▪ Certificate of Analysis ▪

Product: Metals in Soil
Catalog Number: 540
Lot No. D092-540
Certificate Issue Date: March 02, 2016
Expiration Date: July 31, 2019
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	60000	8080	0.384	3990 - 12200	3200 - 13000
Antimony	174	88.2	6.05	1.91 - 174	17.3 - 229
Arsenic	63.1	57.0	16.7	42.8 - 71.2	38.2 - 92.3
Barium	722	110	4.10	90.6 - 130	79.2 - 142
Beryllium	72.1	67.5	2.92	55.9 - 79.1	49.8 - 85.3
Boron	97.1	81.8	9.30	60.1 - 104	49.1 - 115
Cadmium	84.9	77.8	3.99	64.4 - 91.2	57.0 - 98.6
Calcium	13000	6450	0.590	5300 - 7590	4770 - 8120
Chromium	96.2	65.0	10.1	51.4 - 78.7	44.3 - 85.8
Cobalt	63.6	58.8	6.66	49.3 - 68.4	43.7 - 73.9
Copper	65.3	56.4	20.4	45.4 - 67.5	40.9 - 74.1
Iron	29800	14700	5.90	6700 - 22700	5350 - 24100
Lead	106	85.6	12.5	70.2 - 101	59.7 - 112
Magnesium	4600	2710	0.722	2050 - 3360	1750 - 3660
Manganese	485	273	6.75	221 - 324	202 - 344
Mercury	15.7	12.3	2.76	7.88 - 16.7	6.31 - 18.3
Molybdenum	66.3	56.4	3.08	44.2 - 68.6	37.9 - 74.9
Nickel	71.6	61.3	8.40	50.6 - 72.0	43.1 - 79.5
Potassium	29400	2420	1.23	1680 - 3170	1460 - 3390
Selenium	89.4	78.9	3.16	61.2 - 96.6	49.9 - 108
Silver	59.6	54.2	3.74	40.5 - 67.9	36.2 - 72.3
Sodium	14500	914	2.82	654 - 1170	541 - 1290
Strontium	269	90.3	5.58	72.9 - 108	63.4 - 117

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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	197	178	5.04	141 - 214	122 - 233
Tin	179	158	2.72	121 - 194	94.8 - 220
Titanium	2420	355	1.18	110 - 600	101 - 610
Uranium	82.1	76.9	12.3	61.5 - 92.3	63.1 - 90.7
Vanadium	95.9	56.3	14.6	43.4 - 69.2	30.0 - 82.5
Zinc	226	198	6.24	163 - 232	138 - 257

ANALYTICAL VERIFICATION

Parameter	Certified Value[1]	Proficiency Testing Study			NIST Traceability	
		Mean	Recovery[5]	n	SRM Number	Recovery
	mg/kg	mg/kg	%			%
Aluminum	8080	8080	79.3	143	-	-
Antimony	88.2	88.2	51.0	145	-	-
Arsenic	57.0	57.0	68.0	181	-	-
Barium	110	110	87.0	155	-	-
Beryllium	67.5	67.5	95.1	154	-	-
Boron	81.8	81.8	80.2	98	-	-
Cadmium	77.8	77.8	91.6	179	-	-
Calcium	6450	6450	95.0	126	-	-
Chromium	65.0	65.0	86.5	176	-	-
Cobalt	58.8	58.8	94.3	141	-	-
Copper	56.4	56.4	83.7	171	-	-
Iron	14700	14700	90.1	138	-	-
Lead	85.6	85.6	92.0	185	-	-
Magnesium	2710	2710	88.2	130	-	-
Manganese	273	273	93.1	150	-	-
Mercury	12.3	12.3	78.2	132	-	-
Molybdenum	56.4	56.4	86.5	150	-	-
Nickel	61.3	61.3	88.5	172	-	-

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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	2420	2420	86.0	131	-	-
Selenium	78.9	78.9	88.3	169	-	-
Silver	54.2	54.2	89.5	149	-	-
Sodium	914	914	91.7	120	-	-
Strontium	90.3	90.3	97.7	82	-	-
Thallium	178	178	89.7	149	-	-
Tin	158	158	89.5	106	-	-
Titanium	355	355	88.3	97	-	-
Uranium	76.9	76.9	99.1	29	-	-
Vanadium	56.3	56.3	88.1	142	-	-
Zinc	198	198	103	170	-	-

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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

Tom Widera

Quality Officer

David Kilhefner

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