

Certificate of Analysis

CERTIFIED REFERENCE MATERIAL

Trace Metals - Sewage Sludge 3

Number **CRM031-40G**

Lot 017359


Solvent (Matrix) Sewage Sludge

Hazard Irritant

Storage & Handling Store at 4°C.

Expiration Date See Sample Label

Certification Date: August 02, 2012

Certified By:  Christopher Rucinski - QA Director

ISO Guide 34

Cert# AR-1470

ISO/IEC 17025

Cert# AT-1467

Analyte	Units	Certified ^{1,4} Value	k ⁵	Standard ² Deviation	Confidence Interval	Prediction Interval
Aluminum, Al <small>Traceable to: NIST SRM 3101a Lot 992003</small>	mg/Kg	16,200 ± 1560	2.09	2,790	14,600 - 17,800	10,100 - 22,200
Antimony, Sb <small>Traceable to: NIST SRM 3102a Lot 061229</small>	mg/Kg	72.6 ± 15.8	2.10	27.1	56.8 - 88.5	13.6 - 132
Arsenic, As <small>Traceable to: NIST SRM 3103a Lot 010713</small>	mg/Kg	86.5 ± 10.6	2.06	22.3	75.8 - 97.2	39.3 - 134
Barium, Ba <small>Traceable to: NIST SRM 3104a Lot 070222</small>	mg/Kg	761 ± 170	2.11	279	595 - 927	149 - 1,370
Beryllium, Be <small>Traceable to: NIST SRM 3105a Lot 892707</small>	mg/Kg	54.6 ± 5.17	2.09	9.24	49.0 - 60.2	34.5 - 74.8
Boron, B <small>Traceable to: NIST SRM 3107 Lot 070514</small>	mg/Kg	160 ± 19.0	2.18	24.7	138 - 182	102 - 218
Cadmium, Cd <small>Traceable to: NIST SRM 3108 Lot 060531</small>	mg/Kg	87.7 ± 6.22	2.06	13.5	81.2 - 94.1	59.2 - 116
Calcium, Ca <small>Traceable to: NIST SRM 3109a Lot 050825</small>	mg/Kg	44,300 ± 7520	2.12	11,800	35,800 - 52,800	17,900 - 70,600
Chromium, Cr (total) <small>Traceable to: NIST SRM 3112a Lot 990607</small>	mg/Kg	109 ± 11.6	2.07	23.7	97.0 - 121	58.4 - 159
Cobalt, Co <small>Traceable to: NIST SRM 3113 Lot 000630</small>	mg/Kg	93.1 ± 6.14	2.12	9.58	86.7 - 99.6	71.8 - 114
Copper, Cu <small>Traceable to: NIST SRM 3114 Lot 891811</small>	mg/Kg	621 ± 27.1	2.07	55.5	595 - 648	504 - 739
Iron, Fe <small>Traceable to: NIST SRM 3126a Lot 051031</small>	mg/Kg	19,600 ± 2410	2.10	4,140	17,400 - 21,700	10,600 - 28,500
Lead, Pb <small>Traceable to: NIST SRM 3128 Lot 030721</small>	mg/Kg	304 ± 17.8	2.06	37.4	285 - 323	225 - 384
Lithium, Li <small>Traceable to: NIST SRM 3129a</small>	mg/Kg	72.6 ± 11.3	2.18	14.7	60.6 - 84.6	38.3 - 107
Magnesium, Mg <small>Traceable to: NIST SRM 3131a Lot 050302</small>	mg/Kg	8,360 ± 1270	2.12	1,980	7,190 - 9,530	4,000 - 12,700
Manganese, Mn <small>Traceable to: NIST SRM 3132 Lot 050429</small>	mg/Kg	1,430 ± 252	2.10	433	1,190 - 1,670	487 - 2,370
Mercury, Hg <small>Traceable to: NIST SRM 3133 Lot 061204</small>	mg/Kg	13.3 ± 1.92	2.09	3.56	11.4 - 15.1	5.62 - 20.9
Molybdenum, Mo <small>Traceable to: NIST SRM 3134 Lot 891307</small>	mg/Kg	55.7 ± 9.00	2.08	17.3	47.5 - 63.8	18.8 - 92.5
Nickel, Ni <small>Traceable to: NIST SRM 3136 Lot 000612</small>	mg/Kg	227 ± 12.3	2.06	25.8	214 - 240	173 - 282
Potassium, K <small>Traceable to: NIST SRM 3141a Lot 051220</small>	mg/Kg	4,340 ± 284	2.10	487	4,060 - 4,620	3,280 - 5,400
Selenium, Se <small>Traceable to: NIST SRM 3149 Lot 992106</small>	mg/Kg	122 ± 18.4	2.08	35.5	104 - 139	46.1 - 198
Silver, Ag <small>Traceable to: NIST SRM 3151 Lot 992212</small>	mg/Kg	128 ± 5.56	2.12	8.67	122 - 134	108 - 147

Analyte	Units	Certified ^{1,4} Value	k ⁵	Standard ² Deviation	Confidence Interval	Prediction Interval
Sodium, Na <small>Traceable to: NIST SRM 3152a Lot 010728</small>	mg/Kg	1,010 ± 104	2.16	145	909 - 1,110	680 - 1,340
Strontium, Sr <small>Traceable to: NIST SRM 3153a Lot 990906</small>	mg/Kg	601 ± 42.0	2.16	58.3	558 - 644	468 - 734
Thallium, Tl <small>Traceable to: NIST SRM 3158 Lot 993012</small>	mg/Kg	129 ± 13.9	2.10	23.8	114 - 143	76.7 - 181
Tin, Sn <small>Traceable to: NIST SRM 3161a Lot 070330</small>	mg/Kg	118 ± 47.8	2.12	74.8	70.5 - 166	0.00 - 284
Titanium, Ti <small>Traceable to: NIST SRM 3162a Lot 060808</small>	mg/Kg	64.0 ± 16.0	2.11	26.3	47.7 - 80.3	6.21 - 122
Vanadium, V <small>Traceable to: NIST SRM 3165 Lot 992706</small>	mg/Kg	66.9 ± 4.92	2.09	8.79	61.8 - 72.0	47.8 - 86.0
Zinc, Zn <small>Traceable to: NIST SRM 3168a Lot 001402</small>	mg/Kg	1,240 ± 64.3	2.07	132	1,160 - 1,320	957 - 1,520
Ammonia as N	mg/Kg	5,130 ± 1240	2.15	1,820	3,880 - 6,370	1,020 - 9,230
Kjeldahl nitrogen, total (TKN)	Wt%	3.68 ± 0.654	2.15	0.964	3.00 - 4.37	1.50 - 5.86
Nitrate as N <small>Traceable to: NIST SRM 3185 lot 050517</small>	mg/Kg	1,540 ± 150	2.31	130	1,400 - 1,690	1,210 - 1,880
pH <small>Traceable to: NIST SRM 191c</small>	Units	6.89 ± 0.123	2.15	0.181	6.74 - 7.03	6.47 - 7.30
Phosphorus, total <small>Traceable to: NIST SRM 3139a</small>	Wt%	2.27 ± 0.313	2.10	0.537	1.91 - 2.63	1.09 - 3.46
Total Solids (TS)	Wt%	91.3 ± 0.538	2.12	0.841	90.8 - 91.9	89.5 - 93.2
Volatile Solids, Total	Wt%	53.3 ± 1.60	2.16	2.22	51.4 - 55.2	48.2 - 58.5
Sulfur, S	mg/Kg	11,400 ± 1630	2.20	1,960	9,520 - 13,200	6,670 - 16,100

Additional Information

Description

A total sample size of 40 g is provided.

The sample has been chemically and heat sterilized.

The sample has been sized to 100 mesh.

Recommended storage condition is 4°C.

This reference material is suitable for digestion methods USEPA 3050B, 3051, and Aqua Regia digestions.

Storage

The sample should be stored at 4°C. It has been determined to be stable for the duration of the expiration date.

After sub-sampling replace cap securely and store remaining sample at 4°C.

The shelf life of the product was determined by historic stability of similar CRM's. The expiration date may be extended based on stock and popularity upon successful stability testing by a 17025 accredited laboratory.

Stability and shelf life after opening must be determined by the user, taking into account sampling frequency/volume and all local conditions.

Sample Preparation

Determination of the percent moisture content of the material is required.

Report all results on a dry weight basis.

It is recommended that approximately one gram of the soil be digested for metals analysis.

Scope and Application



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CERTIFIED REFERENCE MATERIAL

Trace Metals - Sewage Sludge 3

Number **CRM031-40G**

Lot 017359


Solvent (Matrix) Sewage Sludge

Hazard Irritant

Storage & Handling Store at 4°C.

Expiration Date See Sample Label

Certification Date: August 02, 2012

Certified By:  Christopher Rucinski - QA Director

Scope and Application

This Trace Metal in Sewage Sludge Certified Reference Material (CRM) consists of a single HDPE cup, with a Teflon lined closure containing approximately 40 grams of sterile sewage sludge from domestic origins. Being a natural matrix waste sample the analyst is challenged by the same preparation problems, analytical interferences, etc. as is typical for similar matrices received by the laboratory for analysis. Rigorous analyses identified, quantified, and certified various aliphatic and aromatic banding which are listed on the enclosed Certificate of Analysis. The sample has been analyzed by a minimum of 12 independent laboratories in a round-robin to meet the requirements specified by the ISO Guides 34 and 35, and ISO 17025.

Evaluation of Results

The Reference Value, 95% confidence interval (C.I.) for the Reference Value and 95% Prediction Interval (P.I.) around the Reference Value were obtained by the methods identified in the 'Scope and Application' section of this Certificate of Analysis. Samples were selected in a random fashion from the beginning to the end of the bottling sequence and sent for analysis by an independent laboratory round-robin. The data produced in the round-robin was used to calculate reference values by the USEPA EMSL-CINN's computer program "BIWEIGHT".

The generated BIWEIGHT mean, BIWEIGHT standard deviation and BIWEIGHT standard deviation of the mean are used to calculate the 95% Confidence Interval (CI) for the mean and the 95% Prediction Interval (PI). For normally distributed data, the BIWEIGHT 95% CI compares well to the classical calculation method used to generate a 95% CI. For non-Gaussian data sets, the BIWEIGHT method is more robust in data treatment.

BIWEIGHT data are also used to calculate a 95% PI. The 95% PI compares well to a 95% tolerance limit calculated using classical methods. For normally distributed data, the BIWEIGHT 95% PI typically represents approximately a ± 2 BIWEIGHT standard deviation window around the BIWEIGHT mean. Again, the BIWEIGHT method is more robust than classical methods when handling non-Gaussian data sets.

Laboratories performing the same analytical procedures on a sample whose values have been determined by the BIWEIGHT method can assume that the true mean, as determined by the method, is within the 95% CI window. Laboratories analyzing the sample should have results within the 95% PI window 19 out of 20 analyses. Laboratories should use the PI as guidance for laboratory performance.

Additional information on the program may be obtained by referring to the reference or by downloading the program from the EMSL-CINN web site. Additionally contact RTC for additional guidance - 1(307)742-5452 - support@rt-corp.com - www.rt-corp.com

Health and Safety Information

All RTC Certified Reference Materials are intended only for professional use by properly trained laboratory personnel. This CRM has been reviewed for both health and safety and shipping risks. It is classified as non hazardous and is not classified as hazardous goods for shipping by road, sea or air transport.

A full international MSDS as a downloadable pdf file is available at www.rt-corp.com

- 1 Certified values are the robust statistical mean when prepared according to instructions from an Interlaboratory Study and internal rigorous testing.
- 2 The standard deviation is the robust statistical standard deviation from the round robin interlaboratory study.
- 4 Expanded Uncertainty (Ucrm) - All uncertainty values in this document expressed as \pm *value* are expanded uncertainties.
- 5 **k**: Coverage factor derived from a t-distribution table, based on the degrees of freedom of the data set. **Confidence interval = 95%**

TRACEABILITY: The standard was manufactured under an ISO 17025 certified quality system. The balance used to weigh raw materials is accurate to \pm 0.0001g and calibrated regularly using mass standards traceable to NIST. All dilutions were performed gravimetrically. Additionally, individual analytes are traceable to NIST SRMs where available and specified above.

HOMOGENEITY ASSESSMENT: Between-bottle homogeneity was assessed in accordance with ISO Guide 35. Completed units were sampled over the course of the bottling operation. Samples were taken in the following manner: the units produced in the bottling operation were divided into three chronological groups, those from the Early third, the Middle third, and the Late third (Groups). A pre-determined number of sample units were then randomly selected from each group. A subset of each group was then randomly selected for chemical analysis. The results of the chemical analysis were then compared by Single Factor Analysis of Variance (ANOVA).

UNCERTAINTY STATEMENT: Uncertainty values in this document are expressed as Expanded Uncertainty (Ucrm) corresponding to the 95% confidence interval. Ucrm is derived from the combined standard uncertainty multiplied by the coverage factor k, which is obtained from a t-distribution and degrees of freedom. The components of combined standard uncertainty include the uncertainties due to characterization, homogeneity, long term stability, and short term stability (transport). The components due to stability are generally considered to be negligible unless otherwise indicated by stability studies.

THIS PRODUCT WAS DESIGNED, PRODUCED AND VERIFIED FOR ACCURACY AND STABILITY IN ACCORDANCE WITH ISO 17025 (AClass Cert AT-1467) and ISO GUIDE 34 (AClass Cert AR-1470).

MSDS reports for components comprising greater than 1.0% of the solution or 0.1% for components known to be carcinogens are available upon request.

Manufactured and certified by Sigma-Aldrich RTC, Inc.

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