Certified Reference Material

NASS-6

Seawater Reference Material for Trace Metals

The following table lists the elements for which certified values have been established along with their expanded uncertainty ($U_{CRM} = ku_c$, where u_c is the combined standard uncertainty calculated according to the JCGM Guide [1] and k=2 is the coverage factor). It is intended that U_{CRM} encompasses every aspect that reasonably contributes to the uncertainty of the certified mass fraction. Certified values are based on the results of determinations by at least two independent methods of analysis. Information values (identified with an "*") are listed for elements which could not be certified because of insufficient information for accurate assessment of the associated uncertainties. A measured density of 1.024 g/mL was used to calculate mass concentrations in NASS-6.

Table 1: Certified quantity values for NASS-6

Element	Mass Fraction, (µg/kg)	Mass Concentration, (µg/L)
Arsenic (j,r)	1.40 ± 0.12	1.43 ± 0.12
Cadmium (i,p,r,t)	0.0303 ± 0.0019	0.0311 ± 0.0019
Chromium (p,r)	0.116 ± 0.008	0.118 ± 0.008
Cobalt (q)	0.015*	0.015*
Copper (i,p,r)	0.242 ± 0.025	0.248 ± 0.025
Iron (i,p)	0.483 ± 0.045	0.495 ± 0.046
Lead (p,t)	0.006 ± 0.002	0.006 ± 0.002
Manganese (i,q)	0.516 ± 0.047	0.530 ± 0.050
Molybdenum (p)	9.66 ± 0.70	9.89 ± 0.72
Nickel (i,p,r)	0.294 ± 0.025	0.301 ± 0.025
Uranium (p)	3.*	3.*
Vanadium (q,t)	1.42 ± 0.16	1.46 ± 0.17
Zinc (i,p)	0.251 ± 0.020	0.257 ± 0.020

Coding

The coding refers only to the instrumental method of analyte determination.

i - Immobilized ligand separation, determination by graphite furnace atomic absorption spectrometry (GFAAS)
j - Hydride generation, atomic absorption determination
p - Immobilized ligand separation, determination by isotope dilution ICPMS
q - Immobilized ligand separation, determination by ICPMS
r - Reductive precipitation separation, determination by GFAAS
t - Immobilized ligand separation, determination by ICP-TOFMS

Intended Use

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.

Storage and Sampling

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.

Preparation of NASS-6

The water was collected March 2007 from Sandy Cove, Nova Scotia. 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 a precleaned polyethylene tank and bottled in cleaned 500 mL polyethylene bottles. The salinity of NASS-6 is 33.5. 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.

Stability

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

Expiry

The certified values for NASS-6 are considered valid until June 2020, provided the CRM is handled and stored in accordance with instructions herein.

Certified value

The analytical work was performed within NRC. Certified values were calculated using a procedure that conforms to the ISO framework of combining measurement uncertainties. Individual method uncertainties were calculated and combined with a type B bias uncertainty to derive the final uncertainty values [2].
Based on NRC's experience with similar materials, uncertainty components for homogeneity, and long and short term stability were considered negligible and are thus not included in the uncertainty budget.

Metrological Traceability

Results presented 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.

Accreditation

The Chemical Metrology laboratory is compliant to ISO 17025 and ISO Guide 34, with approval by The Inter-American Metrology System (SIM). The certificate of approval is available upon request.

Updates

Users should ensure that the certificate they have is current. Our web site at http://www.nrc-cnrc.gc.ca will contain any new information.

References

1. Evaluation of measurement data – Guide to the expression of uncertainty in measurement JCGM 100:2008.

2. M.S. Levenson et al., An Approach to Combining Results From Multiple Methods Motivated by the ISO GUM, J. Res. Natl. Inst. Stand. Technol. 105, 571 (2000)

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NASS-6

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Approved by:

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This Certificate is only valid if the corresponding product was obtained directly from NRC or one of our qualified vendors.

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