



## SLRS-4

### *River Water Reference Material for Trace Metals*

The following table shows the twenty-two metals for which certified values have been established for SLRS-4. Certified values are based on the results of determinations by at least two independent methods of analysis. The uncertainties represent 95 percent confidence limits for an individual subsample. That is, 95 percent of samples from any bottle would be expected to have concentrations within the specified range 95 percent of the time.

#### Trace Metals - Micrograms/Litre

Aluminum (c,g,j) <sup>†</sup>	54	±	4
Antimony (d,h)	0.23	±	0.04
Arsenic (c,e,h)	0.68	±	0.06
Barium (d,j)	12.2	±	0.6
Beryllium (c,e)	0.007	±	0.002
Cadmium (d,e,m,n)	0.012	±	0.002
Chromium (e,j,m)	0.33	±	0.02
Cobalt (e,n)	0.033	±	0.006
Copper (c,e,j,m)	1.81	±	0.08
Iron (g,j,m)	103	±	5
Lead (d,e,m,n)	0.086	±	0.007
Manganese (c,g,j)	3.37	±	0.18
Molybdenum (d,e)	0.21	±	0.02
Nickel (e,j,m,n)	0.67	±	0.08
Strontium (d,j)	26.3	±	3.2
Uranium (d)	0.050	±	0.003
Vanadium (c,e,n,j)	0.32	±	0.03
Zinc (c,g,j,m)	0.93	±	0.10

#### Other Metals - Milligrams/Litre

Calcium (f,i)	6.2	±	0.2
Magnesium (f,i)	1.6	±	0.1
Potassium (f,i)	0.68	±	0.02
Sodium (f,i)	2.4	±	0.2

† - See overleaf for key to coding

## Coding

- c - Direct determination by inductively coupled plasma mass spectrometry (ICPMS)
- d - Direct determination by isotope dilution ICPMS
- e - Concentration by evaporation; graphite furnace atomic absorption spectrometry (GFAAS) determination
- f - Direct determination by flame atomic absorption spectrometry (FAAS)
- g - Direct determination by GFAAS
- h - Hydride generation; GFAAS determination
- i - Direct determination by inductively coupled plasma emission spectrometry (ICPAES)
- j - Concentration by evaporation; ICPAES determination
- m - Matrix separation; IDICPMS determination
- n - Matrix separation; ICPMS determination

This reference material is primarily intended for use in the calibration of procedures and the development of methods used for the analysis of river waters for trace metals.

SLRS-4 is the fourth batch of river water certified reference material for trace metals. This sample of river water was gathered at the 2 to 3 m level in the Ottawa River at Chenuaux, Ontario, about 100 km upstream from Ottawa. The water was peristaltically pumped through cleaned polyethylene lined ethyl vinyl acetate tubing and 0.45 µm porosity acrylic copolymer filters. It was acidified immediately with ultrapure nitric acid to pH 1.6 during transfer to 50-litre polypropylene carboys. The water was later refiltered through 0.2 µm porosity acrylic copolymer filters into two 800-litre polyethylene tanks in a clean room at NRC. It was subsequently blended by circulative pumping and bottled in pre-cleaned polyethylene containers. The bottled water was gamma irradiated to a minimum dose of 25 kGy at the Canadian Irradiation Centre, Laval, Québec, to inhibit any bacterial action.

It is recommended that the material be stored in a cool, clean location. The bottles should be opened only in a clean area with precautions taken against contamination during sampling. Studies of similar waters indicate that the material is stable with respect to total trace metal concentrations for at least ten years.

## Certification

Most of the analytical work was done within the Institute for National Measurement Standards. An external expert laboratory cooperated in the certification process. Randomly selected bottles were chosen for the analytical determinations. Results from different bottles showed no significant differences, nor was there any correlation between values obtained and bottle

sequence. Thus, it is assumed that the trace metals concentrations of all bottles are essentially the same. It would appear from the values obtained that the river water was not significantly contaminated in the collection and bottling process. It is anticipated that as more data become available the established values may be updated and certified numbers assigned to more elements. These updates will be posted on our website ([http://inms-ienm.nrc-cnrc.gc.ca/calserv/chemical\\_metrology\\_e.html](http://inms-ienm.nrc-cnrc.gc.ca/calserv/chemical_metrology_e.html)).

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*The results listed in this certificate are traceable to the SI through gravimetrically prepared standards of established purity and international measurement intercomparisons. As such, they serve as suitable reference materials for laboratory quality assurance programs, as outlined in ISO/IEC 17025. This CRM is registered at the Bureau International des Poids et Mesures (BIPM) in Appendix C of the Comité International des Poids et Mesures database listing Calibration and Measurement Capabilities accepted by signatories to the Mutual Recognition Arrangement of the Metre Convention.*

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