



## NASS-5

### 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. 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 Metal Concentrations (micrograms/litre)

Arsenic	1.27	±	0.12
Cadmium	0.023	±	0.003
Chromium	0.110	±	0.015
Cobalt	0.011	±	0.003
Copper	0.297	±	0.046
Iron	0.207	±	0.035
Lead	0.008	±	0.005
Manganese	0.919	±	0.057
Molybdenum	9.6	±	1.0
Nickel	0.253	±	0.028
Selenium(IV)	(0.018)*		
Uranium	(2.6)*		
Vanadium	(1.2)*		
Zinc	0.102	±	0.039

\*information value only

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| c- Co-precipitation separation, isotope dilution inductively coupled plasma mass spectrometry (IDICPMS) determination  | i - Matrix separation, GFAAS determination                       |
| d- Direct determination by graphite furnace atomic absorption spectrometry (GFAAS)                                     | n - Hydride generation, GFAAS determination                      |
| h- Hydride generation, electrothermal vaporization, inductively coupled plasma mass spectrometry (ICPMS) determination | p - Matrix separation, IDICPMS determination                     |
|  | q - Matrix separation, ICPMS determination                       |
|  | r - Reductive precipitation separation, GFAAS determination      |
|  | s - Chelation-solvent extraction separation, GFAAS determination |

NASS-5 is the fifth in a series of ocean water certified reference materials for trace metals. The seawater (salinity 30.4) was collected in the North Atlantic at a depth of 10 m, 35 km southeast of Halifax, NS, Canada. The water 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. The seawater was later homogenized in two linked 800-litre polyethylene tanks in a clean room at NRC and immediately bottled in cleaned 500 ml polyethylene bottles. Because NASS-5 was collected at an entirely different location of the North Atlantic and at a different depth, the trace metal profile is different from the first, second and third NASS series of certified reference materials.

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 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. Two external expert laboratory cooperated in the certification process. It would appear 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)).

These members of the staff of the Institute for National Measurement Standards, NRC, participated in the collection, preparation and analysis of NASS-5: V. Clancy, L. Delorme, J. Lam, P. Maxwell, J.W. McLaren, A. Mykytiuk, S. Willie and L. Yang.

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J. Wu, Department of Earth, Atmospheric & Planetary Sciences, MIT, Cambridge, MA

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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.*

*Comments, information and inquiries should be addressed to:*

**Dr. R.E. Sturgeon**  
**National Research Council of Canada**  
**Institute for National Measurement**  
**Standards**  
**M-12, Montreal Road**  
**Ottawa, Ontario, Canada K1A 0R6**

Telephone (613) 993-2359  
Facsimile (613) 993-2451  
E-mail [crm.inms@nrc-cnrc.gc.ca](mailto:crm.inms@nrc-cnrc.gc.ca)

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