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Certificate of Analysis ISO 17034

Multi-Element Aqueous Certified Reference Material

Product Name: New Hampshire Heavy Metal Mixture

Product No.: DRE-100-90000010-S8 **Lot No.:** 1195716-1

Matrix: 2% HNO_3,1% HCl Acid **Expiration Date:** June 30, 2023

Intended Use: This solution is intended for use as a certified reference material or calibration standard for inductively coupled plasma optical emission spectroscopy (ICP-OES), inductively coupled plasma mass spectrometry (ICP-MS), or alternative techniques for elemental detection, such as flame or furnace atomic absorption spectroscopy (AA or GFAA).

Analyte	Certified Concentration & Uncertainty	Analyte	Certified Concentration & Uncertainty
As	**5.000 ± 0.025 µg/mL**	**Hg**	**9.000 ± 0.045 µg/mL**
Cd	**2.999 ± 0.015 µg/mL**	**Pb**	**9.000 ± 0.045 µg/mL**

Indicative Values: ICP-MS was used to determine trace metal concentrations for this product (*nd = not determined*).

Trace Concentrations (µg/L)

Ag	<0.5	Co	<1	Ge	<0.5	Lu	<0.2	P	<100	Sb	<0.5	Te	<1
Al	<2	Cs	<0.5	Hf	1	Mg	<5	Pb	MAJOR	Sc	<5	Ti	<2
As	MAJOR	Cr	<0.5	Hg	MAJOR	Mn	<1	Pd	<0.5	Se	<2	Tl	<0.5
Au	<0.5	Cu	2	Ho	<0.2	Mo	<0.5	Pr	<0.2	Si	<100	Tm	<0.2
B	<5	Dy	<0.2	In	nd	Na	<25	Pt	<0.5	Sm	<0.2	V	<1
Ba	<1	Er	<0.2	Ir	<0.2	Nb	<0.5	Rb	<0.5	Sn	<0.5	W	<0.5
Bi	<0.2	Eu	<0.2	K	<25	Nd	<0.2	Re	<0.2	Sr	<1	Y	<0.5
Ca	<25	Fe	<10	La	<0.5	Ni	<2	Rh	<0.5	Ta	<0.5	Yb	<0.2
Cd	MAJOR	Ga	<0.5	Li	<2	Os	<0.5	Ru	<0.5	Tb	<0.5	Zn	<2
Ce	<0.2	Gd	<0.2										

Certification & Traceability: This CRM was manufactured, processed, and/or certified under a quality management system that is registered/accredited **ISO 17034**, **ISO/IEC 17025 and** to **ISO 9001**. This CRM was prepared to the certified concentrations shown above by gravimetric methods, using single-element concentrates that were certified using the "High Performance ICP-OES" protocol developed by NIST and are directly traceable to **NIST SRMs (see reverse side)**. The solution was diluted with filtered (0.22 µm), 18 M-ohm deionized water and stabilized with the appropriate high-purity acid as indicated in the listed matrix. The balances used in the preparation of this CRM are calibrated regularly with traceability to NIST, using a calibration provider that is accredited to ISO/IEC 17025 by a mutually recognized accreditation body. All volumetric dilutions are performed in Class A calibrated glassware. The certified concentrations were determined based upon gravimetric procedures. Secondary verification of the certified concentrations was performed using ICP-OES that was calibrated and/or referenced against NIST SRMs. The uncertainty associated with each certified concentration represents the expanded uncertainty at the 95% confidence level using a coverage factor of k=2.

Instructions for Use: Expiry of this reference material is six (6) months after opening of container or as listed above, whichever occurs first. We recommend that the solution be thoroughly mixed by repeated shaking or swirling of the bottle immediately prior to use. To achieve the highest accuracy, the analyst should: (1) use only pre-cleaned containers and transferware, (2) not pipette directly from the CRM's original container, (3) never pour used product back into the original container, (4) make dilutions using calibrated balances or certified Class A volumetric flasks and pipettes, (5) use a minimum sub-sample size of 500 µL, and (6) dilute with the same matrix as the original CRM or other chemically suitable matrix. The solution should be kept tightly capped and stored under normal laboratory conditions. Do not freeze, heat, or immerse the bottle or its contents, and avoid exposure to direct sunlight or moisture.

Period of Validity: LGC Standards ensures the accuracy of this solution until the expiration date shown above provided the Instructions for Use are followed. During the Period of Validity, the purchaser will be notified if this product is recalled due to any significant changes in the stability of the solution.

Chuck Goudreau, Certifying Officer

7 December 2021
Certification Date

ISO 17034 Accredited: Reference Materials Producer, Certificate # 2848.02
ISO/IEC 17025 Accredited: Chemical Testing, Certificate # 2848.01

Quality Certifications

This CRM was prepared under a quality management system that is accredited to the following:

- ISO 17034:2016 Accredited: Reference Materials Producer, A2LA Certificate No. 2848.02 – General Requirements for the Competence of Reference Material Producers
- ISO 17034 references additional requirements specified in ISO Guide 31 and ISO Guide 35
- ISO/IEC 17025:2017 Accredited: Chemical Testing, A2LA Certificate No. 2848.01 – General Requirements for the Competence of Testing and Calibration Laboratories
- ISO 9001:2015 Certified: Quality Management Systems, Registrar: TUV NORD Certificate Registration No. 56 100 19560101

Health and Safety Information

Refer to the **Safety Data Sheet** (SDS), which can be obtained at **lgcstandards.com**

Homogeneity

This solution was determined to be homogeneous by procedures consistent with the requirements of **ISO 17034** and **ISO Guide 35**. Replicate samples of the finished solution were analyzed to confirm its homogeneity, in accordance with internal procedures for the assessment of homogeneity and stability. To ensure homogeneity, users should not take a smaller sub-sample than specified in the Instructions for Use, as doing so will invalidate the certified values and uncertainties.

Further Information

Please contact LGC for further information about this CRM.

CRMs are traceable to the following NIST SRMs:

Analyte	Aq. SRM	MO SRM
Ag	3151	-
Al	3101a	-
As	3103a	3103a
Au	3121	-
B	3107	3107
Ba	3104a	-
Be	3105a	3105a
Bi	3106	3106
Br^-	3184	-
Ca	3109a	3109a
Cd	3108	-
Ce	3110	3110
Cl^-	3182	1818a
Co	3113	3113
Cr	3112a	-
Cs	3111a	-
Cu	3114	-
Dy	3115a	-
Er	3116a	-
Eu	3117a	-
F-	3183	-
Fe	3126a	-
Ga	3119a	-
Gd	3118a	-
Ge	3120a	-

Analyte	Aq. SRM	MO SRM
Hf	3122	-
Hg	3133	3133
Ho	3123a	-
In	3124a	3124a
K	3141a	3141a
La	3127a	3127a
Li	3129a	3129a
Lu	3130a	-
Mg	3131a	3131a
Mn	3132	3132
Mo	3134	3134
Na	3152a	-
Nb	3137	-
Nd	3135a	-
Ni	3136	-
NO_{3^-}	3185	-
P	3139a	3139a
Pb	3128	-
Pd	3138	-
PO_4^{-3}	3186	-
Pr	3142a	-
Pt	3140	3140
Rb	3145a	-
Re	3143	-
Rh	3144	3144

Analyte	Aq. SRM	MO SRM
S	3154	2770
Sb	3102a	3102a
Sc	3148a	3148a
Se	3149	3149
Si	3150	-
Sm	3147a	-
Sn	3161a	-
SO_4^{-2}	3181	-
Sr	3153a	3153a
Ta	3155	-
Tb	3157a	-
Te	3156	-
Th	-	-
Ti	3162a	3162a
Tl	3158	3158
Tm	3160a	-
U	3164	-
V	3165	-
W	3163	3163
Y	3167a	3167a
Yb	3166a	-
Zn	3168a	3168a
Zr	3169	3169