National Research Council Canada | Conseil national de recherches Canada

Certificate of Analysis

Certified Reference Material

SLRS -7

River Water Certified Reference Material for Trace Metals and other Constituents

SLRS-7 is a river water Certified Reference Material (CRM) prepared at the National Research Council of Canada (NRC) with information on trace element content and other constituents. A unit of SLRS-7 consists of approximately 200 mL of river water. This material is intended for use in the method development, validation, and quality control for the analysis of trace and matrix constituents in fresh water matrices.

The following tables show those constituents for which certified, reference and information values have been established for this river water CRM. The density of SLRS-7 is 0.9985 g/mL at 21 °C.

Table 1: Certified values and expanded uncertainties (*k* = 2) for SLRS-7

Element	Mass fraction, µg/kg	Mass concentration, µg/L (21 °C)
aluminium (b,c,d)	33.9 ± 2.2	33.8 ± 2.2
antimony (a,b)	0.3377 ± 0.0058	0.3372 ± 0.0058
arsenic (b,c,e)	0.57 ± 0.08	0.57 ± 0.08
barium (a,b,c,d)	14.30 ± 0.48	14.28 ± 0.48
cadmium (a,b)	0.0063 ± 0.0014	0.0063 ± 0.0014
calcium (c,d)	8770 ± 200	8760 ± 200
chromium (a,b,d)	0.252 ± 0.012	0.252 ± 0.012
copper (a,b,c,d)	24.0 ± 1.8	23.9 ± 1.8
iron (a,b,c,d)	84.5 ± 3.6	84.3 ± 3.6
lead (a,b)	0.170 ± 0.026	0.170 ± 0.026
magnesium (c,d)	2137 ± 58	2133 ± 58
manganese (b,c,d)	2.12 ± 0.10	2.12 ± 0.10
molybdenum (a,b,d)	0.215 ± 0.018	0.215 ± 0.018
nickel (a,b,d)	0.617 ± 0.022	0.616 ± 0.022
potassium (c,d)	652 ± 54	651 ± 54
sodium (c,d)	2770 ± 220	2760 ± 220
strontium (a,b,c,d)	40.72 ± 0.32	40.66 ± 0.32
uranium (a,b)	0.0699 ± 0.0034	0.0698 ± 0.0034
vanadium (b,d)	0.352 ± 0.006	0.351 ± 0.006
zinc (a,b,c,d)	1.76 ± 0.12	1.76 ± 0.12

Refer to the sections below for additional explanations

Period of validity: until August 2036
Storage conditions: at approximately +4 °C under typical refrigerator conditions

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Table 2: Reference values and expanded uncertainties for SLRS-7

Element	Mass fraction, µg/kg	Mass concentration, µg/L (21 °C)
beryllium (b)	0.0066 ± 0.0022	0.0066 ± 0.0022
cobalt (b)	0.053 ± 0.012	0.053 ± 0.012

Table 3: Information values for SLRS-7

Compound	Mass fraction, µg/kg	Mass concentration, µg/L (21 °C)
inorganic arsenic (f)	0.36	0.36
monomethylarsenic (as As) (f)	0.07	0.07
dimethylarsenic (as As) (f)	0.07	0.07
trimethylarsenic (as As) (f)	0.021	0.021

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 water for trace metals. A minimum sample volume of 10 mL is recommended.

Preparation of material

Untreated river water was collected at the City of Ottawa's Britannia Water Purification Plant. The water was peristaltically pumped through 0.45 µm porosity acrylic copolymer filters and immediately acidified with ultrapure nitric acid to pH 1.6 during transfer to polypropylene carboys. The water was later refiltered through 0.2 µm porosity acrylic copolymer filters into a polyethylene tank in a clean room at NRC. It was subsequently blended and bottled in precleaned polyethylene containers. The bottled water was gamma irradiated to a minimum dose of 25 kGy to inhibit any bacterial action. The first batch was released as SLRS-6, while the second batch as SLRS-7. Both batches were processed simultaneously. Both SLRS-6 and SLRS-7 were assessed to ensure they are identical in composition.

Characterization of material

The explanatory list of letters next to each compound (Tables 1 to 3) refers to the instrumental method used for measurements:

a) Isotope dilution inductively-coupled plasma mass spectrometry (ID-ICP-MS)
b) Standard addition inductively-coupled plasma mass spectrometry (SA-ICP-MS)
c) Inductively-coupled plasma mass spectrometry (ICP-MS)
d) Standard addition inductively-coupled plasma atomic emission spectroscopy (SA-ICP-AES)
e) Hydride generation SA-ICP-MS
f) Hydride generation cryo-trapping ICP-MS

Metrological traceability

Results presented in this certificate are traceable to the International System of Units (SI) through gravimetrically prepared standards of established purity, CRMs and international measurement intercomparisons. As such, SLRS-7 serves as suitable reference material for laboratory quality assurance programs, as outlined in ISO/IEC 17025.

Homogeneity

The material was tested for homogeneity at NRC using ICP-MS. Results from 10 mL sub-samples were evaluated using ANOVA and/or the DerSimonian-Laird random effects model and included in the calculation of the certified values [1].

Stability

The predecessor CRMs have been periodically analysed for more than 25 years and found to be stable with respect to total trace metal concentration over this interval. Uncertainty components for long- and short-term stability were considered negligible and are thus not included in the uncertainty budget.

Uncertainty

The expanded uncertainty (U) for all values is equal to $U = ku_c$, where u_c is the combined standard uncertainty calculated according to the Joint Committee for Guides in Metrology (JCGM) [2] and k is the coverage factor. A coverage factor of $k = 2$ was applied which corresponds to a level of confidence of approximately 95 %.

All reasonable sources of uncertainty related to the certified and reference values in Table 1 and 2 were considered. Included in the combined uncertainty estimate are uncertainties in the batch characterization, uncertainties related to possible between-unit variation, and uncertainties related to inconsistency between the various measurement methods. The latter is estimated as the heterogeneity in the random effects model fitted to the results of individual methods, also known as the dark uncertainty [3,4].

Storage

It is recommended that the material be stored at 4 °C under typical refrigerator conditions. The material shall not be frozen.

Instructions for handling and use

The bottles should be opened only in a clean area with precautions taken against contamination during sampling.

Repeated sub-sampling and storage of the CRM solution after initial opening may impact certified values. Users shall take responsibility for demonstrating that their sub-sampling and storage procedures do not impact certified values.

Health and safety information

Only qualified personnel should handle the material and appropriate disposal methods should be used. A Safety Data Sheet (SDS) is available at doi.org/10.4224/crm.2026.slrs-7. For laboratory use only; not for human consumption, therapeutic, drug, household, or any other uses.

Period of validity

The certified and reference values are valid through August 2036, provided the storage and instructions for handling and use specified in this certificate are followed.

Quality Management System

The NRC is Canada's national metrology institute (NMI) and is a signatory of the International Committee for Weights and Measures Mutual Recognition Arrangement (CIPM MRA). The CIPM MRA was developed in a response to a growing need for an open, transparent, and comprehensive scheme to give users reliable quantitative information on the comparability of national metrology services and to provide the technical basis for wider agreements negotiated for international trade, commerce, and regulatory affairs. Our Quality Management System for

measurement services and certified reference materials conforms to the requirements of ISO/IEC 17025 and ISO 17034.

The Calibration and Measurement Capabilities (CMC) supporting the results in Table 1 are listed in the International Bureau of Weights and Measures (BIPM) Key Comparison Database (https://www.bipm.org/kcdb/) which recognizes the validity of the measurements performed by NMIs participating in the CIPM MRA. The NRC has the following CMCs relevant for this material: measurements applied for determining certified values of aluminium (SIM-QM-CA-000000BK-2), antimony (SIM-QM-CA-000000BL-2), arsenic (SIM-QM-CA-000000BM-2), barium (SIM-QM-CA-000000BN-2), beryllium (SIM-QM-CA-000000BO-2), cadmium (SIM-QM-CA-000000BP-2), calcium (SIM-QM-CA-000000CF-2), chromium (SIM-QM-CA-000000BQ-2), cobalt (SIM-QM-CA-000000BR-2), copper (SIM-QM-CA-000000BS-2), iron (SIM-QM-CA-000000BT-2), lead (SIM-QM-CA-000000BU-2), magnesium (SIM-QM-CA-000000CH-2), manganese (SIM-QM-CA-000000BV-2), molybdenum (SIM-QM-CA-000000BW-2), nickel (SIM-QM-CA-000000BX-2), potassium (SIM-QM-CA-000000CG-2), sodium (SIM-QM-CA-000000CI-2), strontium (SIM-QM-CA-000000BY-2), uranium (SIM-QM-CA-000000BZ-2), vanadium (SIM-QM-CA-000000C0-2), zinc (SIM-QM-CA-000000C1-2) in fresh water.

Description of terms

Certified values are those for which the NRC has the highest confidence and that all known and suspected sources of bias have been considered by the NRC and are reflected in the stated expanded uncertainties.

Reference values are those for which not all uncertainty contributions may have been fully investigated or metrological traceability has not been fully established by the NRC.

Information values are those that may be of interest to users, but for which the NRC has not established sufficient information to provide an estimate of uncertainty, or that reflect a lack of agreement between different methods of analysis.

References

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This certificate is only valid if the corresponding material was obtained directly from the NRC or an authorized reseller. Users should ensure that the certificate they have is current. For updates, please refer to doi.org/10.4224/crm.2026.slrs-7.

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