LGC Standards

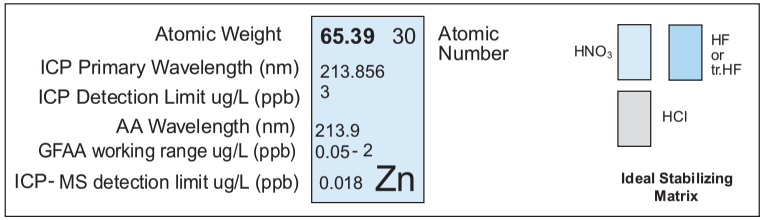
Excellence through measurement

Trace element reference materials for clinical research and diagnostics

ICP Detection Limit:
The detection limit is defined as the concentration of an analyte that will give a signal equal to twice the standard deviation of ten 10-second measurement on blank at the analytical line peak.

ICP-MS Detection Limit:
The detection limit is defined as an analyte concentration providing 3-sigma for a blank; on mass at 5s integration. The values were rounded to the nearest 0.001 ppb and are intended only as an aid to method development. Asterisked items were run under “cool plasma” conditions.

AA Working Ranges:
The lower limit is approximately 10x the Detection Limit. Upper limit of approximately 0.8 Absorbance.



IA	IIA	IIIB	IVB	VB	VIB	VIIB	VIII	VIII	VIII	IB	IIB	IIIA	IVA	VA	VIA	VIIA	VIIIA
1.01 1 H																	4.0 2 He
6.94 3 670.784 0.1 670.8 5-26 <1* Li	9.01 4 313.042 0.2 234.9 1-7 2.2 Be											10.81 5 249.773 5 249.8 750-10000 0.169 B	12.01 6 193.026 40 C	14.01 7 174.272 50000 N	16.0 8 O	19.0 9 F	20.18 10 Ne
22.99 11 588.995 20 589.0 0.25-2 0.015* Na	24.31 12 279.533 0.1 285.2 0.2-2 0.001* Mg											26.98 13 167.079 2 396.2 0.5-50 0.013 Al	28.09 14 251.611 8 251.6 5-260 8.0 Si	30.97 15 177.495 20 213.6 1500-20000 6.0 P	32.07 16 180.731 20 0.016 S	35.45 17 725.665 200000 Cl	39.95 18 Ar
39.10 19 766.490 80 766.5 0.5-5 0.005* K	40.08 20 393.366 0.1 422.7 0.5-6 0.010* Ca	44.96 21 361.384 0.4 391.2 0.038 Sc	47.88 22 334.941 2 364.3 25-460 0.011 Ti	50.94 23 309.311 2 318.4 10-200 0.001 V	52.0 24 267.716 3 357.9 0.5-16 0.027 Cr	54.94 25 257.610 0.4 279.5 0.5-7 0.008 Mn	55.85 26 238.204 2 248.3 1-16 0.003* Fe	58.93 27 238.892 3 240.7 1-40 0.003 Co	58.69 28 231.604 1 232.0 5-50 0.023 Ni	63.55 29 324.754 1 324.7 1-26 0.003 Cu	65.39 30 213.856 3 213.9 0.05-2 0.018 Zn	69.72 31 417.206 20 294.4 25-200 0.021 Ga	72.61 32 265.118 20 265.2 0.007 Ge	74.92 33 188.979 30 193.7 10-60 0.010 As	78.96 34 196.026 30 196.0 25-200 0.276 Se	79.90 35 163.340 7000 0.046 Br	83.80 36 Kr
85.47 37 780.02 300 780 2.5-12 0.002 Rb	87.62 38 407.771 0.1 460.7 5- 30 <0.001 Sr	88.91 39 371.030 0.5 410.2 <0.001 Y	91.22 40 339.198 3 360.1 0.002 Zr	92.91 41 309.418 20 334.9 0.002 Nb	95.94 42 202.030 4 313.3 1-80 0.002 Mo	98.91 43 Tc	101.07 44 240.272 20 349.9 50-260 0.004 Ru	102.91 45 250.429 23 343.5 <0.001 Rh	106.42 46 340.458 30 244.8 15-120 0.002 Pd	107.87 47 328.068 2 328.1 0.25-8 0.001 Ag	112.41 48 214.438 3 228.8 0.15-2.6 0.001 Cd	114.82 49 325.609 30 303.9 50-260 0.001 In	118.71 50 189.926 10 235.5 10-220 0.004 Sn	121.76 51 206.833 20 217.6 7.5-90 0.002 Sb	127.60 52 214.281 40 214.3 5-180 0.032 Te	126.90 53 178.276 40 0.005 I	131.30 54 Xe
132.91 55 455.531 4000 852.1 10-60 0.001 Cs	137.33 56 455.403 0.3 553.6 2- 120 <0.001 Ba	138.91 57 379.478 5 550.1 <0.001 La	178.49 72 264.141 10 307.3 0.001 Hf	180.95 73 240.063 19 271.5 <0.001 Ta	183.85 74 239.709 20 255.1 0.004 W	186.21 75 221.426 6 346.1 <0.001 Re	190.2 76 225.585 0.4 290.9 0.002 Os	192.22 77 224.268 20 208.9 <0.001 Ir	195.09 78 214.423 20 266.0 10-900 0.001 Pt	196.97 79 242.795 6 242.8 5-40 0.001 Au	200.59 184.950 10 253.7 100-3600 0.034 Hg	204.38 81 190.864 30 276.8 5-200 0.002 Tl	207.2 82 220.353 40 217.0 2.5-26 0.007 Pb	208.98 83 223.061 50 223.1 5-70 <0.001 Bi	208.98 84 Po	209.99 85 At	222.02 86 Rn
220.02 87 Fr	226.03 88 Ra	227.0 89 Ac	261.1 104 Rf	262.1 105 Db	263.1 106 Sg	262.1 107 Bh	108 Hs	109 Mt									

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140.12 58 418.660 30 520.0 <0.001 Ce	140.91 59 417.939 20 495.1 <0.001 Pr	144.24 60 401.225 30 492.5 0.001 Nd	146.92 61 Pm	150.36 62 359.262 20 429.7 0.002 Sm	151.97 63 381.967 2 459.4 25-160 <0.001 Eu	157.25 64 342.247 10 368.4 <0.001 Gd	158.93 65 350.917 20 432.7 5-36 <0.001 Tb	162.5 66 353.170 8 421.2 50.360 0.001 Dy	164.93 67 345.600 4 410.4 0.4-160 <0.001 Ho	167.26 68 337.276 6 400.8 100 -760 0.001 Er	168.93 69 346.220 4 371.8 <0.001 Tm	173.04 70 328.937 3 398.8 0.001 Yb	174.97 71 261.542 3 336.0 <0.001 Lu	
232.04 90 283.73 30 0.001 Th	231.04 91 Pa	238.03 92 385.958 100 358.5 <0.001 U	237.05 93 Np	244.06 94 Pu	243.06 95 Am	247.07 96 Cm	247.07 97 Bk	251.08 98 Cf	252.08 99 Es	257.1 100 Fm	258.1 100 Md	259 102 No	260 103 Lw	

Part of LGC Standards

Contents

Introduction

LGC Standards is a leading global producer and distributor of reference materials. We have three ISO Guide 34 accredited facilities for the production of Certified Reference Materials, and are an authorised distributor for respected Measurement Institutes and leading commercial producers. This has enabled us to compile an unrivalled collection of reference materials for trace elements.

The information provided in this catalogue has been taken from electronic sources provided by the suppliers. In many instances original descriptions have been retained. In some cases additional information has been added to make the catalogue easier to use.

The materials have been divided into a number of categories based on their position in the reference material hierarchy, matrix and intended use. This will allow easy selection of the most appropriate reference material for a particular analytical purpose.

If you are unable to locate a material of interest, please contact us at askus@lgcstandards.com

Definitions

The properties of a reference material depend on the extent of characterisation undertaken during the certification process. Throughout this catalogue different terms are used to indicate the degree of confidence associated with the accuracy. The terminology used within this catalogue are defined below.

Certified Values: Certified values are values that have the highest accuracy in that all known or suspected sources of bias have been investigated or taken into account. The values may be derived from the combination of results provided by a National Measurement Institute and collaborating laboratories or determined using higher-order reference measurement procedures calibrated with high-purity reference materials. The uncertainties are expanded uncertainties at the 95 % level of confidence.

Reference Values: Reference values are non-certified values that are the best estimate of the true values based on available data; however, the values do not meet the criteria for certification and are provided with associated uncertainties that may reflect only measurement precision, may not include all sources of uncertainty, or may reflect a lack of sufficient statistical agreement among multiple methods.

Information Values: An information value is considered to be a value that will be of interest to the reference material user, but insufficient information is available to assess the uncertainty associated with the value.

Abbreviations

Abbreviation	Description
AAS	Atomic absorption spectrometry
BAM	Bundesanstalt für Materialforschung und prüfung *Federal Institute for materials research and testing, Germany*
BCR®	Bureau Communautaire de Reference *Registered trademark of IRMM*
CE	Conformité Européenne *European Conformity*
CENAM	Centro Nacional de Metrología Mexico *National Metrology Center of Mexico*
COA	Certificates of Analysis
CRM	Certified Reference Material
DI	De-Ionised
*ERM®	European Reference Material *Registered trademark of IRMM, BAM and LGC*
FLAA	Flame Atomic Absorption Spectroscopy
ICP-AES	Inductively Coupled Plasma Atomic Emission Spectroscopy
ICP-MS	Inductively Coupled Plasma Mass Spectrometry
ICP-OES	Inductively Coupled Plasma Optical Emission Spectrometry
ICP-SFMS	Inductively Coupled Plasma Sector Field Mass Spectrometry
IDMS	Isotope Dilution Mass Spectrometry
IFCC	International Federation of Clinical Chemistry and Laboratory Medicine
IRMM	Institute for Reference Materials and Measurements, Joint Research Centre of the European Commission
ISE	Ion-Selective Electrode
IVD	*In Vitro* Diagnostic
JCTLM	Joint Committee for Traceability in Laboratory Medicine
NIST	National Institute for Standards and Technology
SI	International System of Units
SRM	Standard Reference Material *Registered trademark of NIST*

*European Reference Materials (ERM) are certified reference materials (CRM) which have undergone uncompromising peer review by a consortium of three National Measurement Institutes; The Institute for Reference Materials and Measurements (IRMM) of the European Commission's Directorate General Joint Research Centre, Belgium, The Bundesanstalt für Materialforschung und -prüfung (BAM), Germany and LGC, UK. The consortium produces CRM, which undergo uncompromising peer evaluation and offer highest quality and reliability.

The criteria that define a ERM are:

- Rigorous homogeneity and stability testing
- Characterised by a primary method of measurement, or by laboratory inter-comparison using two or more independent analytical methods
- Methods must be applied under metrologically valid conditions, been validated before use and have precision and accuracy compatible with the target uncertainty
- Measurements must be traceable to the stated reference, and be accompanied by a GUM-compatible uncertainty statement

Single-Element Standards

Single-Element Standards from NIST

National Institute for Standards and Technology (NIST) is a non-regulatory federal agency within the U.S. Department of Commerce.

The following materials constitute the NIST Standard Reference Material (SRM) 3100 Series. They are intended as standard solutions for calibrating instruments used in atomic spectrometry, including atomic absorption spectrophotometry (AAS), inductively coupled plasma optical emission spectrometry (ICP-OES), and inductively coupled plasma mass spectrometry (ICP-MS). They can also be used in conjunction with any other analytical technique or procedure where standard solutions are required.

Order number	Description	Certified value (mg/g)	Nominal acid concentration of matrix	Unit of issue
NIST-3101	Aluminium (Al) Standard Solution	10.001 ± 0.017	HNO3 10%	50 ml
NIST-3102	Antimony (Sb) Standard Solution	10.015 ± 0.028	HNO3 10% + HF 2%	50 ml
NIST-3103	Arsenic (As) Standard Solution	9.999 ± 0.015	HNO3 10%	50 ml
NIST-3104	Barium (Ba) Standard Solution	10.014 ± 0.036	HNO3 10%	50 ml
NIST-3105	Beryllium (Be) Standard Solution	9.960 ± 0.034	HNO3 10%	5 x 10 ml
NIST-3106	Bismuth (Bi) Standard Solution	10.00 ± 0.02	HNO3 10%	5 x 10 ml
NIST-3107	Boron (B) Standard Solution	5.014 ± 0.010	H2O	50 ml
NIST-3108	Cadmium (Cd) Standard Solution	10.005 ± 0.019	HNO3 10%	50 ml
NIST-3109	Calcium (Ca) Standard Solution	10.025 ± 0.017	HNO3 10%	5 x 10 ml
NIST-3110	Cerium (Ce) Standard Solution	9.971 ± 0.030	HNO3 10%	5 x 10 ml
NIST-3111	Cesium (Cs) Standard Solution	9.99 ± 0.02	HNO3 1%	50 ml
NIST-3112	Chromium (Cr) Standard Solution	9.922 ± 0.025	HNO3 10%	5 x 10 ml
NIST-3113	Cobalt (Co) Standard Solution	9.996 ± 0.023	HNO3 10%	5 x 10 ml
NIST-3114	Copper (Cu) Standard Solution	10.005 ± 0.024	HNO3 10%	50 ml
NIST-3115	Dysprosium (Dy) Standard Soln.	10.02 ± 0.03	HNO3 10%	5 x 10 ml
NIST-3116	Erbium (Er) Standard Solution	9.95 ± 0.03	HNO3 10%	5 x 10 ml
NIST-3117	Europium (Eu) Standard Solution	9.868 ± 0.025	HNO3 10%	5 x 10 ml
NIST-3118	Gadolinium (Gd) Standard Soln.	9.96 ± 0.03	HNO3 10%	5x10 ml
NIST-3119	Gallium (Ga) Standard Solution	10.00 ± 0.04	HNO3 10%	5 x 10 ml
NIST-3120	Germanium (Ge) Standard Soln.	10.015 ± 0.021	HNO3 10% + HF 2%	50 ml
NIST-3121	Gold (Au) Standard Solution	9.89 ± 0.02	HCl 10%	5 x 10 ml
NIST-3122	Hafnium (Hf) Standard Solution	10.004 ± 0.021	HNO3 10% + HF 2%	50 ml
NIST-3123	Holmium (Ho) Standard Solution	9.987 ± 0.036	HNO3 10%	5 x 10 ml
NIST-3124	Indium (In) Standard Solution	10.009 ± 0.023	HNO3 10%	5 x 10 ml
NIST-3126	Iron (Fe) Standard Solution	10.001 ± 0.023	HNO3 10%	50 ml
NIST-3127	Lanthanum (La) Standard Solution	9.99 ± 0.02	HNO3 10%	5 x 10 ml
NIST-3128	Lead (Pb) Standard Solution	9.995 ± 0.014	HNO3 10%	5 x 10 ml
NIST-3129	Lithium (Li) Standard Solution	9.969 ± 0.030	HNO3 1%	5 x 10 ml
NIST-3130	Lutetium (Lu) Standard Solution	9.979 ± 0.030	HNO3 10%	5 x 10 ml
NIST-3131	Magnesium (Mg) Standard Soln.	9.99 ± 0.02	HNO3 10%	50 ml
NIST-3132	Manganese (Mn) Standard Soln.	10.00 ± 0.02	HNO3 10%	5 x 10 ml
NIST-3177	Mercuric Chloride Standard Soln.	0.9981 ± 0.0044	HNO3 3% + HCl 4 %	5 x 10 ml
NIST-3133	Mercury (Hg) Standard Solution	9.954 ± 0.053	HNO3 10%	5 x 10 ml
NIST-3134	Molybdenum (Mo) Standard Soln.	9.99 ± 0.03	HCl 10%	5 x 10 ml

Order number	Description	Certified value (mg/g)	Nominal acid concentration of matrix	Unit of issue
NIST-3135	Neodymium (Nd) Standard Soln.	9.94 ± 0.04	HNO3 10%	5 x 10 ml
NIST-3136	Nickel (Ni) Standard Solution	9.738 ± 0.022	HNO3 10%	5 x 10 ml
NIST-3137	Niobium (Nb) Standard Solution	9.984 ± 0.033	HNO3 10% + HF 2%	50 ml
NIST-3138	Palladium (Pd) Standard Solution	10.004 ± 0.016	HCl 10%	5 x 10 ml
NIST-3139	Phosphorus (P) Standard Solution	10.016 ± 0.033	HNO3 0.8%	5 x 10 ml
NIST-3140	Platinum (Pt) Standard Solution	9.98 ± 0.03	HCl 10%	5 x 10 ml
NIST-3141	Potassium (K) Standard Solution	10.011 ± 0.029	HNO3 1%	50 ml
NIST-3142	Praseodymium (Pr) Standard Soln	9.98 ± 0.07	HNO3 10%	5 x 10 ml
NIST-3143	Rhenium (Re) Standard Solution	9.722 ± 0.038	HNO3 10%	5 x 10 ml
NIST-3144	Rhodium (Rh) Standard Solution	1.0220 ± 0.0036	HCl 10%	5 x 10 ml
NIST-3145	Rubidium (Rb) Standard Solution	10.04 ± 0.06	HNO3 1%	5 x 10 ml
NIST-3147	Samarium (Sm) Standard Solution	9.94 ± 0.03	HNO3 10%	5 x 10 ml
NIST-3148	Scandium (Sc) Standard Solution	9.969 ± 0.030	HNO3 10%	5 x 10 ml
NIST-3149	Selenium (Se) Standard Solution	10.042 ± 0.051	HNO3 10%	5 x 10 ml
NIST-3150	Silicon (Si) Standard Solution	10.458 ± 0.032	H2O	50 ml
NIST-3151	Silver (Ag) Standard Solution	10.01 ± 0.03	HNO3 10%	5 x 10 ml
NIST-3152	Sodium (Na) Standard Solution	9.994 ± 0.020	HNO3 1%	50 ml
NIST-3153	Strontium (Sr) Standard Solution	9.07 ± 0.03	HNO3 10%	5 x 10 ml
NIST-3154	Sulfur (S) Standard Solution	10.30 ± 0.03	H2SO4 0.1%	5 x 10 ml
NIST-3155	Tantalum (Ta) Standard Solution	10.002 ± 0.021	HNO3 10% + HF 2%	50 ml
NIST-3156	Tellurium (Te) Standard Solution	10.08 ± 0.03	HCl 10%	5 x 10 ml
NIST-3157	Terbium (Tb) Standard Solution	9.961 ± 0.030	HNO3 10%	5 x 10 ml
NIST-3158	Thallium (Tl) Standard Solution	9.99 ± 0.02	HNO3 10%	5 x 10 ml
NIST-3159	Thorium (Th) Standard Solution	9.98 ± 0.04	HNO3 10%	50 ml
NIST-3160	Thulium (Tm) Standard Solution	12.67 ± 0.04	HNO3 10%	5 x 10 ml
NIST-3161	Tin (Sn) Standard Solution	10.010 ± 0.021	HNO3 5% + HF 1%	50 ml
NIST-3162	Titanium (Ti) Standard Solution	10.011 ± 0.018	HNO3 10% + HF 2%	50 ml
NIST-3163	Tungsten (W) Standard Solution	10.000 ± 0.026	HNO3 7% + HF 4%	50 ml
NIST-3165	Vanadium (V) Standard Solution	4.86 ± 0.02	HNO3 10%	5 x 10 ml
NIST-3166	Ytterbium (Yb) Standard Solution	9.97 ± 0.02	HNO3 10%	5 x 10 ml
NIST-3167	Yttrium (Y) Standard Solution	9.993 ± 0.025	HNO3 10%	5 x 10 ml
NIST-3168	Zinc (Zn) Standard Solution	10.007 ± 0.020	HNO3 10%	50 ml
NIST-3169	Zirconium (Zr) Standard Solution	9.989 ± 0.016	HNO3 10% + HF 2%	50 ml

Single-Element Standards from CENAM (Mexico)

Centro Nacional de Metrología (CENAM) Mexico is the National Metrology Institute of Mexico. The materials in this section are well defined, internationally recognised Certified Reference Materials (CRM) traceable to the International System of Units (SI) and listed on the Joint Committee for Traceability in Laboratory Medicine (JCTLM) website.

CEN DMR-56c Sodium in 2 % Nitric Acid Solution 125 ml

This CRM can be used in: Flame Atomic Absorption Spectroscopy (FLAA), Inductively Coupled Plasma Atomic Emission Spectroscopy (ICP-AES), ICP-MS or other analytical technique that requires the unielemental dissolution of sodium for calibration or quality assurance of analytical measurement processes.

Certified Value *(as mass fraction)*

Sodium (Na)	1007.8 ± 1.8 mg/l

CEN DMR-57d Potassium in 2 % Nitric Acid Solution 125 ml

This CRM can be used in: FLAA, ICP-AES, ICP-MS or other analytical technique that requires the unielemental dissolution of potassium for calibration or quality assurance of analytical measurement processes.

Certified Value *(as mass fraction)*

Potassium (K)	996 ± 12 mg/l

CEN DMR-62d Magnesium in 2 % Nitric Acid Solution 125 ml

This CRM can be used in: FLAA, ICP-AES, ICP-MS or other analytical technique that requires the unielemental dissolution of potassium for calibration or quality assurance of analytical measurement processes.

Certified Value *(as mass fraction)*

Magnesium (Mg)	992.2 ± 4.6 mg/l

Single-Element Standards from VHG Labs

U.S. based VHG Labs were acquired by LGC Standards in May 2012. VHG Labs is accredited to ISO Guide 34 for the production of reference materials for oil based testing and aqueous inorganic standards. It also offers a range of consumable supplies for laboratory instrumentation and analytical testing for high purity materials, metal alloys, consumer products and a wide range of commercial products.

The A-Plus Certified Single-Element Standards produced by VHG Labs, are tested and certified according to the High Performance ICP-AES protocol created by NIST. The HP-ICP protocol provides the most accurate assays and the tightest uncertainties, both of which are directly traceable to the corresponding NIST SRM (3100 series).

Features of VHG Labs A+ Standards

- Ideal for ICP, ICP-MS, AA, GFAA or other elemental techniques
- Prepared from high purity raw materials, acids and 18Mohm de-ionised (DI) water
- Manufactured in our ISO 9001, ISO Guide 34 facility, and certified in our ISO/IEC 17025 laboratory
- Assayed by NIST HP-ICP-AES method (see page 38)
- Purity confirmed by ICP-MS
- Accompanied by NIST-traceable Certificate of Analysis (COA)
- Packaged in acid-leached, triple-rinsed HDPE bottles
- Shipped in poly-sealed bags
- Most elements certified for 18 months shelf life

A+ High Purity Single Element Aqueous Calibration Standards			Concentration (10 µg/ml)	Concentration (1,000 µg/ml)	Concentration (10,000 µg/ml)
Element	**Starting Material, Matrix**	**Vol. (ml)**	**Product No.**	**Product No.**	**Product No.**
Aluminium	Al, HCl	100 500	LALH-100	PALH-100 PALH-500	TALH-100 TALH-500
	$Al(NO_3)_3$, HNO_3	100	LALN-100	PALN-100 PALN-500	TALN-100 TALN-500
Antimony	Sb, HCl	100 500	LSBH-100	PSBH-100 PSBH-500	TSBH-100 TSBH-500
	SB, HNO_3 Tartaric Acid	100 500	LSBWTN-100	PSBWTN-100 PSBWTN-500	TSBWTN-100 TSBWTN-500
Arsenic	As, HNO_3	100 500	LASN-100	PASN-100 PASN-500	TASN-100 TASN-500
Barium	$Ba(NO_3)_2$, HNO_3	100 500	LBAN-100	PBAN-100 PBAN-500	TBAN-100 TBAN-500
Beryllium	$Be_4O(C_2H_3O_2)_6$, HNO_3	100 500	LBEN-100	PBEN-100 PBEN-500	TBEN-100 TBEN-500
Bismuth	Bi, HNO_3	100 500	LBIN-100	PBIN-100 PBIN-500	TBIN-100 TBIN-500
Boron	H_3BO_3, NH_4OH	100 500	LBZ-100	PBZ-100 PBZ-500	TBZ-100 TBZ-500
	H_3BO_3, H_2O	100 500	LBW-100	PBW-100 PBW-500	N/A N/A
Cadmium	Cd, HNO_3	100 500	LCDN-100	PCDN-100 PCDN-500	TCDN-100 TCDN-500
Carbon	CH_3CO_2H, H_2O	100 500		PCW-100 PCW-500	TCW-100 TCW-500
Cerium	Ce, HNO_3	100 500		PCEN-100 PCEN-500	TCEN-100 TCEN-500
Cesium	Cs_3CO_3H, HNO_3	100 500		PCSN-100 PCSN-500	TCSN-100 TCSN-500
Chromium	Cr, HCl	100 500		PCRH-100 PCRH-500	TCRH-100 TCRH-500
	$Cr(NO_3)_3$, HNO_3	100 500	LCRN-100	PCRN-100 PCRN-500	TCRN-100 TCRN-500
Cobalt	Co, HNO_3	100 500	LCON-100	PCON-100 PCON-500	TCON-100 TCON-500

A+ High Purity Single Element Aqueous Calibration Standards			Concentration (10 µg/ml)	Concentration (1,000 µg/ml)	Concentration (10,000 µg/ml)
Element	**Starting Material, Matrix**	**Vol. (ml)**	**Product No.**	**Product No.**	**Product No.**
Copper	Cu, HNO_3	100 500	LCUN-100	PCUN-100 PCUN-500	TCUN-100 TCUN-500
Dysprosium	Dy_2O_3, HNO_3	100 500		PDYN-100 PDYN-500	TDYN-100 TDYN-500
Erbium	Er_2O_3, HNO_3	100 500		PERN-100 PERN-500	TERN-100 TERN-500
Europium	Eu_2O_3, HNO_3	100 500		PEUN-100 PEUN-500	TEUN-100 TEUN-500
Gadolinium	Gd_2O_3, HNO_3	100 500		PGDN-100 PGDN-500	TGDN-100 TGDN-500
Gallium	Ga, HNO_3, tr. HCl	100 500		PGANH-100 PGANH-500	TGANH-100 TGANH-500
Germanium	Ge, HNO_3, tr. HF $(NH_4)_2GeF_6, H_2O$, tr. F-	100 50 100 500	LGENF-100 LGEW-100	PGENF-100 PGENF-500 PGEW-100 PGEW-500	TGENF-100 TGENF-500 N/A N/A
Gold	Au, HCl	100 500		PAUH-100 PAUH-500	TAUH-100 TAUH-500
Hafnium	$HfCl_2O$, HNI	100 500		PHFH-100 PHFH-500	THFH-100 THFH-500
Holmium	Ho_2O_3, HNO_3	100 500		PHON-100 PHON-500	THON-100 THON-500
Indium	In, HNO_3	100 500	LINN-100	PINN-100 PINN-500	TINN-100 TINN-500
Iridium	$IrCl_3$, HCl	100 500	LIRH-100	PIRH-100 PIRH-500	TIRH-100 TIRH-500
Iron	Fe, HNO_3	100 500		PFEN-100 PFEN-500	TFEN-100 TFEN-500
Lanthanum	La_2O_3, HNO_3	100 500		PLAN-100 PLAN-500	TLAN-100 TLAN-500
Lead	Pb, HNO_3	100 500	LPBN-100	PPBN-100 PPBN-500	TPBN-100 TPBN-500
Lithium	$LiCO_3, HNO_3$	100 500	LLIN-100	PLIN-100 PLIN-500	TLIN-100 TLIN-500
Lutetium	Lu_2O_3, HNO_3	100 500		PLUN-100 PLUN-500	TLUN-100 TLUN-500
Magnesium	Mg, HNO_3	100 500		PMGN-100 PMGN-500	TMGN-100 TMGN-500
Manganese	Mn, HNO_3	100 500	LMNN-100	PMNN-100 PMNN-500	TMNN-100 PMNN-500
Mercury	Hg, HNO_3	100 500	LHGN-100	PHGN-100 PHGN-500	THGN-100 THGN-500
Molybdenum	Mo, HNO_3, tr. HF $(NH_4)_2MoO_4, NH_4OH$,	100 500 100 500	LMONF-100	PMONF-100 PMONF-500 PMOZ-100 PMOZ-100	TMONF-100 TMONF-500 TMOZ-100 TMOZ-500

Email: askus@lgcstandards.com Website: www.lgcstandards.com

A+ High Purity Single Element Aqueous Calibration Standards			Concentration (10 µg/ml)	Concentration (1,000 µg/ml)	Concentration (10,000 µg/ml)
Element	**Starting Material, Matrix**	**Vol. (ml)**	**Product No.**	**Product No.**	**Product No.**
Neodymium	Nd_2O_3, HNO_3	100 500		PNDN-100 PNDN-500	TNDN-100 TNDN-500
Nickel	Ni, HNO_3	100 500	LNIN-100	PNIN-100 PNIN-500	TNIN-100 TNIN-500
Niobium	$NbCl_5$, HF	100 500		PNBF-100 PNBF-500	TNBF-100 TNBF-500
	NH_4NbF_6, H_2O, tr. F-	100 500		PNBW-100 PNBW-500	TNBW-100 TNBW-500
Osmium	$(NH_4)_2OsCl_6$, HCl	100 500		POSH-100 POSH-500	N/A N/A
Palladium	Pd, HCl	100 500		PPDH-100 PPDH-500	TPDH-100 TPDH-500
	Pd, HNO_3	100 500		PPDN-100 PPDN-500	TPDN-100 TPDN-500
Phosphorous	H_3PO_4, H_2O	100 500		PPW-100 PPW-500	TPW-100 TPW-500
Platinum	Pt, HCl	100 500	LPTH-100	PPTH-100 PPTH-500	TPTH-100 TPTH-500
Potassium	KNO_3, HNO_3	100 500		PKN-100 PKN-500	TKN-100 TKN-500
Praseodymium	Pr_6O_{11}, HNO_3	100 500		PPRN-100 PPRN-500	TPRN-100 TPRN-500
Rhenium	Re, HNO_3	100 500		PREN-100 PREN-500	TREN-100 TREN-500
Rhodium	$RhCl_3$, HCl	100 500	LRHH-100	PRHH-100 PRHH-500	TRHH-100 TRHH-500
Rubidium	R_b2CO_3, HNO_3	100 500		PRBN-100 PRBN-500	TRBN-100 TRBN-500
Ruthenium	$RuCl_3$, HCl	100 500		PRUH-100 PRUH-500	TRUH-100 TRUH-500
Samarium	Sm_2O_3, HNO_3	100 500		PSMN-100 PSMN-500	TSMN-100 TSMN-500
Scandium	Sc_2O_3, HNO_3	100 500	LSCN-100	PSCN-100 PSCN-500	TSCN-100 TSCN-500
Selenium	Se, HNO_3	100 500	LSEN-100	PSEN-100 PSEN-500	TSEN-100 TSEN-500
Silicon	Si, HNO_3, tr. HF	100 500		PSINF-100 PSINF-500	TSINF-100 TSINF-500
	$(NH_4)_2SiF_6$, H_2O, tr. F^-	100 500		PSIW-100 PSIW-500	TSIW-100 TSIW-500
Silver	Ag, HNO_3	100 500	LAGN-100	PAGN-100 PAGN-500	TAGN-100 TAGN-500
Sodium	Na_2CO_3, HNO_3	100 500		PNAN-100 PNAN-500	TNAN-100 TNAN-500
Strontium	$Sr(NO_3)_2$, HNO_3	100 500	LSRN-100	PSRN-100 PSRN-500	TSRN-100 TSRN-500
Sulfur	$(NH_4)_2SO_4$, H_2O	100 500		PSW-100 PSW-500	TSW-100 TSW-500
Tantalum	$TaCl_5$, HF	100 500		PTAF-100 PTAF-100	TTAF-100 TTAF-500

A+ High Purity Single Element Aqueous Calibration Standards			Concentration (10 µg/ml)	Concentration (1,000 µg/ml)	Concentration (10,000 µg/ml)
Element	**Starting Material, Matrix**	**Vol. (ml)**	**Product No.**	**Product No.**	**Product No.**
Tellurium	Te, HCl	100 500		PTEH-100 PTEH-500	TTEH-100 TTEH-500
	Te, HNO_3	100 500		PTEN-100 PTEN-500	TTEN-100 TTEN-500
Terbium	Tb_4O_7, HNO_3	100 500	LTBN-100	PTBN-100 PTBN-500	TTBN-100 TTBN-500
Thallium	TI, HNO_3	100 500		PTLN-100 PTLN-500	TTLN-100 TTLN-500
Thorium	$Th(NO_3)_4$, HNO_3	100 500		PTHN-100 PTHN-500	TTHN-100 TTHN-500
Thulium	Tm_2O_3, HNO_3	100 500		PTMN-100 PTMN-500	TTMN-100 TTMN-500
Tin	Sn, HCl	100 500	LSNH-100	PSNH-100 PSNH-100	TSNH-100 TSNH-500
	Sn, HNO_3, tr. HF	100 500	LSNNF-100	PSNNF-100 PSNNF-500	TSNNF-100 TSNNF-500
Titanium	Ti, HNO_3, tr. HF	100 500	LTINF-100	PTINF-100 PTINF-500	TTINF-100 TTINF-500
	$(NH_4)_2$, TiF_6, H_2O, tr. F	100 500		PTIW-100 PTIW-500	TTIW-100 TTIW-500
Tungsten	W, HNO_3, tr. HF	100 500		PWNF-100 PWNF-500	TWNF-100 TWNF-500
	$(NH_4)_2WO_4$, H_2O	100 500		PWW-100 PWW-500	TWW-100 PWw-500
Uranium	U_3O_8, HNO_3	100 500	LUN-100	PUN-100 PUN-500	TUN-100 TUN-500
Vanadium	V_2O_5, HNO_3	100 500	LVN-100	PVN-100 PVN-500	TVN-100 TVN-500
Ytterbium	Yb_2O_3, HNO_3	100 500		PYBN-100 PYBN-500	TYBN-100 TYBN-500
Yttrium	Y_2O_3, HNO_3	100 500	LYN-100	PYN-100 PYN-500	TYN-100 TYN-500
Zinc	Zn, HNO_3	100 500	LZNN-100	PZNN-100 PZNN-500	TZNN-100 TZNN-500
Zirconium	$ZrCl_2O$, HCl	100 500		PZRH-100 PZRH-500	TZRH-100 TZRH-500

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Speciation Standards

Is elemental concentration measurement enough? Analysis of biological samples now often involves chromatographic separation of certain elements according to their chemical species followed by detection using AA, ICP-AES or ICP-MS. In some cases, simple low pressure chromatography is adequate, while others require full HPLC separations followed by elemental detection.

Speciation Single-Element Standards					
Element	**Analyte**	**Matrix**	**Concentration (µg/ml)**	**Vol. (ml)**	**Product**
Arsenic	As^{+3} (from As_2O_3)	2% HCl	100	50 100	SPAS3-50 SPAS3-100
	As^{+5} (from As_2O_5)	H_2O	100	50 100	SPAS5W-50 SPAS5W-100
Chromium	Cr^{+3} (from $Cr(NO_3)_3$)	2% HNO_3	100	50 100	SPCR3-50 SPCR3-100
	Cr^{+6} (from Na_2CrO_4)	H_2O	100	50 100	SPCR6-50 SPCR6-100
	Cr^{+6} (from Na_2CrO_4)	H_2O	1000	100 500	PCR6W-100 PCR6W-500
Selenium	Se^{+4} (from H_2SeO_4)	2% HNO_3	100	50 100	SPSE4-50 SPSE4-100
	Se^{+6} (from H_2SeO_4)	H_2O	100	50 100	SPSE6-50 SPSE6-100

Organic Mercury Standard					
Element	**Analyte**	**Matrix**	**Concentration (µg/ml)**	**Vol. (ml)**	**Product**
Organic Mercury	$CH_3Hg(II)Cl$ Methyl Mercury Chloride	H_2O	100	25	MMC-25

Isotopic Standards

Mass spectrometry, in particular ICP-MS, is a powerful technique to measure elemental isotopes. The measurement of individual isotopes can reveal important information about the origin of the element in the sample. Isotope Dilution Mass Spectrometry (IDMS) is often touted as being the most accurate mode of sample ‘unknown’ analysis.

VHG offers a selection of isotope reference materials. These are non-radioactive, "stable" isotopes and can be handled like any aqueous metal standard. Each standard comes with a COA that documents the certified isotopic abundances.

Isotopic Single-Element Standards				
Element	**Matrix**	**Concentration (µg/ml)**	**Size (ml)**	**Product No.**
Boron 10, ^{10}B	2% HNO_3	100	50ml	LIS10BN-50
Boron 11, ^{11}B	H_2O	100	50ml	LIS11B-50
Cadmium 106, ^{106}Cd	2% HNO_3	10	50ml	LIS106CD-50
Chromium 50, ^{50}Cr	2% HNO_3	10	50ml	LIS50CR-50
Copper 65, ^{65}Cu	2% HNO_3	10	50ml	LIS65CU-50
Iron 57, ^{57}Fe	2% HNO_3	10	50ml	LIS57FE-50
Lead, 'Natural' Pb	2% HNO_3	100	50ml	LISPB1-50
Lithium 6, ^{6}Li	2% HNO_3	100	100ml	LIS6LIZ-100
Neodymium, Natural Nd	2% HNO_3	10	50ml	LISND-50
Nickel 61, ^{61}Ni	2% HNO_3	10	50ml	LIS61NI-50
Selenium 78, ^{78}Se	2% HNO_3	10	50ml	LIS78SE-50
Selenium 82, ^{82}Se	2% HNO_3	10	50ml	LIS82SE-50
Strontium, Natural Sr	2% HNO_3	100	50ml	LISSR-50
Strontium 86, ^{86}Sr	2% HNO_3	10	50ml	LIS86SR-50
Tin 122, ^{122}Sn	2% HNO_3 tr. HF	10	50ml	LIS122SN-50
Thallium 203, ^{203}Tl	2% HNO_3	10	50ml	LIS203TL-50
Zinc 68, ^{68}Zn	2% HNO_3	10	50ml	LIS68ZN-50

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Atomic Absorption Standards

VHG's atomic absorption standards are suitable for all spectrometric techniques. They are manufactured from high purity raw materials and have higher accuracy and lower uncertainty than competitive standards. A COA provided with each standard.

AA Aqueous Calibration Standards Concentration: (1,000 µg/ml)			
Element	**Matrix**	**Vol (µg/ml)**	**Product No.**
Aluminium Al	HCl	100 500	AALH-100 AALH-500
Antimony Sb	HCl	100 500	ASBH-100 ASBH-500
Arsenic As	HNO_3	100 500	AASN-100 AASN-500
Barium Ba	HNO_3	100 500	ABAN-100 ABAN-500
Beryllium Be	HNO_3	100 500	ABEN-100 ABEN-500
Bismuth Bi	HNO_3	100 500	ABIN-100 ABIN-500
Boron B	H_2O	100 500	ABW-100 ABW-500
Cadmium Cd	HNO_3	100 500	ACDN-100 ACDN-500
Calcium Ca	HNO_3	100 500	ACAN-100 ACAN-500
Chromium Cr	HCl	100 500	ACRH-100 ACRH-500
Cobalt Co	HNO_3	100 500	ACON-100 ACON-500
Copper Cu	HNO_3	100 500	ACUN-100 ACUN-500
Gold Au	HCl	100 500	AAUH-100 AAUH-500
Iron Fe	HNO_3	100 500	AFEN-100 AFEN-500
Lead Pb	HNO_3	100 500	APBN-100 APBN-500
Lithium Li	HNO_3	100 500	ALIN-100 ALIN-500
Magnesium Mg	HNO_3	100 500	AMGN-100 AmGN-500

AA Aqueous Calibration Standards Concentration: (1,000 µg/ml)			
Element	**Matrix**	**Vol (µg/ml)**	**Product No.**
Manganese Mn	HNO_3	100 500	AMNN-100 AMNN-500
Mercury Hg	HNO_3	100 500	AHGN-100 AHGN-500
Molybdenum Mo	HNO_3 tr. HF	100 500	AMONF-100 AMONF-500
Nickel Ni	HNO_3	100 500	ANIN-100 ANIN-500
Palladium Pd	HCl	100 500	APDH-100 APDH-500
Platinum Pt	HCl	100 500	APTH-100 APTH-500
Potassium K	HNO_3	100 500	AKN-100 AKN-500
Selenium Se	HNO_3	100 500	ASEN-100 ASEN-500
Silicon Si	HNO_3 tr. HF	100 500	ASINF-100 ASINF-500
Silver Ag	HNO_3	100 500	AAGN-100 AAGN-500
Sodium Na	HNO_3	100 500	ANAN-100 ANAN-500
Strontium Sr	HNO_3	100 500	ASRN-100 ASRN-500
Thallium Tl	HNO_3	100 500	ATLN-100 ATLN-100
Tin Sn	HCl	100 500	ASNH-100 ASNH-500
Titanium Ti	HNO_3 tr. HF	100 500	ATINF-100 ATINF-500
Vanadium V	HNO_3	100 500	AVN-100 AVN-500
Zinc Zn	HNO_3	100 500	AZNN-100 AZNN-500

Matrix Modifiers, Ionization Buffers and Releasing Agents

These products have undergone rigorous quality control and are supplied with a COA. Matrix Modifier purity has been checked for over 70 elements.

GFAA Matrix Modifiers			
Modifier	**Matrix**	**Volume (ml)**	**Product No.**
Ammonium Phosphate	10% $NH_4H_2PO_4$, 2% HNO_3	100	MAP10%-100
Magnesium Nitrate	1% $Mg(NO_3)_2$, 2% HNO_3	100	MMGN1%-100
Nickel Nitrate	1% $Ni(NO_3)_2$, 2% HNO_3	100	MNIN1%-100
Palladium Nitrate	0.1% Pd, 10% HNO_3 1% Pd, 10% HNO_3	100 100	MPDN1K-100 MPDN1%-100

Pre-Mixed Matrix Modifiers			
Modifier	**Matrix**	**Volume (ml)**	**Product No.**
Pd + Mg	750 µg/ml Pd & 500 µg/ml $Mg(NO_3)_2$, 2% HNO_3	250	MPM1-250
Pd + Mg	1000 µg/ml Pd & 600 µg/ml $Mg(NO_3)_2$, 2% HNO_3	250	MPM2-250
Amm. Phos + Mg	10 µg/ml $NH_4H_2PO_4$ & 600 µg/ml $Mg(NO_3)_2$, 2% HNO_3	250	MPM3-250

Ionization Buffers			
Material	**Matrix**	**Volume (ml)**	**Product No.**
Lithium Nitrate	1% Li (from carbonate), 5% HNO_3	100	MLIN1%-100
Cesium Nitrate	1% Cs (from carbonate), 5% HNO_3	100	MCSN1%-100

Lanthanum Releasing Agents			
Material	**Matrix**	**Volume (ml)**	**Product No.**
Lanthanum Chloride	1% La (from oxide), 2% HNO_3	100	MLAH1%-100
Lanthanum Nitrate	1% La (from oxide), 5% HNO_3	100	MLAN1%-100

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Ion Chromatography Standards

These standards have been manufactured in our ISO 9001 facility using high purity raw materials and 18Mohm DI water. They are accompanied by NIST-traceable COA.

Anio			Concentration (100 µg/ml)	Concentration (1,000 µg/ml)	Concentration (10,000 µg/ml)
Ion	**Raw Material, Matrix**	**Vol. (ml)**	**Product No.**	**Product No.**	**Product No.**
Acetate $CH_3CO_2^-$	CH_3CO_2Na, H_2O	100 500		IACET-100 IACET-500	I1%ACET-500
Bromate BrO_3^-	$NaBrO_3$, H_2O	100 500		IBRO3-100 IBRO3-100	
Bromide Br^-	KBr, H_2O NH_4Br, H_2O	100 500 100 500		IBR-100 IBR-500	I1%BR-500 I1%ABR-100 I1%ABR-500
Chlorate ClO_3^-	$NaClO_3$, H_2O	100 500		ICLO3-100 ICLO3-500	
Chloride Cl^-	KCl, H_2O NH_4Cl, H_2O	100 500 100 500	ICL 100-500	ICL1K-100 ICL1K-500	I1%CL-100 I1%CL-500 I1%ACL-100 I1%ACL-500
Chlorite ClO_2^-	$NaClO_2$, H_2O	100 500		ICLO2-100 ICLO2-500	I1%CLO2-100 I1%CLO2-500
Chromate CrO_4^{-2}	K_2CrO_4, H_2O	100 500		ICRO-100 ICRO-500	I1%CRO-100 I1%CRO-500
Dichromate $Cr_2O_7^{-2}$	$Na_2Cr_2O_7$, H_2O	100 500		IDCRO-100 IDCRO-500	I1%DCRO-100 I1%DCRO-500
Fluoride F^-	NaF, H_2O	100 500	IF 100-500	IF1K-100 IF1K-100	I1%F-500
Formate HCO_2	HCO_2Na, H_2O	100 500		IFORM-100 IFORM-500	
Glycolate $C_2H_3O_3^-$	$NaC_2H_3O_3$, H_2O	100 500		IGLY-100 IGLY-500	
Iodide I^-	NaI, H_2O NH_4I, H_2O	100 500 100 500		II-100 II-500	I1%I-500 I1%AI-100 I1%AI-500
Molybdate MoO_4^{-2}	Na_2MoO_4, H_2O	100 500	IMOLB100-500	IMOLB-100 IMOLB-500	
Nitrate NO_3^-	$NaNO_3$, H_2O	100 500		INO3-100 INO3-500	I1%NO3-100 I1%NO3-500
Nitrate as N NO_3^-	$NaNO_3$, H_2O	100 500		INO3N-100 INO3N-500	I1%NO3N-100 I1%NO3N-500
Nitrate NO_2^-	$NaNO_2$, H_2O	100 500		INO2-100 INO2-500	I1%NO2-100 I1%NO2-500
Nitrate as N NO_2^-	$NaNO_2$, H_2O	100 500		INO2N-100 INO2N-500	I1%NO2N-100 I1%NO2N-500
Oxalate $C_2O_4^{-2}$	$Na_2C_2O_4$, H_2O	100 500		IOXAL-100 IOXAL-500	I1%OXAL-500
Perchlorate ClO_4^-	$NaClO_4$, H_2O	100 500		ICLO4-100 ICLO4-500	I1%CLO4-500
Phosphate PO_4^{-3}	KH_2PO_4, H_2O	100 500		IPO4-100 IPO4-500	I1%PO4-500
Phosphate P,PO_4^{-3}	KH_2PO_4, H_2O	100 500		IPO4P-100 IPO4P-500	I1%PO4P-500
Silica SiO_2	Na_2SiO_3, H_2O	100 500	ISIO2100-500	ISIO21K-100 ISIO21K-500	
Sulfate $SO4^{-2}$	K_2SO_4, H_2O	100 500	ISIO4100-500	ISO41K-100 ISO41K-500	I1%SO4-100 I1%SO4-500

All VHG product codes now have the prefix 'VHG–'.

Cations			Concentration (100 µg/ml)	Concentration (1,000 µg/ml)	Concentration (10,000 µg/ml)
Ion	**Raw Material, Matrix**	**Vol. (ml)**	**Product No.**	**Product No.**	**Product No.**
Ammonium NH_4^+	$(NH_4)_2SO_4$, H_2O	100 500	INH4100-500	INH41K-100 INH41K-500	I1%NH4-100 IHN1%NH4-500
Barium Ba^{+2}	$Ba(NO_3)_2$, dil. HNO_3	100 500		IBA-100 IBA-500	
Calcium Ca^{+2}	$CaCO_3$, dil. HNO_3	100 500		ICA-100 ICA-500	
Ethanolamine	$HOCH_2CH_2NH_2$, H_2O	100 500		IETA1K-100 IETA1K-500	IETA1%-500
Lithium Li^+	Li_2CO_3, dil. HNO_3	100 500	ILI100-500	ILI1K-100 ILI1K-500	
Magnesium Mg^{+2}	Mg, dil. HNO_3	100 500		IMG-100 IMG-500	
Potassium K^+	KNO_3, dil. HNO_3	100 500		IK-100 IK-500	
Sodium Na^+	Na_2CO_3, dil. HNO_3	100 500		INAN-100 INAN-500	
	NaCL, H_2O	100 500	INAW100-500	INAW1K-100 INAW1K-500	

Ammonia				
Ion	**Raw Material, Matrix**	**Conc. (µg/ml)**	**Volume (ml)**	**Product No.**
Ammonia NH_3	$(NH_4)_2SO_4$, H_2O	1	100 500	INH3-1-100 INH3-1-500
Ammonia NH_3	$(NH_4)_2SO_4$, H_2O	10	100 500	INH3-10-100 INH3-10-500
Ammonia NH_3	$(NH_4)_2SO_4$, H_2O	100	100 500	INH3-100-100 INH3-100-500
Ammonia NH_3	$(NH_4)_2SO_4$, H_2O	1000	100 500	INH3-1K-100 INH3-1K-500
Ammonia NH_3	$(NH_4)_2SO_4$, H_2O	10,000	100 500	INH3-1P-100 INH3-1P-500

For other anion and cation single-element standards at 100 µg/ml or 1%, please enquire.

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Multi-Ion Standards for Ion Chromatography

Multi-Anion Standards			
Ions	**Conc. (µg/ml)**	**Matrix**	**Product No.**
Multi-Anion Standard 1 - Volume 100 ml	100	H_2O	ICM1-100
F^-, Cl^-, Br^-, NO_3^-, PO_4^{-3}, SO_4^{-2}			
Multi-Anion Standard 2 - Volume 100 ml	100	H_2O	ICM2-100
F^-, Cl^-, SO_4^{-2}			
Multi-Anion Standard 3 - Volume 100 ml		H_2O	ICM3-100
F^- Cl^- NO_3^- PO_4^{-3}, SO_4^{-2}	20 30 100 150		
Multi-Anion Standard 4 - Volume 100 ml		H_2O	ICM4-100
F^- Cl^- Br^-, NO_3^-, SO_4^{-2} PO_4^{-3},	100 200 400 600		
Multi-Anion Standard 7A - Volume 100 ml	1000	H_2O	ICM7-100
F^-, Cl^-, NO_3^-, as N, Br^-, PO_4^{-3}as P			
Multi-Anion Standard 8 - Volume 100 ml	1000	H_2O	ICM8-100
Cl^-, F^-, NO_3^-, SO_4^{-2}			

Multi-Cation Standards			
Ions	**Conc. (µg/ml)**	**Matrix**	**Product No.**
Multi-Cation Standard 1 - Volume 100 ml		dil. HNO_3	ICM5A-100
Ca_2^+, K^+, Li^+ Mg^{+2} Na^+ NH_4^+	500 500 50 250 200 250		

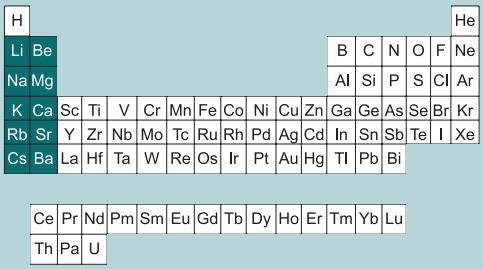
Multi-Element Standards

These standards are intended for calibration or quality control of ICP-AES or ICP-MS. These certified, NIST-traceable, multi-element mixes have elements conveniently grouped to provide nearly comprehensive coverage of the entire periodic table.

Alkalis & Alkaline Earths

Ba, Be, Ca, Cs, K, Li, Mg, Na, Rb, Sr @ 100µg/ml
Matrix: 5% HNO_3

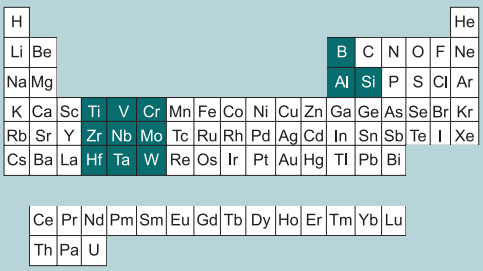
Volume	Product No.
100ml	SM10-100
500ml	SM10-500



Refractory Elements

Al, B, Cr, Hf, Mo, Nb, Si, Ta, Ti, V, W, Zr @ 100µg/ml
Matrix: 5% HCl, tr. HF

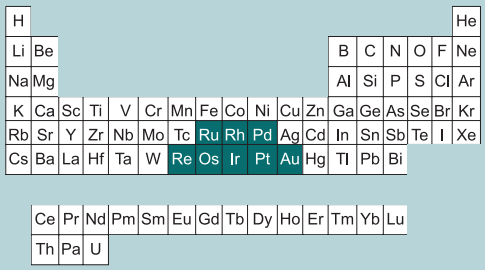
Volume	Product No.
100ml	SM30A-100
500ml	SM30A-500



Noble Metals

Au, Ir, Os, Pd, Pt, Re, Rh, Ru @ 100µg/ml
Matrix: 20% HCl

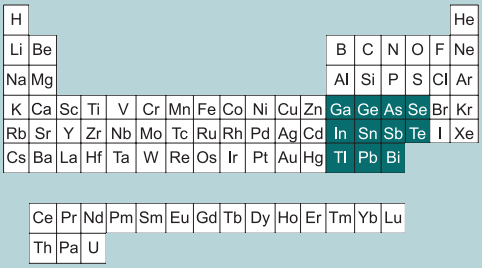
Volume	Product No.
100ml	SM40-100
500ml	SM40-500



Metalloids/Hydride Elements

As, Bi, Ga, Ge, In, Pb, Sb, Se, Sn, Te, Tl @ 100µg/ml
Matrix: 20% HCl, tr. HF

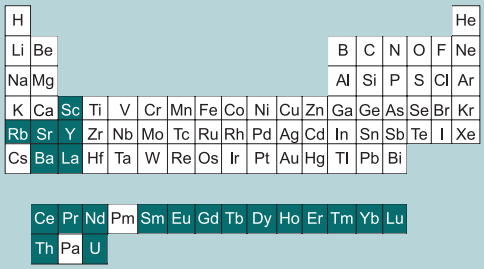
Volume	Product No.
100ml	SM50B-100
500ml	SM50B-500



Rare Earth and 'Geo' Elements

Ba, Ce, Dy, Er, Eu, Gd, Ho, La, Lu, Nd, Pr, Rb, Sc, Sm, Sr, Tb, Th, Tm, U, Y, Yb @ 100µg/ml
Matrix: 5% HNO_3

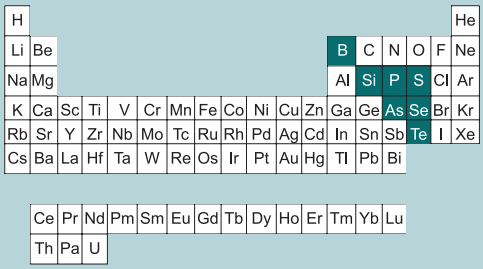
Volume	Product No.
100ml	SM60A-100
500ml	SM60A-500



Non-Metals

As, B, P, S, Se, Si, Te @ 100µg/ml
Matrix: 5% HCl, tr. HF

Volume	Product No.
100ml	SM25A-100
500ml	SM25A-500

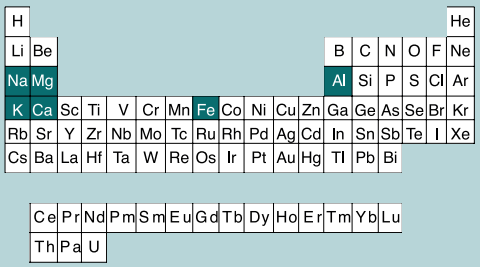


Email: askus@lgcstandards.com Website: www.lgcstandards.com

Major Cations Mix

Al, Ca, Fe, K, Mg, Na @ 1000µg/ml
Matrix: 5% HNO_3

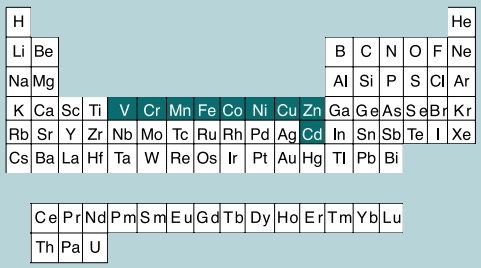
Volume	Product No.
100ml	SM16-100
500ml	SM16-500



Common Elements Mix 1

Cd, Co, Cr, Cu, Fe, Mn, Ni, V, Zn @ 100µg/ml
Matrix: 5% HNO_3

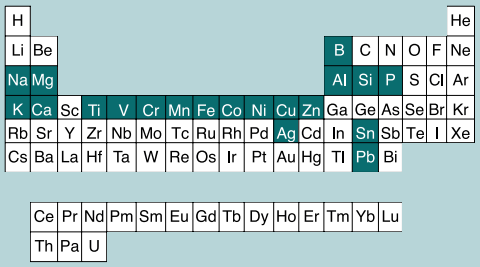
Volume	Product No.
100ml	SM35A-100
500ml	SM35A-500



Common Elements Mix 2

Ag, Al, B, Ca, Co, Cr, Cu, Fe, K, Mg,
Mn, Na, Ni, P, Pb, Si, Sn, Ti, V, Zn @ 100µg/ml
Matrix: 5% HNO_3 tr. HF

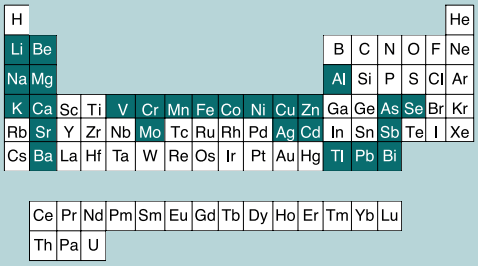
Volume	Product No.
100ml	SM70B-100
500ml	SM70B-500



Common & Transition – Multi Conc.

Ag, Al, As, Ba, Be, Bi, Cd, Cr, Co, Cu, Fe, Li, Mn,
Mo, Ni, Pb, Sb, Se, Sr, Tl, V, Zn @ 100 µg/ml;
Ca, K, Mg, Na @ 1000 µg/ml
Matrix: 5% HNO_3/0.2% HF

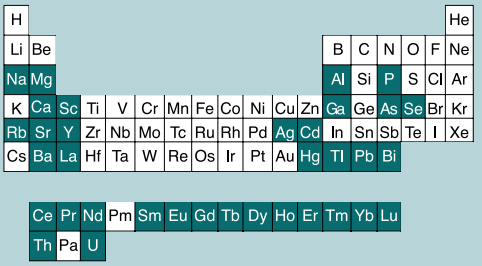
Volume	Product No.
100ml	SM75B-100
500ml	SM75B-500



Comprehensive Mix A

Ag, Al, As, Ba, Bi, Ca, Cd, Ce, Dy, Er, Eu, Ga,
Gd, Hg, Ho, La, Lu, Mg, Na, Nd, P, Pb, Pr, Rb,
Sc, Se, Sm, Sr, Tb, Th, Tl, Tm, U, Y, Yb @ 10µg/ml
Matrix: 40% aq. regia

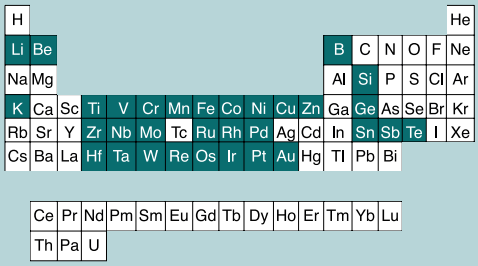
Volume	Product No.
100ml	SM80B-100
500ml	SM80B-500



Comprehensive Mix B

Au, B, Be, Co, Cr, Cu, Fe, Ge, Hf, Ir, K, Li, Mn,
Mo, Nb, Ni, Os, Pd, Pt, Re, Rh, Ru, Sb, Si, Sn, Ta,
Te, Ti, V, W, Zn, Zr @ 10µg/ml
Matrix: 40% aq. regia, tr. HF

Volume	Product No.
100ml	SM90C-100
500ml	SM90C-500



NIST Trace Element Clinical Standards

NIST-915B Calcium Carbonate (Clinical Standard) 20 g

This reference material is intended for use as an analytical standard of known purity. It is intended primarily for use in the calibration and standardisation of procedures for calcium determinations employed in clinical analysis and for routine critical evaluation of the daily working standards used in these procedures.

Certified Values *(as mass fractions)*

Calcium Carbonate ($CaCO_3$)	99.907 ± 0.021 %
Calcium (Ca)	40.0104 ± 0.0083 %
Carbonate (CO_3)	59.923 ± 0.012 %

Information Values

Barium (Ba)	2 µg/g
Chloride (Cl)	8 µg/g
Magnesium (Mg)	40 µg/g
Phosphorus (P)	3 µg/g
Silicon (Si)	5 µg/g
Sodium (Na)	17 µg/g
Strontium (Sr)	150 µg/g
Sulphur (S)	30 µg/g

NIST-918B Potassium Chloride (Clinical Standard) 30 g

This reference material is intended for use as an analytical standard of known purity. It is intended primarily for use in the calibration and standardisation of procedures for potassium and chloride determinations employed in clinical analysis and for routine critical evaluation of the daily working standards used in these procedures.

Certified Values *(as mass fractions)*

Potassium Chloride (KCl)	99.927 ± 0.014 %
Potassium (K)	52.4121 ± 0.0086 %
Chloride (Cl)	47.5284 ± 0.0049 %

Reference Value

Bromine (Br)	130 ± 45 µg/g

Information Values

Rubidium (Rb)	2.6 µg/g
Silicon (Si)	1.8 µg/g
Sodium (Na)	35 µg/g

NIST-919B Sodium Chloride (Clinical Standard) 30 g

This reference material is intended for the production of saline solutions of accurately known concentration and the calibration of instrumentation and standardisation of procedures used in the determination of sodium and chloride ions in clinical analysis.

Certified Values *(as mass fractions)*

Sodium Chloride (NaCl)	99.835 % ± 0.020 %
Chloride (Cl)	60.564 % ± 0.014 %
Sodium (Na)	39.2747 % ± 0.0075 %

Information Values

Aluminium (Al)	0.4 µg/g
Barium (Ba)	< 1 µg/g
Bromine (Br)	15 µg/g
Caesium (Cs)	< 0.5 µg/g
Calcium (Ca)	1 µg/g
Fluorine (F)	< 5 µg/g
Iron (Fe)	< 25 µg/g
Lithium (Li)	< 1 µg/g
Magnesium (Mg)	< 1 µg/g
Nickel (Ni)	< 2 µg/g
Phosphorus (P)	0.5 µg/g
Potassium (K)	7 µg/g
Rubidium (Rb)	< 1 µg/g
Silicon (Si)	5 µg/g
Sulphur (S)	10 µg/g

NIST-924A Lithium Carbonate (Clinical Standard) 30 g

This reference material is intended for use as a chemical of known purity. It is intended primarily for use in the calibration and standardisation of procedures employed in clinical analysis and for the routine critical evaluation of the daily working standards used in these procedures.

Certified Value *(as mass fraction)*

Lithium Carbonate (Li_2CO_3)	99.867 % ± 0.017 %

NIST-928 Lead Nitrate (Clinical Standard) 30 g

This reference material is intended for use as an assay standard for lead. It is intended primarily for use in the calibration and standardisation of procedures employed in clinical analysis and for the routine critical evaluation of the daily working standards used in these procedures.

Certified Value *(as mass fraction)*

Lead Nitrate ($Pb(NO_3)_2$)	100.00 ± 0.03

Information Values

Chromium (Cr)	3 µg/g
Nickel (Ni)	3 µg/g
Silver (Ag)	2 µg/g

NIST-929A Magnesium Gluconate Dihydrate (Clinical Standard for Magnesium) 5 g

This reference material is certified for use as an assay standard for magnesium. It is intended primarily for use in the calibration and standardisation of procedures employed in clinical analysis and for the routine critical evaluation of daily working standards used in these procedures**.**

Certified Value *(as mass fraction)*

Magnesium (Mg)	5.362 ± 0.027 %

NIST-937 Iron metal (Clinical Standard)

This reference material is a material of known purity intended for use as an assay standard for iron. It is intended primarily for use in the calibration and standardisation of procedures employed in clinical analysis and for the routine critical evaluation of daily working standards used in these procedures.

Certified Value *(as mass fraction)*

Iron (Fe)	99.90 ± 0.02 %

Information Values

Carbon (C)	0.007 %
Chromium (Cr)	0.007%
Nickel (Ni)	0.041 %
Silicon (Si)	0.008 %
Copper (Cu)	0.006 %
Cobalt (Co)	0.007 %
Manganese (Mn)	0.006 %
Oxygen (O)	0.006 %
Sulphur (S)	0.006 %
Molybdenum (Mo)	0.005 %
Phosphorus (P)	0.003 %
Germanium (Ge)	0.001 %
Nitrogen (N)	0.001 %

Trace Element Certified Reference Materials in Matrix

This chapter collates matrix CRM produced by institutes or international organisations with responsibility for metrological traceability. The materials have been thoroughly characterised using the best available measurement procedures, sometimes as part of international comparison between national metrology institutes and/ or collaborating laboratories. These materials are traceable to SI units and the uncertainties associated with the certified values are the smallest attainable. Many of these materials are classed as higher order reference materials and are listed on the JCTLM website.

Trace Elements in Blood

NIST-955C Toxic Metals in Frozen Caprine Blood 4 x 2 ml

This reference material is intended primarily for use in evaluating the accuracy of lead, arsenic, cadmium, mercury (total), ethylmercury, inorganic mercury, and methylmercury concentration determinations in whole blood. It can also be used in validation schemes for analytical methods and in traceability schemes for working or secondary blood reference materials containing these constituents.

Level 1

Analytes	Certified Value	Reference Value
Lead (Pb)	0.424 ± 0.011 µg/dl	-
Arsenic (As)	-	2.07 ± 0.63 µg/l
Cadmium (Cd)	0.0317 ± 0.0062 µg/l	-
Mercury (Hg) (Total)	0.017 ± 0.011 µg/l	-

Level 2

Analytes	Certified Value	Reference Value
Lead (Pb)	13.950 ± 0.080 µg/dl	-
Arsenic (As)	-	21.9 ± 1.7 µg/l
Cadmium (Cd)	-	2.14 ± 0.24 µg/l
Mercury (Hg) (Total)	-	4.95 ± 0.76 µg/l

Level 3

Analytes	Certified Value	Reference Value
Lead (Pb)	27.76 ± 0.16 µg/dl	-
Arsenic (As)	-	53.9 ± 3.4 µg/l
Cadmium (Cd)	5.201 ± 0.038 µg/l	-
Mercury (Hg) (Total)	17.8 ± 1.6 µg/l	-
Ethylmercury (as Hg)	5.06 ± 0.47 µg/l	-
Inorganic Mercury (as Hg)	9.0 ± 1.3 µg/l	-
Methylmercury (as Hg)	4.5 ± 1.0 µg/l	-

Level 4

Analytes	Certified Value	Reference Value
Lead (Pb)	45.53 ± 0.27 µg/dl	-
Arsenic (As)	-	77.5 ± 4.2 µg/l
Cadmium (Cd)	-	9.85 ± 0.17 µg/l
Mercury (Hg) (Total)	-	33.9 ± 2.1 µg/l

IAEA-A-13 Trace Elements in Freeze Dried Animal Blood 25 g

This sample is intended to be used as a reference material for the measurement of trace elements in blood. It can also be used as a quality control material for the assessment of a laboratory's analytical work, for the validation of analytical methods and for quality assurance within a laboratory.

Certified Values *(based on dry weight)*

Analytes	Certified Value	95% Confidence Interval
Bromine (Br)	22 mg/kg	19 – 24 mg/kg
Calcium (Ca)	286 mg/kg	226 - 332 mg/kg
Copper (Cu)	4.3 mg/kg	3.7 – 4.8 mg/kg
Iron (Fe)	2400 mg/kg	2200 – 2500 mg/kg
Potassium (K)	2500 mg/kg	2100 – 2700 mg/kg
Sodium (Na)	12600 mg/kg	11600 – 13500 mg/kg
Rubidium (Rb)	2.3 mg/kg	1.7 – 3.1 mg/kg
Sulphur (S)	6500 mg/kg	6000 – 7000 mg/kg
Selenium (S)	0.24 mg/kg	0.15 – 0.31 mg/kg
Zinc (Zn)	13 mg/kg	12 – 14 mg/kg

Information Values *(based on dry weight)*

Analytes	Certified Value	95% Confidence Interval
Magnesium (Mg)	99 mg/kg	81 - 139 mg/kg
Nickel (Ni)	1.0 mg/kg	0.6 – 1.4 mg/kg
Phosphorous (P)	940 mg/kg	690 - 1120 mg/kg
Lead (Pb)	0.18 mg/kg	0.15 – 0.29 mg/kg

BCR-634 Lead and Cadmium in Human Blood (Low), Lyophilised 3 ml

This material is intended for use as calibration material and as a quality control standard for evaluation of routine methods employed for the measurement of lead and cadmium in human blood.

Certified Values *(mass concentration in reconstituted material)*

Cadmium (Cd)	1.4 ± 0.4 µg/l
Lead (Pb)	46 ± 5 µg/l

BCR-635 Lead and Cadmium in Human Blood (Medium), Lyophilised 3 ml

This material is intended for use as calibration material and as a quality control standard for evaluation of routine methods employed for the measurement of lead and cadmium in human blood.

Certified Values *(mass concentration in reconstituted material)*

Cadmium (Cd)	6.6 ± 0.6 µg/l
Lead (Pb)	210 ± 24 µg/l

BCR-636 Lead and Cadmium in Human Blood (High), Lyophilised 3 ml

This material is intended for use as calibration material and as a quality control standard for evaluation of routine methods employed for the measurement of lead and cadmium in human blood.

Certified Values *(mass concentration in reconstituted material)*

Cadmium (Cd)	11.6 ± 0.6 µg/l
Lead (Pb)	(0.52 ± 0.05) 10^3 µg/l

ERM-CE195 Lead and Cadmium in Bovine Blood, Lyophilised 5.75 ml

This material is intended for use as calibration material and as a quality control standard for evaluation of routine methods employed for the measurement of lead and cadmium in whole blood.

Certified Values *(mass concentration in reconstituted material)*

Cadmium (Cd)	5.06 ± 0.15 µg/l
Lead (Pb)	416 ± 9 µg/l

ERM-CE196 Lead and Cadmium in Bovine Blood, Lyophilised 5.75 ml

This material is intended for use as calibration material and as a quality control standard for evaluation of routine methods employed for the measurement of lead and cadmium in whole blood.

Certified Values *(mass concentration in reconstituted material)*

Cadmium (Cd)	12.33 ± 0.20 µg/l
Lead (Pb)	772 ± 11 µg/l

NCS ZC84010 and NCS ZC84011, Lead and Cadmium in freeze-dried bovine blood, were out of stock at time of printing.

Trace Elements in Plasma

NIST-1950 Metabolites in Frozen Human Plasma 5 x 1 ml

This reference material is intended primarily for validation of methods for determining metabolites such as fatty acids, electrolytes, vitamins, hormones, and amino acids in human plasma and similar materials. This material can also be used for comparison of measurement technologies used in metabolomic studies and for quality assurance when assigning values to in-house reference materials. Only trace element values are listed here. For a full description of certified analytes, please request a COA.

Analytes	Certified Value	95% Confidence Interval
Calcium (Ca)	1.936 ± 0.024 mmol/l	-
Copper (Cu)	-	1.008 ± 0.008 mg/kg
Magnesium (Mg)	0.696 ± 0.004 mmol/l	-
Potassium (K)	3.665 ± 0.025 mmol/l	-
Selenium (Se)	-	0.1055 ± 0.0038 mg/kg
Sodium (Na)	141.76 ± 0.31 mmol/l	-
Zinc (Zn)	-	0.698 ± 0.030 mg/kg

Trace Elements in Serum

NIST-909C Frozen Human Serum 3 x 2 ml

This reference material is intended primarily for use in validating analytical methods for the determination of specified constituents in human serum.

Analytes	Certified Value	95% Confidence Interval
Cholesterol	3.703 ± 0 081 mmol/l	-
Creatinine	0.07289 ± 0.00161 mmol/l	-
Glucose	1.214 ± 0.017 mmol/l	-
Selenium (Se)	1.503 ± 0.035 µmol/l	-
Sodium (Na)	-	141.8 ± 0.2 mmol/l
Total glycerides	5.050 ± 0 059 mmol/l	-
Total Protein	-	69.0 ± 2.0 g/l
Urea	4.321 ± 0.089 mmol/l	-
Uric acid	0.278 ± 0.006 mmol/l	-

NIST-956C Electrolytes in Frozen Human Serum 6 x 2 ml

This reference material is primarily intended for use in the calibration and validation of procedures and methods employed in clinical analysis for the determination of electrolytes in either diluted or undiluted human serum or plasma. This material can be used for calibrating direct-reading ion-selective electrode (ISE) analyzers and for quality assurance in validating secondary reference materials.

Certified Values

Analytes	Level 1	Level 2	Level 3
Total Calcium (Ca)	2.981 ± 0.022 mmol/l	2.538 ± 0.016 mmol/l	2.095 ± 0.013 mmol/l
Chloride (Cl)	104.9 ± 3.2 mmol/l	121.5 ± 2.5 mmol/l	137.4 ± 1.8 mmol/l
Lithium (Li)	1.606 ± 0.024 mmol/l	1.068 ± 0.016 mmol/l	0.457 ± 0.007 mmol/l
Magnesium (Mg)	1.247 ± 0.013 mmol/l	0.857 ± 0.010 mmol/l	0.470 ± 0.005 mmol/l
Potassium (K)	5.976 ± 0.051 mmol/l	3.977 ± 0.034 mmol/l	1.982± 0.017 mmol/l
Sodium (Na)	118.8 ± 1.0 mmol/l	137.5 ± 1.6 mmol/l	157.4 ± 1.4 mmol/l

Reference Value

Analytes	Level 1	Level 2	Level 3
Ionized Calcium (Ca)	1.78 ± 0.08 mmol/l	1.48 ± 0.07 mmol/l	1.19 ± 0.05 mmol/l

NIST-1598A Inorganic Constituents in Frozen Animal (Bovine and Porcine) Serum 2 x 5 ml

This reference material is intended primarily for use in calibrating instrumentation and evaluating the accuracy of analytical methods for selected elements in blood serum, plasma, and similar biological fluids.

Analytes	Certified Value	95% Confidence Interval
Aluminium (Al)	-	2.3 ± 0.6 µg/l
Antimony (Sb)	1.00 ± 0.15 µg/l	-
Cadmium (Cd)	0.048 ± 0.004 µg/l	-
Calcium (Ca)	-	96 ± 7 mg/l
Cesium (Cs)	0.64 ± 0.10 µg/l	-
Chromium (Cr)	-	0.33 ± 0.08 µg/l
Cobalt (Co)	1.24 ± 0.07 µg/l	-
Copper (Cu)	0.64 ± 0.10 µg/l	-
Iron (Fe)	1680 ± 60 µg/l	-
Manganese (Mn)	1.78 ± 0.33 µg/l	-
Mercury (Hg)	-	0.32 ± 0.19 µg/l
Molybdenum (Mo)	-	5.5 ± 1.0 µg/l
Nickel (Ni)	0.94 ± 0.18 µg/l	-
Rubidium (Rb)	274 ± 19 µg/l	-
Selenium (Se)	134.4 ± 5.8 µg/l	-
Vanadium (V)	1.88 ± 0.11 µg/l	-
Zinc (Zn)	880 ± 24 µg/l	-

ERM-DA120 Frozen Human Serum - Trace Metals (Cu, Se, Zn) 1.1 ml

This reference material is intended for use in the validation of new and existing methods, and monitoring the performance of methods commonly used in clinical laboratories to determine the important trace elements; copper, selenium and zinc in human serum samples. It can also be used in the training and evaluation of staff.

Certified Values

Copper (Cu)	1130 ± 33 µg/kg
Selenium (Se)	64.1 ± 3 µg/kg
Zinc (Zn)	658 ± 33 µg/kg

Certification in progress for Fe, Mg, Ca, K and Selenomethionine. Due for completion Nov 2013.

BCR-637 Human Serum (Aluminium, Selenium, Zinc) (Low), Frozen 4.5 ml

Certified Values

This material is intended for use as calibration material and as a quality control standard for evaluation of routine methods employed for the measurement of the specified components in human serum.

Aluminium (Al)	12.5 ± 3 µg/l
Selenium (Se)	81 ± 7 µg/l
Zinc (Zn)	1110 ± 220 µg/l

BCR-638 Human Serum (Aluminium, Selenium, Zinc) (Medium), Frozen 4.5 ml

Certified Values

This material is intended for use as calibration material and as a quality control standard for evaluation of routine methods employed for the measurement of the specified components in human serum.

Aluminium (Al)	55 ± 7 µg/l
Selenium (Se)	104 ± 7 µg/l
Zinc (Zn)	1430 ± 210 µg/l

BCR-639 Human Serum (Aluminium, Selenium, Zinc) (High), Frozen 4.5 ml

Certified Values

This material is intended for use as calibration material and as a quality control standard for evaluation of routine methods employed for the measurement of the specified components in human serum.

Aluminium (Al)	194 ± 14 µg/l
Selenium (Se)	133 ± 12 µg/l
Zinc (Zn)	2360 ± 140 µg/l

BCR-304 Calcium, Magnesium and Lithium in Human Serum, Lyophilised 5.3 ml

This material is intended for use as calibration material and as a quality control standard for evaluation of routine methods employed for the measurement of the specified constituents in human serum.

Certified Values

Calcium (Ca)	2.201 ± 0.019 mmol/l
Magnesium (Mg)	1.85 ± 0.03 mmol/l
Lithium (Li)	0.985 ± 0.029 mmol/l

ERM-DA250 Creatinine and Electrolytes in Frozen Human Serum (High) 1 ml

The material is intended for use in the validation and ongoing monitoring of methods of analysis for the determination of creatinine and electrolytes in human blood samples.

Certified Values

Calcium (Ca)	123 ± 5 mg/kg
Creatinine	39 ± 3 mg/kg
Lithium (Li)	6.6 ± 0.4 mg/kg
Magnesium (Mg)	47 ± 3 mg/kg
Potassium (K)	277 ± 14 mg/kg
Sodium (Na)	3370 ± 110 mg/kg

ERM-DA251 Creatinine and Electrolytes in Frozen Human Serum (Low) 1 ml

The material is intended for use in the validation and ongoing monitoring of methods of analysis for the determination of creatinine and electrolytes in human blood samples.

Certified Values

Calcium (Ca)	71 ± 3 mg/kg
Creatinine	22 ± 2 mg/kg
Lithium (Li)	4.5 ± 0.3 mg/kg
Magnesium (Mg)	19 ± 2 mg/kg
Potassium (K)	136 ± 7 mg/kg
Sodium (Na)	2740 ± 80 mg/kg

ERM-DA252 Creatinine in Frozen Human Serum (Low) 1 ml

The material is intended for use in the validation and ongoing monitoring of methods of analysis for the determination of creatinine in human blood samples.

Certified Value

Creatinine	3.1 ± 0.5 mg/kg

Information Values

Calcium (Ca)	58 mg/kg
Lithium (Li)	1.3 mg/kg
Magnesium (Mg)	8.1 mg/kg
Potassium (K)	67 mg/kg
Sodium (Na)	2400 mg/kg

ERM-DA253 Creatinine in Frozen Human Serum (High) 1 ml

The material is intended for use in the validation and ongoing monitoring of methods of analysis for the determination of creatinine in human blood samples.

Certified Value

Creatinine	50 ± 2 mg/kg

Information Values

Calcium (Ca)	96 mg/kg
Lithium (Li)	8.4 mg/kg
Magnesium (Mg)	35 mg/kg
Potassium (K)	238 mg/kg
Sodium (Na)	3260 mg/kg

JCCRM111-6 Electrolytes (Na, K, Cl) in Frozen Human Serum 3 x 0.5 ml

This material is primarily intended for use in evaluating the accuracy of serum (plasma) sodium, potassium and chloride measurements with (direct and indirect) ion selective electrodes in clinical laboratory tests. Its major use applications are evaluation of routine serum-electrolyte analysers, evaluation of newly developed serum-electrolyte analysers or ion selective electrodes. It can also be used to assess the accuracy of serum Na, K measurements by flame spectrometry and serum chloride measurements by routine coulometric titration.

Certified Values

Analytes	High Level	Medium Level	Low Level
Sodium (Na)	157.2 ± 0.4 mmol/l	141.3 ± 0.4 mmol/l	123.9 ± 0.3 mmol/l
Potassium (K)	5.662 ± 0.018 mmol/l	4.473 ± 0.017 mmol/l	3.246 ± 0.010 mmol/l
Chloride (Cl)	123.9 ± 0.3 mmol/l	3.246 ± 0.010 mmol/l	89.8 ± 0.2 mmol/l

JCCRM321-6 Ionised Calcium (Ca2+) and Electrolytes (Na, K, Cl, total Ca, total Mg and Inorganic Phosphorus) in Frozen Human Serum 6 x 1.2 ml (3 at each level)

This material is intended for ISE measurements of ionized calcium as defined in “IFCC Recommended Reference Method for the Determination of the Substance Concentration of Ionized Calcium in Undiluted Serum, Plasma or Whole Blood” issued by IFCC WG on ISE. It can also be used to assess the accuracy of analytical methods for the specified electrolytes.

Certified Values

Analytes	Low Level	High Level
Ionised Calcium (Ca^{2+})	1.22 ± 0.03 mmol/l	1.52 ± 0.04 mmol/l
Total Calcium (Ca)	9.38 ± 0.08 mg/dl	11.82 ± 0.10 mg/dl
Total Magnesium (Mg)	1.94 ± 0.03 mg/dl	3.40 ± 0.05 mg/dl
Inorganic Phosphorus	3.2 ± 0.1 mg/dl	-
Sodium (Na)	142.1 ± 0.5 mmol/l	155.7 ± 0.5 mmol/l
Potassium (K)	4.14 ± 0.02 mmol/l	5.63 ± 0.03 mmol/l
Chloride (Cl)	104.5 ± 0.4 mmol/l	121.5 ± 0.6 mmol/l

JCCRM322-4 Iron (Fe) in Frozen Human Serum 6 x 1 ml (3 at each level)

This CRM is intended primarily for use in evaluating the accuracy of procedures and calibrating procedures for determination of serum iron.

Certified Value

Analytes	Medium Level	High Level
Serum Iron (Fe)	43.1 ± 1.7 µg/dl	129.3 ± 4.5 µg/dl

Trace Elements in Urine

NIST-2670A Toxic Elements in Freeze-Dried Human Urine 2 x 2 x 20 ml

This reference material is primarily intended for use in evaluating the accuracy of clinical methods used to determine the mass concentration of toxic metals and other elements in human urine or similar matrices. It can also be used to validate working or secondary reference materials.

Certifed Values

Analytes	Low Level	High Level
Antimony (Al)	0.971 ± 0.033 µg/l	0.824 ± 0.070 µg/l
Cadmium (Cd)	0.0591 ± 0.0034 µg/l	5.16 ± 0.11 µg/l
Cesium (Cs)	1.075 ± 0.031 µg/l	1.085 ± 0.052 µg/l
Cobalt (Co)	0.166 ± 0.040 µg/l	51.2 ± 3.2 µg/l
Iodine (I) (as Iodide)	88.2 ± 1.1 µg/l	88.2 ± 1.1 µg/l
Lead (Pb)	0.49 ± 0.16 µg/l	249.9 ± 4.3 µg/l
Mercury (Hg)	0.066 3 ± 0.0058 µg/l	95.1 ± 0.98 µg/l
Manganese (Mn)	-	99 ± 12 µg/l
Molybdenum (Mo)	-	114.1 ± 4.8 µg/l
Platinum (Pt)	-	51.5 ± 6.6 µg/l
Selenium (Se)	-	229.5 ± 8.3 µg/l
Thallium (Tl)	0.0162 ± 0.0045 µg/l	5.417 ± 0.064 µg/l
Thorium (Th)	0.0053 ± 0.0014 µg/l	0.01606 ± 0.00077 µg/l
Uranium (U)	0.1020 ± 0.0023 µg/l	4.997 ± 0.071 µg/l

Reference Values

Analytes	Low Level	High Level
Calcium (Ca)	29 ± 2 mg/l	30 ± 2 mg/l
Magnesium (Mg)	21.0 ± 0.2 mg/l	21.2 ± 0.2 mg/l
Potassium (K)	410 ± 10 mg/l	415 ± 10 mg/l
Sodium (Na)	856 ± 15 mg/l	942 ± 20 mg/l
Arsnic (As)	-	220 ± 10 µg/l
Copper (Cu)	-	110 ± 4 µg/l
Manganese (Mn)	2.6 ± 0.7 µg/l	-
Selenium (Se)	8 ± 3 µg/l	-
Tin (Sn)	-	89 ± 7 µg/l
Zinc (Zn)	130 ± 30 µg/l	410 ± 30 µg/l

Information Values

Analytes	Low Level	High Level
Aluminum (Al)	4 µg/l	100 µg/l
Arsenic (As)	3 µg/l	-
Barium (Ba)	2 µg/l	2 µg/l
Beryllium (Be)	-	5 µg/l
Chromium (Cr)	2 µg/l	20 µg/l
Copper (Cu)	5 µg/l	-
Molybdenum (Mo)	17 µg/l	-
Nickel (Ni)	2 µg/l	100 µg/l
Tin (Sn)	<1 µg/l	-
Tungsten (W)	<1 µg/l	<1 µg/l
Vanadium (V)	<1 µg/l	30 µg/l

NIST-2668 Toxic Elements in Frozen Human Urine 5 x 2 x 1.5 ml

This reference material is intended primarily for validating analytical methods and measurements for the determination of toxic elements in human urine.

Certified Values

Analytes	Level 1	Level 2
Antimony (Al)	-	22.4 ± 1.0 µg/l
Arsenic (As)	10.81 ± 0.54 µg/l	213.1 ± 4.4 µg/l
Barium (Ba)	-	254.6 ± 3.2 µg/l
Beryllium (Be)	-	54.5 ± 2.4 µg/l
Cadmium (Cd)	1.056 ± 0.052 µg/l	16.40 ± 0.25 µg/l
Cesium (Cs)	4.90 ± 0.30 µg/l	221 ± 12 µg/l
Chromium (Cr)	-	27.7 ± 2.1 µg/l
Cobalt (Co)	0.816 ± 0.058 µg/l	51.8 ± 1.7 µg/l
Copper (Cu)	-	134.1 ± 5.4 µg/l
Lead (Pb)	1.234 ± 0.061 µg/l	137.9 ± 3.6 µg/l
Manganese (Mn)	-	47.6 ± 3.4 µg/l
Molybdenum (Mo)	-	1687 ± 58 µg/l
Nickel (Ni)	-	115.3 ± 5.2 µg/l
Vanadium (V)	0.980 ± 0.086 µg/l	48.5 ± 4.6 µg/l

Reference Values

Analytes	Level 1	Level 2
Antimony (Sb)	0.242 ± 0.031 µg/l	-
Barium (Ba)	1.96 ± 0.14 µg/l	-
Beryllium (Be)	1.073 ± 0.081 µg/l	-
Chlorine (Cl)	2730 ± 120 mg/l	2620 ± 100 mg/l
Chromium (Cr)	1.08 ± 0.31 µg/l	-
Copper (Cu)	28.1 ± 2.0 µg/l	-
Creatinine	626 mg/l	618 mg/l
Fluoride (F)	12.25 ± 0.14 mg/l	18.83 ± 0.92 mg/l
Manganese (Mn)	1.08 ± 0.16 µg/l	-
Molybdenum (Mo)	51.6 ± 1.8 µg/l	-
Nickel (Ni)	2.31 ± 0.32 µg/l	-
Platinum (Pt)	1.04 ± 0.12 µg/l	117.0 ± 9.8 µg/l
Potassium (K)	1581 ± 86 mg/l	1540 ± 110 2 mg/l
Sodium (Na)	1840 ± 100 mg/l	1802 ± 53 2 mg/l
Thallium (Tl)	0.719 ± 0.029 µg/l	115.2 ± 2.8 µg/l
Tin (Sn)	1.69 ± 0.14 µg/l	171.0 ± 9.0 µg/l
Tungsten (W)	1.252 ± 0.080 µg/l	62.5 ± 1.0 µg/l
Uranium (U)	0.0340 ± 0.0024 µg/l	13.37 ± 0.49 µg/l

NIST-2669 Arsenic Species in Frozen Human Urine 5 x 2 x 1.5 ml

This reference material is intended primarily for validating analytical methods and measurements for the determination of arsenic species in human urine.

Certified Values

Analytes	Level 1	Level 2
Arsenous acid (AsIII)	1.47 ± 0.10 µg/l	5.03 ± 0.31 µg/l
Arsenic acid (AsV)	2.41 ± 0.30 µg/l	6.16 ± 0.95 µg/l
Monomethylarsonic acid (MMA)	1.87 ± 0.39 µg/l	7.18 ± 0.56 µg/l
Dimethylarsinic acid (DMA)	3.47 ± 0.41 µg/l	25.3 ± 0.7 µg/l
Trimethylarsine oxide (TMAO)	-	1.94 ± 0.27 µg/l
Arsenobetaine (AB)	12.4 ± 1.9 µg/l	1.43 ± 0.08 µg/l
Arsenocholine (AC)	3.74 ± 0.35 µg/l	-

Reference Value

Analytes	Level 1	Level 2
Arsenic, total	22.2 ± 4.8 µg/l	50.7 ± 6.3 µg/l

Information Values

Analytes	Level 1	Level 2
Trimethylarsine oxide (TMAO)	< 0.8 µg/l	-
Arsenocholine (AC)	< 0.7 µg/l	-

NIST-3668 Mercury, Perchlorate, and Iodide in Frozen Human Urine 5 x 2 x 1.5 ml

This reference material is intended primarily for validating analytical methods and measurements for the determination of toxic elements and anions in human urine.

Certified Values

Analytes	Low Level	High Level
Mercury (Hg)	0.910 ± 0.055 µg/l	6.38 ± 0.46 µg/l
Perchlorate	2.70 ± 0.21 µg/l	13.47 ± 0.96 µg/l
Nitrate	38.7 ± 3.0 mg/l	90.3 ± 5.6 mg/l

Reference Values

Analytes	Low Level	High Level
Iodine (I) (as Iodide)	142.7 ± 1.6 µg/l	279.0 ± 3.9 µg/l
Thiocyanate	1160 ± 150 µg/l	6920 ± 450 µg/l

Information Value

Analytes	Low Level	High Level
Creatinine	574 mg/l	567 mg/l

Trace Elements in Tissue

ERM-CE278K Mussel Tissue - Trace Elements (Lyophilised Powder) 8 g

This reference material is primarily intended for use in evaluating the accuracy of clinical methods used to determine the mass concentration of toxic metals and other elements in human urine or similar matrices. It can also be used to validate working or secondary reference materials.

Certified Values *(as mass fractions)*

Arsenic (As)	6.7 ± 0.4 mg/kg
Cadmium (Cd)	0.336 ± 0.025 mg/kg
Chromium (Cr)	0.73 ± 0.22 mg/kg
Copper (Cu)	5.98 ± 0.27 mg/kg
Iron (Fe)	161 ± 8 mg/kg
Lead (Pb)	2.18 ± 0.18 mg/kg
Maganese (Mn)	4.88 ± 0.24 mg/kg
Mercury (Hg)	0.071 ± 0.007 mg/kg
Nickel (Ni)	0.69 ± 0.15 mg/kg
Rubidium (Rb)	2.46 ± 0.16 mg/kg
Selenium (Se)	1.62 ± 0.12 mg/kg
Strontium (Sr)	19.0 ± 1.2 mg/kg
Zinc (Zn)	71 ± 4 mg/kg

Reference Value *(as mass fraction)*

Silver (Ag)	0.044 ± 0.016 mg/kg

Information Values *(as mass fractions)*

Calcium (Ca)	1.83 g/kg
Cobalt (Co)	0.21 mg/kg
Lithium (Li)	22.8 g/kg
Magnesium (Mg)	5.37 g/kg
Potassium (K)	1.51 g/kg
Sodium (Na)	13.9 g/kg

ERM-BB184 Bovine Muscle - Trace Elements (Lyophilised Powder) 7 g

This material is intended to be used for analytical method validation and performance control.

Certified Values *(as mass fractions)*

Arsenic (As)	0.0234 ± 0.0026 mg/kg
Cadmium (Cd)	0.0022 ± 0.0004 mg/kg
Copper (Cu)	2.31 ± 0.09 mg/kg
Iron (Fe)	75 ± 4 mg/kg
Maganese (Mn)	0.276 ± 0.013 mg/kg
Selenium (Se)	0.45 ± 0.04 mg/kg
Zinc (Zn)	146 ± 7 mg/kg

Reference Value *(as mass fraction)*

Mercury (Hg)	0.0018 ± 0.0010 mg/kg

Information Values *(as mass fractions)*

Calcium (Ca)	0.155 g/kg
Chlorine (Cl)	1.54 g/kg
Magnesium (Mg)	1.00 g/kg
Potassium (K)	15.8 g/kg
Sodium (Na)	1.80 g/kg

ERM-BB186 Pig Kidney - Trace Elements (Lyophilised Powder) 10 g

This material is intended to be used for analytical method validation and performance control.

Certified Values *(as mass fractions)*

Cadmium (Cd)	1.09 ± 0.05 mg/kg
Copper (Cu)	36.5 ± 1.8 mg/kg
Iron (Fe)	255 ± 13 mg/kg
Lead (Pb)	0.040 ± 0.05 mg/kg
Maganese (Mn)	7.26 ± 0.25 mg/kg
Selenium (Se)	10.3 ± 0.9 mg/kg
Zinc (Zn)	134 ± 5 mg/kg

Reference Values *(as mass fractions)*

Arsnic (As)	0.008 ± 0.006 mg/kg
Mercury (Hg)	0.0023 ± 0.011 mg/kg

Information Values *(as mass fractions)*

Calcium (Ca)	0.29 g/kg
Chlorine (Cl)	7.1 g/kg
Cobalt (Co)	0.106 mg/kg
Magnesium (Mg)	0.79 g/kg
Potassium (K)	12.0 g/kg
Sodium (Na)	6.0 g/kg

NIST-1400 Bone Ash 50 g

This reference material is intended primarily for use in evaluating analytical methods for the determination of selected major, minor and trace elements in bone and in material of a similar matrix.

Analytes	Certified Value	Reference Value
Aluminium (Al)	-	530 µg/g
Arsenic (As)	-	0.4 µg/g
Cadmium (Cd)	-	0.03 µg/g
Calcium (Ca)	38.18 ± 0.13 wt%	-
Copper (Cu)	-	2.3 µg/g
Fluorine (F)	-	1250 µg/g
Iron (Fe)	660 ± 27 µg/g	-
Lead (Pb)	9.07 ± 0.12 µg/g	-
Magnesium (Mg)	-	17 µg/g
Manganese (Mn)	0.684 ± 0.013 wt%	-
Phosphorus (P)	17.91 ± 0.19 wt%	-
Potassium (K)	186 ± 8 µg/g	-
Selenium (Se)	-	0.08 µg/g
Silicon (Si)	-	0.13 wt%
Sodium (Na)	-	0.6 wt%
Strontium (Sr)	249 ± 7 µg/g	-
Zinc (Zn)	181 ± 3 µg/g	-

NIST-1486 Bone Meal 50 g

This reference material is intended primarily for use in evaluating analytical methods for the determination of selected major, minor and trace elements in bone and in material of a similar matrix.

Analytes	Certified Value	Reference Value
Aluminium (Al)	-	<1 µg/g
Arsenic (As)	-	0.006 µg/g
Cadmium (Cd)	-	0.003 µg/g
Calcium (Ca)	26.58 ± 0.24 wt%	-
Carbon (Total)	-	18.6 wt%
Copper (Cu)	-	0.8 µg/g
Fluorine (F)	-	800 µg/g
Iron (Fe)	99 ± 8 µg/g	-
Lead (Pb)	1.335 ± 0.014 µg/g	-
Magnesium (Mg)	0.466 ± 0.017 wt%	-
Manganese (Mn)	-	1 µg/g
Phosphorus (P)	12.30 ± 0.19 wt%	-
Potassium (K)	412 ± 4 µg/g	-
Selenium (Se)	-	0.13 µg/g
Silicon (Si)	-	<0.02 wt%
Sodium (Na)	-	0.5 wt%
Strontium (Sr)	264 ± 7 µg/g	-
Zinc (Zn)	147 ± 16 µg/g	-

Trace Elements in Hair

ERM-DB001 Human Hair - Trace Elements (Powder) 3.5 g

This material is intended to be used for analytical method validation and performance control.

Certified Values *(as mass fractions)*

Arsnic (As)	0.044 ± 0.006 mg/kg
Cadmium (Cd)	0.125 ± 0.007 mg/kg
Copper (Cu)	33 ± 4 mg/kg
Mercury (Hg)	0.365 ± 0.028 mg/kg
Lead (Pb)	2.14 ± 0.20 mg/kg
Selenium (Se)	3.24 ± 0.24 mg/kg
Zinc (Zn)	209 ± 12 mg/kg

IAEA-085 Methylmercury, Total Mercury and other trace elements in Human Hair (Powder) 5 g

This material is intended as reference material primarily for the measurements of total mercury (Hg) and methylmercury (MeHg), but also for indicated trace elements. The material can also be used for the assessment and control of a laboratory's analytical work, and for the validation of analytical methods used in a laboratory, i.e., in general quality assurance within a laboratory and for training purposes.

Certified Values *(based on dry weight)*

Analytes	Value	95% Confidence Interval
Mercury (Hg)	23.2 mg/kg	22.4 - 24.0 mg/kg
Iron (Fe)	79.3 mg/kg	71.0 - 87.8 mg/kg
Zinc (Zn)	163 mg/kg	156 - 170 mg/kg
Methylmercury (MeHg)	22.9 mg/kg	21.9 - 23.9 mg/kg

Information Values *(based on dry weight)*

Analytes	Value	95% Confidence Interval
Calcium (Ca)	929 mg/kg	847 - 1010 mg/kg
Copper (Cu)	16.8 mg/kg	15.7 - 17.8 mg/kg
Magnesium (Mg)	140 mg/kg	127 - 153 mg/kg
Manganese (Mn)	8.8 mg/kg	8.4 - 9.2 mg/kg
Scandium (Sc)	0.0092 mg/kg	0.0084 - 0.0100 mg/kg
Selenium (Se)	1.07 mg/kg	0.96 - 1.17 mg/kg

IAEA-086 Methylmercury, Total Mercury and other trace elements in Human Hair (Powder) 5 g

This material is intended as reference material primarily for the measurements of total mercury (Hg) and methylmercury (MeHg), but also for indicated trace elements. The material can also be used for the assessment and control of a laboratory's analytical work, and for the validation of analytical methods used in a laboratory, i.e., in general quality assurance within a laboratory and for training purposes.

Certified Values *(based on dry weight)*

Analytes	Value	95% Confidence Interval
Mercury (Hg)	0.573 mg/kg	0.524 – 0.612 mg/kg
Iron (Fe)	123 mg/kg	110 - 136 mg/kg
Zinc (Zn)	167 mg/kg	159 - 174 mg/kg
Methylmercury (MeHg)	0.258 mg/kg	0.236 – 0.279 mg/kg

Information Values (based on dry weight)

Analytes	Value	95% Confidence Interval
Calcium (Ca)	1120 mg/kg	1000 - 1240 mg/kg
Copper (Cu)	17.6 mg/kg	16.6 – 18.5 mg/kg
Magnesium (Mg)	140 mg/kg	156 - 197 mg/kg
Manganese (Mn)	8.8 mg/kg	8.9 – 10.3 mg/kg
Scandium (Sc)	0.0092 mg/kg	0.013 - 0.016 mg/kg

GBW09101b Trace elements in Human Hair (Powder) 7 g

This CRM was produced by the Shanghai Institute of Nuclear Research of the Chinese Academy of Sciences Shanghai, China. It is intended for verification and calibration of analytical instruments, validation of analytical methods used in biological materials with similar matrix, and evaluation of measurement data.

Certified Values

Element	Value
Silver (Ag)	0.037 ± 0.002 µg/g
Aluminium (Al)	23.2 ± 2.0 µg/g
Arsenic (As)	0.198 ± 0.023 µg/g
Barium (Ba)	11.1 ± 1.3 µg/g
Calcium (Ca)	1537 ± 68 µg/g
Cadmium (Cd)	0.072 ± 0.010 µg/g
Cobalt (Co)	0.153 ± 0.015 µg/g
Chromium (Cr)	8.74 ± 0.97 µg/g
Copper (Cu)	33.6 ± 2.3 µg/g
Iron (Fe)	160 ± 16 µg/g
Mercury (Hg)	1.06 ± 0.28 µg/g

Element	Value
Iodine (I)	0.96 ± 0.20 µg/g
Magnesium (Mg)	248 ± 14 µg/g
Manganese (Mn)	3.83 ± 0.39 µg/g
Molybdenum (Mo)	1.06 ± 0.12 µg/g
Sodium (Na)	445 ± 40 µg/g
Phosphorus (P)	174 ± 43 µg/g
Lead (Pb)	3.83 ± 0.18 µg/g
Antimony (Sb)	0.12 ± 0.02 µg/g
Selenium (Se)	0.59 ± 0.04 µg/g
Strontium (Sr)	0.96 ± 0.69 µg/g
Zinc (Zn)	248 ± 16 µg/g

Information Values

Element	Value
Potassium (K)	14.4 µg/g
Lanthanum (La)	0.029 µg/g
Sulfur (S)	4.62 %
Chlorine (Cl)	48.2 µg/g

Element	Value
Titanium (Ti)	2.10 µg/g
Vanadium (V)	0.089 µg/g
Bromine (Br)	0.59 µg/g
Nickel (Ni)	5.77 µg/g

NCS DC73347a Trace Elements in Human Hair 6 g

This material is approved by the China National Analysis Centre for Iron and Steel for use as a measurement of trace elements in hair. The material can be used for validation of analytical methods, quality assurance and for training purposes.

Certified Values

Element	Value
Arsenic (As)	0.28 ± 0.05 (10^{-6})
Boron (B)	2.9 ± 0.5 (10^{-6})
Barium (Ba)	11.4 ± 0.6 (10^{-6})
Beryllium (Be)	110 ± 7 (10^{-9})
Bismuth (Bi)	21 ± 2 (10^{-9})
Calcium (Ca)	0.145 ± 0.020 (10^{-2})
Cadmium (Cd)	0.07 ± 0.01 (10^{-9})
Cobalt (Co)	0.045 ± 0.009 (10^{-6})
Chromium (Cr)	0.41 ± 0.12 (10^{-6})
Copper (Cu)	14.3 ± 1.6 (10^{-6})
Dysprosium (Dy)	20 ± 7 (10^{-9})
Erbium (Er)	14 ± 5 (10^{-9})
Europium (Eu)	3.7 ± 1.1 (10^{-9})
Iron (Fe)	36 ± 5 (10^{-6})
Gadolinium (Gd)	20 ± 5 (10^{-6})
Mercury (Hg)	670 ± 100 (10^{-9})
Holmium (Ho)	4.6 ± 1.8 (10^{-9})
Iodine (I)	0.8 ± 0.2 (10^{-6})
Lanthanum (La)	0.16 ± 0.04 (10^{-6})
Manganese (Mn)	2.0 ± 0.3 (10^{-6})
Molybdenum (Mo)	0.17 ± 0.03 (10^{-6})

Element	Value
Nitrogen (N)	13.9 ± 0.5 (10^{-2})
Sodium (Na)	0.0089 ± 0.0012 (10^{-6})
Neodymium (Nd)	0.093 ± 0.020 (10^{-6})
Nickel (Ni)	0.43 ± 0.12 (10^{-6})
Phosphorus (P)	0.014 ± 0.002 (10^{-2})
Lead (Pb)	5.7 ± 0.5 (10^{-6})
Praseodymium (Pr)	25 ± 6 (10^{-9})
Sulphur (S)	4.19 ± 0.11 (10^{-2})
Selenium (Se) (10-6)	0.58 ± 0.12
Samarium (Sm)	19 ± 6 (10^{-9})
Strontium (Sr)	7.7 ± 0.4 (10^{-6})
Terbium (Tb)	3.3 ± 0.9 (10^{-9})
Thorium (Th)	0.064 ± 0.011 (10^{-6})
Thallium (Tl)	7.7 ± 1.1 (10^{-9})
Thulium (TM)	21 ± 0.7 (10^{-9})
Uranium (U)	99 ± 15 (10^{-9})
Vanadium (V)	0.50 ± 0.18 (10^{-6})
Yttrium (Y)	11.2 ± 1.7 (10^{-6})
Ytterbium (Yb)	15 ± 6 (10^{-9})
Zinc (Zn)	137 ± 9 (10^{-6})

Information Values

Element	Value
Silver (Ag)	50 (10^{-9})
Aluminium (Al)	2 (10^{-2})
Bromine (Br)	1.1 (10^{-6})
Cerium (Ce)	0.35 (10^{-6})
Chlorine(Cl)	0.018 (10^{-2})
Cesium (Cs)	0.003 (10^{-6})
Fluorine (F)	11 (10^{-6})
Hafnium (Hf)	0.6 (10^{-6})
Potassium (K)	0.002 (10^{-2})
Lithium (Li)	1.6 (10^{-6})

Element	Value
Lutetium (Lu)	2.8 (10^{-9})
Magnesium (Mg)	0.014 (10^{-2})
Rubidium (Rb)	0.06 (10^{-6})
Antimony (Sb)	0.065 (10^{-6})
Scandium (Sc)	0.018 (10^{-6})
Silicon (Si)	0.06 (10^{-2})
Tin (Sn)	0.2 (10^{-6})
Titanium (Ti)	3.3 (10^{-6})
Ash	5.5 (%)

Trace Element Calibrators

Whole Blood Calibrator for Trace Elements

This reference material is a working calibrator. It is intended for calibration of analytical systems for determination of the specified trace elements in occupational, environmental and clinical toxicology laboratories. It is at a concentration suitable for one-point-calibration. The mean values and confidence intervals were established in independent reference laboratories.

REC-9943 Whole Blood Calibrator for Trace Elements, Lyophilised 5 x 5 ml

Arsenic (As)	24.1 µg/l	Magnesium (Mg)	47.7 mg/l	Potassium (K)	N/A g/l
Cadmium (Ca)	8.70 µg/l	Manganese (Mn)	24.7 µg/l	Selenium (Se)	187 µg/l
Chromium (Cr)	12.9 µg/l	Mercury (Hg)	8.45 µg/l	Silver (Ag)	N/A µg/l
Cobalt (Co)	N/A µg/l	Nickel (Ni)	14.9 µg/l	Thallium (Tl)	12.9 µg/l
Copper (Cu)	1.96 mg/l	Palladium (Pd)	N/A µg/l	Zinc (Zn)	8.46 mg/l
Lead (Pb)	357 µg/l	Platinium (Pt)	N/A µg/l		

N/A = Not available at the time of printing. Please enquire.

Plasma Calibrator for Trace Elements

This reference material is a working calibrator. It is intended for calibration of analytical systems for determination of the specified trace elements in occupational, environmental and clinical toxicology laboratories. It is at a concentration suitable for one-point-calibration. The mean values and confidence intervals were established in independent reference laboratories.

REC-9985 Plasma Calibrator for Trace Elements, Lyophilised 5 x 3 ml

Aluminium (Al)	159 µg/l	Fluoride (F)	613 µg/l	Nickel (Ni)	15.1 µg/l
Antimony (Sb)	14.6 µg/l	Gold (Au)	1450 µg/l	Platinum (Pt)	113 ng/l
Arsenic (As)	76.1 µg/l	Lithium (Li)	7.01 mg/l	Selenium (Se)	102 µg/l
Cadmium (Ca)	10.0 µg/l	Magnesium (Mg)	24.6 mg/l	Thallium (Tl)	9.32 µg/l
Chromium (Cr)	13.3 µg/l	Manganese (Mn)	12.8 µg/l	Tin (Sn)	46.7 µg/l
Cobalt (Co)	14.2 µg/l	Mercury (Hg)	7.57 µg/l	Vanadium (V)	9.07 µg/l
Copper (Cu)	1224 µg/l	Molybdenum (Mo)	5.46 µg/l	Zinc (Zn)	2619 µg/l

Serum Calibrator for Trace Elements

This reference material is a working calibrator. It is intended for calibration of analytical systems for determination of the specified trace elements in occupational, environmental and clinical toxicology laboratories. It is at a concentration suitable for one-point-calibration. The mean values and confidence intervals were established in independent reference laboratories.

REC-9982 Serum Calibrator for Trace Elements, Lyophilised 5 x 3 ml

Aluminium (Al)	82.6 µg/l	Copper (Cu)	1.47 µg/l	Nickel (Ni)	10.6 µg/l
Antimony (Sb)	12.3 µg/l	Fluoride (F)	559 µg/l	Palladium (Pd)	59.2 µg/l
Arsenic (As)	27.9 µg/l	Gold (Au)	2.18 mg/l	Platinum (Pt)	166 µg/l
Barium (Ba)	151 µg/l	Iron (Fe)	1.63 mg/l	Selenium (Se)	123 µg/l
Beryllium (Be)	22.2 µg/l	Lithium (Li)	9.45 mg/l	Silver (Ag)	72.7 µg/l
Bismuth (Bi)	7.50 µg/l	Magnesium (Mg)	26.5 mg/l	Thallium (Tl)	9.86 µg/l
Cadmium (Ca)	7.50 µg/l	Manganese (Mn)	10.8 µg/l	Tin (Sn)	92.4 µg/l
Chromium (Cr)	9.26 µg/l	Mercury (Hg)	12.0 µg/l	Vanadium (V)	12.1 µg/l
Cobalt (Co)	4.85 µg/l	Molybdenum (Mo)	7.33 µg/l	Zinc (Zn)	2.31mg/l

Urine Calibrator for Trace Elements

This reference material is a working calibrator. It is intended for calibration of analytical systems for determination of the specified trace elements in occupational, environmental and clinical toxicology laboratories. It is at a concentration suitable for one-point-calibration. The mean values and confidence intervals were established in independent reference laboratories.

REC-9988 Urine Calibrator for Trace Elements, Lyophilised 5 x 10 ml

Aluminium (Al)	193 µg/l	Fluoride (F)	11.7 mg/l	Nickel (Ni)	48.8 µg/l
Antimony (Sb)	56.1 µg/l	Iodide (I)	597 µg/l	Palladium (Pd)	12.8 µg/l
Arsenic (As)	132 µg/l	Iron (Fe)	246 µg/l	Platinum (Pt)	0.157 µg/l
Beryllium (Be)	0.339 µg/l	Lead (Pb)	67.2 µg/l	Selenium (Se)	104 µg/l
Cadmium (Ca)	19.6 µg/l	Magnesium (Mg)	58.1 mg/l	Thallium (Tl)	23.3 µg/l
Chromium (Cr)	25.0 µg/l	Manganese (Mn)	24.6 µg/l	Tin (Sn)	11.9 µg/l
Cobalt (Co)	41.9 µg/l	Mercury (Hg)	25.4 µg/l	Vanadium (V)	57.6 µg/l
Copper (Cu)	138 µg/l	Molybdenum (Mo)	107 µg/l	Zinc (Zn)	618 µg/l

Trace Element Controls

Whole Blood Controls for Trace Elements

These reference materials are intended for use as quality control to verify the precision and trueness of laboratory measurement procedures for the specified components in whole blood. The assigned values for several key elements are traceable to reference methods or NIST CRM. The value assignment has been established in accordance with the Essential Requirements (Annex 1) of the IVD Directive 98/79/EC, and the ISO/DIS 17511 International Standard. The uncertainty of the assigned values is presented as a range based on an uncertainty budget in relation to the pre-analytical treatment of the sample, the measurement of the value and the stability of the component.

The method used in value assignment was Inductively Coupled Plasma Sector Field Mass Spectrometry (ICP-SFMS).

SERO210105 Trace Elements in Whole Blood, Level 1, Lyophilised 10 x 3 ml

Traceable Analytical Values

Analytes	Value
Aluminium (Al)	9.2 ± 6.4 µg/l
Antimony (Sb)	1.91 ± 0.38 µg/l
Arsenic (As)	2.4 ± 0.5 µg/l
Beryllium (Be)	0.007 ± 0.003 µg/l
Bismuth (Bi)	0.005 ± 0.001 µg/l
Cadmium (Cd)	0.36 ± 0.02 µg/l
Chromium (Cr)	0.86 ± 0.25 µg/l
Cobalt (Co)	0.16 ± 0.03 µg/l
Copper (Cu)	0.68 ± 0.14 mg/l
Iodine (I)	25.6 ± 1.6 µg/l

Analytes	Value
Lead (Pb)	10.2 ± 2.1 µg/l
Manganese (Mn)	20.7 ± 4.2 µg/l
Mercury (Hg)	1.50 ± 0.30 µg/l
Molybdenum (Mo)	0.94 ± 0.22 µg/l
Nickel (Ni)	1.18 ± 0.24 µg/l
Selenium (Se)	59 ± 12 µg/l
Thallium (Tl)	0.008 ± 0.002 µg/l
Tin (Sn)	0.30 ± 0.15 µg/l
Vanadium (V)	1.3 ± 0.1 µg/l
Zinc (Zn)	4.4 ± 0.2 mg/l

Additional Analytical Values

Barium (Ba)	345 µg/l	Iron (Fe)	331 mg/l	Silver (Ag)	0.12 µg/l
Boron (B)	457 µg/l	Lanthanum (La)	76 ng/l	Sodium (Na)	1408 mg/l
Bromine (Br)	782 µg/l	Lithium (Li)	0.46 µg/l	Strontium (Sr)	15.3 µg/l
Calcium (Ca)	15.0 mg/l	Lutetium (Lu)	0.7 ng/l	Sulphur (S)	1155 mg/l
Cerium (Cs)	81 ng/l	Magnesium (Mg)	16.2 mg/l	Tantalum (Ta)	<0.002 µg/l
Cesium (Cs)	2.5 µg/l	Neodymium (Nd)	53 ng/l	Tellurium (Te)	0.021 µg/l
Dysprosium (Dy)	6 ng/l	Niobium (Nb)	50 ng/l	Terbium (Tb)	1.0 ng/l
Erbium (Er)	4 ng/l	Phosphorus (P)	206 mg/l	Thorium (Th)	6 ng/l
Europium(Eu)	<0.001 µg/l	Platinum (Pt)	5 ng/l	Thulium (Tm)	0.7 ng/l
Gadolinium(Gd)	11 ng/l	Potassium (K)	1053 mg/l	Titanium (Ti)	14 µg/l
Gallium (Ga)	<0.02 µg/l	Praseodymium (Pr)	14 ng/l	Tungsten (W)	0.32 µg/l
Gold (Au)	<0.005 µg/l	Rhenium (Re)	<0.001 µg/l	Uranium (U)	46 ng/l
Hafnium (Hf)	5 ng/l	Rubidium (Rb)	1.35 mg/l	Ytterbium (Yb)	4 ng/l
Holmium (Ho)	1.3 ng/l	Samarium (Sm)	9 ng/l	Yttrium (Y)	46 ng/l
Iridium (Ir)	<0.0005 µg/l	Silicon (Si)	0.71 mg/l	Zirconium (Zr)	273 ng/l

SERO210205 Trace Elements in Whole Blood, Level 2, Lyophilised 10 x 3 ml

Traceable Analytical Values

Analytes	Value
Aluminium (Al)	70.9 ± 2.5 µg/l
Antimony (Sb)	30.5 ± 6.1 µg/l
Arsenic (As)	14.3 ± 2.9 µg/l
Beryllium (Be)	5.68 ± 0.23 µg/l
Bismuth (Bi)	5.18 ± 0.17 µg/l
Cadmium (Cd)	5.8 ± 0.2 µg/l
Chromium (Cr)	11.8 ± 2.4 µg/l
Cobalt (Co)	5.8 ± 1.2 µg/l
Copper (Cu)	1.33 ± 0.27 mg/l
Fluoride (F)	100 µg/l Added
Iodine (I)	105 ± 5 µg/l

Analytes	Value
Lead (Pb)	310 ± 62 µg/l
Manganese (Mn)	29.9 ± 6.0 µg/l
Mercury (Hg)	16.0 ± 3.2 µg/l
Molybdenum (Mo)	6.42 ± 1.29 µg/l
Nickel (Ni)	17.9 ± 3.6 µg/l
Selenium (Se)	112 ± 23 µg/l
Thallium (Tl)	10.3 ± 0.3 µg/l
Tin (Sn)	5.7 ± 1.2µg/l
Vanadium (V)	6.0 ± 0.4 µg/l
Zinc (Zn)	6.5 ± 0.3 mg/l

Additional Analytical Values

Barium (Ba)	346 µg/l	Iron (Fe)	319 mg/l	Silver (Ag)	0.128 µg/l
Boron (B)	500 µg/l	Lanthanum (La)	72 ng/l	Sodium (Na)	1445 mg/l
Bromine (Br)	761 µg/l	Lithium (Li)	0.44 µg/l	Strontium (Sr)	14.9 µg/l
Calcium (Ca)	14.3 mg/l	Lutetium (Lu)	0.8 ng/l	Sulphur (S)	1060 mg/l
Cerium (Cs)	77 ng/l	Magnesium (Mg)	15.4 mg/l	Tantalum (Ta)	<0.002 µg/l
Cesium (Cs)	2.5 µg/l	Neodymium (Nd)	50 ng/l	Tellurium (Te)	0.043 µg/l
Dysprosium (Dy)	7 ng/l	Niobium (Nb)	57 ng/l	Terbium (Tb)	1.1 ng/l
Erbium (Er)	5 ng/l	Phosphorus (P)	191 mg/l	Thorium (Th)	6 ng/l
Europium(Eu)	<0.001 µg/l	Platinum (Pt)	6 ng/l	Thulium (Tm)	0.7 ng/l
Gadolinium(Gd)	12 ng/l	Potassium (K)	997 mg/l	Titanium (Ti)	15 µg/l
Gallium (Ga)	<0.02 µg/l	Praseodymium (Pr)	12 ng/l	Tungsten (W)	0.34 µg/l
Gold (Au)	<0.005 µg/l	Rhenium (Re)	<0.001 µg/l	Uranium (U)	47 ng/l
Hafnium (Hf)	4 ng/l	Rubidium (Rb)	1.36 mg/l	Ytterbium (Yb)	5 ng/l
Holmium (Ho)	1.3 ng/l	Samarium (Sm)	10 ng/l	Yttrium (Y)	45 ng/l
Iridium (Ir)	<0.0005 µg/l	Silicon (Si)	0.40 mg/l	Zirconium (Zr)	150 ng/l

SERO210305 Trace Elements in Whole Blood, Level 3, Lyophilised 10 x 3 ml

Traceable Analytical Values

Analytes	Value
Aluminium (Al)	105 ± 21 µg/l
Antimony (Sb)	22.4 ± 4.5 µg/l
Arsenic (As)	30.4 ± 7.3 µg/l
Beryllium (Be)	12.5 ± 2.5 µg/l
Bismuth (Bi)	57.6 ± 11.6 µg/l
Cadmium (Cd)	12.1 ± 1.3 µg/l
Chromium (Cr)	23.2 ± 4.7 µg/l
Cobalt (Co)	11.4 ± 1.2 µg/l
Copper (Cu)	2.47 ± 0.25 mg/l
Fluoride (F)	200 µg/l Added
Iodine (I)	200 ± 8 µg/l

Analytes	Value
Lead (Pb)	186 ± 46 µg/l
Manganese (Mn)	447 ± 9.5 µg/l
Mercury (Hg)	47.3 ± 7.5 µg/l
Molybdenum (Mo)	37.1 ± 1.5 µg/l
Nickel (Ni)	12.6 ± 2.5 µg/l
Selenium (Se)	272 ± 55 µg/l
Thallium (Tl)	34.1 ± 6.9 µg/l
Tin (Sn)	9.8 ± 1.2 µg/l
Vanadium (V)	5.7 ± 1.1 µg/l
Zinc (Zn)	9.11 ± 1.83 mg/l

Additional Analytical Values

Barium (Ba)	700 µg/l	Lithium (Li)	0.36 µg/l	Strontium (Sr)	15.0 µg/l
Bromine (Br)	552 µg/l	Lutetium (Lu)	1.5 ng/l	Sulphur (S)	1268 mg/l
Calcium (Ca)	14.2 mg/l	Magnesium (Mg)	17.2 mg/l	Terbium (Tb)	1.5 ng/l
Cerium (Cs)	99 ng/l	Neodymium (Nd)	72 ng/l	Thorium (Th)	9 ng/l
Cesium (Cs)	2.8 µg/l	Niobium (Nb)	25 ng/l	Titanium (Ti)	12.8 µg/l
Dysprosium (Dy)	9 ng/l	Phosphorus (P)	214 mg/l	Tungsten (W)	0.34 µg/l
Gadolinium(Gd)	133 ng/l	Platinum (Pt)	0.32 ng/l	Uranium (U)	69 ng/l
Holmium (Ho)	1.8 ng/l	Potassium (K)	1074 mg/l	Ytterbium (Yb)	6.3 ng/l
Iron (Fe)	383 mg/l	Rubidium (Rb)	1.35 mg/l	Yttrium (Y)	89 ng/l
Lanthanum (La)	100 ng/l	Sodium (Na)	1509 mg/l		

The following reference materials are intended for use as internal quality assurance in occupational, environmental and clinical toxicology laboratories. The mean values and confidence intervals were established in independent reference laboratories.

For the determination of the trace elements AAS was used as well as ICP-MS. The results should be within the ranges indicated on the data sheet irrespective of analytical technique used.

REC-8840 Whole Blood Control for Trace Elements, Level I, Lyophilised 10 x 5 ml

Arsenic (As)	5.52 µg/l	Magnesium (Mg)	26.7 mg/l	Potassium (K)	1.23 g/l
Cadmium (Ca)	1.32 µg/l	Manganese (Mn)	7.87 µg/l	Selenium (Se)	74.3 µg/l
Chromium (Cr)	1.69 µg/l	Mercury (Hg)	1.49 µg/l	Silver (Ag)	2.07 µg/l
Cobalt (Co)	1.90 µg/l	Nickel (Ni)	1.90 µg/l	Thallium (Tl)	0.892 µg/l
Copper (Cu)	0.689 mg/l	Palladium (Pd)	0.943 µg/l	Zinc (Zn)	4.63 mg/l
Lead (Pb)	58.4 µg/l	Platinum (Pt)	1.73 µg/l		

REC-8841 Whole Blood Control for Trace Elements, Level II, Lyophilised 10 x 5 ml

Arsenic (As)	10.4 µg/l	Magnesium (Mg)	34.6 mg/l	Potassium (K)	1.62 g/l
Cadmium (Ca)	3.03 µg/l	Manganese (Mn)	13.7 µg/l	Selenium (Se)	123 µg/l
Chromium (Cr)	6.05 µg/l	Mercury (Hg)	6.35 µg/l	Silver (Ag)	4.27 µg/l
Cobalt (Co)	7.38 µg/l	Nickel (Ni)	5.10 µg/l	Thallium (Tl)	4.53 µg/l
Copper (Cu)	1.06 mg/l	Palladium (Pd)	1.87 µg/l	Zinc (Zn)	6.40 mg/l
Lead (Pb)	224 µg/l	Platinum (Pt)	2.56 µg/l		

REC-8842 Whole Blood Control for Trace Elements, Level III, Lyophilised 10 x 5 ml

Arsenic (As)	19.6 µg/l	Magnesium (Mg)	42.5 mg/l	Potassium (K)	1.99 g/l
Cadmium (Ca)	6.54 µg/l	Manganese (Mn)	19.9 µg/l	Selenium (Se)	162 µg/l
Chromium (Cr)	11.9 µg/l	Mercury (Hg)	7.98 µg/l	Silver (Ag)	8.97 µg/l
Cobalt (Co)	13.6 µg/l	Nickel (Ni)	13.8 µg/l	Thallium (Tl)	9.12 µg/l
Copper (Cu)	1.61 mg/l	Palladium (Pd)	4.29 µg/l	Zinc (Zn)	8.02 mg/l
Lead (Pb)	427 µg/l	Platinum (Pt)	5.23 µg/l		

REC-8843 Whole Blood Control for Trace Elements, Level I-III, Lyophilised 3 x 3 x 5 ml

Plasma Controls for Trace Elements

These reference materials are intended for use as internal quality assurance in occupational, environmental and clinical toxicology laboratories. The mean values and confidence intervals were established in independent reference laboratories.

For the determination of the trace elements AAS was used as well as ICP-MS. The results should be within the ranges indicated on the data sheet irrespective of analytical technique used.

REC-8883 Plasma Control for Trace Elements, Level I, Lyophilised 10 x 3 ml

Aluminium (Al)	17.3 µg/l	Fluoride (F)	123 µg/l	Palladium (Pd)	2.13 µg/l
Antimony (Sb)	3.75 µg/l	Gold (Au)	0.096 µg/l	Platinum (Pt)	6.50 ng/l
Arsenic (As)	47.8 µg/l	Iodide (I)	57.3 µg/l	Selenium (Se)	80.0 µg/l
Beryllium (Be)	0.952 µg/l	Lithium (Li)	3.34 mg/l	Silver (Ag)	2.21 µg/l
Bismuth (Bi)	1.0 µg/l	Magnesium (Mg)	16.9 mg/l	Thallium (Tl)	5.49 µg/l
Cadmium (Ca)	2.37 µg/l	Manganese (Mn)	6.72 µg/l	Tin (Sn)	2.80 µg/l
Chromium (Cr)	3.56 µg/l	Mercury (Hg)	2.03 µg/l	Vanadium (V)	1.45 µg/l
Cobalt (Co)	2.20 µg/l	Molybdenum (Mo)	1.82 µg/l	Zinc (Zn)	925 µg/l
Copper (Cu)	871 µg/l	Nickel (Ni)	5.59 µg/l		

REC-8884 Plasma Control for Trace Elements, Level II, Lyophilised 10 x 3 ml

Aluminium (Al)	52.2 µg/l	Fluoride (F)	232 µg/l	Palladium (Pd)	8.35 µg/l
Antimony (Sb)	6.87 µg/l	Gold (Au)	1.95 µg/l	Platinum (Pt)	47.0 ng/l
Arsenic (As)	92.1 µg/l	Iodide (I)	112 µg/l	Selenium (Se)	118 µg/l
Beryllium (Be)	17.7 µg/l	Lithium (Li)	8.48 mg/l	Silver (Ag)	7.08 µg/l
Bismuth (Bi)	4.45 µg/l	Magnesium (Mg)	29.7 mg/l	Thallium (Tl)	10.4 µg/l
Cadmium (Ca)	10.5 µg/l	Manganese (Mn)	16.9 µg/l	Tin (Sn)	9.32 µg/l
Chromium (Cr)	11.1 µg/l	Mercury (Hg)	9.35 µg/l	Vanadium (V)	10.0 µg/l
Cobalt (Co)	9.34 µg/l	Molybdenum (Mo)	6.42 µg/l	Zinc (Zn)	1363 µg/l
Copper (Cu)	1406 µg/l	Nickel (Ni)	15.2 µg/l		

REC-8885 Plasma Control for Trace Elements, Level I, II, Lyophilised 2 x 5 x 3 ml

Serum Controls for Trace Elements

These reference materials are intended for use as quality control to verify the precision and trueness of laboratory measurement procedures for the specified components in serum. The assigned values for several key elements are traceable to reference methods or NIST Certified Reference Materials. The value assignment has been established in accordance with the Essential Requirements (Annex 1) of the IVD Directive 98/79/EC, and the ISO/DIS 17511 International Standard. The uncertainty of the assigned values is presented as a range based on an uncertainty budget in relation to the pre-analytical treatment of the sample, the measurement of the value and the stability of the component.

The method used in value assignment was ICP-SFMS.

SERO201405 Trace Elements in Serum, Level 1, Lyophilised 6 x 3 ml

Traceable Analytical Values

Analytes	Value
Aluminium (Al)	33.6 ± 1.9 µg/l
Calcium (Ca)	94.2 ± 4.4 mg/l
Chromium (Cr)	1.5 ± 0.2 µg/l
Cobalt (Co)	1.2 ± 0.2 µg/l
Copper (Cu)	1691 ± 84 µg/l
Fluoride (F)	75 (Spiked Value)
Gold (Au)	540 ± 45µg/l
Iron (Fe)	1.39 ± 0.08 mg/l

Analytes	Value
Lithium (Li)	5741 ± 321 µg/l
Magnesium (Mg)	20.1 ± 1.3 mg/l
Manganese (Mn)	15.0 ± 0.9 µg/l
Mercury (Hg)	0.73 ± 0.10 µg/l
Nickel (Ni)	5.8 ± 0.7 µg/l
Phosphorus (P)	70 ± 3 mg/l
Selenium (Se)	107 ± 7 µg/l
Zinc (Zn)	1738 ± 71 µg/l

Additional Analytical Values

Antimony (Sb)	80 µg/l	Iridium (Ir)	1.2 ng/l	Strontium (Sr)	26.3 µg/l
Arsenic (As)	0.47 µg/l	Lanthanum (La)	39.5 ng/l	Sulphur (S)	1148 mg/l
Barium (Ba)	126 µg/l	Lead (Pb)	1.02 µg/l	Tantalum (Ta)	3.1 ng/l
Beryllium (Be)	1.8 ng/l	Lutetium (Lu)	0.7 ng/l	Tellurium (Te)	29 ng/l
Bismuth (Bi)	3.7 ng/l	Molybdenum (Mo)	0.7 µg/l	Thallium (Tl)	23 ng/l
Boron (B)	154 µg/l	Neodymium (Nd)	22.8 ng/l	Terbium (Tb)	1.3 ng/l
Bromine (Br)	488 µg/l	Niobium (Nb)	40 ng/l	Thorium (Th)	2.9 ng/l
Cadmium (Cd)	0.126 µg/l	Platinum (Pt)	6.9 ng/l	Thulium (Tm)	0.9 ng/l
Cerium (Cs)	38.7 ng/l	Potassium (K)	126 mg/l	Tin (Sn)	0.52 µg/l
Cesium (Cs)	18.6 ng/l	Praseodymium (Pr)	7.4 ng/l	Titanium (Ti)	11.2 µg/l
Dysprosium (Dy)	3.5 ng/l	Rhenium (Re)	1.7 ng/l	Tungsten (W)	91 ng/l
Erbium (Er)	3.5 ng/l	Rubidium (Rb)	5.25 µg/l	Uranium (U)	48 ng/l
Gadolinium (Gd)	5.2 ng/l	Samarium (Sm)	7.7 ng/l	Vanadium (V)	0.96 µg/l
Gallium (Ga)	8.9 ng/l	Scandium (Sc)	7.6 ng/l	Ytterbium (Yb)	2.5 ng/l
Hafnium (Hf)	5.7 ng/l	Silicon (Si)	0.74 mg/l	Yttrium (Y)	19 ng/l
Holmium (Ho)	1.9 ng/l	Silver (Ag)	0.16 µg/l	Zirconium (Zr)	278 ng/l
Iodine (I)	84 µg/l	Sodium (Na)	2998 mg/l		

SERO203105 Trace Elements in Serum, Level, 2, Lyophilised 6 x 3 ml

Traceable Analytical Values

Analytes	Value
Aluminium (Al)	104 ± 6 µg/l
Calcium (Ca)	145 ± 8 mg/l
Chromium (Cr)	4.8 ± 0.4 µg/l
Cobalt (Co)	3.2 ± 0.2 µg/l
Copper (Cu)	2887 ± 99 µg/l
Fluoride (F)	200 µg/l Added
Gold (Au)	2030 ± 170µg/l
Iron (Fe)	2.03 ± 0.13 mg/l

Analytes	Value
Lithium (Li)	10950 ± 969 µg/l
Magnesium (Mg)	40.8 ± 4.7 mg/l
Manganese (Mn)	19.9 ± 1.1 µg/l
Mercury (Hg)	1.87 ± 0.13 µg/l
Nickel (Ni)	9.8 ± 0.6 µg/l
Phosphorus (P)	113 ± 7 mg/l
Selenium (Se)	163 ± 10 µg/l
Zinc (Zn)	2520 ± 206 µg/l

Additional Analytical Values

Antimony (Sb)	80 µg/l	Iridium (Ir)	2.4 ng/l	Strontium (Sr)	36.3 µg/l
Arsenic (As)	0.67 µg/l	Lanthanum (La)	57.7 ng/l	Sulphur (S)	1558 mg/l
Barium (Ba)	140 µg/l	Lead (Pb)	11.1 µg/l	Tantalum (Ta)	2.5 ng/l
Beryllium (Be)	6.6 ng/l	Lutetium (Lu)	0.8 ng/l	Tellurium (Te)	21 ng/l
Bismuth (Bi)	5.2 ng/l	Molybdenum (Mo)	0.9 µg/l	Thallium (Tl)	31 ng/l
Boron (B)	203 µg/l	Neodymium (Nd)	39 ng/l	Terbium (Tb)	1.6 ng/l
Bromine (Br)	513 µg/l	Niobium (Nb)	45 ng/l	Thorium (Th)	3.4 ng/l
Cadmium (Cd)	0.130 µg/l	Platinum (Pt)	11.6 ng/l	Thulium (Tm)	0.9 ng/l
Cerium (Cs)	58.2 ng/l	Potassium (K)	240 mg/l	Tin (Sn)	0.51 µg/l
Cesium (Cs)	24 ng/l	Praseodymium (Pr)	13 ng/l	Titanium (Ti)	12.9 µg/l
Dysprosium (Dy)	4.7 ng/l	Rhenium (Re)	1.9 ng/l	Tungsten (W).	110 ng/l
Erbium (Er)	4.9 ng/l	Rubidium (Rb)	9.73 µg/l	Uranium (U)	48 ng/l
Gadolinium(Gd)	7.0 ng/l	Samarium (Sm)	13 ng/l	Vanadium (V)	1.01 µg/l
Gallium (Ga)	11.3 ng/l	Scandium (Sc)	11 ng/l	Ytterbium (Yb)	2.9 ng/l
Hafnium (Hf)	5.6 ng/l	Silicon (Si)	0.97 mg/l	Yttrium (Y)	26 ng/l
Holmium (Ho)	2.4 ng/l	Silver (Ag)	0.23 µg/l	Zirconium (Zr)	278 ng/l
Iodine (I)	89 µg/l	Sodium (Na)	3736 mg/l		

The following reference materials are intended for use as internal quality assurance in occupational, environmental and clinical toxicology laboratories. The mean values and confidence intervals were established in independent reference laboratories.

For the determination of the trace elements AAS was used as well as ICP-MS. The results should be within the ranges indicated on the data sheet irrespective of analytical technique used.

REC-8880 Serum Control for Trace Elements, Level I, Lyophilised 10 x 3 ml

Aluminium (Al)	56.8 µg/l	Copper (Cu)	606 µg/l	Copper (Cu)	606 µg/l
Antimony (Sb)	2.60 µg/l	Fluoride (F)	75.6 µg/l	Fluoride (F)	75.6 µg/l
Arsenic (As)	11.3 µg/l	Gold (Au)	99.6 µg/l	Gold (Au)	99.6 µg/l
Barium (Ba)	138 µg/l	Iron (Fe)	612 µg/l	Iron (Fe)	612 µg/l
Beryllium (Be)	1.73 µg/l	Lithium (Li)	4.05 mg/l	Lithium (Li)	4.05 mg/l
Bismuth (Bi)	0.890 µg/l	Magnesium (Mg)	11.6 mg/l	Magnesium (Mg)	11.6 mg/l
Cadmium (Ca)	2.56 µg/l	Manganese (Mn)	28.4 µg/l	Manganese (Mn)	28.4 µg/l
Chromium (Cr)	2.97 µg/l	Mercury (Hg)	1.69 µg/l	Mercury (Hg)	1.69 µg/l
Cobalt (Co)	1.85 µg/l	Molybdenum (Mo)	1.64 µg/l	Molybdenum (Mo)	1.64 µg/l

REC-8881 Serum Control for Trace Elements, Level II, Lyophilised 10 x 3 ml

Aluminium (Al)	63.7 µg/l	Copper (Cu)	606 µg/l	Nickel (Ni)	9.83 µg/l
Antimony (Sb)	5.87 µg/l	Fluoride (F)	491 µg/l	Palladium (Pd)	52.1 µg/l
Arsenic (As)	19.7 µg/l	Gold (Au)	1884 µg/l	Platinum (Pt)	158 µg/l
Barium (Ba)	175 µg/l	Iron (Fe)	1538 µg/l	Selenium (Se)	103 µg/l
Beryllium (Be)	17.8 µg/l	Lithium (Li)	8.76 mg/l	Silver (Ag)	54.7 µg/l
Bismuth (Bi)	4.72 µg/l	Magnesium (Mg)	24.1 mg/l	Thallium (Tl)	6.97 µg/l
Cadmium (Ca)	4.92 µg/l	Manganese (Mn)	32.7 µg/l	Tin (Sn)	76.9 µg/l
Chromium (Cr)	6.99 µg/l	Mercury (Hg)	9.71 µg/l	Vanadium (V)	33.4 µg/l
Cobalt (Co)	3.13 µg/l	Molybdenum (Mo)	5.30 µg/l	Zinc (Zn)	1738 µg/l

REC-8882 Serum Control for Trace Elements, Level I, II, Lyophilised 2 x 5 x 3 ml

Urine Controls for Trace Elements

These reference materials are intended for use as quality control to verify the precision and trueness of laboratory measurement procedures for the specified components in urine. The assigned values for several key elements are traceable to reference methods or NIST CRM. The value assignment has been established in accordance with the Essential Requirements (Annex 1) of the IVD Directive 98/79/EC, and the ISO/DIS 17511 International Standard. The uncertainty of the assigned values is presented as a range based on an uncertainty budget in relation to the pre-analytical treatment of the sample, the measurement of the value and the stability of the component.

The method used in value assignment was Inductively ICP-SFMS.

SERO210605 Trace Elements Urine, Level 1, Lyophilised 10 x 5 ml

Analytes	Value
Aluminium (Al)	4.6 ± 3.5 µg/l
Antimony (Sb)	24.7 ± 5.0 µg/l
Arsenic (As)	79 ± 16 µg/l
Beryllium (Be)	0.004 ± 0.002 µg/l
Bismuth (Bi)	0.005 ± 0.002 µg/l
Cadmium (Cd)	0.20 ± 0.04 µg/l
Cobalt (Co)	0.72 ± 0.15 µg/l
Iodine (I)	84 ± 6 µg/l
Lead (Pb)	0.66 ± 0.13 µg/l

Analytes	Value
Manganese (Mn)	0.73 ± 0.15 µg/l
Mercury (Hg)	0.036 ± 0.014 µg/l
Nickel (Ni)	1.51 ± 0.30 µg/l
Selenium (Se)	13.9 ± 2.8 µg/l
Tellurium (Te)	8.0 ± 1.7 ng/l
Thallium (Tl)	0.16 ± 0.01 µg/l
Tin (Sn)	0.43 ± 0.09 µg/l
Vanadium (V)	0.66 ± 0.08 µg/l
Zinc (Zn)	334 ± 67 µg/l

Additional Analytical Values

Barium (Ba)	28 µg/l	Iron (Fe)	13.7 µg/l	Silver (Ag)	13 ng/l
Boron (B)	723 µg/l	Lanthanum (La)	36 ng/l	Sodium (Na)	2331 mg/l
Bromine (Br)	2.2 mg/l	Lithium (Li)	7 µg/l	Strontium (Sr)	89 µg/l
Calcium (Ca)	71 mg/l	Lutetium (Lu)	<0.0005 µg/l	Sulphur (S)	521 mg/l
Cerium (Cs)	31 ng/l	Magnesium (Mg)	64 mg/l	Tantalum (Ta)	<0.002 µg/l
Cesium (Cs)	5.8 µg/l	Molybdenum (Mo)	37 µg/l	Terbium (Tb)	2.1 ng/l
Copper (Cu)	31 µg/l	Neodymium (Nd)	17 ng/l	Thorium (Th)	2.9 ng/l
Dysprosium (Dy)	2.5 ng/l	Niobium (Nb)	30 ng/l	Thulium (Tm)	<0005 µg/l
Erbium (Er)	1.5 ng/l	Phosphorus (P)	559 mg/l	Titanium (Ti)	13.5 µg/l
Europium (Eu)	<0.001 µg/l	Platinum (Pt)	1.4 ng/l	Tungsten (W)	0.15 µg/l
Gadolinium (Gd)	3.9 ng/l	Potassium (K)	1495 mg/l	Uranium (U)	51 ng/l
Gallium (Ga)	<0.02 µg/l	Praseodymium (Pr)	25 ng/l	Ytterbium (Yb)	1.0 ng/l
Gold (Au)	<0.002 µg/l	Rhenium (Re)	20 ng/l	Yttrium (Y)	13 ng/l
Hafnium (Hf)	<0.0005 µg/l	Rubidium (Rb)	0.99 mg/l	Zirconium (Zr)	65 ng/l
Holmium (Ho)	<0.001 µg/l	Samarium (Sm)	3.7 ng/l		
Iridium (Ir)	<0.0005 µg/l	Silicon (Si)	5.9 mg/l		

SERO210705 Trace Elements Urine, Level 2, Lyophilised 10 x 5 ml

Traceable Analytical Values

Analytes	Value
Aluminium (Al)	103 ± 11 µg/l
Antimony (Sb)	108 ± 22 µg/l
Arsenic (As)	184 ± 37 µg/l
Beryllium (Be)	5.0 ± 0.2 µg/l
Bismuth (Bi)	20.6 ± 1.2 µg/l
Cadmium (Cd)	4.9 ± 0.2 µg/l
Chromium (Cr)	21.2 ± 4.3 µg/l
Cobalt (Co)	10.6 ± 2.1 µg/l
Fluoride (F)	4.0 mg/l Added
Iodine (I)	304 ± 22 µg/l

Analytes	Value
Lead (Pb)	90.7 ± 18.3 µg/l
Manganese (Mn)	10.9 ± 2.2 µg/l
Mercury (Hg)	39.8 ± 8.0 µg/l
Nickel (Ni)	41.3 ± 8.3 µg/l
Selenium (Se)	70.1 ± 14.1 µg/l
Tellurium (Te)	24.7 ± 0.8 ng/l
Thallium (Tl)	9.70 ± 0.67 µg/l
Tin (Sn)	49.7 ± 10.0 µg/l
Vanadium (V)	25.0 ± 1.5 µg/l
Zinc (Zn)	1338 ± 269 µg/l

Additional Analytical Values

Barium (Ba)	31 µg/l	Iron (Fe)	13.6 µg/l	Silver (Ag)	16 ng/l
Boron (B)	785 µg/l	Lanthanum (La)	36 ng/l	Sodium (Na)	2294 mg/l
Bromine (Br)	2.2 mg/l	Lithium (Li)	7 µg/l	Strontium (Sr)	88 µg/l
Calcium (Ca)	71 mg/l	Lutetium (Lu)	<0.0005 µg/l	Sulphur (S)	519 mg/l
Cerium (Cs)	24 ng/l	Magnesium (Mg)	64 mg/l	Tantalum (Ta)	<0.002 µg/l
Cesium (Cs)	5.8 µg/l	Molybdenum (Mo)	38 µg/l	Terbium (Tb)	1.4 ng/l
Copper (Cu)	22 µg/l	Neodymium (Nd)	15 ng/l	Thorium (Th)	2.9 ng/l
Dysprosium (Dy)	2.2 ng/l	Niobium (Nb)	33 ng/l	Thulium (Tm)	<0005 µg/l
Erbium (Er)	1.7 ng/l	Phosphorus (P)	543 mg/l	Titanium (Ti)	14.1 µg/l
Europium (Eu)	<0.001 µg/l	Platinum (Pt)	1.6 ng/l	Tungsten (W)	0.14 µg/l
Gadolinium (Gd)	3.9 ng/l	Potassium (K)	1468 mg/l	Uranium (U)	23 ng/l
Gallium (Ga)	<0.02 µg/l	Praseodymium (Pr)	22 ng/l	Ytterbium (Yb)	1.1 ng/l
Gold (Au)	<0.002 µg/l	Rhenium (Re)	19 ng/l	Yttrium (Y)	10 ng/l
Hafnium (Hf)	<0.0005 µg/l	Rubidium (Rb)	0.98 mg/l	Zirconium (Zr)	91 ng/l
Holmium (Ho)	<0.001 µg/l	Samarium (Sm)	3.1 ng/l		
Iridium (Ir)	<0.0005 µg/l	Silicon (Si)	6.4 mg/l		

Other Components *(added – not analysed)*

1-Hydroxypyrene	55 µg/l	Mandelic Acid	490 µg/l
Fluoride (F)	4.0 mg/l	Tetracloroethylene	1000 µg/l
Formic Acid	10.8 mg/l	Trichloroacetic Acid (TCA)	350 µmol/l
Phenol	300 mg/l		

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The following reference materials are intended for use as internal quality assurance in occupational, environmental and clinical toxicology laboratories. The mean values and confidence intervals were established in independent reference laboratories.

For the determination of the trace elements AAS was used as well as ICP-MS. The results should be within the ranges indicated on the data sheet irrespective of analytical technique used.

REC-8847 Urine Control for Trace Elements, Level I, Lyophilised 10 x 10 ml

Aluminium (Al)	95.2 µg/l	Fluoride (F)	4.0 mg/l	Nickel (Ni)	6.22 µg/l
Antimony (Sb)	12.0 µg/l	Iodide (I)	115 µg/l	Palladium (Pd)	1.67 µg/l
Arsenic (As)	44.6 µg/l	Iron (Fe)	40.9 µg/l	Platinum (Pt)	0.052 µg/l
Beryllium (Be)	0.051 µg/l	Lead (Pb)	24.0 µg/l	Selenium (Se)	29.3 µg/l
Cadmium (Ca)	2.42 µg/l	Magnesium (Mg)	20.5 mg/l	Thallium (Tl)	7.60 µg/l
Chromium (Cr)	4.23 µg/l	Manganese (Mn)	4.18 µg/l	Tin (Sn)	4.81 µg/l
Cobalt (Co)	2.35 µg/l	Mercury (Hg)	2.48 µg/l	Vanadium (V)	19.6 µg/l
Copper (Cu)	58.6 µg/l	Molybdenum (Mo)	22.9 µg/l	Zinc (Zn)	215 µg/l

REC-8848 Urine Control for Trace Elements, Level II, Lyophilised 10 x 10 ml

Aluminium (Al)	148 µg/l	Fluoride (F)	11.3 mg/l	Nickel (Ni)	44.7 µg/l
Antimony (Sb)	47.8 µg/l	Iodide (I)	501 µg/l	Palladium (Pd)	9.83 µg/l
Arsenic (As)	84.5 µg/l	Iron (Fe)	225 µg/l	Platinum (Pt)	0.135 µg/l
Beryllium (Be)	0.248 µg/l	Lead (Pb)	64.3 µg/l	Selenium (Se)	79.0 µg/l
Cadmium (Ca)	14.7 µg/l	Magnesium (Mg)	46.9 mg/l	Thallium (Tl)	18.8 µg/l
Chromium (Cr)	20.3 µg/l	Manganese (Mn)	19.7 µg/l	Tin (Sn)	9.50 µg/l
Cobalt (Co)	35.6 µg/l	Mercury (Hg)	18.1 µg/l	Vanadium (V)	48.0 µg/l
Copper (Cu)	111 µg/l	Molybdenum (Mo)	102 µg/l	Zinc (Zn)	536 µg/l

REC-8849 Urine Control for Trace Elements, Level I, II, Lyophilised 2 x 5 x 10 ml

Urine Controls for Arsenic Species

These reference materials are intended for use as internal quality assurance in occupational, environmental and clinical toxicology laboratories. The mean values and confidence intervals were established in independent reference laboratories in cooperation with Institute and Outpatient Clinic of Occupational, Social and Environmental Medicine University of Erlangen-Nuremberg. For the determination of all parameters, chromatographic techniques were used.

REC-8931 Urine Control for Arsenic Species, Level I, II, Lyophilised 2 x 5 x 5 ml

Analyte	Level I	Level II
Arsenic III	2.40 µg/l	9.40 µg/l
Arsenic V	3.50 µg/l	25.2 µg/l
Monomethylarsonic Acid	2.50 µg/l	6.70 µg/l
Dimethylarsinic Acid	9.80 µg/l	43.4 µg/l
Arsenobetaine	16.8 µg/l	28.8 µg/l

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