# Development of SRM 2706 (New Jersey Soil, Organics and Trace Elements), a New Reference Material for the Monitoring and Assessment of Soils.

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# National Institute of Standards and Technology - History

## Origins

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1824 Office of Standard Weights and Measures

1901 National Bureau of Standards (NBS)

Federal Government's first physical science research laboratory
Number of Staff - 12

1988 National Institute of Standards and Technology (NIST) 1988

# NIST TODAY: MISSION

"To promote U.S. innovation and industrial competitiveness by advancing measurement science, standards, and technology in ways that enhance economic security and improve our quality of life"

# Early Driver for New Standards

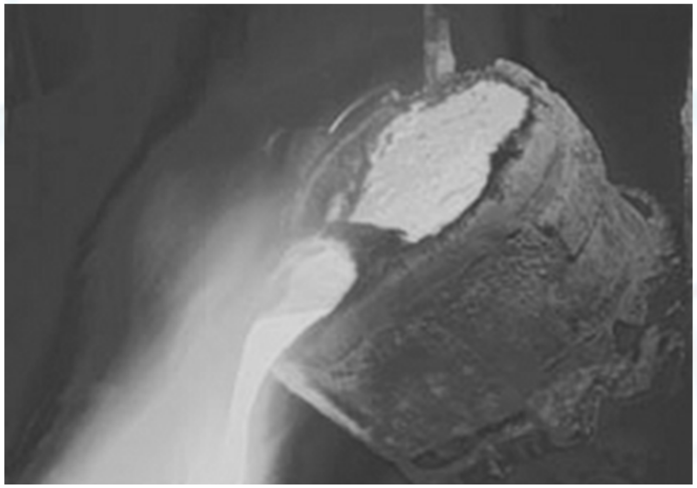
## 1904

- Out-of-town fire companies arriving at a Baltimore fire cannot couple their hoses to the hydrants. 1526 buildings destroyed

## 1905

- National Fire Protection Association adopted NBS-developed national hose coupling standard

# Birth of the "Standard Samples" Program

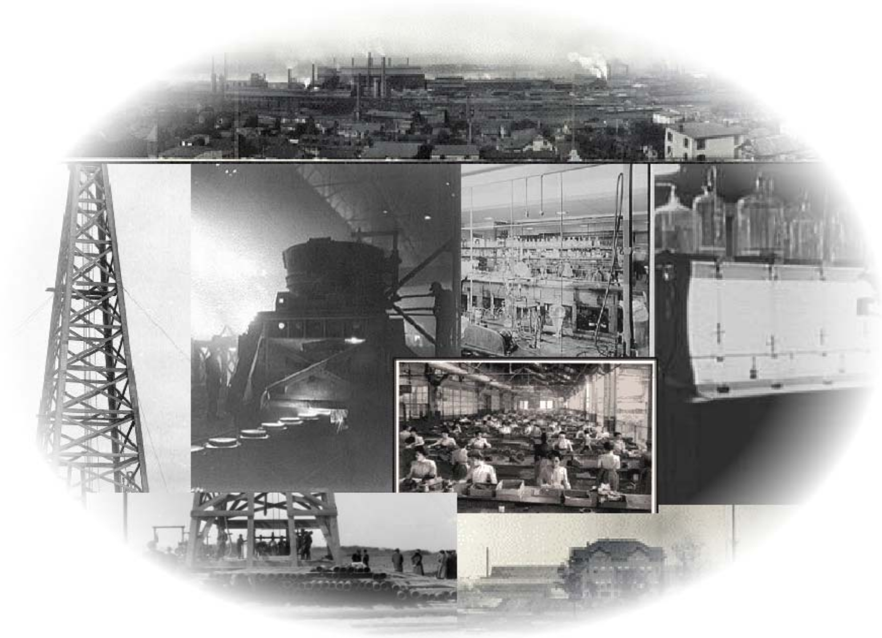


**1905**

**Standard samples program begins with "standardized irons" in collaboration with the American Foundrymans Association**

**1906**

**At the request of the Association of American Steel Manufacturers, the Bureau began work on certification of 17 types of steel**



- By 1951, there were 502 Standard Samples, 98 of these were steels
- Today there are more than 1400 different SRMs

# Standard Reference Materials (SRMs)

- **Standard Reference Materials (SRMs)** are **Certified Reference Materials (CRMs)** issued by the National Institute of Standards and Technology (NIST)
- Homogeneous, stable materials well-characterized for one or more chemical and/or physical properties
- Assist laboratories worldwide in validating analytical measurements of chemical and physical composition

# How Reference Materials Can Augment Current Method QC

- Reference materials (especially SRMs produced by NIST) are routinely utilized in method QC in non-EPA method compendiums (AOAC, ASTM, NIOSH)

- NIST SRMs are routinely used to validate US EPA SW846 methods and their use has been required as part of CLP projects

- **NIST SRMs**
  - **NIST Certified Value** - A value reported on an SRM certificate or certificate of analysis for which NIST has the highest confidence in its accuracy in that all known or suspected sources of bias have been fully investigated or accounted for by NIST.

  - **NIST Reference Value** - A best estimate of the true value provided on a NIST certificate, certificate of analysis, or report of investigation where all known or suspected sources of bias have not been fully investigated by NIST.

# Soil and Sediment SRMs

## Soils


- SRM 2709a San Joaquin Soil
- SRM 2710a Montana I Soil
- SRM 2711a Montana II Soil
- SRM 2700 Hexavalent Chromium in Contaminated Soil (Low)
- SRM 2701 Hexavalent Chromium in Contaminated Soil (High)

## Sediments

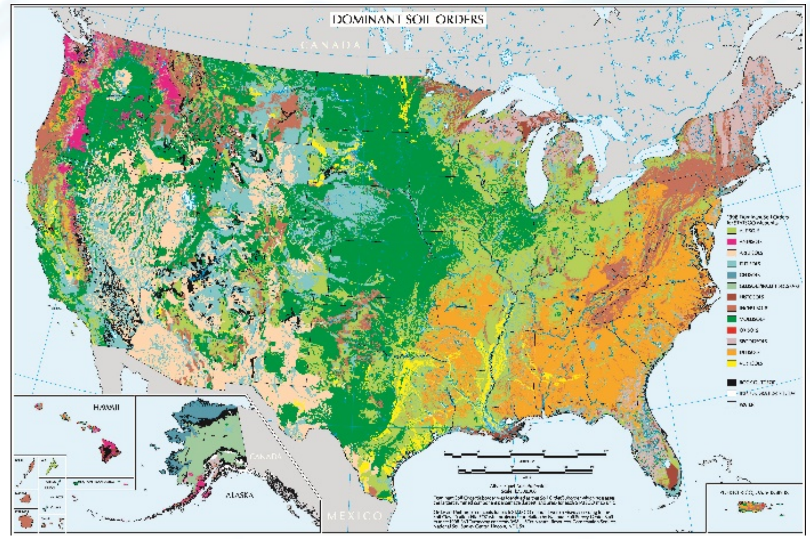
- SRM 1646a Estuarine Sediment
- SRM 1941b Organics in Marine Sediment
- SRM 1944 New York/new Jersey Waterway Sediment
- SRM 2702 Inorganics in Marine Sediment
- RM 8704 Buffalo River Sediment

# Why We Need Another Soil SRM

Current NIST soil SRM inventory is mostly from Western US sources (Montana, California)

Existing soil SRMs do not contain all analytes of interest,  eg organics

Concentrations are often much higher than found in "typical" soil samples




Objective: To create a new soil SRM from Eastern US Sources containing a wide range of inorganic and organic contaminants at typical environmental concentrations

**NIST SRM 2706, New Jersey Soil Organics and Trace Elements**

# Primary Project Stakeholders

| | |
|---|---|
| NJDEP | Trenton, NJ |
| NIST | Gaithersburg, MD<br>Charleston, SC |
| USGS | Denver, CO |
| US EPA | Research Triangle Park, NC |
| US EPA Region 2 | Edison, NJ |
| Pace Analytical | Greensburg, PA |

# SRM 2706 Project Process I

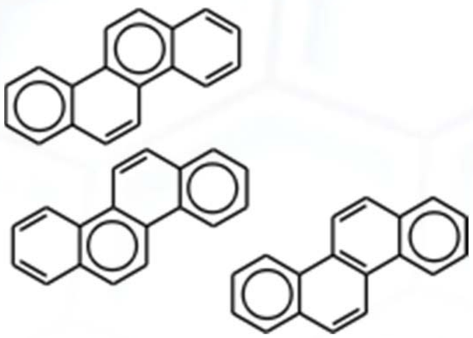
- Assemble group of interested parties representing government, academia and the certified laboratory community
- Identify key contaminants of concern
- Locate "suitable" sampling locations
  - Publicly-funded sites
  - Easy access for sampling
- Analyze sample retains to assess concentrations
  - USEPA Region 2
  - Pace Analytical
- Select source for uncontaminated background soil (Rutgers University, NJ)

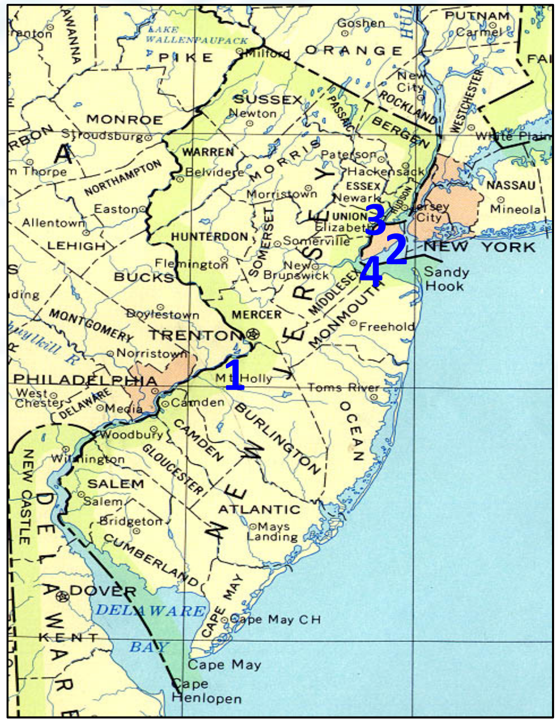
# SRM 2706 Project Process II

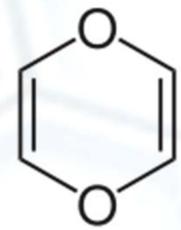
- Using the results from the preliminary analyses, develop a "recipe" for mixing/blending samples from the various sites to create a SRM with the desired analyte concentrations - **10-15X "typical analyte concentrations"**
- Ship samples to USGS for processing
- USGS and NIST studies assess "bottle-to-bottle" chemical homogeneity and stability
- Value assignment at NIST – primary methods (eg IDMS) / combined methods
- Intercomparison study to develop ancillary values using SW846 methods for elements and organics

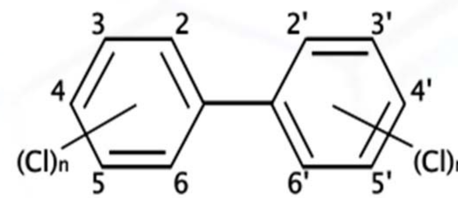
# SRM 2706 Soil Sampling Sites

As, Pb,
trace elements






| Site | Location | Primary Contaminants | Concentration Range (mg/kg) |
|---|---|---|---|
| 1. Paul Tank | Burlington, NJ | PCBs | 0.01- 84 |
| 2. Mariners Marsh | Staten Island, NY | PAHs | 0.04 -10,000 |
| 3. Melon Leasing | Kearney, NJ | Dioxins/Furans | 0.00001 – 0.2 |
| 4. Raritan Bay Slag | Sayreville, NJ | As, Pb, other metals | 3 – 20,000 |


# Processing

- Collected material retains were transferred to five-gallon plastic buckets and shipped to the USGS laboratory with blank soil for processing.
- At USGS, the materials were dried at room temperature, disaggregated, and sieved to remove coarse material (≥2 mm). The dried materials were then ball-milled in 50 kg portions, and blended with dried background soil using a cross-flow V-blender for mixing.
- Blended soil SRM was radiation sterilized prior to bottling as 50 g units using a custom-designed spinning riffler.
- 2400 units produced

# SRM 2706
# Certified Values Inorganic

SRM 2706 = 23
SRM 2709a = 19


| Constituent | Value | *U* | Units | *k* | Assigned | Methods |
|---|---|---|---|---|---|---|
| Aluminum | 2.70 | 0.19 | % | 2 | Certified | ICP-OES; WDXRF |
| Calcium | 0.588 | 0.046 | % | 2 | Certified | ICP-OES; WDXRF |
| Iron | 2.22 | 0.15 | % | 2 | Certified | ICP-OES; INAA; WDXRF |
| Magnesium | 0.289 | 0.014 | % | 2 | Certified | ICP-OES; WDXRF |
| Potassium | 0.946 | 0.028 | % | 2 | Certified | ICP-OES; WDXRF |
| Silicon | 39.17 | 0.47 | % | 2 | Certified | WDXRF |
| Sodium | 0.268 | 0.012 | % | 2 | Certified | ICP-OES; WDXRF |
| Titanium | 0.290 | 0.042 | % | 2 | Certified | ICP-OES; WDXRF |
| Antimony | 149 | 11 | mg/kg | 2 | Certified | ICP-MS; INAA |
| Barium | 319 | 43 | mg/kg | 2 | Certified | ICP-OES; WDXRF |
| Chromium | 60.1 | 5.4 | mg/kg | 2 | Certified | INAA; WDXRF |
| Cobalt | 5.99 | 0.23 | mg/kg | 2 | Certified | ICP-MS; INAA |
| Copper | 88.1 | 6.8 | mg/kg | 2 | Certified | ICP-OES; WDXRF |
| Lead | 653 | 36 | mg/kg | 2 | Certified | ICP-MS; WDXRF |
| Manganese | 244 | 15 | mg/kg | 2 | Certified | ICP-OES; WDXRF |
| Mercury | 0.1329 | 0.0033 | mg/kg | 2 | Certified | CV ID-ICP-MS |
| Nickel | 22.8 | 5.4 | mg/kg | 2 | Certified | ICP-OES; WDXRF |
| Phosphorus | 407 | 21 | mg/kg | 2 | Certified | ICP-OES; WDXRF |
| Rubidium | 37.6 | 1.9 | mg/kg | 2 | Certified | ICP-MS; INAA |
| Strontium | 60.3 | 3.1 | mg/kg | 2 | Certified | ICP-OES; WDXRF |
| Vanadium | 51.9 | 6.5 | mg/kg | 2 | Certified | ICP-OES; WDXRF |
| Zinc | 135.4 | 6.9 | mg/kg | 2 | Certified | ICP-OES; WDXRF |
| Zirconium | 303 | 25 | mg/kg | 2 | Certified | ICP-MS; WDXRF |

**Key to Methods**

| | |
|---|---|
| CV ID-ICP-MS | Cold vapor isotope dilution inductively coupled plasma mass spectrometry at NIST |
| ICP-MS | Inductively coupled plasma mass spectrometry at the USGS |
| ICP-OES | Inductively coupled plasma optical emission spectrometry at NIST and USGS |
| INAA | Instrumental neutron activation analysis at NIST |
| WDXRF | Wavelength dispersive X-ray fluorescence spectrometry at NIST and USGS |

# SRM 2706
# Reference Values Inorganic

SRM 2706 = 29
SRM 2709a = 15


| Constituent | Value | *U* | Units | *k* | Assigned | Methods |
|---|---|---|---|---|---|---|
| Sulfur | 0.217 | 0.012 | % | 2 | Reference | ICP-OES |
| Arsenic | 30.3 | 2.7 | mg/kg | 2 | Reference | ICP-MS |
| Beryllium | 0.84 | 0.17 | mg/kg | 2 | Reference | ICP-OES |
| Bismuth | 0.159 | 0.012 | mg/kg | 2 | Reference | ICP-MS |
| Cadmium | 0.31 | 0.14 | mg/kg | 2 | Reference | ICP-MS |
| Cerium | 34.5 | 1.7 | mg/kg | 2 | Reference | ICP-MS |
| Cesium | 1.35 | 0.10 | mg/kg | 2 | Reference | ICP-MS |
| Dysprosium | 2.41 | 0.21 | mg/kg | 2 | Reference | ICP-MS |
| Erbium | 1.45 | 0.15 | mg/kg | 2 | Reference | ICP-MS |
| Europium | 0.602 | 0.038 | mg/kg | 2 | Reference | ICP-MS |
| Gadolinium | 2.63 | 0.16 | mg/kg | 2 | Reference | ICP-MS |
| Gallium | 6.78 | 0.29 | mg/kg | 2 | Reference | ICP-MS |
| Holmium | 0.488 | 0.052 | mg/kg | 2 | Reference | ICP-MS |
| Lanthanum | 15.50 | 0.83 | mg/kg | 2 | Reference | ICP-MS |
| Lithium | 16.4 | 1.8 | mg/kg | 2 | Reference | ICP-OES |
| Lutetium | 0.219 | 0.024 | mg/kg | 2 | Reference | ICP-MS |
| Molybdenum | 1.211 | 0.076 | mg/kg | 2 | Reference | ICP-MS |
| Neodymium | 14.82 | 0.73 | mg/kg | 2 | Reference | ICP-MS |
| Niobium | 7.18 | 0.49 | mg/kg | 2 | Reference | ICP-MS |
| Praseodymium | 3.99 | 0.18 | mg/kg | 2 | Reference | ICP-MS |
| Samarium | 2.93 | 0.23 | mg/kg | 2 | Reference | ICP-MS |
| Scandium | 4.3 | 1.1 | mg/kg | 2 | Reference | ICP-MS; INAA |
| Terbium | 0.390 | 0.028 | mg/kg | 2 | Reference | ICP-MS |
| Thallium | 0.24 | 0.10 | mg/kg | 2 | Reference | ICP-MS |
| Thorium | 4.37 | 0.20 | mg/kg | 2 | Reference | ICP-MS |
| Thulium | 0.216 | 0.020 | mg/kg | 2 | Reference | ICP-MS |
| Tin | 36 | 11 | mg/kg | 2 | Reference | ICP-MS |
| Tungsten | 0.90 | 0.23 | mg/kg | 2 | Reference | ICP-MS |
| Uranium | 1.38 | 0.21 | mg/kg | 2 | Reference | ICP-MS |

# SRM 2706,
# Certified and Reference Values, PAHs

## 35 PAH Congeners


| Constituent | Value | *U* | *k* | Assigned | Methods |
|---|---|---|---|---|---|
| Naphthalene | 15.3 | 3.0 | 2 | Certified | 1;2 |
| Acenaphthylene | 0.29 | 0.12 | 2 | Certified | 1;2 |
| Acenaphthene | 0.0130 | 0.0020 | 2 | Certified | 1;2 |
| Phenanthrene | 0.471 | 0.046 | 2 | Certified | 1;2 |
| 4H-cyclopenta[def]phenanthrene | 0.040 | 0.010 | 2 | Certified | 1;2 |
| Fluoranthene | 0.516 | 0.066 | 2 | Certified | 1;2 |
| Pyrene | 0.504 | 0.064 | 2 | Certified | 1;2 |
| Benzo[*ghi*]fluoranthene | 0.071 | 0.030 | 2 | Certified | 1;2 |
| Benzo[c]phenanthrene | 0.058 | 0.010 | 2 | Certified | 1;2 |
| Benz[*a*]anthracene | 0.241 | 0.068 | 2 | Certified | 1;2 |
| Benzo[*b*]fluoranthene | 0.314 | 0.052 | 2 | Certified | 1;2 |
| Benzo[*k*]fluoranthene | 0.144 | 0.042 | 2 | Certified | 1;2 |
| Benzo[*j*]fluoranthene | 0.122 | 0.018 | 2 | Certified | 1;2 |
| Benzo[*a*]fluoranthene | 0.129 | 0.060 | 2 | Certified | 1;2 |
| Benzo[*e*]pyrene | 0.332 | 0.040 | 2 | Certified | 1;2 |
| Benzo[*a*]pyrene | 0.255 | 0.032 | 2 | Certified | 1;2 |
| Perylene | 0.074 | 0.030 | 2 | Certified | 1;2 |
| Benzo[*ghi*]perylene | 0.363 | 0.060 | 2 | Certified | 1;2 |
| Dibenz[*a,j*]anthracene | 0.055 | 0.016 | 2 | Certified | 1;2 |
| Dibenz[*a,c*]anthracene | 0.049 | 0.012 | 2 | Certified | 1;2 |
| Dibenz[*a,h*]anthracene | 0.055 | 0.010 | 2 | Certified | 1;2 |
| Benzo[*b*]chrysene | 0.064 | 0.030 | 2 | Certified | 1;2 |
| Picene | 0.076 | 0.022 | 2 | Certified | 1;2 |
| Dibenzo[*b,k*]fluoranthene | 0.068 | 0.012 | 2 | Certified | 1;2 |
| Dibenzo[*a,e*]pyrene | 0.0720 | 0.0060 | 2 | Certified | 1;2 |
| Coronene | 0.064 | 0.010 | 2 | Certified | 1;2 |
| Biphenyl | 0.060 | 0.036 | 2 | Reference | 1;2 |
| Fluorene | 0.030 | 0.010 | 2 | Reference | 1 |
| Dibenzothiophene | 0.071 | 0.062 | 2 | Reference | 1;2 |
| Anthracene | 0.060 | 0.044 | 2 | Reference | 1;2 |
| Cyclopenta[*cd*]pyrene | 0.052 | 0.036 | 2 | Reference | 1;2 |
| Triphenylene | 0.132 | 0.044 | 2 | Reference | 1 |
| Chrysene | 0.285 | 0.074 | 2 | Reference | 1 |
| Triphenylene + Chrysene | 0.345 | 0.018 | 2 | Reference | 2 |
| Indeno[1,2,3-*cd*]pyrene | 0.31 | 0.19 | 2 | Reference | 1;2 |

**Key to Methods**
1. Hexane/acetone pressurized fluid extraction GC/MS at NIST with Rxi-PAH GC column
2. Dichloromethane pressurized fluid extraction GC/MS at NIST with ZB-50 GC column

# SRM 2706, EPA Methods used in the Appendix Study

| | |
|---|---|
| EPA Method 3050B | *Acid Digestion of Sediments, Sludges and Soils* |
| EPA Method 200.2 | *Sample Preparation Procedure for Spectrochemical Determination of Total Recoverable Elements* |
| EPA Method 200.8 | *Determination of Trace Elements in Water and Wastes by Inductively Coupled Plasma Mass Spectrometry* |
| EPA Method 6010 | *Inductively Coupled Plasma-Atomic Emission Spectrometry* |
| EPA Method 6020 | *Inductively Coupled Plasma Mass Spectrometry* |
| EPA Method 7471 | *Mercury in Solid or Semisolid Waste (Manual Cold- Vapor Technique)* |
| EPA Method 7473 | *Mercury in Solids and Solutions by Thermal Decomposition, Amalgamation, and Atomic Absorption Spectrometry* |

| | |
|---|---|
| EPA Method 3550 | *Ultrasonic Extraction* |
| EPA Method 3570 | *Microscale Solvent Extraction (MSE)* |
| EPA Method 3630 | *Silica Gel Cleanup* |
| EPA Method 8082 | *Polychlorinated Biphenyls (PCBs) by Gas Chromatography* |
| EPA Method 8270 | *Semivolatile Organic Compounds by GC/MS* |
| EPA Method 1613 | *Tetra- through Octa-Chlorinated Dioxins and Furans by Isotope Dilution HRGC/HRMS* |
| EPA Method 8290 | *Polychlorinated Dibenzo-dioxins (PCDDs) and Polychlorinated Dibenzo-furans (PCDFs) by High-Resolution Gas Chromatography/High Resolution Mass Spectrometry (HRGC/HRMS)* |

# SRM 2706 Appendix Values

## Major and Trace Elements (39 elements)


| Element | n | Range (mg/kg) | | | Median (mg/kg) | Mean (mg/kg) | Recovery (%)[a] |
|---|---|---|---|---|---|---|---|
| Aluminum | 6 | 6100 | - | 10000 | 7800 | 8100 | 30 |
| Antimony | 5 | 40 | - | 150 | 54 | 70 | 47 |
| Arsenic | 6 | 20 | - | 31 | 28 | 27 | 89 |
| Barium | 6 | 84 | - | 110 | 93 | 96 | 30 |
| Beryllium | 6 | 0.4 | - | 0.55 | 0.47 | 0.47 | 57 |
| Boron | 1 | --- | | --- | 7.8 | 7.8 | -- |
| Cadmium | 5 | 0.26 | - | 0.35 | 0.3 | 0.31 | 99 |
| Calcium | 6 | 3700 | - | 4500 | 4000 | 4100 | 70 |
| Cerium | 1 | --- | | --- | 22 | 22 | 64 |
| Chromium | 6 | 14 | - | 21 | 19 | 18 | 31 |
| Cobalt | 5 | 4.1 | - | 5.3 | 5.2 | 4.8 | 81 |
| Copper | 6 | 72 | - | 96 | 86 | 84 | 96 |
| Iron | 6 | 11000 | - | 19000 | 17000 | 16000 | 74 |
| Lanthanum | 1 | --- | | --- | 9 | 9 | 58 |
| Lead | 6 | 530 | - | 670 | 610 | 610 | 94 |
| Lithium | 3 | 7 | - | 8.1 | 7.9 | 7.7 | 47 |
| Magnesium | 6 | 1300 | - | 2000 | 1600 | 1600 | 56 |
| Manganese | 6 | 140 | - | 180 | 170 | 160 | 67 |
| Mercury | 6 | 0.12 | - | 0.14 | 0.12 | 0.13 | 96 |
| Molybdenum | 4 | 0.83 | - | 1.7 | 1.2 | 1.2 | 101 |
| Neodymium | 1 | --- | | --- | 9.5 | 9.5 | 65 |
| Nickel | 6 | 12 | - | 18 | 17 | 16 | 69 |
| Phosphorus | 2 | 280 | - | 360 | 320 | 320 | 79 |
| Potassium | 6 | 980 | - | 2000 | 1400 | 1400 | 15 |
| Praseodymium | 1 | --- | | --- | 2.5 | 2.5 | 63 |
| Selenium | 4 | 0.13 | - | 1.8 | 0.46 | 0.71 | -- |
| Silver | 3 | 0.11 | - | 0.14 | 0.14 | 0.13 | -- |
| Sodium | 4 | 180 | - | 250 | 200 | 210 | 8 |
| Strontium | 5 | 23 | - | 27 | 25 | 25 | 41 |
| Sulfur | 1 | --- | | --- | 1500 | 1500 | 70 |
| Thallium | 2 | 0.11 | - | 0.12 | 0.11 | 0.11 | 47 |
| Thorium | 1 | --- | | --- | 2.3 | 2.3 | 53 |
| Tin | 5 | 24 | - | 37 | 31 | 30 | 84 |
| Titanium | 5 | 120 | - | 300 | 190 | 200 | 7 |
| Uranium | 1 | --- | | --- | 0.66 | 0.66 | 48 |
| Vanadium | 6 | 24 | - | 34 | 30 | 30 | 58 |
| Yttrium | 2 | 4.7 | | 6.3 | 5.5 | 5.5 | -- |
| Zinc | 6 | 110 | - | 130 | 120 | 120 | 88 |
| Zirconium | 1 | --- | | --- | 3.9 | 3.9 | 1 |

[a] Recovery (mean value) relative to the certified/reference value, where applicable

# SRM 2706 Appendix Values

## Chlorinated Dibenzo-*p*-dioxin Congeners

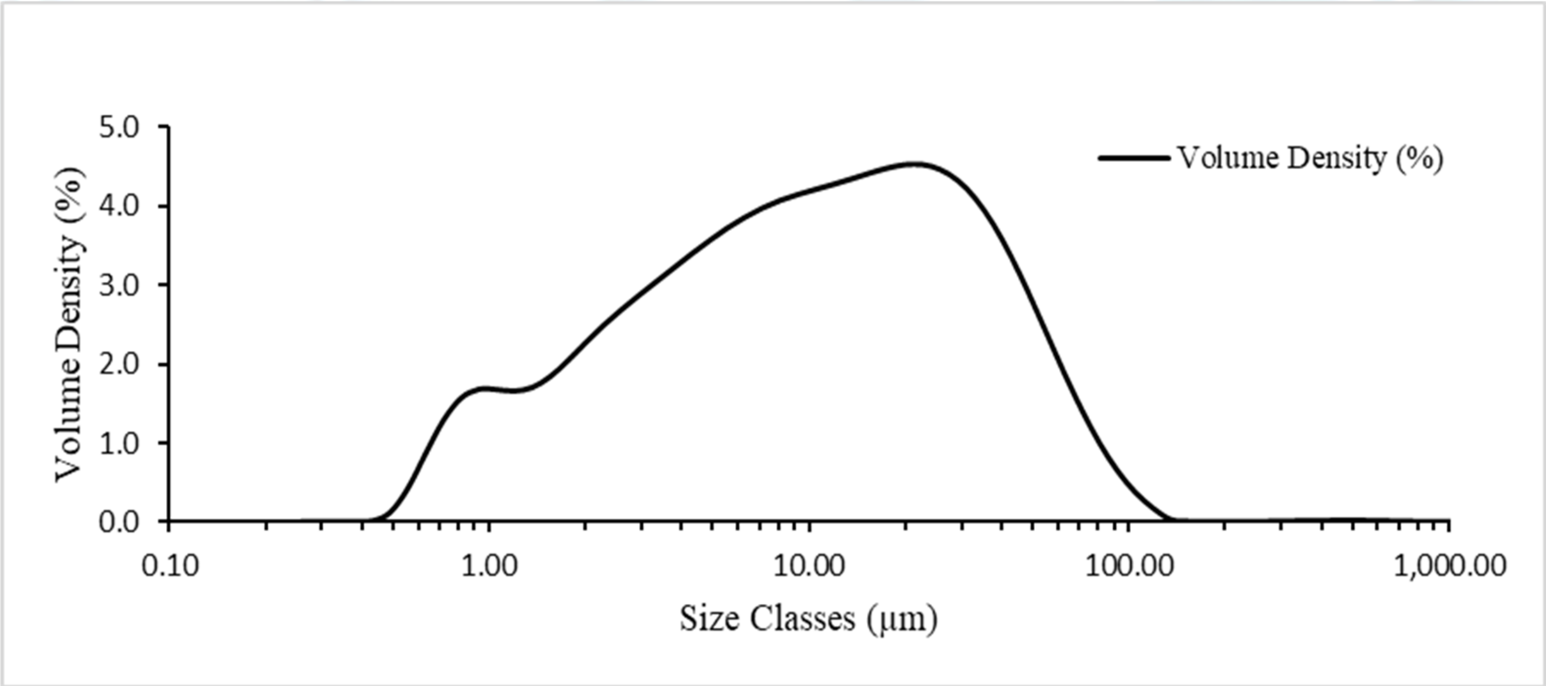
| PAHs/PCBs | n | Range (µg/kg) | | | Median (µg/kg) | Mean (µg/kg) | Recovery (%)[a] |
|---|---|---|---|---|---|---|---|
| Acenapthene | 1 | --- | | --- | 9.1 | 9.1 | 70 |
| Acenaphthylene | 2 | 53 | - | 57 | 55 | 55 | 19 |
| Anthracene | 1 | --- | | --- | 41 | 41 | 69 |
| Benzo(*a*)anthracene | 1 | --- | | --- | 110 | 110 | 46 |
| Benzo(*a*)pyrene | 1 | --- | | --- | 88 | 88 | 35 |
| Benzo(*b*)fluoranthene | 4 | 210 | - | 280 | 240 | 240 | 77 |
| Benzo(*g,h,i*)perylene | 2 | 130 | - | 140 | 130 | 130 | 36 |
| Benzo(*k*)fluoranthrene | 3 | 64 | - | 160 | 64 | 97 | 68 |
| Chrysene | 2 | 160 | - | 190 | 180 | 180 | 64 |
| Dibenzo(*a,h*)anthracene | 1 | --- | | --- | 34 | 34 | 62 |
| Fluoranthrene | 4 | 230 | - | 370 | 290 | 290 | 57 |
| Fluorene | 1 | --- | | --- | 21 | 21 | 70 |
| Indeno(1,2,3-*cd*)pyrene | 1 | --- | | --- | 93 | 93 | 30 |
| Naphthalene | 3 | 3600 | - | 7400 | 5200 | 5400 | 36 |
| Phenanthrene | 2 | 200 | - | 200 | 200 | 200 | 43 |
| Pyrene | 2 | 220 | - | 220 | 220 | 220 | 44 |
| | | | | | | | |
| Aroclor 1260 | 3 | 750 | - | 820 | 800 | 790 | -- |

[a] Recovery (mean value) relative to the certified/reference value, where applicable

## Chlorinated Dibenzofuran Congeners

| | n | Range (ng/kg) | | | Median (ng/kg) | Mean (ng/kg) |
|---|---|---|---|---|---|---|
| 2,3,7,8-TCDD | 1 | --- | | --- | 34 | 34 |
| 1,2,3,7,8-PeCDD | 1 | --- | | --- | 81 | 81 |
| 1,2,3,4,7,8-HxCDD | 1 | --- | | --- | 79 | 79 |
| 1,2,3,6,7,8-HxCDD | 1 | --- | | --- | 170 | 170 |
| 1,2,3,7,8,9-HxCDD | 1 | --- | | --- | 67 | 67 |
| 1,2,3,4,6,7,8-HpCDD | 3 | 920 | - | 1000 | 970 | 960 |
| OCDD | 3 | 8100 | - | 8800 | 8700 | 8500 |
| 2,3,7,8-TCDF | 2 | 280 | - | 670 | 480 | 480 |
| 1,2,3,7,8-PeCDF | 3 | 5400 | - | 7600 | 5500 | 6200 |
| 2,3,4,7,8-PeCDF | 2 | 8800 | - | 13000 | 11000 | 11000 |
| 1,2,3,4,7,8-HxCDF | 3 | 150000 | - | 210000 | 150000 | 170000 |
| 1,2,3,6,7,8-HxCDF | 2 | 32000 | - | 43000 | 38000 | 38000 |
| 2,3,4,6,7,8-HxCDF | 3 | 7700 | - | 11000 | 11000 | 9700 |
| 1,2,3,7,8,9-HxCDF | 2 | 2300 | - | 2500 | 2400 | 2400 |
| 1,2,3,4,6,7,8-HpCDF | 3 | 470000 | - | 660000 | 480000 | 540000 |
| 1,2,3,4,7,8,9-HpCDF | 3 | 17000 | - | 22000 | 18000 | 19000 |
| OCDF | 3 | 280000 | - | 430000 | 370000 | 360000 |
| | | | | | | |
| Total TCDF | 1 | --- | | --- | 44000 | 44000 |
| Total TCDD | 1 | --- | | --- | 740 | 740 |
| Total PeCDF | 1 | --- | | --- | 100000 | 100000 |
| Total PeCDD | 1 | --- | | --- | 1100 | 1100 |
| Total HxCDF | 2 | 300000 | - | 410000 | 360000 | 360000 |
| Total HxCDD | 1 | --- | | --- | 1300 | 1300 |
| Total HpCDF | 2 | 540000 | - | 740000 | 640000 | 640000 |
| Total HpCDD | 2 | 2300 | - | 2400 | 2400 | 2400 |

# SRM 2706, Particle Size Distribution




Malvern laser-based light scattering system
The mass median diameter is 10.4 µm. Size Range 0.5 µm to 590 µm in diameter
Approximately 49 % is below 10.1 µm in diameter

SRM 2706
Expected
availability
October 2018

National Institute of Standards & Technology

# Certificate of Analysis

## Standard Reference Material® 2706

### New Jersey Soil

### Organics and Trace Elements

This Standard Reference Material (SRM) is intended primarily for use in the analysis of selected inorganic constituents, polycyclic aromatic hydrocarbons (PAH), polychlorinated biphenyls (PCB), chlorinated dibenzo-*p*-dioxin congeners, and chlorinated dibenzofuran congeners in soils, sediments, or other materials of a similar matrix. SRM 2706 is a natural agricultural soil blended with waste soil materials containing target constituents. A unit of SRM 2706 consists of 50 g of dried, powdered soil.

**Certified Values:** Certified mass fraction values [1] of trace elements and PAHs, reported on a dry-mass basis, are provided in Tables 1 and 2. Certified values are based on results obtained from critically evaluated independent analytical techniques. A NIST certified value is a value for which NIST has the highest confidence in its accuracy in that all known or suspected sources of bias have been investigated or taken into account [2]. The measurands are the total mass fractions of the elements or PAHs reported in Tables 1 and 2. Metrological traceability is to the SI derived unit of mass fraction (expressed as either % or mg/kg) for trace elements and for selected PAHs.

**Reference Values:** Reference mass fraction values for additional trace elements and PAHs, reported on a dry-mass basis, are provided in Tables 3 and 4. The reference values are based on results obtained from NIST analytical methods, or participating external laboratories. Reference values are non-certified values that are the best estimate of the true value; however, the values do not meet NIST criteria for certification and are provided with associated uncertainties that may not include all sources of uncertainty [2]. The measurands are the total mass fractions of the trace elements or PAHs reported in Tables 3 and 4. Metrological traceability is to the SI derived unit of mass fraction (expressed as either % or mg/kg).

**Information Values:** Information values for selected trace elements and loss on fusion, are provided in Table 5. An information value is considered to be a value that will be of use to the SRM user, but insufficient information is available to assess the uncertainty associated with the value or only a limited number of analyses were performed [2]. Information values cannot be used to establish metrological traceability.

**Expiration of Certification:** The certification of **SRM 2706** is valid, within the measurement uncertainties specified, until **1 May 2028**, provided the SRM is handled in accordance with the instructions given in this certificate (see "Instructions for Use"). This certification is nullified if the SRM is damaged, contaminated, or otherwise modified.

**Maintenance of SRM Certification:** NIST will monitor this SRM over the period of its certification. If substantive technical changes occur that affect the certification before the expiration of this certificate, NIST will notify the purchaser. Registration (see attached sheet or register online) will facilitate notification.

Coordination of the technical measurements leading to the certification was performed by S.E. Long of the NIST Chemical Sciences Division.

Consultation on the statistical design and evaluation of the data was provided by Z.Q.J. Lu of the NIST Statistical Engineering Division.

# Conclusions and Future Work

The successful development of SRM 2706 (New Jersey Soil) was a highly complex project involving close cooperation between five different major stakeholders, and numerous additional contributors including nine external laboratories

## Future Work

- Addition of perfluorinated compounds eg. PFOA, PFAS
    - Method development underway at NIST

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