Certified Reference Material

MOOS-2

Seawater certified reference material for nutrients

The following table lists the measurands 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 in amount content.

Table 1: Certified quantity values for MOOS-2

Nutrient	µmol/L
Orthophosphate	1.58 ± 0.10
Silicate	28.8 ± 1.0
Nitrite	3.31 ± 0.18
Nitrite and Nitrate	24.9 ± 1.0

Intended use

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

Analytical methods

Methods based on traditional colorimetric procedures were predominately used, such as those of the USEPA [2-4]. Independent methods, based on ion chromatography for nitrite and nitrate and ion exclusion chromatography inductively coupled plasma mass spectrometry for silicate and phosphate, were developed at NRC to augment the colorimetric results.

Storage and sampling

This material should be stored in the original bottle in a refrigerator (4 °C), although samples stored at -20 °C or +40 °C for two month periods have not undergone detectable changes.

Once opened, contamination may induce changes in the measurand. Care should be taken if it is intended to remove only a portion of the sample and store the remainder for use at a later date. The bottle should be opened for the minimal period in a clean area and otherwise remain tightly closed.

Collection of water for MOOS-2

MOOS-2 was collected at latitude 47.062833 ^{o}N, longitude 59.982333 ^{o}W, off the northern tip of Cape Breton Island, NS, Canada. The water was sampled from a depth of about 200 m using a rosette containing 22 Niskins, each of about 10 L volume. The contents of each Niskin were transferred, using a peristaltic pump, through a 0.05 µm cartridge filter into 50 L carboys. The water was collected June 24, 1996 irradiated July 16, 1996 and stored in a cold room at NRC. In May 2008, the water was homogenized and bottled.

Certified value

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 values [5]. An inhomogeneity contribution to uncertainty based on experimentally determined between-unit variance was included for orthophosphate. No similar trend was observed for the other certified measurands. Uncertainty components for long and short term stability were considered negligible and are thus not included in the uncertainty budget as no significant change occurred in the certified concentrations in MOOS-1 over a period of 12 years.

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. J. Zhang and G. Berberian, EPA Method 366.0, Determination of dissolved silicate in estuarine and coastal waters by gas segmented continuous flow colorimetric analysis. Sept., 1997. U.S. Environmental Protection Agency, Cincinnati, Ohio.

3. C.F. Zimmermann and C.W. Keefe, EPA Method 365.5, Determination of orthophosphate in estuarine and coastal waters by automated colorimetric analysis. Sept., 1997. U.S. Environmental Protection Agency, Cincinnati, Ohio.

4. J. Zhang, P.B.Ortner and C.J. Fischer, EPA Method 353.4, Determination of Nitrate and Nitrite in Estuarine and Coastal Waters by Gas Segmented Continuous Flow Colorimetric Analysis. Sept., 1997. U.S. Environmental Protection Agency, Cincinnati, Ohio.

5. 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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