Completion - End FY 00.

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12. (14.) SRMs 2583-2585 Organic Contaminants in Household Dust

Status: New SRMs

Impact: House dust is a repository of pesticides and other chemicals used indoors or tracked in from outdoors. Pesticides become associated with house dust primarily through interior use of pest control formulations, intrusion of vapors from foundation and crawl space treatments, and tracked-in lawn and garden chemicals. Polycyclic aromatic hydrocarbons (PAHs) are derived from indoor sources such as combustion, cooking, and smoking, as well as from tracked-in contaminated yard soil or residues from garage floors. Once indoors where they are protected from environmental degradation, pollutants associated with dust persist for long periods, particularly if the dust is embedded in carpets. The National Cancer Institute (NCI), which is investigating a possible association between cancer risks and pesticides in house dust, found 19 of 26 pesticides, 10 of 10 PAHs, and 5 of 6 polychlorinated biphenyls targeted in house dust samples collected from 15 homes.

Technical Work Objective: Evaluate the existing SRMs and/or the "excess" bulk dust material to determine whether they were suitable as candidate SRMs. Evaluate current approach for the certification of pesticides and PAHs in environmental samples as applied to the household dust matrix using such techniques as Soxhlet extraction and gas chromatography/mass spectrometry (GC/MS) with columns of different selectivity.

Project Duration: 2 years; Expected Completion - End FY 01.

16. (15.) SRM 1947 Lake Michigan Fish Tissue

Status: New-In Progress SRM

Impact: An SRM made from Lake Michigan trout tissue, with concentrations of contaminants indicative of typical urban levels, is being developed for the environmental and food communities. Its purpose will be primarily for validation of analytical methods.

Technical Work Objective: Develop a fresh, frozen fish homogenate material that will be certified for inorganic constituents, total mercury, methylmercury, proximates, and fatty acids by appropriate state-of-the-art analytical methods.

Project Duration: 2 years; Expected Completion - End FY 01.

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17. (16.) Electronic Scrap SRM

Status: New SRM

Impact: Recycling of electronic scrap from consumer electronic products can have significant economic and ecological ramifications. The quality of analytical characterization of the materials will determine proper disposal or reclamation. The current worldwide market for electronic scrap is estimated at $ 114M, with most of U.S. industry scrap being exported and reclaimed in Canada and Europe. An SRM to properly assign component concentrations to the scrap will minimize the cost of disposal and/or enhance recovery for profit.

Technical Work Objective: Produce the prototype for a "green product" material electronic scrap SRM. The material will be defined with Motorola, in liaison with other U.S. industries. Motorola will also help to develop the final production and certification plan.

Project Duration: 1 year; Expected Completion - End FY 00 (for prototype).

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15. (17.) Performance Standards for Liquid/Gas Chromatography Mass Spectrometers

Status: New SRMs

Impact: Mass spectrometers interfaced with either gas or liquid chromatographs are widely used to make chemical measurements. These instrument systems require frequent monitoring to test for sensitivity and other aspects of performance. At present each instrument manufacturer tends to use certain compounds that are known to behave well on its systems to verify performance. This can be a subject for dispute by the customer. The goal of this project is to develop two sets of SRM materials, one for all manufacturers and users of gas chromatography/mass spectrometry (GC/MS) equipment and the other for all manufacturers and users of liquid chromatography/mass spectrometry (LC/MS) equipment.

Technical Work Objective: Identify the appropriate materials. If a suite of materials can be identified, samples would be prepared and bottled. Measurements involving combinations of GC, GC/MS, LC, LC/MS, gravimetry will then be used to certify concentrations.

Project Duration: 1 year. Expected Completion - End FY 00 (for prototype).

18. SRMs 1281-1283 Sebiloys (ASTM/NIST Cooperative Agreement Activity)

Status: New SRMs

Impact: The high lead content of plumbing systems in older homes and public buildings is a worldwide health concern so a new type of copper alloy is now being used as a lead-free replacement for fluid control piping and other plumbing devices that supply drinking water. This new class of copper alloy, called sebiloys, has unique selenium and bismuth contents that are not covered by existing copper alloy SRMs.

Technical Work Objective: Produce a series of SRMs that benchmark the Sebiloy class of copper alloys.

Project Duration: 2 years; Expected Completion - End FY 01.

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19. Trace Elements in Ceramics Standards

Status: New SRMs

Impact: The ceramics industry has had a great deal of difficulty in the determination of minor and trace elements in many ceramics. NIST Special Publication 879 (July, 1995) reported results of an international study on advanced ceramics involving the U.S., Germany, and Sweden under the auspices of the International Energy Agency. The report provided a look at the current state of the art in ceramic characterization and showed that the analytical results in that study for minor and trace elements were worthless. As a result, data from different analytical techniques and their dissolution methods could not be understood.

Technical Work Objective: Develop a suite of ceramic materials and measure them by instrumental neutron activation analysis (INAA). This technique can nondestructively provide accurate values for elements in such ceramic materials as silicon nitride.

Project Duration: 1 year; Expected Completion - End FY 00 (for prototype).

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13. (20.) SRM 2386 Trans Fatty Acids in Foods

Status: New SRM

Impact: The Food and Drug Administration (FDA) is being asked to promulgate trans fatty acid labeling. Trans fat, considered by public health professionals to be the greatest contributor of xenobiotic chemical species in the U.S. food supply, is estimated to make up 2.6 % of the average daily diet. Fried fast foods and commercially baked foods are targeted in particular because they typically contribute a significant portion of dietary trans fatty acids. If nutritional labeling requirements for trans fatty acids are established, measurement laboratories would need a standard.

Technical Work Objective: Identify, develop, and measure an appropriate reference material for trans fatty acid contents.

Project Duration: 2 years; Expected Completion - End FY 01.

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Physics Laboratory

□ Production Plans – SRM Projects submitted for Working Capital (WC) Funding

1. **SRM 4324B Uranium-232 Solution Standard**
2. **SRM 4328B Thorium-229 Solution Standard**
10. **SRM 4919H Strontium-90 Solution Standard**
12. **SRM 4332D Americium-243 Solution Standard**
13. **SRM 4326 Polonium-209 Solution Standard** (additional units only)

Status: Renewal SRMs

Impact: Radioactive SRMs are essential for environmental monitoring and remediation of Department of Energy clean up sites and areas surrounding nuclear weapons facilities. SRMs are used as tracers (yield monitors) and to calibrate instruments and analytical methods used in environmental radioactivity measurements.

Technical Work Objective: Use established production and calibration procedures to provide solution radioactivity standards.

Project Duration: 1 year; Expected Completion - End FY 00.

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3. SRM 4906LC Plutonium-238 Point Source Standard

Status: Renewal SRM

Impact: Alpha-particle spectrometry measurements are applied in the areas of radiological safety monitoring, environmental monitoring and restoration, and waste characterization monitoring. Plutonium-238 point sources are used to calibrate the efficiency of instruments for alpha spectrometry. Accurately determined efficiencies and measurements lead to improved monitoring capabilities.

Technical Work Objective: Use established production and calibration procedures to provide plutonium-238 as a point source radioactivity standard..

Project Duration: 1 year; Expected Completion - End FY 00.

4. SRM 4337 Lead-210 Solution Standard

Status: New SRM

Impact: Lead-210 is a member of the natural uranium-238 decay chain and is widely distributed in the environment. It is used as a monitor for natural uranium contamination and for decay chain equilibrium, and is also used for short-term geological dating.

Technical Work Objective: Use established production and calibration procedures to provide lead-210 as a solution radioactivity standard.

Project Duration: 1 year; Expected Completion - End FY 00.

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6. SRM 1008 Photo Film Step Tablet

Status: Renewal/Continuous SRM

Impact: A wide range of organizations in the nuclear, automotive, aerospace, and medical industries test a variety of materials using radiographic nondestructive evaluation. This evaluation involves the measurement of optical transmission density, which must be calibrated to a known standard. SRM 1008 provides a traceable standard certified using the NIST Diffuse Transmission Densitometer.

Technical Work Objective: Calibrate additional Photo Film Step Tablet units.

Project Duration: Ongoing.

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7. Multi-Angle White Reflectance Standard

Status: New SRM

Impact: This SRM will be used to validate and/or benchmark the ASTM standard test method for multi-angle color measurements of metal flake pigmented materials designed to provide meaningful color information that can be utilized for quality control, color matching, and formulating in the characterization of these types of materials.

Technical Work Objective: Calibrate 15 pieces of highly polished opal glass. The selected glass will be calibrated for five geometries, an incident angle of 45°, and observation aspecular angles of 15°, 25°, 45°, 75°, and 110° for the spectral range of 360 nm to 780 nm at 10 nm intervals.

Project Duration: 1 year; Expected Completion - End FY 00.

8. Gray Scale Diffuse Reflectance Standard

Status: New SRM

Impact: Absolute reflectance measurements are finding increasing applications in the ultraviolet spectral region for the remote sensing community. In the visible spectral range, color and appearance reflectance measurements indicate the quality and acceptability for a wide range of products from paints to textiles. The food and pharmaceutical industries perform reflectance measurements in the infrared region for quality control.

Technical Work Objective: Certify a set of gray diffusers with a range of reflectance values that can be used to check the linearity of detector systems for reflectance spectrophotometry.

Project Duration: 1 year; Expected Completion - End FY 00.

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9. SRM 2057 Infrared Reflectance Standard [See also SD Project 3.]

Status: New SRM

Impact: The need for reference materials for infrared regular reflectance affects all manufacturers and users of infrared optical elements and devices including infrared lasers, infrared spectrophotometers, infrared detectors, optical temperature sensing devices, infrared reflectors, windows, and filters. A very broad range of industries employ infrared spectral measurements of one type or another, e.g., the chemical and petroleum industries, the semiconductor industry, metals processing industries, remote sensing and environmental monitoring industries, etc. Because direct absolute measurement of reflectance is difficult, much higher accuracy is possible in a relative measurement made with a standard for comparison.

Technical Work Objective: Produce and certify the first in a series of SRMs that will serve as standards for the infrared spectral range.

Project Duration: 2 years; Expected Completion - End FY 01.

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11. SRM 4915E Cobalt-60 Solution Standard

Status: Renewal SRM

Impact: National laboratories, nuclear power plants, and radioactive source suppliers require standards in order to accurately determine the gamma-ray emission rates of radionuclides. Cobalt-60 is critical for the calibration of germanium detectors that are used to make such measurements. It also serves as the basis for international intercomparison measurements.

Technical Work Objective: Use established production and calibration procedures to provide cobalt-60 as a solution radioactivity standard.

Project Duration: 1 year; Expected Completion - End FY 00.

□ Development Plans – SRM Projects submitted for Service Development (SD) Funding

1. SRM 4358 Ocean Shellfish Standard

Status: New SRM

Impact: Natural matrix SRMs are needed for the calibration of analytical instruments and methods for environmental radioactivity measurements. Mussel (shellfish) was chosen because it is a bioaccumulator that is currently being used as a prime indicator of radioactive contamination in the ocean. No such reference material is available at this time.

Technical Work Objective: This is the third year of a three year project for the development of a new natural matrix SRM for environmental radioactivity. The material will undergo extensive round robin measurement evaluation.

Project Duration: 1 year; Expected Completion - End FY 00.

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2. SRM 4359 Seaweed Standard

Status: New SRM

Impact: Natural matrix reference materials are needed for the calibration of analytical instruments and methods used to make environmental radioactivity measurements. Seaweed serves as a filter and as an early warning indicator of contamination because it tends to concentrate radionuclides from the water. Seaweed is also a food so the presence of radionuclides could increase the risk to humans of radioactivity exposure. Currently, the international ocean-studies community has no basis for measurement comparability, methodology validation, or traceability to NIST or any other national standard.

Technical Work Objective: This is the first year of a three-year project for the development of a new natural matrix SRM for environmental radioactivity. The first phase of development will include material acquisition, preparation for measurement, and preliminary characterization.

Project Duration: 3 years; Expected Completion - End FY 02.

3. **SRM 2057 Infrared Regular Reflectance Standard** [See also WCF Project 9.]
4. **SRM 2058 Infrared High Emittance Standard**
5. **SRM 2060 Infrared Transmittance Standard**

Status: New SRMs

Impact: : The need for reference materials for infrared regular reflectance affects all manufacturers and users of infrared optical elements and devices including infrared lasers, infrared spectrophotometers, infrared detectors, optical temperature sensing devices, infrared reflectors, windows, and filters. A very broad range of industries employ infrared spectral measurements of one type or another, e.g., the chemical and petroleum industries, the semiconductor industry, metals processing industries, remote sensing and environmental monitoring industries, etc. Because direct absolute measurement of reflectance is difficult, much higher accuracy is possible in a relative measurement made with a standard for comparison.

Technical Work Objective: Develop a series of SRMs to serve as standards for the infrared spectral range.

Project Duration: 1 year; Expected Completion - End FY 00.

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Materials Science and Engineering Laboratory

□ Production Plans – SRM Projects submitted for Working Capital (WC) Funding

1. SRMs 2092, 2096, 2098 Charpy V-notch Specimens [See also SD Project 1.]

Status: Renewal/Continuous SRMs

Impact: The Charpy impact test uses a swinging hammer to assess the resistance of a material to brittle fracture. The energy absorbed in fracturing the specimens is measured from a calibrated scale, encoder, or an instrumented striker. The low cost and simple configuration of the test have made it a common requirement in codes for critical structures such as pressure vessels, buildings, and bridges as well as a common specification for metals purchasing. The NIST SRM Charpy program establishes the U.S. national scale for this measurement and provides a common base of comparison for national and international trade.

Technical Work Objective: Provide additional Charpy V-notch Specimens, post-test evaluation, and customer technical support.

Project Duration: Ongoing.

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2. SRMs 1358a through 1364b Nonmagnetic Coating on Steel Standards

Status: Renewal SRMs

Impact: These SRMs are used to calibrate instrumentation employed during the measurement of nonmagnetic coatings on steel. These standards are used by the organic and inorganic coating industries to assess the thickness of coatings on finished goods and commercial construction. These SRMs serve as primary standards in the calibration of portable magnetic gages.

Technical Work Objective: Provide additional thickness standards for nonmagnetic coatings on steel.

Project Duration: 1 year; Expected Completion - End FY 00.

3. SRMs 2814, 2815, and 2816 Rockwell B Scale Hardness

Status: New SRMs

Impact: Rockwell hardness is a common measure for materials performance and is often used in purchasing specifications. The Rockwell B scale (HRB) is the most commonly used hardness scale for aircraft alloys and for steel alloys that are not heat treated for high strength. SRMs 2814 (low range), 2815 (mid range) and 2816 (high range) will establish the national B scale for Rockwell hardness, and allow international intercomparisons of hardness scales.

Technical Work Objective: Provide Rockwell B Scale Hardness standards calibrated to the U.S. national B scale. Hardness blocks will be certified using the NIST Dead-weight Standardizing Machine.

Project Duration: 1 year; Expected Completion - End FY 00.

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4. SRM 1918 Bulk Density and Pore Volume Standard

Status: New SRM

Impact: Mercury porosimetry uses the non-wetting property of mercury to determine bulk density, pore volume, and pore size distribution by forcing mercury into pores at high pressures. These characteristics of solids and powders are of particular interest to the ceramics processing industry. No certified standard currently exists to calibrate these porosimeters; development of such a standard was requested by the Ceramic Processing and Characterization Council.

Technical Work Objective: Acquire and process a lot of raw material, statistically sample and measure the lot. Distribute for round robin testing.

Project Duration: 2 years; Expected Completion - End FY 01.

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5. SRM Specific Surface Area Standard

Status: New SRM

Impact: Specific surface area measurement by the Brunauer-Emmett-Teller (BET) technique is one of the most common, quick, and inexpensive analytical techniques used in industrial laboratories to characterize a variety of solid materials using a variety of environmentally benign gases. Industry estimates of yearly sales of BET instruments are in the 200+/year range. BET analysis is used to characterize zeolites, polymers, metals, ceramics, composites, and biomaterials. Modifications to the technique can yield detailed information on porosity, pore size distribution, surface chemisorption, density, and bio-activity.

Technical Work Objective: Provide fully certified surface area standard units for RM 8572 using the BET technique.

Project Duration: 2 years; Expected Completion - End FY 01.

6. SRM 2490 Standard Fluid for Rheological Measurements

Status: New SRM

Impact:. SRM 2490 Standard Solution for Rheological Measurements is a fluid that demonstrates the non-Newtonian behaviors of shear-thinning and normal stresses. It will be used to calibrate rheometers that make such measurements, and for research into improved methods of measurement.

Technical Work Objective: Provide certified liquid standard. Testing will be performed using the Rheometric Scientific ARES rheometer. Certified properties will be the shear-rate dependence of the viscosity and first normal stress difference, and the linear viscoelastic behavior. These properties will be specified at 0 °C, 25 °C, and 50 °C.

Project Duration: 0.5 year; Expected Completion - Mid FY 00.

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7. Ultra-High Molecular Weight Polyethylene Bar [See also SD Project 8. (Not rated.)]

Status: New RM

Impact: Ultra-high molecular weight polyethylene (UHMWPE) is the material of choice for orthopedic implant applications where low-friction surfaces are a requirement. The orthopedics industry would like to have a material against which to compare candidate materials. The orthopedics industry, standards organizations, and regulators of human implant materials will use this SRM. A previous supply of UHMWPE reference bars, available from the Hospital for Special Surgery, is gone so a replacement is needed.

Technical Work Objective: Obtain a UHMWPE reference material and evaluate for selected mechanical properties, e.g., yield strength, tensile strength, and elongation to failure.

Project Duration: 1 year; Expected Completion - End FY 00.

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8. SRM 2888 Polymer Molecular Mass Standard [See also SD Project 3.]

Status: New

Impact: Polymer standards certified for average molecular mass are used by industry and research laboratories to calibrate gel permeation chromatographs, the instrumentation commonly used to estimate mass distribution. Current methods of certifying such standards are labor intensive and may require working with toxic solvents at elevated temperatures. Matrix assisted laser desorption/ionization mass spectrometry (MALDI-MS) shows promise as a new method of determining the mass distribution of synthetic polymer.

Technical Work Objective: Provide a polystyrene standard that is certified for mass distribution by both MALDI-MS and classical methods as determined by NIST and interlaboratory comparison.

Project Duration: 1 year; Expected Completion - End FY 00.

9. SRM for Oral Dentifrices

Status: New SRM

Impact: The toothpaste market for the pharmaceutical industry is approximately $ 6.5B per year worldwide. The industry must meet American Dental Association (ADA) and ISO abrasivity standards. Similar abrasivity standards are currently part of the MD156/ADA Specification and ISO 11609:1995E standard for toothpaste. Approximately 500 kg of pyrophosphate abrasive is used each year for abrasivity testing and certification of market products.

Technical Work Objective: Characterize calcium pyrophosphate particulate for use in abrasivity testing of dentrifice formulations. Evaluate particle size distribution, chemistry, and morphology characterization; verify abrasivity via standardized testing on human tooth enamel; investigate alternative particulates (e.g., silica) as a possible alternative reference abrasive.

Project Duration: 1 year; Expected Completion - End FY 00.

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10. SRM 1021 Particle Size Distribution Standard [See also SD Project 5.]

Status: New SRM

Impact: Particle size distribution (PSD) is a critical parameter in ceramic, glass, and drug manufacturing and processing. This SRM is needed for the calibration and evaluation of particle size measurement instrumentation in the increasingly important 1 µm to 10 µm size range. There are no instrument-independent (spherical particle) size distribution standards in this range available from NIST.

Technical Work Objective: Provide PSD standard certified by two independent methods.

Project Duration: 2 years; Expected Completion - Mid FY 01.

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11. SRM 1003c Particle Size Distribution Standard [See also SD Project 6.]

Status: Renewal SRM

Impact: Particle size distribution (PSD) is a critical parameter in ceramic, glass, and drug manufacturing. This SRM is needed for the calibration and evaluation of particle size measurement instrumentation in the 10 µm to 60 µm size range. The previous issue, SRM 1003b, sold over 90 units/year before it had to be removed from inventory due to damage from environmental effects. There are currently no instrument-independent (spherical particle) size distribution standards in this range available from NIST.

Technical Work Objective: Provide PSD standard certified by two independent methods.

Project Duration: 1.5 years; Expected Completion - Mid FY 01.

□ Development Plans – SRM Projects submitted for Service Development (SD)

1. SRM for Charpy V-notch Program [See also WCF Project 1.]

Status: New SRM

Impact: The Charpy impact test uses a swinging hammer to assess the resistance of a material to brittle fracture. The energy absorbed in fracturing the specimens is measured from a calibrated scale, encoder, or an instrumented striker. Three different levels are provided; low, high, and superhigh. This project will investigate alternative sources of superhigh material.

Technical Work Objective: Provide technical support to heat treaters of the Charpy specimens and evaluate/develop an alternative material to the T-200 steel currently used.

Project Duration: 1 year; Expected Completion - End FY 00 (for prototype).

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2. Ferrite SRM for Metal Casting

Status: New SRM

Impact: Stainless steel castings often contain a small amount of ferrite to impart desired mechanical and physical properties. The quantitative measurement of this ferrite is important commercially, as it is commonly specified in contracts and production standards. The amount of ferrite is measured magnetically or optically (on polished sections) following industry standards. These standards require a different standard than the RM 8480 and 8481 currently in the SRM Program inventory.

Technical Work Objective: Select and evaluate prototype material.

Project Duration: 1 year; Expected Completion - End FY 00.

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3. SRM 2888 Polymer Molecular Mass Standard [See also WCF Project 8.]

Status: New

Impact: Polymer standards certified for average molecular mass are used by industry and research laboratories to calibrate gel permeation chromatographs, the instrumentation commonly used to estimate mass distribution. Current methods of certifying such standards are labor intensive and may require working with toxic solvents at elevated temperatures. Matrix assisted laser desorption/ionization mass spectrometry (MALDI-MS) shows promise as a new method of determining the mass distribution of synthetic polymer.

Technical Work Objective: Resolve technical problems associated with the MALDI-MS technique for use in certifying the mass distribution of polystyrene materials. To renew by custom synthesis polystyrene materials of similar properties followed by recertification.

Project Duration: 1 year; Expected Completion - End FY 00.

4. SRMs 2818, 2819, and 2820 Rockwell N and T Scale Hardness Standards

Status: New SRMs

Impact: The HRN and HRT scales are used extensively for testing metal sheet and thin metal products. The test blocks will help establish the U.S. Rockwell hardness scale and be used to calibrate the Rockwell test machines of secondary standards producers and large calibration laboratories.

Technical Work Objective: Run experimental HRN and HRT tests to determine how variations in test procedures affect measurement results. Evaluate the HRC and HRB test block materials as candidate test block material for the HRN and HRT scales

Project Duration: 1 year; Expected Completion - End FY 00.

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5. SRM 1021 Particle Size Distribution Standard [See also WCF Project 10.]

Status: New SRM

Impact: Particle size distribution (PSD) is a critical parameter in ceramic, glass, and drug manufacturing and processing. This SRM is needed for the calibration and evaluation of particle size measurement instrumentation in the increasingly important 1 μm to 10 μm size range. There are no instrument-independent (spherical particle) size distribution standards in this range available from NIST.

Technical Work Objective: Provide PSD standard certified by two independent methods.

Project Duration: 2 years; Expected Completion - Mid FY 01.

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6. SRM 1003c Particle Size Distribution Standard [See also WCF Project 11.]

Status: Renewal SRM

Impact: Particle size distribution (PSD) is a critical parameter in ceramic, glass, and drug manufacturing. This SRM is needed for the calibration and evaluation of particle size measurement instrumentation in the 10 μm to 60 μm size range. The previous issue, SRM 1003b, sold over 90 units/year before it had to be removed from inventory due to damage from environmental effects. There are currently no instrument-independent (spherical particle) size distribution standards in this range available from NIST.

Technical Work Objective: Provide PSD standard certified by two independent methods.

Project Duration: 1.5 years; Expected Completion - Mid FY 01.

7. SRM 1979 Crystallite Size Broadening Standard

Status: New SRM

Impact: This SRM will address the characterization of crystallite size through the analysis of profile shapes obtained from x-ray powder diffraction equipment. Crystallite size is an important material parameter that affects the mechanical properties of ceramics and metals.

Technical Work Objective: Identify, procure, and evaluate candidate materials. The materials will be certified with respect to crystallite size via the application of the Maximum Entropy Method to the analysis of x-ray diffraction profile shapes.

Project Duration: 1.5 years; Expected Completion - Mid FY 01.

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8. (Not rated.) Ultra-High Molecular Weight Polyethylene Bar [See also WCF Project 7.]

Status: New RM

Impact: Ultra-high molecular weight polyethylene (UHMWPE) is the material of choice for orthopedic implant applications where low-friction surfaces are a requirement. The orthopedics industry would like to have a material against which to compare candidate materials. The orthopedics industry, standards organizations, and regulators of human implant materials will use this SRM. A previous supply of UHMWPE reference bars, available from the Hospital for Special Surgery, is gone so a replacement is needed.

Technical Work Objective: Obtain a UHMWPE reference material and evaluate for selected mechanical properties, e.g., yield strength, tensile strength, and elongation to failure.

Project Duration: 1 year; Expected Completion - End FY 00.

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9. (Not rated.) SRM 764a Platinum Magnetic Susceptibility Standard

Status: Renewal SRM

Impact: High purity platinum wire is a suitable material for a magnetic susceptibility standard due to its highly paramagnetic state and atmospheric inertness. Consequently it will be evaluated to calibrate Superconducting Quantum Interference Device (SQUID) magnetometers where an outside source of magnetic flux is undesirable, to calibrate vibrating sample magnetometers (VSMs) and other types of magnetometers at low ranges, and to determine true zeros for field and magnetic moment. This renewal standard would replace SRM 764 Platinum Magnetic Susceptibility Standard whose supplies have been exhausted for some time.

Technical Work Objective: Obtain a supply of 99.999+ % pure platinum in wire form and evaluate for selected magnetic properties, e.g., magnetic moment and magnetic susceptibility.

Project Duration: 1 year; Expected Completion - End FY 00.

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Building and Fire Research Laboratory

□ Production Plans – SRM Projects submitted for Working Capital (WC) Funding

1. SRM 1415 Pyroceram 9606 Standard

Status: New SRM

Impact: For many years the thermal testing community has requested thermal reference data for engineering materials with thermal conductivities between 2 W/(m•K) and 10 W/(m•K). A NIST SRM in this range will be useful to several industries including the ceramic, carbon products, composites, glass, and steel industries. Several ASTM Test Methods (e.g., ASTM E 1530 and E 1225) call for Pyroceram 9606 as an industry standard.

Technical Work Objective: Critically assess previous NIST work and available literature data to establish SRM 1415 values for thermal diffusivity, thermal conductivity, volumetric heat capacity, and possibly, thermal expansion.

Project Duration: 1 year; Expected Completion - End FY 00.

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2. SRMs 2686, 2687, and 2688 Cement Clinkers

Status: New SRMs (Upgrade from existing RMs 8486, 8487, 8488)

Impact: The NIST Reference Clinkers are used for development and testing methods for phase abundance analysis. They are used within ASTM Committee C01 on Cement for both ASTM C 1365 and C 1356, optical microscopy and x-ray powder diffraction standard test methods. They also serve as a set of clinkers suitable for training petrographers.

Technical Work Objective: Use ASTM optical microscopic and x-ray powder diffraction standard test methods to generate additional data in order to independently evaluate and then certify the phase compositions of these clinkers.

Project Duration: 1 year; Expected Completion - End FY 00.

□ Development Plans – SRM Projects submitted for Service Development (SD) Funding

None submitted.

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Principal NIST Technical Contacts for FY 2000 SRM® Projects

[Name, telephone number, and e-mail address listed by Laboratory and project priority.]

■ 2 – Technology Services

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■ 81 – Electronics and Electrical Engineering Laboratory

□ Production Plans

1. SRM 2520 Optical Fiber Cladding Diameter
   Timothy J. Drapela **303.497.5858** **timothy.drapela@nist.gov**

2. SRM 2517 Wavelength Reference Absorption Cell, Acetylene
3. SRM 2519 Wavelength Reference Absorption Cell, Hydrogen Cyanide
5. SRM 2515 Wavelength Reference Absorption Cell, Acetylene
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4. SRM 2544 Silicon Resistivity Standard
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6. SRM 2538 Polarization Mode Dispersion (Non-Mode-coupled) Standard
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7. SRM 2537 Polarization Dependent Loss Reference Standard [See also SD Project 2.]
   Rex M. Craig **303.497.3359** **rex.craig@nist.gov**

- Development Plans

1. SRM 2516 Wavelength Reference Absorption Cell
   Sarah L. Gilbert **303.497.3120** **sarah.gilbert@nist.gov**

2. SRM 2537 Polarization Dependent Loss Reference Standard [See also WCF Project 7.]
   Rex M. Craig **303.497.3359** **rex.craig@nist.gov**

3. Magnetic Thin Film Reference Standard
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■ 82 – Manufacturing Engineering Laboratory

- Production Plans

1. SRM 2800 Optical Microscope Magnification Standard
   James E. Potzick **301.975.3481** **james.potzick@nist.gov**

2. SRM 2059 Optical Photomask Linewidth Standard
   James E. Potzick **301.975.3481** **james.potzick@nist.gov**

3. SRM 5001 Two-Dimensional Grid Standard
   Richard M. Silver **301.975.5609** **richard.silver@nist.gov**

4. SRM 2089 AFM Pitch/Height Standard
   Ronald G. Dixson **301.975.4399** **ronald.dixson@nist.gov**

5. SRM Gage Block Standards [See also SD Project 3.]
   John R. Stoup **301.975.3476** **john.stoup@nist.gov**

6. SRM 2071c Sinusoidal Roughness Block
   Jun-feng Song **301.975.3799** **junfeng.song@nist.gov**

7. SRM 2091 SEM Sharpness Standard
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- Development Plans

1. SRM 5000 Standard Overlay Artifact
   Richard M. Silver **301.975.5609** **richard.silver@nist.gov**

2. SRM 2091 Bullets and Casings Standard for Forensics
   Jun-feng Song **301.975.3799** **junfeng.song@nist.gov**

3. SRM Gage Block Standards [See also WCF Project 5.]
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4. Scanning Electron Microscope Linewidth SRM
   Michael T. Postek **301.975.2299** **michael.postek@nist.gov**

5. NIST Traceable Stage Micrometer
   William B. Penzes **301.975.3477** **william.penzes@nist.gov**

6. Scanning Probe Microscopy Organic Crystal
   John A. Kramar **301.975.3447** **john.kramar@nist.gov**

7. Transmission Electron Microscope (TEM) Magnification Standard
   Michael T. Postek **301.975.2299** **michael.postek@nist.gov**

■ 83 – Chemical Science and Technology Laboratory

□ Production Plans

1. SRM 1930 Glass Filters for Spectrophotometry (Extended Visible)
2. SRM 2030a Glass Filter for Transmittance Measurement (Spice Filter)
3. SRM 2031a Metal-on-Fused-Silica Filters for Spectrophotometry (UV/Visible)
7. SRM 930e Glass Filters for Spectrophotometry (Visible)
   John C. Travis **301.975.4117** **john.travis@nist.gov**

4. SRMs 3181 and 3186 Anion Standard Solutions
   Johanna B. Smeller **301.975.4125** **johanna.smeller@nist.gov**

5. SRMs 3190 through 3199 Aqueous Electrolytic Conductivity Standard Solutions
   Rubina Jameel **301.975.4133** **rubina.jameel@nist.gov**

6. SRMs 3101a through 3169 Single Element Standard Solutions
   Therese A. Butler **301.975.4120** **therese.butler@nist.gov**

8. SRM 1662a 1000 μmol/mol Sulfur Dioxide in Nitrogen
   Gerald D. Mitchell **301.975.5185** **gerald.mitchell@nist.gov**

9. SRM 1666b 10 μmol/mol Propane in Air
10. SRM 1667b 50 μmol/mol Propane in Air
11. SRM 1668b 100 μmol/mol Propane in Air
12. SRM 1669b 500 μmol/mol Propane in Air
    Walter R. Miller **301.975.3938** **walter.miller@nist.gov**

13. SRM 1676 362 μmol/mol Carbon Dioxide in Air
    Walter R. Miller **301.975.3938** **walter.miller@nist.gov**

14. SRM 1683b 50 μmol/mol Nitric Oxide in Nitrogen
15. SRM 1684b 100 μmol/mol Nitric Oxide in Nitrogen
19. SRM 2629a 20 μmol/mol Nitric Oxide in Nitrogen
    William J. Thorn III **301.975.3905** **william.thorn@nist.gov**

16. SRM 1693a 50 μmol/mol Sulfur Dioxide in Nitrogen
17. SRM 1694a 100 μmol/mol Sulfur Dioxide in Nitrogen
    Gerald D. Mitchell **301.975.5185** **gerald.mitchell@nist.gov**

18. SRM 1941b Organics in Marine Sediment
    Michele M. Schantz **301.975.3106** **michele.schantz@nist.gov**

20. SRM 2644 250 μmol/mol Propane in Nitrogen
Walter R. Miller **301.975.3938** **walter.miller@nist.gov**

21. SRM 913b Uric Acid
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44. (22.) SRM 1545 Antibiotics in Milk
Katherine S. Sharpless **301.975.3121** **katherine.sharpless@nist.gov**

22. (23.) SRM 1946 Lake Superior Fish Tissue (for Organics)
Michele M. Schantz **301.975.3106** **michele.schantz@nist.gov**

23. (24.) SRM 2036 Combination Transmittance/Diffuse Reflectance Near Infrared Standard
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24. (25.) SRM 2037 Red Diesel Dye
Gary W. Kramer **301.975.4132** **gary.kramer@nist.gov**

25. (26.) SRM 2384 Baking Chocolate
Katherine S. Sharpless **301.975.3121** **katherine.sharpless@nist.gov**

45. (27.) SRM 2385 Spinach
Katherine S. Sharpless **301.975.3121** **katherine.sharpless@nist.gov**

26. (28.) SRM 2721 Moisture and Sulfur in Crude Oil
27. (29.) SRM 2722 Moisture and Sulfur in Crude Oil
William Robert Kelly **301.975.4139** **william.kelly@nist.gov**

28. (30.) SRM 2783 Urban Air Particulate Matter (APM) Filter for Trace Elements
Rolf L. Zeisler **301.975.6290** **rolf.zeisler@nist.gov**

33. (31.) SRM 2784 Baltimore Urban Air Particulate Matter on Filter for Carbonaceous Species
George A. Klouda **301.975.3931** **george.klouda@nist.gov**

34. (32.) SRM 2921 Cardiac Troponin I
Michael J. Welch **301.975.3100** **michael.welch@nist.gov**

38. (33.) SRMs 2452, 2453, and 2454 Hydrogen in Titanium Alloy (ASTM/NIST Cooperative Agreement Activity)
Richard M. Lindstrom **301.975.6281** **richard.lindstrom@nist.gov**

39. (34.) Microhomogeneity Sediment (Small Sample Solid Sampling Techniques)
Rolf L. Zeisler **301.975.6290** **rolf.zeisler@nist.gov**

40. (35.) SRM 2371 Isotopically Depleted Proteins for Use as Mass Spectrometry Calibration Standard
Joseph Dalluge **301.975.3651** **joseph.dalluge@nist.gov**

41. (36.) SRM 3000 series Semi-Volatile Organic Compounds (VOCs)
Michele M. Schantz **301.975.3106** **michele.schantz@nist.gov**

43. (38.) SRM 3000 series VOCs in Methanol [See also SD Project 11.]
Franklin R. Guenther **301.975.3939** **franklin.guenther@nist.gov**

48. (41.) SRM 3000 series PCBs in Oil
Dianne L. Poster **301.975.4166** **dianne.poster@nist.gov**

42. (37.) Ultraviolet Solution Absorbance Standard (Potassium Dichromate in Sulfuric Acid)
John C. Travis **301.975.4117** **john.travis@nist.gov**

46. (39.) SRM 154b Titanium Oxide
Kenneth W. Pratt **301.975.4131** **kenneth.pratt@nist.gov**

47. (40.) SRM 1575a Pine Needles
Liz A. Mackey **301.975.5149** **liz.mackey@nist.gov**

49. (42.) SRM 1643d Trace Elements in Water
Michael S. Epstein **301.975.4136** **michael.epstein@nist.gov**

50. (43.) SRM 2670a Toxic Elements in Urine
Robert D. Vocke Jr. **301.975.4103** **robert.vocke@nist.gov**

37. (44.) SRMs 2709a, 2710a, 2711a Soils (Trace Elements)
Robert R. Greenberg **301.975.6285** **robert.greenberg@nist.gov**

51. (45.) SRM 2712 Inorganic Sediment SRM (renewal for SRM 2704 and RM 8704)
Rolf L. Zeisler **301.975.6290** **rolf.zeisler@nist.gov**

52. (46.) SRM 2380 Drugs of Abuse in Human Hair Segments
Michael J. Welch **301.975.3100** **michael.welch@nist.gov**

53. (47.) RM 8559, RM 8560, and RM 8561 Natural Gas Isotopic Reference Materials
R. Michael Verkouteren **301.975.3933** **r.verkouteren@nist.gov**

54. (48.) SRMs 2298 and 2299 Low Sulfur in Gasoline
William Robert Kelly **301,975.4139** **william.kelly@nist.gov**

Not rated. SRM 217d 2,2,4-Trimethylpentane (*Iso*-octane)
Duane R. Kirklin **301.975.2580** **duane.kirklin@nist.gov**

29. (Not rated.) SRM 2426 Galvalume™ (ASTM/NIST Cooperative Agreement Activity)
John R. Sieber **301.975.3920** **john.sieber@nist.gov**

36. (Not rated.) SRMs 853a and 1240c Aluminum Alloy 3004
SRMs 854a and 1241c Aluminum Alloy 5182
SRMs 1255a and 1256a Aluminum Alloys 356 and 380
(all ASTM/NIST Cooperative Agreement Activities)
John D. Fassett **301.975.4109** **john.fassett@nist.gov**

36. (Not rated.) SRM 173c 6Al-4V Titanium Alloy (ASTM/NIST Cooperative Agreement Activity)
John D. Fassett **301.975.4109** **john.fassett@nist.gov**

70. (Not rated.) SRM 1649b Air Particulate (Organics)
Dianne L. Poster **301.975.4166** **dianne.poster@nist.gov**

70. (Not rated.) SRM 1650b Diesel Particulate (Organics)
Michele. M. Schantz **301.975.3106** **michele.schantz@nist.gov**

□ Development Plans

1. Thermal Analysis Standard Set
Robert F. Huie **301.975.2559** **robert.huie@nist.gov**

2. (6.) SRM 3000 series Anion Solutions
Thomas W. Vetter **301.975.4123** **thomas.vetter@nist.gov**

Not rated. (11.) SRM 3000 series Very Volatile Organic compounds in Methanol
[See also WCF Project 43. (38.)]
Franklin R. Guenther **301.975.3939** **franklin.guenther@nist.gov**

3. (2.) Organic and Elemental Carbon Particle Reference Materials on Filter Substrates
Robert A. Fletcher **301.975.3912** **robert.fletcher@nist.gov**

4. (3.) SRM 2394 Heteroplasmic Mitochrondrial DNA
Barbara C. Levin **301.975.6682** **barbara.levin@nist.gov**

5. (4.) SRM 2395 Y Chromosome Microsatellites
Margaret C. Kline **301.975.3134** **margaret.kline@nist.gov**

6. (5.) SRM 2396 Oxidatively Modified DNA Base Biomarker
Henry Rodriguez **301.975.2578** **henry.rodriquez@nist.gov**

7. Fluorescein Fluorescence Intensity Standard
Adolfas Gaigalas **301.975.2873** **adolfas.gaigalas@nist.gov**

Not rated. (8.) Elemental Primary Standard SRMs
Gregory C. Turk **301.975.4118** **gregory.turk@nist.gov**

8. (9.) SRMs 1704-1709 Low Concentration Nitric Oxide Gas Standards
William J. Thorn III **301.975.3905** **william.thorn@nist.gov**

9. (10.) Raman Intensity SRMs for 785 nm Excitation
Steven J. Choquette **301.975.3096** **steven.choquette@nist.gov**

10. (12.) SRM 2427 Anode Tin (ASTM/NIST Cooperative Agreement Activity)
John R. Sieber **301.975.3920** **john.sieber@nist.gov**

11. (13.) SRM 1928 Additives in Smokeless Gunpowder
William A. MacCrehan **301.975.3122** **william.maccrehan@nist.gov**

12. (14.) SRMs 2583-2585 Organic Contaminants in Household Dust
Stephen A. Wise **301.975.3112** **stephen.wise@nist.gov**

16. (15.) SRM 1947 Lake Michigan Fish Tissue
Steven J. Christopher **301.975.4114** **steven.christopher@nist.gov**

17. (16.) Electronic Scrap SRM
Rolf L. Zeisler **301 975.6290** **rolf.zeisler@nist.gov**

15. (17.) Performance Standards for Liquid/Gas Chromatography Mass Spectrometers
Michael J. Welch **301.975.3100** **michael.welch@nist.gov**

18. SRMs 1281-1283 Sebiloys (ASTM/NIST Cooperative Agreement Activity)
John R. Sieber **301.975.3920** **john.sieber@nist.gov**

19. Trace Elements in Ceramics Standards
Rabia Demiralp **301.975.5141** **rabia.demiralp@nist.gov**

13. (20.) SRM 2386 Trans Fatty Acids in Foods
Curtis Phinney **301.975.3141** **curtis.phinney@nist.gov**

■ 84 – Physics Laboratory

□ Production Plans

1. SRM 4324B Uranium-232 Solution Standard
2. SRM 4328B Thorium-229 Solution Standard
10. SRM 4919H Strontium-90 Solution Standard
12. SRM 4332D Americium-243 Solution Standard
13. SRM 4326 Polonium-209 Solution Standard (additional units only)
Larry L. Lucas **301.975.5546** **larry.lucas@nist.gov**

3. SRM 4906LC Plutonium-238 Point Source Standard
Larry L. Lucas **301.975.5546** **larry.lucas@nist.gov**

4. SRM 4337 Lead-210 Solution Standard
Larry L. Lucas **301.975.5546** **larry.lucas@nist.gov**

6. SRM 1008 Photo Step Tablet
Edward A. Early **301.975.2343** **edward.early@nist.gov**

7. Multi-Angle White Reflectance Standard
Maria E. Nadal **301.975.4632** **maria.nadal@nist.gov**

8. Gray Scale Reflectance Standard
Maria E. Nadal **301.975.4632** **maria.nadal@nist.gov**

9. SRM 2057 Infrared Reflectance Standard [See also SD Project 3.]
Leonard M. Hanssen **301.975.2344** **leonard.hanssen@nist.gov**

11. SRM 4915E Cobalt-60 Solution Standard
Larry L. Lucas **301.975.5546** **larry.lucas@nist.gov**

□ Development Plans

1. SRM 4358 Ocean Shellfish Standard
Kenneth G.W. Inn **301.975.5541** **kenneth.inn@nist.gov**

2. SRM Seaweed Standard
Kenneth G.W. Inn **301.975.5541** **kenneth.inn@nist.gov**

3. SRM 2057 Infrared Regular Reflectance Standard [See also WCF Project 9.]
4. SRM 2058 Infrared High Emittance Standard
5. SRM 2060 Infrared Transmittance Standard
   Leonard M. Hanssen **301.975.2344** **leonard.hanssen@nist.gov**

■ 85 – Materials Science and Engineering Laboratory

□ Production Plans

1. SRMs 2092, 2096, 2098 Charpy V-notch Specimens [See also SD Project 1.]
   Thomas A. Siewert **303.497.3523** **thomas.siewert@nist.gov**

2. SRMs 1358a through 1364b Nonmagnetic Coating on Steel Standards
   Carlos R. Beauchamp **301.975.6411** **carlos.beauchamp@nist.gov**

3. SRMs 2814, 2815, and 2816 Rockwell B Scale Hardness
   Samuel R. Low III **301.975.5709** **samuel.low@nist.gov**

4. SRM 1918 Bulk Density and Pore Volume Standard
   Dennis B. Minor **301.975.5787** **dennis.minor@nist.gov**

5. SRM Specific Surface Area Standard
   Dennis B. Minor **301.975.5787** **dennis.minor@nist.gov**

6. SRM 2490 Standard Fluid for Rheological Measurements
   Carl R. Schultheisz **301.975.6847** **carl.schultheisz@nist.gov**

7. Ultra-High Molecular Weight Polyethylene Bar [See also SD Project 8. (Not rated.)]
   John A. Tesk **301.975.6799** **john.tesk@nist.gov**

8. SRM 2888 Polymer Molecular Mass Standard [See also SD Project 3.]
   Charles M. Guttman **301.975.6729** **charles.guttman@nist.gov**

9. SRM for Oral Dentifrices
   Francis W. Wang **301.975.6726** **francis.wang@nist.gov**

10. SRM 1021 Particle Size Distribution Standard [See also SD Project 5.]
    James F. Kelly **301.975.5794** **james.kelly@nist.gov**

11. SRM 1003c Particle Size Distribution Standard [See also SD Project 6.]
    James F. Kelly **301.975.5794** **james.kelly@nist.gov**

□ Development Plans

1. SRM for Charpy V-notch Program [See also WCF Project 1.]
   Thomas A. Siewert **303.497.3523** **thomas.siewert@nist.gov**

2. Ferrite SRM for Metal Casting
   Thomas A. Siewert **303.497.3523** **thomas.siewert@nist.gov**

3. SRM 2888 Polymer Molecular Mass Standard [See also WCF Project 8.]
   Charles M. Guttman **301.975.6729** **charles.guttman@nist.gov**

4. SRMs 2818, 2819, and 2820 Rockwell N and T Hardness Standards
   Samuel R. Low III **301.975.5709** **samuel.low@nist.gov**

5. SRM 1021 Particle Size Distribution Standard [See also WCF Project 10.]
   James F. Kelly **301.975.5794** **james.kelly@nist.gov**

6. SRM 1003c Particle Size Distribution Standard [See also WCF Project 11.]
   James F. Kelly **301.975.5794** **james.kelly@nist.gov**

7. SRM 1979 Crystallite Size Broadening Standard
   James P. Cline **301.975.5793** **james.cline@nist.gov**

8. (Not rated.) Ultra-High Molecular Weight Polyethylene Bar [See also WCF Project 7.]
   John A. Tesk **301.975.6799** **john.tesk@nist.gov**

9. (Not rated.) SRM 764a Platinum Magnetic Susceptibility Standard
   Robert D. Schull **301.975.6035** **robert.schull@nist.gov**

■ 86 – Building and Fire Research Laboratory

□ Production Plans

1. SRM 1415 Pyroceram 9606 Standard
   Robert R. Zarr **301.975.6436** **robert.zarr@nist.gov**

2. SRMs 2686, 2687, and 2688 Cement Clinkers
   Paul E. Stutzman **301.975.6715** **paul.stutzman@nist.gov**

□ Development Plans

None submitted.