▪ Certificate of Analysis ▪

Product: Metals in Soil
Catalog Number: 540
Lot No. D095-540
Certificate Issue Date: December 07, 2016
Expiration Date: April 30, 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	8040	6.77	3990 - 12100	3170 - 12900
Antimony	230	91.4	4.68	D.L. - 206	22.9 - 252
Arsenic	176	146	7.63	116 - 175	102 - 194
Barium	721	102	11.2	82.3 - 122	72.9 - 139
Beryllium	169	134	6.97	107 - 162	101 - 185
Boron	152	102	12.3	68.6 - 135	61.1 - 172
Cadmium	81.3	63.2	5.15	50.4 - 76.1	46.3 - 89.4
Calcium	13600	5930	3.87	4690 - 7170	4370 - 8070
Chromium	137	89.3	8.56	68.2 - 110	61.7 - 128
Cobalt	155	119	5.18	95.7 - 143	88.8 - 169
Copper	76.2	60.8	16.9	48.0 - 73.6	44.2 - 86.1
Iron	29800	14400	9.90	6350 - 22400	5120 - 23600
Lead	136	98.5	9.44	78.0 - 119	69.7 - 135
Magnesium	4630	2580	3.96	1910 - 3240	1640 - 3510
Manganese	644	370	4.14	291 - 450	280 - 497
Mercury	15.0	13.3	6.04	9.05 - 17.5	6.81 - 19.7
Molybdenum	109	83.7	5.35	63.5 - 104	57.9 - 119
Nickel	90.8	66.6	7.82	53.0 - 80.2	47.1 - 97.4
Potassium	29400	2340	5.14	1610 - 3070	1400 - 3280
Selenium	169	136	7.35	103 - 170	91.2 - 186
Silver	61.0	48.9	6.18	34.9 - 63.0	32.5 - 68.2
Sodium	14000	318	9.84	209 - 428	129 - 508
Strontium	286	88.0	6.18	67.5 - 109	61.8 - 120

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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	170	138	5.13	106 - 170	93.8 - 188
Tin	128	96.9	4.60	70.8 - 123	54.8 - 139
Titanium	2520	429	7.62	119 - 738	133 - 724
Uranium	147	124	14.9	102 - 145	93.5 - 154
Vanadium	118	69.7	11.5	52.4 - 87.0	40.9 - 98.5
Zinc	233	177	9.83	142 - 213	123 - 232

ANALYTICAL VERIFICATION

Parameter	Certified Value[1]	Proficiency Testing Study			NIST Traceability	
		Mean	Recovery[5]	n	SRM Number	Recovery
	mg/kg	mg/kg	%			%
Aluminum	8040	8040	79.6	155	-	-
Antimony	91.4	91.4	39.9	170	-	-
Arsenic	146	146	82.7	204	-	-
Barium	102	102	81.0	177	-	-
Beryllium	134	134	79.9	170	-	-
Boron	102	102	65.3	116	-	-
Cadmium	63.2	63.2	77.8	199	-	-
Calcium	5930	5930	80.7	140	-	-
Chromium	89.3	89.3	77.0	188	-	-
Cobalt	119	119	77.5	168	-	-
Copper	60.8	60.8	77.7	202	-	-
Iron	14400	14400	88.0	152	-	-
Lead	98.5	98.5	80.1	202	-	-
Magnesium	2580	2580	83.3	142	-	-
Manganese	370	370	81.9	172	-	-
Mercury	13.3	13.3	88.4	132	-	-
Molybdenum	83.7	83.7	77.5	167	-	-
Nickel	66.6	66.6	75.3	201	-	-

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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	2340	2340	84.6	147	-	-
Selenium	136	136	80.7	186	-	-
Silver	48.9	48.9	78.9	171	-	-
Sodium	318	318	76.0	141	-	-
Strontium	88.0	88.0	80.8	118	-	-
Thallium	138	138	80.5	173	-	-
Tin	96.9	96.9	76.9	126	-	-
Titanium	429	429	84.2	124	-	-
Uranium	124	124	112	31	-	-
Vanadium	69.7	69.7	81.3	168	-	-
Zinc	177	177	89.6	191	-	-

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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

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