



## CASS-4

### *Nearshore Seawater Reference Material for Trace Metals*

The following table shows the twelve metals for which certified values have been established. Certified values are based on the results of determinations by at least two independent methods of analysis. Each uncertainty is based on a 95 percent confidence limit for the mean. 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 Metal Concentrations (micrograms/litre)

Arsenic (f,h,j,r)	1.11	±	0.16
Cadmium (c,i,p,r,s)	0.026	±	0.003
Chromium (i,p)	0.144	±	0.029
Cobalt (f,i,q)	0.026	±	0.003
Copper (i,p,r,s)	0.592	±	0.055
Iron (i,p,s)	0.713	±	0.058
Lead (c,i,p,s)	0.0098	±	0.0036
Manganese (f,i,q,s)	2.78	±	0.19
Molybdenum (d,p)	8.78	±	0.86
Nickel (c,i,p,r,s)	0.314	±	0.030
Uranium (p)	(3.0)*		
Vanadium (f,q)	1.18	±	0.16
Zinc (f,i,p,s)	0.381	±	0.057

\*information value only

- c - Chelation-solvent extraction separation, inductively coupled plasma mass spectrometry (ICPMS)
- d - Direct determination by graphite furnace atomic absorption spectrometry (GFAAS)
- f - Reductive precipitation separation, ICPMS determination
- h - Hydride generation, electrothermal vaporization ICPMS determination

- i - Immobilized ligand separation, GFAAS determination
- j - Hydride generation, atomic absorption determination
- p - Immobilized ligand separation, isotope dilution ICPMS
- q - Immobilized ligand separation, ICPMS
- r - Reductive precipitation separation, GFAAS determination
- s - Chelation-solvent extraction separation, GFAAS determination

The water was collected June 1998 from Halifax harbour at a depth of 12 m and has a salinity of 30.7. The sample was peristaltically pumped through cleaned polyethylene lined ethyl vinyl acetate tubing and 0.45 µm acrylic copolymer filters. It was acidified to pH 1.6 with ultrapure nitric acid during its immediate transfer to 50-litre acid leached polypropylene carboys previously conditioned with ultrapure water acidified to pH 1.6. In a clean room at NRC the seawater was later refiltered through 0.2 µm acrylic copolymer filters, homogenized in precleaned polyethylene tank and immediately bottled in cleaned 500 mL polyethylene bottles. 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.

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

Randomly selected bottles were chosen for the homogeneity testing and 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.

Studies of similar waters indicate that the material is stable with respect to total trace metal concentrations for at least ten years.

Most of the analytical work was done within the Institute for National Measurement Standards. Several external expert laboratories cooperated in the certification process. It appears from the values obtained that the seawater 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 sent to all users of this reference material and 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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