U. S. Department of Commerce
Malcolm Baldrige
Secretary

National Bureau of Standards
Ernest Ambler, Director

National Bureau of Standards

Certificate

Standard Reference Material 1643a

Trace Elements in Water

This Standard Reference Material is intended primarily for evaluating the accuracy of trace element determinations in filtered and acidified fresh water and for calibrating instrumentation used in these determinations. SRM 1643a approximates the elemental composition of fresh water-27 $\mu g/g$ calcium, 9 $\mu g/g$ sodium, 8 $\mu g/g$ magnesium, and 2 $\mu g/g$ potassium. Nitric acid is present at a concentration of 0.5 moles per liter to stablize the trace elements.

Concentrations of Constituent Elements: The concentrations of the trace elements that were determined are shown in the following table. The certified values are based on results obtained either by reference methods of known accuracy or by two or more independent, reliable analytical methods. Noncertified values, which are given for information only, appear in parentheses.

Notice and Warnings to Users:

Expiration of Certification: This certification is invalid after two years from the shipping date.

Precautions: The bottle should be shaken before use because of possible water vapor condensation. Pipets should not be inserted into the bottle to prevent possible contamination of the SRM. After use, the bottle should be capped tightly and placed inside the aluminized bag, which should be folded and sealed with a sealing tape. This safeguard will protect the SRM from possible environmental contamination and long-term loss of water.

Elemental determinations at ng/g levels are limited by contamination. Apparatus should be scrupulously cleaned and only the purest grade reagents employed. Samplings and manipulations, such as evaporations, should be done in a clean environment-for example, a Class 100 clean hood.

The overall direction and coordination of the technical measurements leading to this certificate were performed under the chairmanship of I. L. Barnes and J. R. Moody.

The technical and support aspects involved in the preparation, certification, and issuance of this Standard Reference Material were coordinated through the Office of Standard Reference Materials by R. Alvarez.

Washington, D.C. 20234
July 19, 1982
(Revision of Certificate
dated March 3, 1980)

George A. Uriano, Chief
Office of Standard Reference Materials

(over)

Concentration of Constituent Elements

Element	Concentration[a] ng/g	Element	Concentration[a] ng/g
Arsenic	76 ± 7	Manganese	31 ± 2
Barium	46 ± 2	Mercury[b]	(<0.2)
Beryllium	19 ± 2	Molybdenum	95 ± 6
Cadmium	10 ± 1	Nickel	55 ± 3
Chromium	17 ± 2	Selenium	11 ± 1
Cobalt	19 ± 2	Silver	2.8 ± 0.3
Copper	18 ± 2	Strontium	239 ± 5
Iron	88 ± 4	Vanadium	53 ± 3
Lead	27 ± 1	Zinc	68 ± 4

[a]The estimated uncertainty is based on judgment and represents an evaluation of the combined effects of method imprecision and possible systematic errors among methods. (No attempt was made to derive exact statistical measures of imprecision because several methods were involved in the determination of the constituents.) To convert to nanograms per milliliter, multiply by the density of the SRM. The density at 23 °C is 1.017 grams per milliliter.

[b]Mercury is *not certified.* Gold had been added at a concentratio of 15 ng/mL in an attempt to stabilize mercury added at a concentration of 1 ng/mL.

Source and Preparation of Material: SRM 1643a was prepared at the U.S. Geological Survey, National Water Quality Laboratory, Arvada, Colorado, under the direction of L. Schroeder of that laboratory and J. R. Moody of the NBS Center for Analytical Chemistry. Only high-purity reagents were used and the containers were acid-cleaned and sterilized before use. In the preparation, a polyethylene cylindrical tank was filled with approximately 1000 liters of distilled water and sufficient nitric acid to make the solution approximately 0.5 moles HNO_3 per liter. Solutions containing known amounts of calcium, sodium, magnesium, potassium, gold, and the elements to be determined were added to the acidified water solution with constant stirring. After thoroughly mixing, the solution was filtered, sterilized, and then transferred to one liter polythylene bottles.

Analytical Methods Used:

Atomic absorption spectrometry, electrothermal atomization

Atomic absorption spectrometry, vapor generation

Flame emission spectrometry

Isotope dilution mass spectrometry, thermal ionization

Neutron activation, instrumental

Neutron activation, radiochemical

Photon activation

Polarography

Spectrophotometry

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