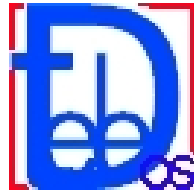




**The IAEA-CU-2007-03 world wide open proficiency test on
the determination of radionuclides in soil, spinach and water**

**Laboratory's Individual Evaluation Report
Laboratory Code: 146 (CuNo: 13949)
Total Pages (with cover): 6**



Individual Evaluation Report
for
Laboratory No. 146

Your personal customer number: 13949

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The IAEA-CU-2007-03 World-wide open proficiency test

Evaluation Criterias

Based on more than 40 years experience with open world-wide laboratory intercomparison studies, it was decided in the Chemistry Unit of the IAEA Seibersdorf laboratories to use a modified u-score evaluation, where the trueness and precision of participants' results are evaluated separately.

For trueness evaluation the participants' results are assigned 'Acceptable' if:

$$A1 \leq A2$$

where

$$A1 = |Value_{IAEA} - Value_{Lab}|$$
$$A2 = 2.58 \times \sqrt{Unc_{IAEA}^2 + Unc_{Lab}^2}$$

For evaluation of precision estimator P is calculated for each participant, according to the following formula:

$$P = \sqrt{\left(\frac{Unc_{IAEA}}{Value_{IAEA}}\right)^2 + \left(\frac{Unc_{Lab}}{Value_{Lab}}\right)^2} \times 100 \quad [\%]$$

P directly depends on the measurement uncertainty claimed by the participant. The acceptance limit for precision (LAP) for each analyte respectively is defined in Tables 1 - 3 including any adjustment due to the concentration or activity level of the analytes concerned and the complexity of the analytical problem. Participants' results are scored as 'Acceptable' for precision when (P < LAP) or (P = LAP).

In the final evaluation, both scores for trueness and precision are combined. A result must obtain 'Acceptable' score in both criteria to be assigned final score 'Acceptable'. Obviously, if a score 'Not Acceptable' was obtained for both, trueness and precision, the final score will also be 'Not Acceptable'. In cases where either precision or trueness is 'Not Acceptable', further check is applied. The value of the relative bias (RB) is compared with the maximum acceptable bias (MAB), which is defined by the IAEA in advance, similarly as LAP. If (RB < MAB) or (RB = MAB), the final score will be 'Warning'. If RB > MAB, the result will be 'Not Acceptable'. 'Warning' will reflect mainly two situations. The first situation will be a biased result with small measurement uncertainty, however still within MAB. The second situation will appear when result close to the assigned property value will be reported, but the associated uncertainty is large.

The results of Am-241, P-238 and Pu-239+240 were evaluated against the Upper Limit of Evaluation (ULE) which is shown in the table 1. The participant's result is assigned 'Acceptable' if: Lab Value - Lab Unc < ULE

References:

- 1.) Guide to the Expression of Uncertainty in Measurement, International Organization for Standardization, Geneva, 1995.
- 2.) Quantifying Uncertainty in Nuclear Analytical Measurements, TECDOC-1401, International Atomic Energy Agency, Vienna, 2004.
- 3.) C. J. Brookes, I. G. Betteley, and S. M. Loxton, Fundamentals of Mathematics and Statistics, Wiley, UK, 1979.
- 4.) ISO 5725 (E), 'Accuracy (trueness and precision) of Measurement Methods and Results', International Organization for Standardization, Geneva, 1994.

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Acceptance Limits

Please find below in the tables the acceptance limits for LAP (%) and MAB (%) in relation to the matrix and the analyte that have been used for the evaluation.

Parameter Table 1 for IAEA-330

Analyte	LAP(%)	MAB(%)	ULE (Bq/kg)
Am-241	n.a.	n.a.	0.13
Cs-137	15	15	n.a.
K-40	15	15	n.a.
Pu-238	n.a.	n.a.	0.05
Pu-239+240	n.a.	n.a.	0.11
Sr-90	15	15	n.a.
U-234	20	20	n.a.
U-238	20	20	n.a.

Parameter Table 2 for IAEA-444

Analyte	LAP(%)	MAB(%)	ULE (Bq/kg)
Am-241	20	20	n.a.
Cd-109	20	20	n.a.
Co-60	15	15	n.a.
Cs-134	15	15	n.a.
Cs-137	15	15	n.a.
Mn-54	15	15	n.a.
Pb-210	20	20	n.a.
Zn-65	15	15	n.a.

Parameter Table 3 for IAEA-445

Analyte	LAP(%)	MAB(%)	ULE (Bq/kg)
Am-241	15	15	n.a.
Cd-109	15	15	n.a.
Co-60	10	10	n.a.
Cs-134	10	10	n.a.
Cs-137	10	10	n.a.
Mn-54	10	10	n.a.
Pb-210	25	25	n.a.
Zn-65	10	10	n.a.

The IAEA-CU-2007-03 World-wide open proficiency test

Laboratory No. 146, Results submitted on 2008-02-25

2009-06-19

Evaluation on Sample 330, Spinach

Reference Date: 15th of October 2007

Analyte	IAEA Value [Bq/kg d.m.]	IAEA Unc [Bq/kg d.m.]	Lab Value [Bq/kg d.m.]	Lab Unc [Bq/kg d.m.]	Lab Unc %	Rel. Bias %	z-Score	u-Test	Ratio Lab/IAEA	A1	A2	Trueness	P(%)	Precision	Final Score
Cs-137	1235	35	1164.43	86.85	7.46	-5.71	-0.57	-0.75	0.94	70.57	241.58	A	7.98	A	A
K-40	1188	30	1213.33	95.41	7.86	2.13	0.21	0.25	1.02	25.33	258.04	A	8.26	A	A
Sr-90	20.1	2.1													
U-234	1.02	0.07													
U-238	0.95	0.05	<11.75	0.03											

Analyte	Lab Value [Bq/kg d.m.]	Lab Unc [Bq/kg d.m.]	ULE	Final Score
Am-241	<21.45	0.05	0.13	A
Pu-238			0.05	n.a.
Pu-239+240			0.11	n.a.

Evaluation on Sample 444, Soil

Reference Date: 15th of October 2007

Analyte	IAEA Value [Bq/kg d.m.]	IAEA Unc [Bq/kg d.m.]	Lab Value [Bq/kg d.m.]	Lab Unc [Bq/kg d.m.]	Lab Unc %	Rel. Bias %	z-Score	u-Test	Ratio Lab/IAEA	A1	A2	Trueness	P(%)	Precision	Final Score
Am-241	55.6	1.6	55.47	7.36	13.27	-0.23	-0.02	-0.02	1.00	0.13	19.43	A	13.58	A	A
Cd-109	248.7	5.18	813.10	94.78	11.66	226.94	22.69	5.95	3.27	564.40	244.90	N	11.84	A	N
Co-60	82.6	2.01	82.50	6.14	7.44	-0.12	-0.01	-0.02	1.00	0.10	16.67	A	7.83	A	A
Cs-134	59.4	1.73	57.53	4.39	7.63	-3.15	-0.31	-0.40	0.97	1.87	12.17	A	8.17	A	A
Cs-137	68.5	1.38	67.04	5.26	7.85	-2.13	-0.21	-0.27	0.98	1.46	14.03	A	8.10	A	A
Mn-54	61	1.24	63.51	4.94	7.78	4.11	0.41	0.49	1.04	2.51	13.14	A	8.04	A	A
Pb-210	48	1.5	53.42	7.06	13.22	11.29	1.13	0.75	1.11	5.42	18.62	A	13.58	A	A
Zn-65	29.9	0.99	38.25	4.55	11.90	27.93	2.79	1.79	1.28	8.35	12.01	A	12.35	A	A

Evaluation on Sample 445, Water

Reference Date: 15th of October 2007

Analyte	IAEA Value [Bq/kg]	IAEA Unc [Bq/kg]	Lab Value [Bq/kg]	Lab Unc [Bq/kg]	Lab Unc %	Rel. Bias %	z-Score	u-Test	Ratio Lab/IAEA	A1	A2	Trueness	P(%)	Precision	Final Score
Am-241	7.11	0.05	<10.57	0.01											
Cd-109	34.96	0.2	<43.78	0.04											
Co-60	7.52	0.06	7.22	0.92	12.74	-3.99	-0.40	-0.33	0.96	0.30	2.38	A	12.77	N	W
Cs-134	7.65	0.1	6.09	0.81	13.30	-20.39	-2.04	-1.91	0.80	1.56	2.11	A	13.36	N	N
Cs-137	8.12	0.06	7.31	0.97	13.27	-9.98	-1.00	-0.83	0.90	0.81	2.51	A	13.29	N	W
Mn-54	4.74	0.02	5.99	0.80	13.36	26.37	2.64	1.56	1.26	1.25	2.06	A	13.36	N	N
Pb-210	29.34	0.5	<59.76	0.06											
Zn-65	13.06	0.15	19.82	2.64	13.32	51.76	5.18	2.56	1.52	6.76	6.82	A	13.37	N	N