U.S. Department of Commerce
Juanita M. Kreps
Secretary
National Bureau of Standards
Ernest Ambler, Acting Director

# National Bureau of Standards Certificate

## Standard Reference Material 1643

### 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 1643 approximates the elemental composition of fresh water--27 $\mu$g/g calcium, 10 $\mu$g/g sodium, 7 $\mu$g/g magnesium, and 2 $\mu$g/g potassium. Nitric acid is present at a concentration of 0.5 moles per liter to stabilize 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 one year from the shipping date because of limited information on the long-term stability of this SRM.

**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.

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
May 11, 1977

J. Paul Cali, Chief
Office of Standard Reference Materials

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Concentration of Constituent Elements

| Element | Concentration[a] ng/g | Element | Concentration, ng/g |
|---|---|---|---|
| Aluminum | 77 ± 1 | Manganese | 29 ± 1 |
| Arsenic | 76 ± 1 | Mercury[c] | (2) |
| Barium[b] | (18) | Molybdenum | 105 ± 3 |
| Beryllium | 19 ± 1 | Nickel | 49 ± 1 |
| Cadmium | 8 ± 1 | Selenium | 12 ± 1 |
| Chromium | 15 ± 1 | Silver | 3.4 ± 0.4 |
| Cobalt | 17 ± 1 | Strontium | 212 ± 4 |
| Copper | 16 ± 1 | Vanadium | 50 ± 1 |
| Iron | 75 ± 1 | Zinc | 65 ± 3 |
| Lead[d] | 20 ± 1 | | |

[a] The estimates of accuracy shown are believed to express the overall uncertainty of the certified values. To convert to nanograms per milliliter, multiply by the density of the SRM. The density at 23 °C is 1.015 grams per milliliter.

[b] Barium is *not certified* because of the large difference between its initial concentration (39 ng/g), corresponding to the amount added to the water, and the stabilized concentration (18 ng/g). However, this stabilized concentration has remained constant in the test-bottles for over four months.

[c] Mercury is *not certified* because polyethylene is not a satisfactory container-material for maintaining long-term integrity of stabilized concentrations of this element. Gold was added at a concentration of 10 nanograms per milliliter to stabilize the mercury added originally.

[d] Although the concentration of lead that corresponded to the amount added to the water matrix was 24 ng/g, the stabilized concentration reported by five independent analytical methods has remained at 20 ± 1 ng/g for over nine months.

**Source and Preparation of Material:** SRM 1643 was prepared by J. R. Moody. Only high-purity reagents were used and all equipment and containers were acid-cleaned before use. In the preparation, weighed amounts of water and nitric acid were added to fill a polyethylene drum, which contained approximately 230 liters. 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. The solution was thoroughly mixed by stirring for several days with a polyethylene paddle and by removing some of the solution through a spigot at the bottom of the drum and returning it to the top. The solution was transferred to one liter bottles. All of the manipulations and operations were carried out in a Class 100 clean laboratory.