The IAEA-TEL-2017-03 world wide open proficiency test on the determination of anthropogenic and natural radionuclides in water, milk powder and Ca-carbonate of natural origin

Laboratory's Individual Evaluation Report
Laboratory Code: 36 (CuNo: 13949)
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Individual Evaluation Report
for
Laboratory Nr. 36

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Description of the evaluation criterias:

The data is evaluated according to the following steps:

The relative bias between the reported and the target value (the best estimation of the true value) is expressed by the following equation:

$$Bias_{relative} = \frac{Value_{reported} - Value_{target}}{Value_{target}} \times 100\%$$

The relative bias will be compared to the Maximum Acceptable Relative Bias (**MARB**) which has been determined for each measurand, considering the physical background of radioanalytical methods, including the level of the radioactivity and the complexity of the task.

If the **$Bias_{relative}$ ≤ MARB** value the result will be "Accepted" for accuracy.

Based on fit for purpose and the good laboratory practice principles the expanded relative combined uncertainty should cover the relative bias:

$$P = \sqrt[2]{\left(\frac{u_{target}}{A_{target}}\right)^2 + \left(\frac{u_{reported}}{A_{reported}}\right)^2} \times 100$$

$$Bias_{relative} \leq k * P$$

where k is the coverage factor, for the 95% confidential level **k** is 2.56. If the reported result is between the ± **MARB** values, but it is not overlapping with the target value within their uncertainties, this equation helps to decide whether they are significantly different or not.

The **P** value will be compared to the **MARB** also. If both the **P ≤ MARB** and **$Bias_{relative}$ ≤ k*P** are fulfilled the reported result will be "Accepted" for the precision. If one of them is insufficient the result will be assigned the "Not accepted" status for precision.

The final score according to the above detailed evaluation:
"**Accepted**" when both accuracy and precision achieved "Accepted" status,
"**Not Accepted**" when the accuracy is "Not accepted" and
"**Warning**" when accuracy is “Accepted”, but the precision is "Not accepted".

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Target Value Tables for the proficiency test parameters:

Table of Target Values and Evaluation Parameters (MARB) for Sample 1

Sample Code	Analyte	Target Value	Uncertainty	MARB
1	H-3	29.8	0.6	25 %
1	Sr-90	11.2	0.3	20 %
1	Ba-133	16.9	0.5	15 %
1	Cs-137	13.1	0.4	15 %

Table of Target Values and Evaluation Parameters (MARB) for Sample 2

Sample Code	Analyte	Target Value	Uncertainty	MARB
2	Zr-95	8	0.22	30 %
2	Tc-99m	53.8	2.2	30 %
2	Mo-99	55.9	1.9	25 %
2	Ru-103	3.94	0.12	40 %
2	I-132	54.1	2.2	25 %
2	Ba-140	37.1	1.1	30 %
2	Ce-141	15.7	0.4	30 %
2	Ce-143	48	4	25 %
2	Ce-144	1.85	0.24	60 %
2	Nd-147	15	0.5	30 %
2	Np-239	3100	70	20 %

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Table of Target Values and Evaluation Parameters (MARB) for Sample 4

Sample Code	Analyte	Target Value	Uncertainty	MARB
4	Sr-90	99.9	5	15 %
4	Ba-133	137.4	5	15 %
4	Cs-137	98.6	5	15 %

Table of Target Values and Evaluation Parameters (MARB) for Sample 5

Sample Code	Analyte	Target Value	Uncertainty	MARB
5	Ra-228	90	4	30 %
5	Ra-226	6970	200	20 %

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Evaluation Tables for Labcode 36.

Evaluation Result Table for Sample 1

Sample Code	Analyte	Target Value	Target Unc.	MARB	Rep. Value	Rep. Unc	Rel. Bias	Robust SD	Z-Score	U-Test	Accuracy	P	Precision	Final Score
1	Ba-133	16.9	0.5	15 %	18.0	1.6	6.51 %	0.9	1.22	0.66	A	9.37	A	A
1	Cs-137	13.1	0.4	15 %	14.3	1.1	9.16 %	0.6	2.00	1.03	A	8.28	A	A

Evaluation Result Table for Sample 2

Sample Code	Analyte	Target Value	Target Unc.	MARB	Rep. Value	Rep. Unc	Rel. Bias	Robust SD	Z-Score	U-Test	Accuracy	P	Precision	Final Score
2	Ba-140	37.1	1.1	30 %	40.9	5.4	10.24 %	3.5	1.09	0.69	A	13.53	A	A
2	Ce-141	15.7	0.4	30 %	18.4	2.3	17.20 %	0.9	3.00	1.16	A	12.76	A	A
2	Mo-99	55.9	1.9	25 %	69	13	23.43 %	10.1	1.30	1.00	A	19.14	A	A
2	Np-239	3100	70	20 %	3110	190	0.32 %	363	0.03	0.05	A	6.51	A	A
2	Zr-95	8	0.22	30 %	8.3	1.1	3.75 %	0.6	0.50	0.27	A	13.54	A	A

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Evaluation Result Table for Sample 4

Sample Code	Analyte	Target Value	Target Unc.	MARB	Rep. Value	Rep. Unc	Rel. Bias	Robust SD	Z-Score	U-Test	Accuracy	P	Precision	Final Score
4	Ba-133	137.4	5	15 %	141.6	7.4	3.06 %	15.9	0.26	0.47	A	6.37	A	A
4	Cs-137	98.6	5	15 %	102.9	7.2	4.36 %	8	0.54	0.49	A	8.64	A	A

Evaluation Result Table for Sample 5

Sample Code	Analyte	Target Value	Target Unc.	MARB	Rep. Value	Rep. Unc	Rel. Bias	Robust SD	Z-Score	U-Test	Accuracy	P	Precision	Final Score

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Intercomparison Parameter Evaluation:
Calculation of Evaluation Parameters
robust average: x*=median of xi (i=1,2..p), robust standart deviation s*=1.483 * median of |xi-x*|, z-score: z=(Reported-Value - TargetValue)/s*
z-score evaluation: z<2: accepted, 2<=z<=3: warning, z>3: not accepted

Sample Code	Analyte	Robust Mean	Robust SD	Rep. Value	Rep. Unc	Z-Score	Z-Score Evaluation

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The analytes listed in the table below have been identified but are not present in the samples (false positive):

Sample Code	Analyte	Reported Value