▪ Certificate of Analysis ▪

Product: Metals in Soil
Catalog Number: 540
Lot No. D094-540
Certificate Issue Date: September 12, 2016
Expiration Date: March 31, 2020
Revision Number: Original

CERTIFICATION

Parameter	Total Concentration[6]	Certified Value[1]	Uncertainty[2]	QC Performance Acceptance Limits[3]	PT Performance Acceptance Limits[4]
	mg/kg	mg/kg	%	mg/kg	mg/kg
Aluminum	59900	8090	4.40	4030 - 12100	3200 - 13000
Antimony	215	99.3	5.05	D.L. - 206	21.4 - 255
Arsenic	115	100	6.62	80.9 - 120	69.6 - 131
Barium	848	217	2.44	177 - 257	160 - 278
Beryllium	169	147	5.75	120 - 175	111 - 185
Boron	111	85.2	7.76	60.5 - 110	51.1 - 128
Cadmium	99.8	83.7	5.42	68.0 - 99.5	61.3 - 110
Calcium	13000	6010	2.43	4860 - 7150	4430 - 7590
Chromium	152	107	6.22	82.9 - 130	74.3 - 144
Cobalt	147	123	5.38	101 - 145	91.4 - 160
Copper	192	166	10.5	134 - 197	125 - 213
Iron	29800	14600	8.76	6580 - 22600	5270 - 23900
Lead	113	88.4	11.6	71.8 - 105	61.8 - 115
Magnesium	4990	2930	3.27	2190 - 3670	1930 - 3940
Manganese	545	311	4.84	249 - 373	233 - 390
Mercury	2.76	2.90	3.80	2.13 - 3.68	1.47 - 4.33
Molybdenum	66.5	54.1	5.49	41.8 - 66.3	36.2 - 71.9
Nickel	63.5	49.8	10.9	40.3 - 59.2	34.4 - 67.3
Potassium	29700	2620	1.44	1810 - 3430	1600 - 3640
Selenium	106	87.7	6.27	66.7 - 109	56.2 - 119
Silver	47.1	41.4	6.39	30.5 - 52.2	27.3 - 55.4
Sodium	13800	252	7.76	174 - 331	82.9 - 422
Strontium	239	58.8	9.01	47.0 - 70.6	41.0 - 76.6

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Parameter	Total Concentration[6]	Certified Value[1]	Uncertainty[2]	QC Performance Acceptance Limits[3]	PT Performance Acceptance Limits[4]
	mg/kg	mg/kg	%	mg/kg	mg/kg
Thallium	68.9	58.1	6.26	45.1 - 71.2	37.1 - 79.2
Tin	185	154	4.81	116 - 192	92.3 - 215
Titanium	2440	370	4.01	110 - 630	77.5 - 663
Uranium	65.2	58.6	5.84	46.6 - 70.7	43.2 - 74.0
Vanadium	194	140	5.47	107 - 172	97.8 - 181
Zinc	180	145	10.9	119 - 171	98.2 - 192

ANALYTICAL VERIFICATION

Parameter	Certified Value[1]	Proficiency Testing Study			NIST Traceability	
		Mean	Recovery[5]	n	SRM Number	Recovery
	mg/kg	mg/kg	%			%
Aluminum	8090	8090	80.1	146	-	-
Antimony	99.3	99.3	46.4	150	-	-
Arsenic	100	100	87.3	189	-	-
Barium	217	217	85.8	164	-	-
Beryllium	147	147	87.8	163	-	-
Boron	85.2	85.2	73.4	109	-	-
Cadmium	83.7	83.7	83.9	195	-	-
Calcium	6010	6010	88.6	132	-	-
Chromium	107	107	81.5	186	-	-
Cobalt	123	123	84.8	155	-	-
Copper	166	166	85.3	184	-	-
Iron	14600	14600	89.4	147	-	-
Lead	88.4	88.4	88.4	202	-	-
Magnesium	2930	2930	84.9	135	-	-
Manganese	311	311	88.2	157	-	-
Mercury	2.90	2.90	105	133	-	-
Molybdenum	54.1	54.1	82.7	157	-	-
Nickel	49.8	49.8	81.3	188	-	-

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Parameter	Certified Value[1]	Proficiency Testing Study			NIST Traceability	
		Mean	Recovery[5]	n	SRM Number	Recovery
	mg/kg	mg/kg	%			%
Potassium	2620	2620	85.9	136	-	-
Selenium	87.7	87.7	82.7	171	-	-
Silver	41.4	41.4	86.0	164	-	-
Sodium	252	252	84.1	122	-	-
Strontium	58.8	58.8	93.6	103	-	-
Thallium	58.1	58.1	82.9	158	-	-
Tin	154	154	84.0	117	-	-
Titanium	370	370	86.7	108	-	-
Uranium	58.6	58.6	96.6	26	-	-
Vanadium	140	140	86.2	157	-	-
Zinc	145	145	100	184	-	-

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1. The **Certified Values** are equal to the mean recoveries for the parameters as determined in an interlaboratory round robin study based on all applicable digestion techniques reported in the study. The Certified Values are based on an "as received" basis, assuming 100% solids content. The certified values are monitored and purchasers will be notified of any significant changes resulting in recertification or withdrawal of this certified reference material during the period of validity of this certificate.

2. The **Uncertainty** is the total propagated uncertainty at the 95% confidence interval. The uncertainty is based on the preparation and internal analytical verification of the product by ERA, multiplied by a coverage factor. The uncertainty applies to the product as supplied and does not take into account any required or optional dilution and/or preparations the laboratory may perform while using this product.

3. The **QC Performance Acceptance Limits (QC PALs™)**are based on actual historical data collected in ERA's Proficiency Testing program. The QC PALs™ reflect any inherent biases in the methods used to establish the limits and closely approximate a 95% confidence interval of the performance that experienced laboratories should achieve using accepted environmental methods. Use the QC PALs™ to realistically evaluate your performance against your peers.

4. The **PT Performance Acceptance Limits (PT PALs™)** are calculated using the regression equations and fixed acceptance criteria specified in the NELAC proficiency testing requirements. Use the PT PALs™ when analyzing this QC standard alongside USEPA and NELAC compliant PT standards. Please note that many PT study acceptance limits are concentration dependent (some non-linearly) and, therefore, the acceptance limits of this QC standard and any PT standard may differ relative to their difference in concentrations.

5. The **PT Data/Traceability** data include the mean value, percent recovery and number of data points reported by the laboratories in our Proficiency Testing study compared to the Certified Values. In addition, where NIST Standard Reference Materials (SRMs) are available, each analyte has been analytically traced to the NIST SRM listed. This product is traceable to the lot numbers of its starting materials. All gravimetric and volumetric measurements related to its manufacture are traceable to NIST through an unbroken chain of comparisons.
Traceability Recovery (%) = [(% recovery certified standard)/(% recovery NIST SRM)]*100
The traceability data shown were compiled by analyzing the ERA standards or their associated stock solutions against the applicable NIST SRMs.

6. The **Total Concentrations** are equal to the background concentrations in the blank soil matrix (measured using neutron activation, XRF, and total acid digestion techniques), plus the amount of each analyte spiked onto the soil. For Trace Metals, the values listed are only ""Theoretical Values"" based upon the methodologies listed.

7. For additional information on this product such as intended use, instructions for use, level of homogeneity, and safety information, please refer to the provided Instruction Sheet

If you have any questions or need technical assistance, please call ERA technical assistance at 1-800-372-0122 or send an email to info@eraqc.com.

Certifying Officer

Brian Miller

Quality Officer

Patrick Larson

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