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ALMERA Proficiency Test: Determination of Natural and Artificial Radionuclides in Soil and Water

IAEA-TEL-2011-04

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ALMERA PROFICIENCY TEST: DETERMINATION OF NATURAL AND ARTIFICIAL RADIONUCLIDES IN SOIL AND WATER

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IAEA Analytical Quality in Nuclear Applications No. IAEA/AQ/32

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IAEA-TEL-2011-04

INTERNATIONAL ATOMIC ENERGY AGENCY
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FOREWORD

The Analytical Laboratories for the Measurement of Environmental Radioactivity (ALMERA) network is a cooperative effort of analytical laboratories worldwide. Members of the network are nominated by their respective Member States on the expectation of providing reliable and timely analysis of environmental samples in the event of an accidental or intentional release of radioactivity.

The ALMERA network consists of 131 laboratories representing 81 Member States at December 2012. The IAEA's Environment Laboratories in Seibersdorf and Monaco are the central coordinators of the ALMERA network activities.

The IAEA helps the ALMERA network to maintain their readiness by coordinating activities, including the organization of meetings, development of standardized methods of sample collection and analysis, and organization of interlaboratory comparison exercises and proficiency tests as tools for external quality control.

IAEA proficiency tests and interlaboratory comparison exercises are organized on a regular basis specifically for the members of the ALMERA network. At least one exercise is organized per year by the IAEA for the ALMERA network. These exercises are designed to monitor and to demonstrate the performance and analytical capabilities of the network members, and to identify gaps and problem areas where further development is needed. The ALMERA proficiency tests enable ALMERA members to report their results on gamma emitting radionuclides in a very short time frame, i.e. three days, which is what would be required for emergency response.

This publication presents the results of the ALMERA proficiency test IAEA-TEL-2011-04 on the determination of natural and artificial radionuclides in water and soil. The methodologies, data evaluation approach, summary evaluation of each radionuclide and individual evaluation reports for each laboratory are also described.

The IAEA would like to express its appreciation to A. Shakhashiro for the design and preparation of this proficiency test, as well as to S. Tarjan for assistance in the evaluation of results and report preparation. The IAEA officer responsible for this publication was A. Pitois of the IAEA Environment Laboratories.

EDITORIAL NOTE

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CONTENT

1. INTRODUCTION

The 2011 ALMERA proficiency test was related to the determination of natural and anthropogenic radionuclides in water and soil samples. It covered the main radionuclides and environmental matrices of interest for environmental radioactivity monitoring activities.
In this proficiency test, the sample set consisted of three water samples and one soil sample. The water samples were spiked with anthropogenic radionuclides and the soil sample contained both natural radionuclides and anthropogenic radionuclides from the Chernobyl accident. The participating laboratories were requested to analyse H-3, Co-60, Ba-133, Cs-134, Cs-137, Eu-152 and Am-241 in water and K-40, Sr-90, Cs-137, radioisotopes from the uranium and thorium decay series, Pu-238, Pu-239+240 and Am-241 in soil. These materials represent the 'regular' type of ALMERA proficiency test samples as agreed during the second ALMERA coordination meeting.

Fifty-seven laboratories registered to the 2011 ALMERA proficiency test. The test items were prepared and distributed in November 2011 to the 57 ALMERA laboratories. They then had the possibility to report their results on gamma emitting radionuclides in a very short time frame, i.e. 3 days, as this would be required for emergency response. The deadline for receiving all results from the participants was set to the 30th January 2012, and 51 of the initially registered laboratories reported their results on time. This 89% reporting ratio is the highest in the history of the ALMERA network. All those participants who have reported their results are listed at the end of this report in the Appendix III. A laboratory code is associated to each participant and therefore the participating laboratories in this proficiency test can be identified. In addition 38 ALMERA laboratories took part in the world-wide proficiency test, open to all laboratories around the world; therefore altogether 89 ALMERA laboratories can be considered as having taken part to a proficiency test organised by the IAEA in 2011. Exactly the same sample set was used for both the ALMERA and world-wide proficiency tests in order to be able to compare their respective performances.

Shortly after closing the database a rapid evaluation of the proficiency test, including all the important parameters and the obtained scores, was made available to participants. This provided an opportunity for the immediate correction or fine tuning of the applied radioanalytical methods.

2. MATERIALS AND METHODS

2.1. PROFICIENCY TEST OBJECTIVES

The 2011 ALMERA proficiency test was organised by IAEA on the determination of natural and anthropogenic radionuclides in water and soil samples, and it covered some of the most important tasks performed by laboratories involved in environmental radioactivity monitoring.

The sample set consisted of three water samples and one soil sample. The water samples contained anthropogenic gamma emitting radionuclides and H-3 isotope.

The gamma emitting radionuclides covered a wide energy range, i.e. 59.5-1332.5 keV, and several of them were cascade decaying radionuclides. The participants had therefore to apply true coincidence summing correction to achieve appropriate results. The concentration of the H-3 isotope was not directly measurable due to the presence of other beta emitters and the Compton effect of the gamma photons. Preparation steps such as distillation and removal of the dissolved O_2 were required for the measurement of H-3.

The IAEA-360 reference material was chosen for the soil sample. This material was collected close to the Chernobyl area and contained both natural radioisotopes typical of the geological environment and anthropogenic radioisotopes from the fallout following the reactor accident, including the transuranic (TRU) radionuclides. A total sample digestion technique was required for the determination of both natural uranium and TRU radioisotopes by alpha spectrometry to avoid any incomplete dissolution of uranium or TRU radionuclides during sample digestion.

This proficiency test aimed to assess the analytical performance of the ALMERA laboratories in their environmental radioactivity monitoring activities. The reported results were evaluated in a short time frame and the laboratories were encouraged to take any corrective actions or technical improvements in case of identification of any shortcomings.

2.2. PARTICIPANTS

Fifty-one ALMERA laboratories from 57 initially registered reported their results to IAEA. A list of the participating laboratories, which reported their results in this proficiency test, is given in the Appendix III with their laboratory code.

2.3. COMPOSITION OF PROFICIENCY TEST MATERIALS

The PT sample set consisted of 4 samples as detailed in the following table.

TABLE 1. SAMPLES DISTRIBUTED TO THE PARTICIPANTS

Sample ID	Material	Volume	Target analytes
01	Water	500 g	Co-60, Ba-133, Cs-134, Cs-137, Eu-152, Am-241 and H-3
02	Water	500 g	
03	Water	500 g	
04	Soil (IAEA-360)	200 g	K-40, Sr-90, Cs-137, Tl-208,Pb-210, Po-210, Pb-212, Pb-214, Bi-214, Ra-226, Ac-228, U-234, U-235, U-238, Pu-238, Pu-239+240 and Am-241

The photo of the sample set is shown on Fig. 1.

FIG. 1. The distributed sample set.

The activity levels of the materials were under the exemption levels and therefore did not require any special rules for their handling.

Each water sample had a determined control weight; the participants were requested to weigh the water samples at the delivery of the package and to report the values to the IAEA for check.

2.4. WATER SAMPLES (SAMPLES 01, 02 AND 03)

2.4.1. Preparation of the spiked water samples

The water samples have been prepared by three consecutive gravimetric dilutions from the high precision reference solutions. For the stability of the diluted stock solutions, inactive carrier was added in strong acidic environment. The identification and manufacturer of the high precision certified radioactive solutions are listed in Table 2.

TABLE 2. IDENTIFICATION OF THE CERTIFIED RADIOACTIVE SOLUTIONS USED FOR THE PREPARATION OF THE WATER SAMPLES

Radionuclide	Code of the Certificate	Manufacturer
H-3	SRM4927F	NIST
Co-60	Co60-ELSB50	CERCA
Ba-133	RSRBa-11	PLATOM
Cs-134	Cs134ELSR50	CERCA
Cs-137	CDZ64/S4/14/70	Amersham
Eu-152	Eu152-ELMB90	CERCA
Am-241	ER-25/178-18	UVVVR

Dilution factors of the first two solutions were validated by point source preparation applying relative measurements of the sources from the consecutive dilution steps while the final dilution was checked by volume source measurement.

Dilution of the master spiking solution (containing all of the radionuclides for the water samples mentioned in Table 2) was performed using filtered and acidified tap water originated from Seibersdorf, Austria. The tap water had been previously analysed for each target radionuclide. The activity concentration of each radionuclide of interest was found to be below the detection limit of the proposed analytical method.

Altogether three different water batches were produced with radioactivity levels varying within a factor of two. For homogenising the spiked water, a pump with multiple outlets was used to circulate the water in a tank of 600 litres. The total weight of all the bulk materials was 185 kg each, and for each one 370 bottles containing 500 g of water sample were prepared.

2.4.2. Target values and associated combined uncertainty

A well maintained and regularly controlled five digit AX 205/M analytical balance (SN 119472675) was used for the first two dilution steps. The accuracy of the balance was tested by the certified control weight 5.00000 g (type: YCS 01 352, certificate No 60128482). The water used for the final dilution step was weighed on a digital balance Sartorius I-31.
The target values of the analytes were derived from the original certified values for traceability reasons. The uncertainties of each preparation step were determined and propagated into the final uncertainty [1].
The combined standard uncertainty has two main contributors:

- Uncertainty of the certified radioactive solutions specified in the certificate;
- Uncertainty of the weight of water being spiked in the final dilution step.

According to the accuracy of the analytical balance the uncertainties of the first two dilution steps are negligible as compared with the above mentioned components. As an independent control of the gamma emitting radionuclides, the point sources of these dilutions were compared to certified point sources of the same radioisotope prepared by a metrological institute. The results confirmed the certified values within the reported measurement results uncertainties.

During the preparation the bottles were numbered according to their production order and the total mass of each bottle was registered for further quality control purpose. One sample from the beginning, one from the middle and one from the end were analysed for all radionuclides of interest to investigate any potential production trend. The standard deviations of all analytes were below the repeatability of the methods, showing the satisfactory homogeneity of the samples on the one hand and no production trend during the preparation on the other hand. The results of the control measurements were also in agreement with the derived target values and demonstrated that the entire preparation process was well controlled. The target values and associated uncertainties for water samples at the reference date 15 November 2011 are given in Table 3.

TABLE 3. TARGET VALUES AND ASSOCIATED UNCERTAINTIES FOR WATER SAMPLES AT THE REFERENCE DATE 15 NOVEMBER 2011

Nuclide	Sample 01		Sample 02		Sample 03	
	Activity[a], Bq/kg	Uncertainty[b], Bq/kg	Activity[a], Bq/kg	Uncertainty[b], Bq/kg	Activity[a], Bq/kg	Uncertainty[b], Bq/kg
H-3	50.2	0.9	25.0	0.5	35.1	0.6
Co-60	15.3	0.2	7.6	0.1	10.7	0.2
Ba-133	5.0	0.1	2.5	0.1	3.5	0.1
Cs-134	7.7	0.1	3.8	0.1	5.4	0.1
Cs-137	6.2	0.1	3.1	0.1	4.4	0.1
Eu-152	15.4	0.2	7.7	0.1	10.8	0.2
Am-241	4.7	0.1	2.4	0.1	3.3	0.1

[a]Activity = massic activity
[b]Uncertainty = standard combined uncertainty (with k = 1 coverage factor)

2.5. SOIL SAMPLE (SAMPLE 04)

2.5.1. Preparation and homogeneity study of the soil sample

The soil was collected from the Chernobyl area for a reference material purpose. It was processed by the "Collaboration Centre for Reference Material of Terrestrial Origin (Hungary)". The preparation included the following steps: drying, milling, sieving below the 250 micron particle size and the homogenisation of 220 kg of this material. The particle size distribution was determined at the IAEA Terrestrial Environment Laboratory (TEL) in Seibersdorf, Austria and the result is shown on Fig. 2. This soil was assigned the name IAEA-360 by the IAEA reference material certification committee after a thorough characterisation of the material.

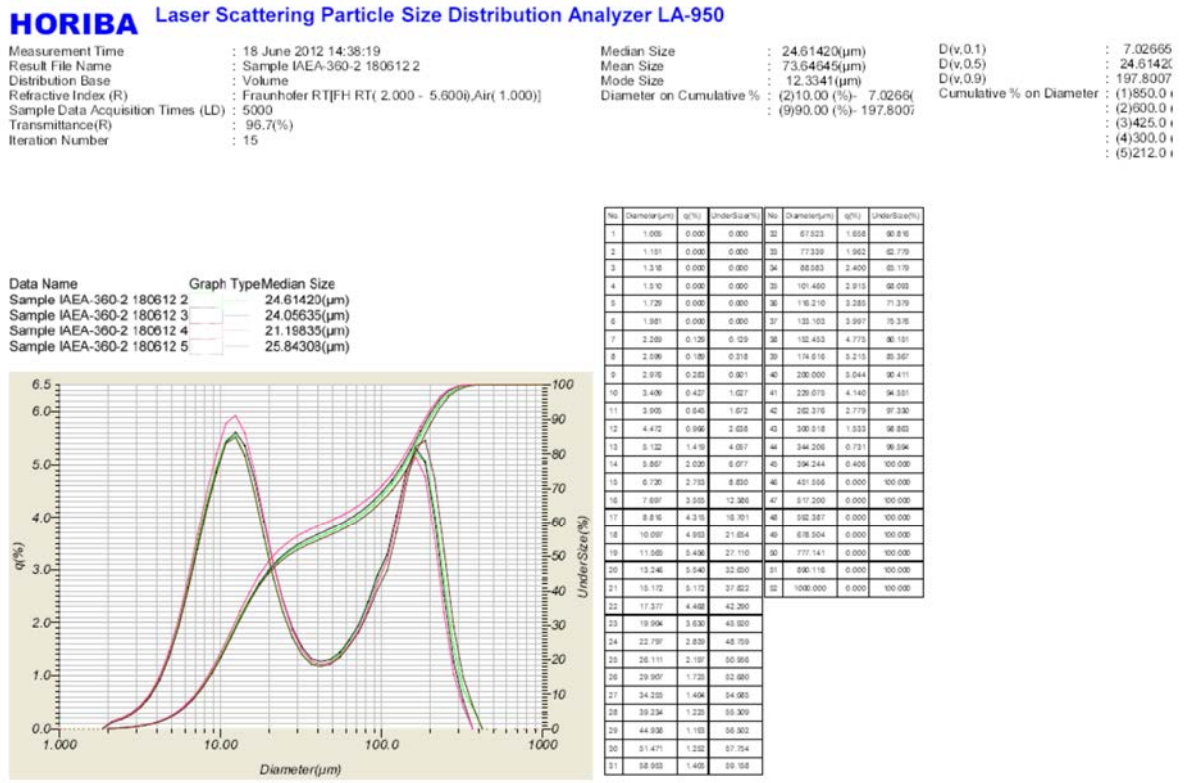

FIG. 2. Particle size distribution of the IAEA-360 soil.

The homogenisation was performed in one batch. Before bottling, the homogeneity was tested using bulk sampling method and determination of gamma emitting radionuclides by high resolution gamma ray spectrometry. The bottling was carried out under normal laboratory conditions within one day taking all necessary precautions to avoid the segregation of the material. The bottles were numbered according to the production order for trend analysis and further quality control purposes. The dry content of the material was controlled during the entire preparation steps. Altogether 1200 packing units were prepared.

The material was sterilised after bottling using gamma ray irradiation with a total dose of 25 kGy, indicated by the red label on the bottle.

The homogeneity study and trend analysis had been carried out from the bottled material according to the recommendation of the ISO Guide 35 [2]. Eleven bottles were selected using a random number generator and three replicates of each bottle were analysed by gamma ray spectrometry. The sample, closed into the Rn-tight metal sample container, had a weight of 50.0 g. A N-type, 30% relative efficiency, coaxial HPGe detector with carbon epoxy window in 10 cm lead shield was used for the measurements. The spectrum collection time was 80000 s. The sample-detector distance was adjusted to 5 mm. No absorber was applied. The good reproducibility of the geometry was obtained by a special sample holder tray system, which has a tightly fitted socket for the sample container. The positioning was tested with a calibration source in the same geometry; a 80 000 s long measurement time was used to achieve a high counting statistics and a standard deviation of the peak area better than 0.1%. Under these circumstances the standard deviation for the sample obtained from five repeated measurement was better than 0.2%. The contribution of the long term counting stability was also determined from five consecutive measurements without replacement of the calibration source.

The results are shown on Fig. 3. No significant heterogeneity in the sample was observed by trend analysis or ANOVA calculation.

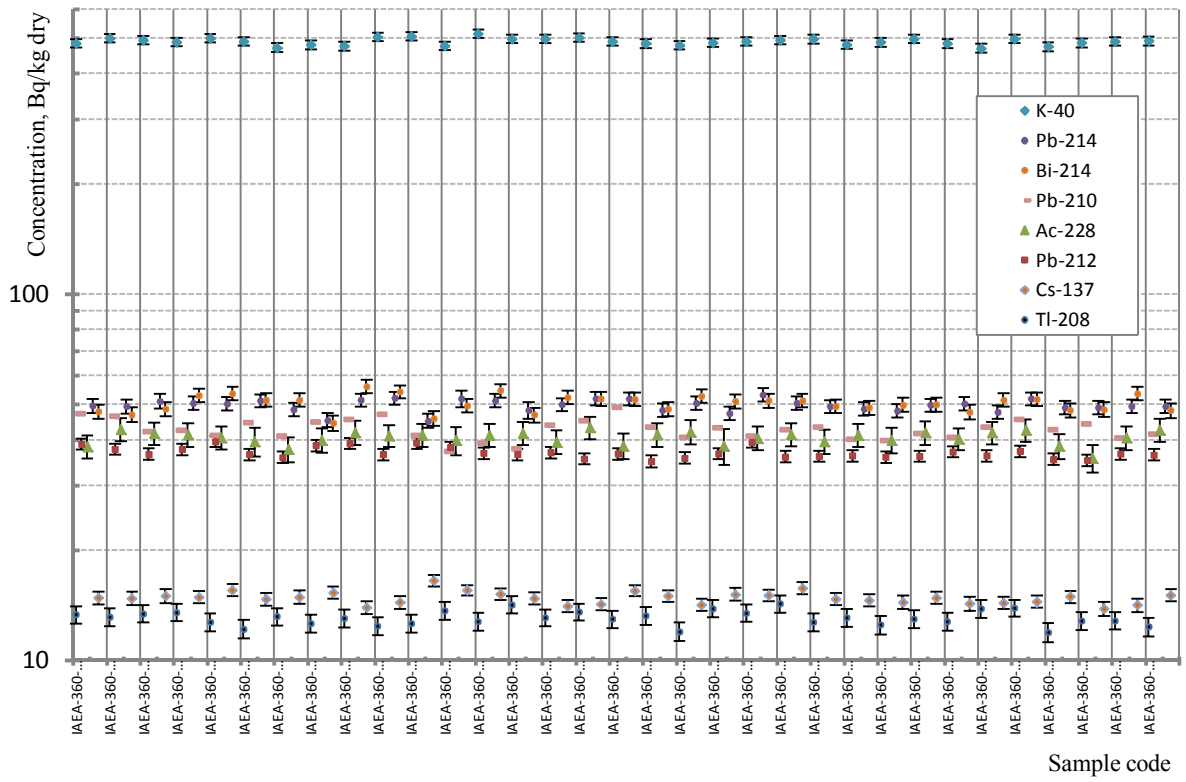

FIG. 3. Results of the homogeneity study for gamma emitting radionuclides in the IAEA-360.

2.5.2. Methods of characterisation of the soil sample

Gamma emitting radionuclides

The following gamma emitting radionuclides were characterised in this material:

- K-40 and Cs-137, which have no decay series;
- Radionuclides from the U-238 decay series, i.e.Th-234, Pb-214, Bi-214 and Pb-210 (Po-210);
- Radionuclides from the Th-232 decay series, i.e.Ac-228, Pb-212 and Tl-208.

The gamma ray spectrum of the material is shown on Fig. 4.

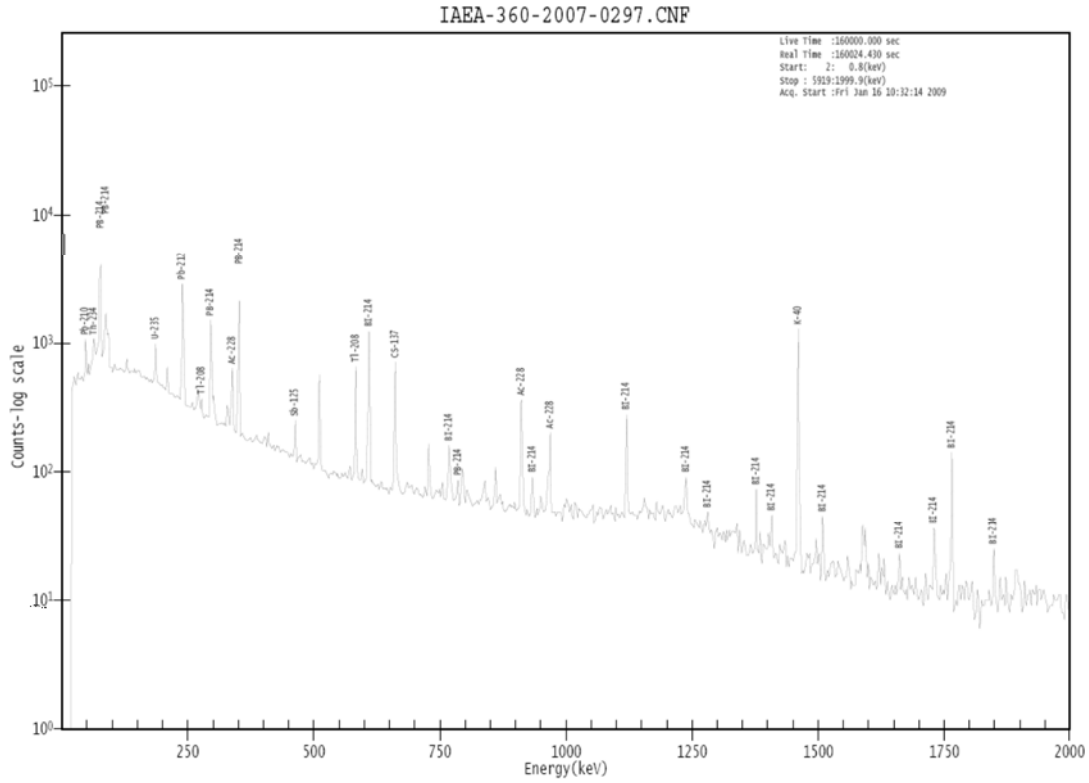

FIG. 4. Gamma ray spectrum of the IAEA-360.

Beta emitting radionuclide

The activity concentration of Sr-90 (in equilibrium with its progeny Y-90) was measured in the soil sample. The applied radioanalytical method was based on the isotope dilution analysis of the radiostrontium. A relatively large amount of inactive strontium (0.7125 g) was added as a carrier to the 50 g soil sample at the beginning of the sample preparation. The leaching technique was then used to dissolve the strontium from the sample. Chemical separation and two purification steps were carried out afterwards to remove any disturbing beta emitters. The OXFORD LB 05 low background alpha and beta counter, equipped with gas proportional detector, was applied for the measurement of the solid $SrSO_4$ precipitate, once the Sr-90–Y-90 equilibrium had been reached. An AlphaGuard was installed in the counting room for controlling the main parameters, which may have an influence on the count rate. The Rn-222 concentration in the air and other parameters, such as room temperature, air pressure and humidity content, were recorded continuously. Eight samples were analysed for Sr-90 and their results are shown on Fig. 5.

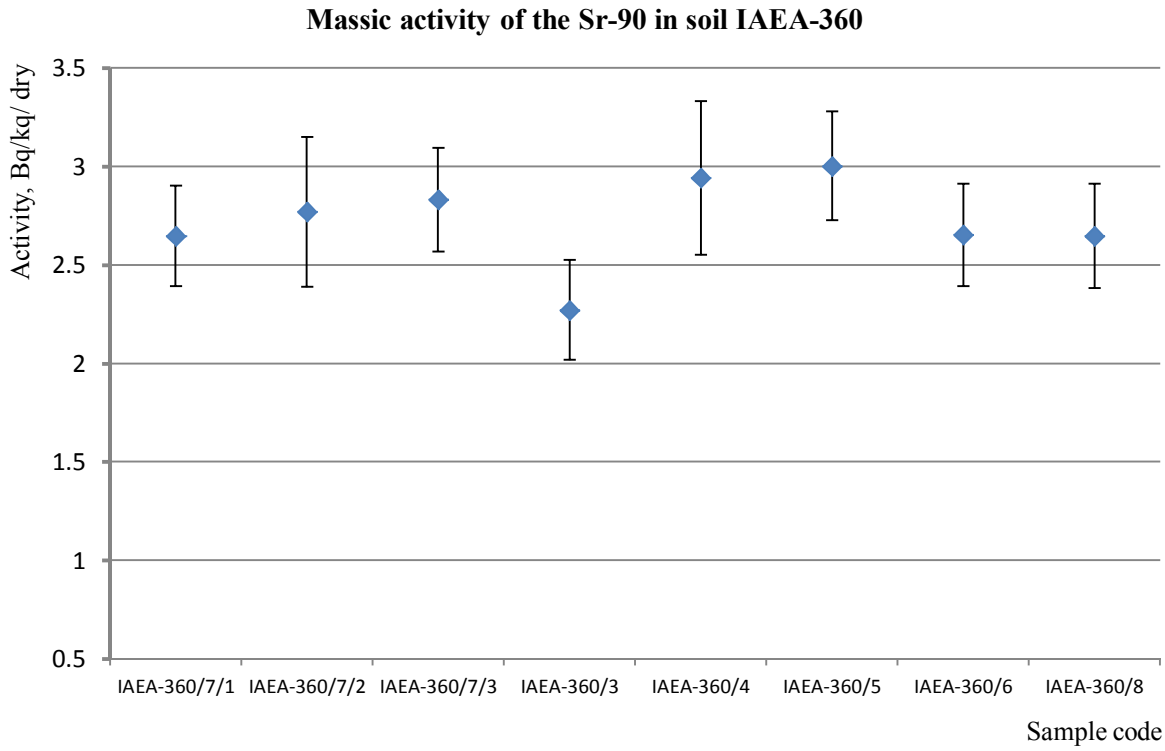

FIG. 5. Results of the determination of Sr-90 (activity calculated for the reference date October 2009).

The arithmetical mean value and its uncertainty were 2.7 (0.5) Bq/kg dry material at the date of measurements, on 1st October 2009.

Alpha emitting radionuclides

Both natural and anthropogenic alpha emitting radionuclides were measured in the soil sample. The uranium and radium content of the sample are characteristic of the geological environment. The uranium content is expected to be in the range of the world average, which is around 25 Bq/kg. The sample contains also TRU isotopes, due to its origin close to the Chernobyl area.

Uranium and transuranic isotopes

The concentration of the uranium isotopes in the soil sample was measured by two independent methods, namely, by isotope dilution with U-233 tracer and measurement by ICP-MS, and by isotope dilution with U-232 tracer and measurement by alpha spectrometry. The concentration of the transuranic isotopes was measured by isotope dilution with Pu-242 and Am-243 tracers and measurement by alpha spectrometry.

The sample preparation is based on the fusion technique using a Katanax K1 type fluxer. The fluxer at work is shown on Fig. 6.

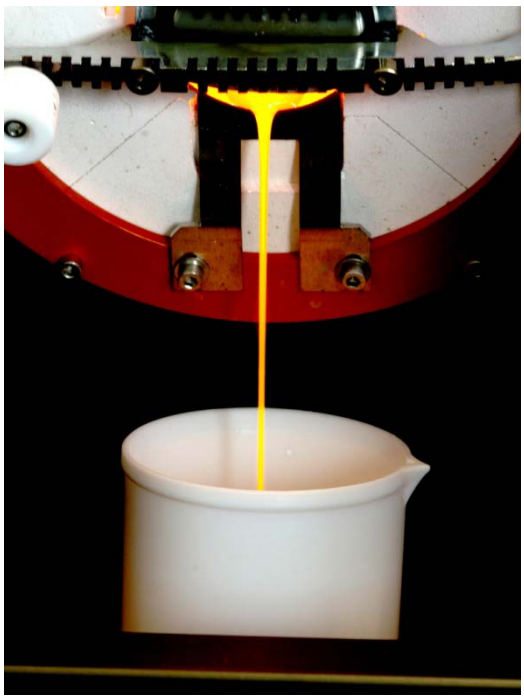

FIG. 6. The Katanax fluxer at work.

A total wet digestion with HF, HCl and HNO_3 was also used to study the behaviour of the material. Results obtained by the fusion and wet digestion are shown on Fig. 7.

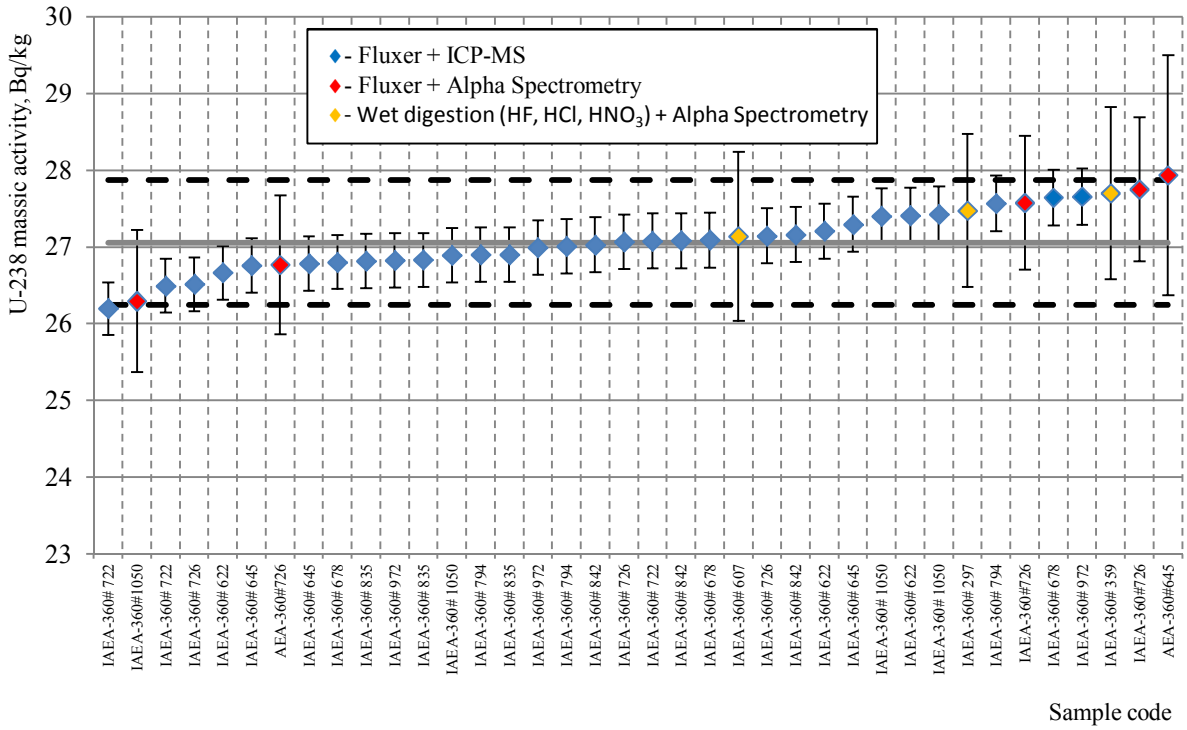

FIG. 7. The results obtained from different sample digestion techniques for the IAEA-360.

Radium-226

Ra-226 was determined by isotope dilution alpha spectrometry. The samples were spiked with Th-229 tracer in equilibrium with its Ra-225 daughter. The samples were melt and dissolved using Li-methaborate fusion. Radium was pre-concentrated by co-precipitation with $PbSO_4$. The precipitates were dissolved and alpha spectrometry sources were made by micro co-precipitation with $BaSO_4$. The sources were measured when the At-217 (Astate) decay product of Ra-225 reached its maximum activity.

2.5.3. Target values and associated combined uncertainties

A group of expert laboratories was invited for the characterisation of the sample. The target values and assigned uncertainties, which are the best estimations of the true values, were derived from their reported results using robust statistics and weighted mean approach. The target values and associated uncertainties are given in Table 4, as characterised in the reference material IAEA-360.

TABLE 4. TARGET VALUES FOR THE IAEA-360 SOIL (SAMPLE 04)

Isotope	Target value[a] Bq/kg	Uncertainty[b] Bq/kg	Remarks
K-40	485	11	
Sr-90	2.4	0.5	Information value
Cs-137	14.0	0.6	
Th-series			
Ac-228	41.0	2.0	
Pb-212	36.5	1.6	
Tl-208	13.0	0.7	
U-235	1.24	0.02	
U-series			
U-238	27.0	1.4	
U-234	26.4	2.0	
Ra-226	50.2	2.0	
Pb-214	50.0	3.8	
Bi-214	50.0	2.8	
Pb-210	42.6	2.2	
TRU isotopes			
Am-241	0.213	0.080	Information value[c]
Pu-238	0.050	0.014	Information value[c]
Pu-239+240	0.261	0.055	Information value[c]

[a] Reference date is 15 November 2011
[b] Combined standard uncertainty at k = 1 coverage factor
[c] Those are considered as an information value due to the low massic activity and high uncertainty

Due to their low massic activity and high uncertainty value, the following analytes: Sr-90, Pu-238, Pu-239+240 and Am-241 were considered for interlaboratory comparisons only. The interlaboratory comparisons results for these analytes are given on Fig. 79-82 and in Tables 43-46 in the Appendix I; these analytes were not included in the proficiency test evaluation.

3. PERFORMANCE CRITERIA

Several rating systems have been developed for determining a laboratory's performance and the meaning of the results of the different scoring systems is not always comparable. Among various statistics, z-scores and u-scores are most often used. The drawback of z-scores is that the uncertainty of the participant's measurement result is not taken into account for the evaluation of performance. In the case of u-scores, the evaluation includes uncertainties of the participant's measurements and the uncertainty of the assigned value. Laboratories performing well in classical proficiency testing (z-scores) will not necessarily exhibit the same level of performance when their analytical uncertainties are considered in the evaluation.

The proficiency testing scoring system applied by the IAEA Terrestrial Environment Laboratory takes into consideration the trueness and the precision of the reported data and it includes in the evaluation both the standard combined uncertainty associated with the target value of proficiency test samples and the standard uncertainty reported by the participating laboratories. According to the adopted approach, the reported results are evaluated against the acceptance criteria for accuracy and precision and assigned the status 'Accepted' or 'Not accepted', accordingly. In addition an intermediate status 'Warning' indicates potential problems [3]. A result must pass both criteria to be assigned the final status of 'Accepted'. The advantage of this approach is that it checks the credibility of uncertainty statement given by the participating laboratories, and results are no longer compared against fixed criteria but participants establish their individual acceptance range on the basis of the uncertainties assigned to the values. Such an approach highlights not only methodological problems affecting the accuracy of the reported data but also identifies shortcomings in uncertainty estimation.

In addition, three other statistical parameters namely: z-score, IAEA/Laboratory result ratio and relative bias are calculated as complementary information for the participating laboratories.

3.1. RELATIVE BIAS

The first stage in producing a score for the reported result $Value_{rep}$ as a 'single measurement of the analyte concentration in a test material' is to obtain the estimate of the bias. To evaluate the bias of the reported results, the relative bias between the reported value and the target value is calculated and expressed as a percentage:

$$Bias_{rel} = \frac{Value_{rep} - Value_{tar}}{Value_{tar}} \times 100\%$$

where:

$Bias_{rel}$	is the relative bias;
$Value_{rep}$	is the reported value by the participant;
$Value_{tar}$	is the target value established by the IAEA.

3.2. PROFICIENCY TEST EVALUATION CRITERIA

The proficiency test results were evaluated against the acceptance criteria for trueness and precision and assigned the status 'Accepted', 'Warning' or 'Not Accepted' accordingly [3].

3.2.1. Trueness

The participant result is assigned 'Accepted' status for trueness if:

$$A1 \leq A2$$

where:

$$A1 = \left|Value_{tar} - Value_{rep}\right|$$

and

$$A2 = 2.58 \times \sqrt{u_{tar}^2 + u_{rep}^2}$$

3.2.2. Precision

To evaluate the precision of the measurement result an estimator P is calculated for each reported uncertainty, according to the following formula:

$$P = \sqrt{\left(\frac{u_{tar}}{Value_{tar}}\right)^2 + \left(\frac{u_{rep}}{Value_{rep}}\right)^2} \times 100$$

P directly depends on the uncertainty of the measurement result stated by the participant. Numerical values of the 'Limit of Acceptable Precision' (LAP) for each analyte respectively are defined for the proficiency test in advance, 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 'Accepted' for the stated uncertainty when P ≤ LAP. The LAP values used in the evaluation of all radionuclides are listed in Table 5. In the final evaluation, both scores for trueness and precision are combined. A result must obtain an 'Accepted' score in both criteria to be assigned the final score 'Accepted'. Obviously, if a score of 'Not accepted' was obtained for both trueness and precision, the final score will also be 'Not accepted'. In cases where either precision or trueness is 'Not accepted', a further check is applied. The reported relative bias ($Bias_{rel}$) is compared with the maximum acceptable bias (MAB). If $Bias_{rel} \leq$ MAB, the final score will be 'Accepted with warning'. 'Warning' will reflect mainly two situations. The first situation will be a result with small measurement uncertainty; however its bias is still within MAB. The second situation will appear when a result close to the assigned property value is reported, but the associated uncertainty is large.

If Bias > MAB, the result will be 'Not accepted'. The MAB values used in the evaluation of all radionuclides are listed in Table 5.

From the participants' measurements results, two groups of radioanalytical difficulties may be identified:

- A missing or improper application of corrections for the following phenomena:
  - Spectral interferences;
  - Self-attenuation of the sample;
  - True coincidence summing effect;
  - Efficiency transfer for quite different geometries;
  - Moisture content correction.
- Measurement of relatively low activity (low concentrations).

The established MAB and LAP values are given in Table 5 for each analyte.

TABLE 5. THE MAB AND LAP VALUES FOR EACH ANALYTE

Sample ID	Nuclide	MAB	LAP
Sample 01-02-03 (Water)	H-3	20	20
	Co-60	15	15
	Ba-133	20	20
	Cs-134	20	20
	Cs-137	20	20
	Eu-152	15	15
	Am-241	20	20
Sample 04 (Soil)	K-40	20	20
	Sr-90	-	-
	Cs-137	20	20
	Ac-228	20	20
	Pb-212	20	20
	Tl-208	20	20
	U-235	20	20
	U-238	20	20
	Ra-226	20	20
	Pb-214	20	20
	Bi-214	20	20
	Pb-210 (Po-210)	20	20
	Am-241	-	-
	Pu-238	-	-
	Pu-239+240	-	-

3.3. THE Z-SCORE VALUE

The z-score is calculated from the laboratory results, the target value and a standard deviation in accordance with the following equation:

$$z_{score} = \frac{Value_{rep} - Value_{tar}}{\sigma}$$

where:

σ is the standard deviation of the target value.

On basis of the 'fitness for purpose' principle, the target standard deviation

(σ) is set to: 0.10 x $Value_{tar}$.

The laboratory performance is evaluated as

- Satisfactory if $| z_{score} | \leq 2$;
- Questionable for $2 < | z_{score} | < 3$;
- Unsatisfactory for $| z_{score} | \geq 3$.

3.4. THE U-SCORE VALUE

The value of the u_{test} was calculated according to the following equation:

$$u_{test} = \frac{|Value_{tar} - Value_{rep}|}{\sqrt{u_{tar}^2 + u_{rep}^2}}$$

where:

u_{test} is the value of the u-test;
u_{tar} is the uncertainty of the target value;
u_{rep} is the uncertainty of the reported value.

This value was compared with the critical value listed in the t-statistic tables to determine if the reported result differs significantly from the expected value at a given level of probability. The advantage of the u_{test} is that it takes into consideration the propagation of measurement uncertainties when defining the combined standard uncertainty. This is especially useful when evaluating results, which uncertainty may overlap with the reference interval.

The limiting value for the u-test parameter has been set to 2.58 for this proficiency test for a level of probability at 99%. A result passes the test if $u < 2.58$.

4. RESULTS AND DISCUSSION

4.1. GENERAL

Fifty-seven sample sets were distributed to the participants and 51 of them reported back their measurement results. Altogether 1547 measurement results were evaluated for the assessment of the laboratories' performance.

The individual evaluation of each laboratory was sent shortly after the closing of the database, enabling each laboratory to identify analytical issues and take corrective actions if necessary. The number of the reported results and obtained scores (Accepted, Warning, Not accepted) are summarised on Fig. 8. The laboratories were ordered according to the decreasing number of 'Accepted' (green) scores and then according to the increasing number of the 'Not accepted' (red) scores. The 'Warning' scores were marked with yellow, while the 'Not reported' analytes were marked with grey bars. They were not included into the ordering procedure. The total number of analytes is 34. This graphical method of presenting results allows the participating laboratories to compare their scores to those obtained by other laboratories and to benchmark their performance level.

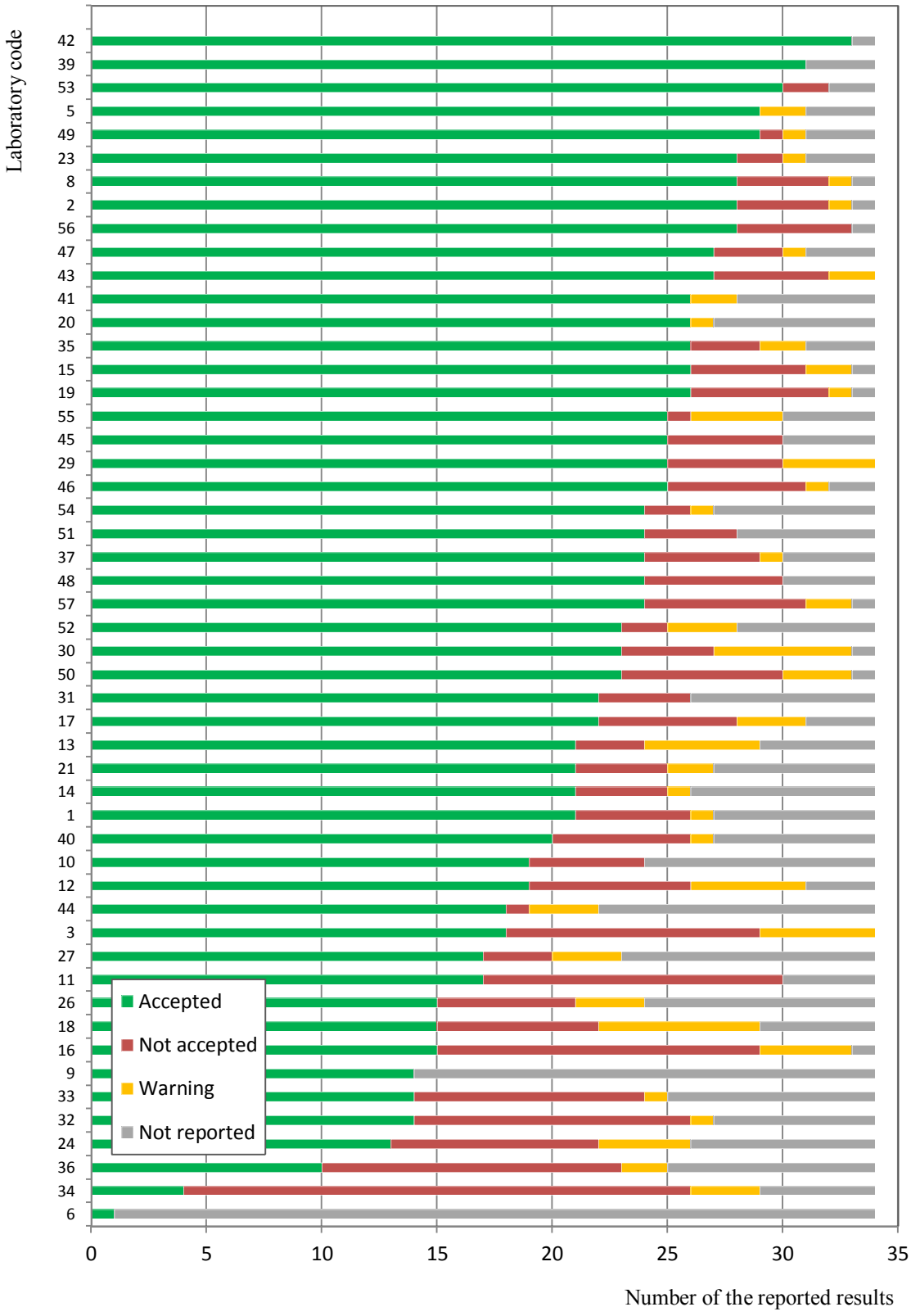

FIG. 8. The individual performance of the laboratories.

The overall distribution of the scores are 64% ‘Accepted’, 15% ‘Not accepted’, 5% ‘Warning’ and 16% of non-reported results , as shown on Fig. 9.

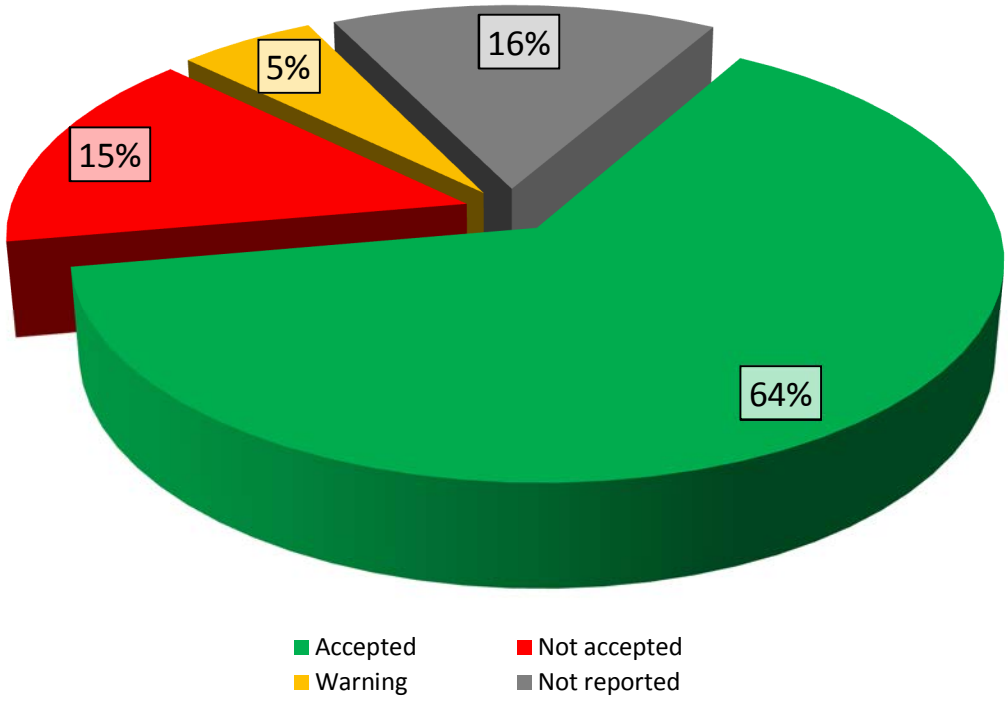

FIG. 9. The total performance of the laboratories.

Since the same sample set was used for both the ALMERA and world-wide proficiency tests, the performance of the ALMERA and world-wide laboratories can be compared. In addition 38 ALMERA laboratories took part in the world-wide proficiency test; therefore altogether 88 ALMERA laboratories can be considered as having taken part to a proficiency test organised by the IAEA in 2011. Table 6 contains the world-wide, ALMERA and the combined ALMERA performance, i.e. with the addition of the ALMERA laboratories having taken part to the world-wide proficiency test.

TABLE 6. COMPARISON OF THE PERFORMANCES OF THE WORLD-WIDE AND ALMERA LABORATORIES

Group	Accepted, %	Not accepted, %	Warning, %	Not reported, %	Numbers of laboratories
World-wide	54	14	7	25	208
ALMERA	64	15	5	16	51
Combined ALMERA	58	16	6	20	89

The individual performances of the combined ALMERA group are shown on Fig. 10.

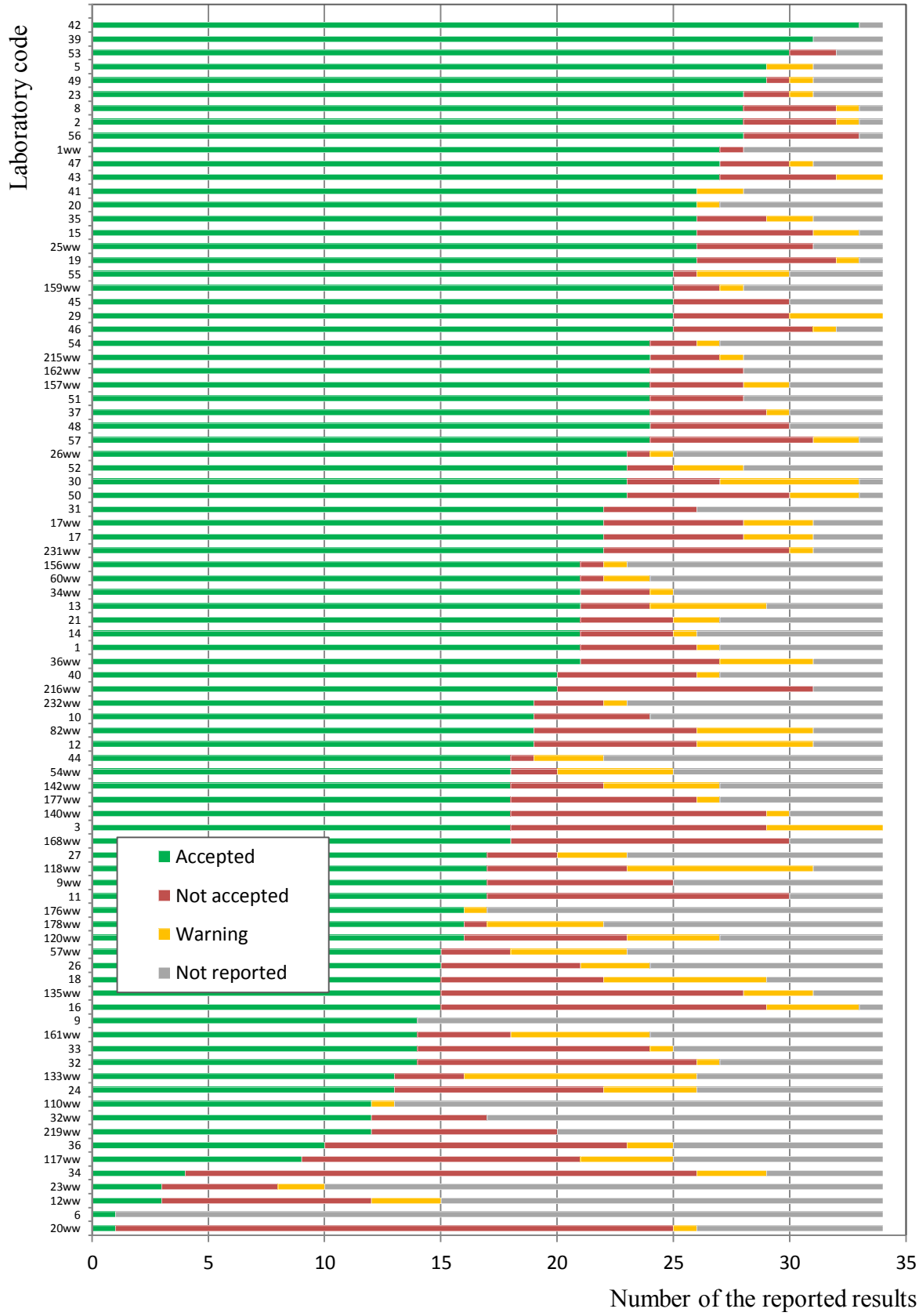

FIG. 10. The combined ALMERA performance.

4.2. WATER SAMPLES

Anthropogenic gamma emitting radionuclides and H-3 isotope were requested to be determined by the participating laboratories in three water samples. The isotopic ratios were identical in all samples but the concentrations were different for each sample.

4.2.1. Tritium

The tritium H-3 results were reported by 33 laboratories (66%) among the 50 participating laboratories.

The tritium concentration was relatively high in all water samples (see Table 3.). However other beta and gamma emitting radionuclides were present in the samples and the Compton electrons from the interaction of the gamma photon with water represented a strong disturbing effect. Significant overestimation of the tritium concentration by some participating laboratories may be related to an inappropriate sample preparation (removing the gamma emitting radionuclides by distillation). The overall performance and the reported results are shown on Fig. 11-16 in the Appendix I, while the detailed data with the achieved scores are summarised in Tables 9-11 in the Appendix I.

4.2.2. Single gamma emitting radionuclides

The Cs-137 isotope is a common radionuclide present in the environment. Most of the laboratories are analysing it in their routine monitoring program. The determination of the Cs-137 activity was therefore a relatively easy task. All together 96% of the laboratories reported this isotope. The 'Accepted' scores were 94%, 88% and 90% for the samples 01, 02 and 03, respectively. The radionuclide specific performances and the reported results with their uncertainties are shown on Fig. 17-22, while the detailed data with the achieved scores are summarised in Tables 12-14 in the Appendix I.

The Am-241 isotope is a low energy gamma emitting radionuclide at 59.5 keV. The determination of this radionuclide can be carried out either with a N-type or BeGe or extended range detector with appropriate efficiency calibration in the low energy range. Significantly fewer laboratories reported ^{241}Am results and the overall percentage of 'Accepted' scores was about 66-74% depending on the sample. The overall performances and reported results are shown on Fig. 23-28 in the Appendix I and the numerical data are summarised in Tables 15-17 in the Appendix I. In some cases relatively high uncontrolled biases were observed, which might be due to an extrapolated efficiency curve.

4.2.3. Cascade decaying gamma emitting radionuclides

The water sample set contained four cascade decaying radionuclides, i.e. Co-60, Ba-133, Cs-134 and Eu-152. From these isotopes the Co-60 has two consecutive transitions, which have more than 99.9% probability. The Co-60 has one clear 'cascade transition' producing a simple true coincidence summing (TCS) loss (summing-out) in close geometry. The energy level diagram of the Co-60 is shown on Fig. 83 in the Appendix II.

The Ba-133 and Cs-134 radionuclides have a more complex internal energy structure, as shown on Fig. 84 and 85 in the Appendix II. Both of them have multiple cascade transitions, and even the summing effects of three transitions can be observed. None of them have a direct transition to the ground level of the daughter nucleus.

The Eu-152 has two different decay modes, one is electron capture (EC) and another is e^- emission (β^- decay); their probabilities are 72.08% and 27.92% respectively. Due to the β^- decay the high probability energy levels are in cascade (1123.189 keV and 344.282 keV) leading to TCS effect (Fig. 86 in the Appendix II). For the EC decaying of Eu-152 there is a special energy level at 1085.897 keV having direct transition to the ground level and there are a few contributors with smaller probability from higher energy levels. However from this energy level there are three another relatively high probability transitions to the ground levels through intermediate steps, giving chance for the visible true coincidence 'summing-in' effect. More details are given on the energy level diagrams of the Eu-152 on Fig. 86 and 87 in the Appendix II. In case of the Eu-152 both 'summing-out' and 'summing-in' possibilities should be considered.

The most frequently applied calibration methods by the participating laboratories were the following:

- Calibration with the same isotope, in the same geometry and use of direct comparison;
- Calibration with 'multi-gamma' isotope mixture;
- Calibration with 'multi-gamma' isotope mixture, and correction of the true coincidence summing effect during the calibration;
- Generating the efficiency curve by model calculation, using characterised detector;
- Calculating the efficiency value by efficiency transfer method (or software) based on detector parameters and one or more real spectra of calibrants.

The calibration method with the same isotope, in the same geometry and use of direct comparison, can remove the difficulties related to the TCS effects. The calibration method with 'multi-gamma' isotope mixture is the most widely applied, cheaper and quicker technique to determine the efficiency function using a multi-gamma source. Typical compositions of the multi-gamma sources are shown in Table 6.

TABLE 6. TYPICAL COMPOSITION OF CALIBRATION SOURCES

Nuclide	Half life	Energy, keV	"Normal" calibrant	"Cascade free" calibrant
Pb-210	22.23 (12) a	46.54	+	+
Am-241	432.6 (6) a	59.54	+	+
Cd-109	461.4 (12) d	88.03	+	+
Co-57	271.80 (5) d	122.06	+	+
Ce-139	137.641 (20) d	165.9	+	+
Hg-203	46.594 (12) d	279.2	+	+
113Sn	115.09 (3) d	391.7	+	+
Sr-85	64.850 (7) d	514.0	+	+
Cs-137	30.05 (8) a	661.67	+	+
Mn-54	312.13 (3) d	898.0	-	+
Y-88	**106.626 (21) d**	**898.04 1836.05**	+	-
Zn-65	244.01 (9) d	1115.54		+
Co-60	**5.2711 (8) y**	**1173.23 1332.49**	+	-

Using a 'normal' multi-gamma source the efficiency curve will be underestimated in the high energy range because of the TCS effect of the cascade lines for both Co-60 and Y-88. During the spectra evaluation this may result in an overestimation for the single gamma emitting radionuclides and acceptable results for the cascade gamma emitting radionuclides.

The last three calibration methods consider the TCS effect, and the results are dependent on the software, the characterisation and the experience of the user.

From the answers given by the participants in the questionnaire the results were separated into three groups:

- Users who applied the TCS corrections;
- Users who did not apply the TCS correction;
- Users who did not answer this question.

Approximately 35% of the laboratories indicated that they did not apply the TCS corrections, while 47% used it for the evaluation. A relatively large number of the participants, i.e.18% of them, did not answer this question. The arithmetical mean values of the reported results are summarised in Table 7.

TABLE 7. THE SEPARATED ARITHMETICAL MEAN VALUES ACCORDING TO THE TCS CORRECTION

Isotope	Used		Not used		Not reported it		Target value
	Number of laboratories[a]	Activity, Bq/kg	Number of laboratories	Activity, Bq/kg	Number of laboratories	Activity, Bq/kg	Activity, Bq/kg
Sample 01 Water							
Co-60	16	15.1	12	15.3	5	15.3	15.3
Ba-133	16	4.8	11	4.7	6	4.5	5.0
Cs-134	16	7.5	11	7.0	6	7.0	7.7
Eu-152	16	14.9	10	14.2	6	14.2	15.4
Sample 02 Water							
Co-60	15	7.7	11	7.6	5	7.3	7.6
Ba-133	16	2.7	10	2.3	5	2.2	2.5
Cs-134	15	3.8	11	3.5	6	3.5	3.8
Eu-152	15	7.7	11	7.1	6	7.1	7.7
Sample 03 Water							
Co-60	16	10.5	11	10.6	6	10.4	10.7
Ba-133	15	3.5	11	3.4	6	3.4	3.5
Cs-134	16	5.1	11	4.8	6	5.0	5.4
Eu-152	14	10.6	9	10.2	6	9.8	10.8

[a] The results loaded by heavy calibration problem were removed from this evaluation.

The comparison of the results of these groups for the Ba-133, Cs-134, Eu-152 radionuclides shows some negative bias due to the gap in TCS correction. However this bias is dependent on the sample.

Reported results of the Co-60 isotope in water samples are in good agreement with the target values, regardless of the TCS correction because of the above mentioned effect.
The overall performances for these radionuclides and the reported results are shown on Fig. 29-52 in the Appendix I. The numerical data and scores are summarised in Tables 18-29 in the Appendix I.

4.3. SOIL SAMPLE (SAMPLE 04)

4.3.1. Gamma emitting radionuclides

The soil sample contained readily detectable K-40 and the progenies of the natural thorium and uranium decay series [4].

Potassium-40

The overall performance of the laboratories is shown on Fig. 55. The reported results and their uncertainties are given on Fig. 56. It can be noticed from these two figures that most of the 'Warning' and 'Not accepted' results are coming from a slight overestimation of the ^{40}K activity. The evaluation data were summarised in Table 31.

The possible reasons for this overestimation may be:
- An undercorrected background intensity;
- An underestimated efficiency;
- An extrapolated efficiency over the calibrated energy range.

The last possible reason may happen if the Co-60 isotope represents the highest energy in the calibration source.

Caesium-137

The concentration of the Cs-137 isotope in the soil sample is relatively low considering the environment of origin. The typical detection limit is about 1-2 Bq/kg considering a 30% HPGe detector and a 100 cm^3 volume cylindrical sample holder in close geometry to the detector. The activity concentration of the sample is therefore close to the detection limit.

All laboratories measured this isotope and 48 of them obtained an 'Accepted' score. This corresponds to 96% of all laboratories. The scores and the reported data are shown on Fig. 53 and 54 in the Appendix I. The numerical data with the evaluation are summarised in Table 30 in the Appendix I.

Progenies of the Th-232 decay series

The Ac-228, Pb-212 and Tl-208 radioisotopes were measured for the Th-232 decay series. The overall performances for these radioisotopes are shown on Fig. 57, 59 and 61 in the Appendix I. The reported results are shown with their uncertainties on Fig. 58, 60 and 62 in the Appendix I. The peculiarity of this series is the branching of Bi-212 into Po-212 by beta and Tl-208 by alpha decay. The probability of the alpha decay is 35.93% [5]. There are still a few old nuclide libraries in use, which contain the gamma emission probability modified with the branching ratio. Those lead to overestimated results as shown on Fig. 62 in the Appendix I. The results of the evaluation are summarised in Tables 32-34 in the Appendix I.

Progenies of the U-238 decay series

The Pb-214, Bi-214 and Pb-210 radioisotopes were measured from the U-238 decay series. The Ra-226 isotope can also be considered as a gamma emitting radionuclide, but it has a strong spectral interference with the U-235 isotope. The Ra-226 has a weak (3.555%) gamma line at 186.21 keV, which is overlapping with the high intensity (57.0 %) line of the U-235.

The difference between the gamma intensity almost was compensated by the activity ratio of these two radionuclides in the sample, and resulted in comparable order of magnitude contribution to the peak area at 186 keV. A number of correction methods are available, but their results are usually questionable. As a consequence the evaluation of Ra-226 will be discussed in the section on the alpha emitting radionuclides.

A characteristic of this series is the Rn-222 noble gas progeny. Its half-life is 3.8232 days and it is long enough to escape from the sample by diffusion, if the sample holder is not radon-tight. The Pb-214 and Bi-214 are in equilibrium with the Ra-226 via Rn-222. The exhalation of Rn-222 induces therefore an underestimation of Pb-214 and Bi-214 activities. The achieved scores and the reported values for the Pb-214 and Bi-214 are shown on Fig. 63-66 in the Appendix I. The overall performances of the laboratories are 50% and 34% respectively for these two radionuclides. The underestimation of the activities for these two radionuclides is probably related to the exhalation of the Rn-222. The smaller ratio of the 'Accepted' scores for the Bi-214 comes from the uncorrected TCS effect, which leads to an additional bias into the same direction too. The evaluation data are summarised in Tables 35 and 36 in the Appendix I.

The Pb-210 radioisotope is a low energy (46.51 keV) gamma emitter of the uranium decay series. The precise measurement of this radioisotope requires the same detector configuration as proposed for the Am-241, but in addition the 'low background' option is strongly recommended. The achieved scores and the reported results are shown on Fig. 67 and 68 in the Appendix I. The evaluation data are summarised in Table 37 in the Appendix I. All together 70% of the laboratories reported measurement results for Pb-210 and 71% of them obtained an 'Accepted' score.

Polonium-210

The sample was collected after the Chernobyl accident and was processed and bottled in 2008-2009. The sample preparation was carried out by physical steps only, without any influence on the chemical composition. Considering the age of the sample the Po-210-Pb-210 equilibrium is reached in the sample, and therefore the characterised value for the Pb-210 is equal to the Po-210 concentration. A few participants, i.e. 17 of them, reported Po-210 results only. The reported values are in the 30-60 Bq/kg activity range, which is a quite moderated range balanced around the target value, as shown on Fig. 77 in the Appendix I. The distribution of the scores is given on Fig. 78 in the Appendix I, while the reported data are summarised in Table 42 in the Appendix I.

4.3.2. Beta emitting radionuclide

The activity level of the Sr-90 was close to the detection limit of several methods, in particular the one based on the use of the Sr-spec crown-ether column for the separation. The amount of sample intake for these methods is about 1-5 g, and therefore it was considered as an information value only. As a consequence the usual PT evaluation was not performed. The results are shown on Fig. 79 in the Appendix I and the numerical values are summarised in Table 43 in the Appendix I.

4.3.3. Alpha emitting radionuclides

Uranium isotopes

The analysis of the uranium isotopes in soil is a relatively complex task for the laboratories. A total digestion of the soil sample is required to avoid any loss of uranium during the sample preparation. All together 30 laboratories measured U-238 in the soil sample, corresponding to 60% of the participants. A lower number of laboratories measured the other uranium isotopes. The achieved scores and the reported results are shown on Fig. 69-74 in the Appendix I. The numerical data are summarised in Tables 38-40 in the Appendix I. The 'Not accepted' scores are related to an underestimation of the uranium concentration, probably due to an incomplete dissolution of the uranium content of the sample.

Radium-226

All together 41 laboratories measured the Ra-226 isotope in the soil sample, i.e. 82% of the participating laboratories. More than half of them, i.e. 58%, reported 'Accepted' results. The reported activity range varies between 15 Bq/kg and 99 Bq/kg, which correspond to a relatively large range.
The distribution of scores and reported results are shown on Fig. 75 and 76 in the Appendix I. The detailed data are summarised in Table 41 in the Appendix I.

Transuranic radioisotopes

The soil sample contained both americium and plutonium isotopes. Similarly to the Sr-90 isotope, the concentration level of these radioisotopes was close to the detection limit of the most widely used radioanalytical methods. For this reason the usual PT evaluation was not performed. The reported results are scattered for these three isotopes (Pu-238, Pu-239+240 and Am-241), the range of reported results covering almost three orders of magnitude.

The reported values are shown on Fig. 80-82 in the Appendix I and the reported values are summarised in Tables 44-46 in the Appendix I.

5. CONCLUSIONS

The 2011 ALMERA proficiency test covered a large number of radionuclides measured in routine monitoring programmes. The results of this proficiency test enable the identification of the radioanalytical issues encountered by the laboratories and those, which need to be tackled in the frame of their internal Quality Control programme.

Regarding gamma ray spectrometry, the main fields of development are related to:
- The correction of the true coincidence summing effects for the determination of the cascade gamma emitting radionuclides;
- The determination of the low energy gamma emitting radionuclides.

Another issue is related to the radon-radium equilibrium in the sample, it deals with the sample preparation and the usage of appropriate (radon tight) sample holder especially if the radon exhalation of the sample is high.

Regarding the branching ratio of the Tl-208 isotope the update of the nuclide library by the laboratory is recommended. The DDEP database [4] is freely available on the home page of the 'Laboratoire National Henri Becquerel': *www.nucleide.org/NucData.htm*

The radionuclides, which require the chemical processing of the sample, are generally more difficult for the laboratories to handle. This is demonstrated by a relatively wide range of reported results. In this field the laboratories should pay more attention to the radioanalytical work and the provider should share more information about the behaviour of the sample.

The performances of the laboratories in the ALMERA and world-wide proficiency tests have been compared and their comparison is shown in Table 8.

TABLE 8. COMPARISON OF THE PERFORMANCE OF THE LABORATORIES IN ALMERA AND WORLD-WIDE PROFICIENCY TESTS

Performance	ALMERA	World-wide
Over 50 % Accepted results	82%	66%
Over 80 % Accepted results	22%	14%

A better performance of the ALMERA participants is observed, which can be explained by the regular participation of the ALMERA laboratories in the 'external Quality Control' programme and by the organisation of several trainings for the ALMERA members.

APPENDIX I.
EVALUATION PER ANALYTE.

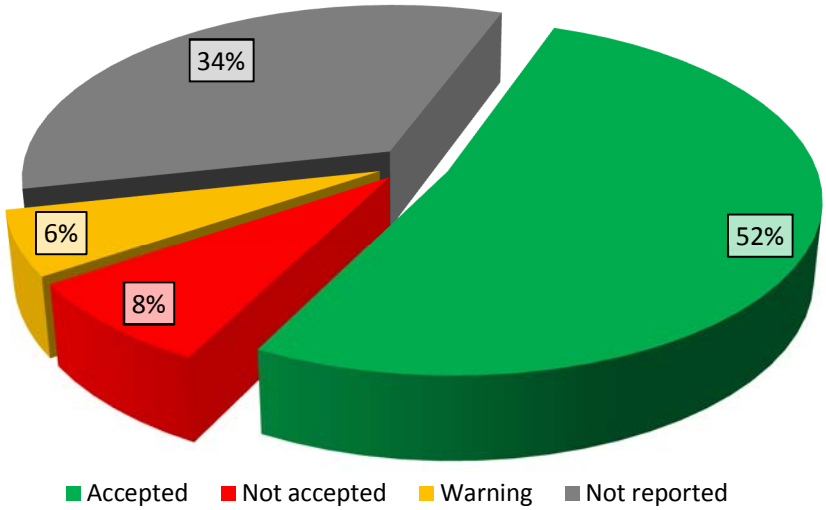

FIG. 11. Distribution of the scores for H-3 in water (sample 01).

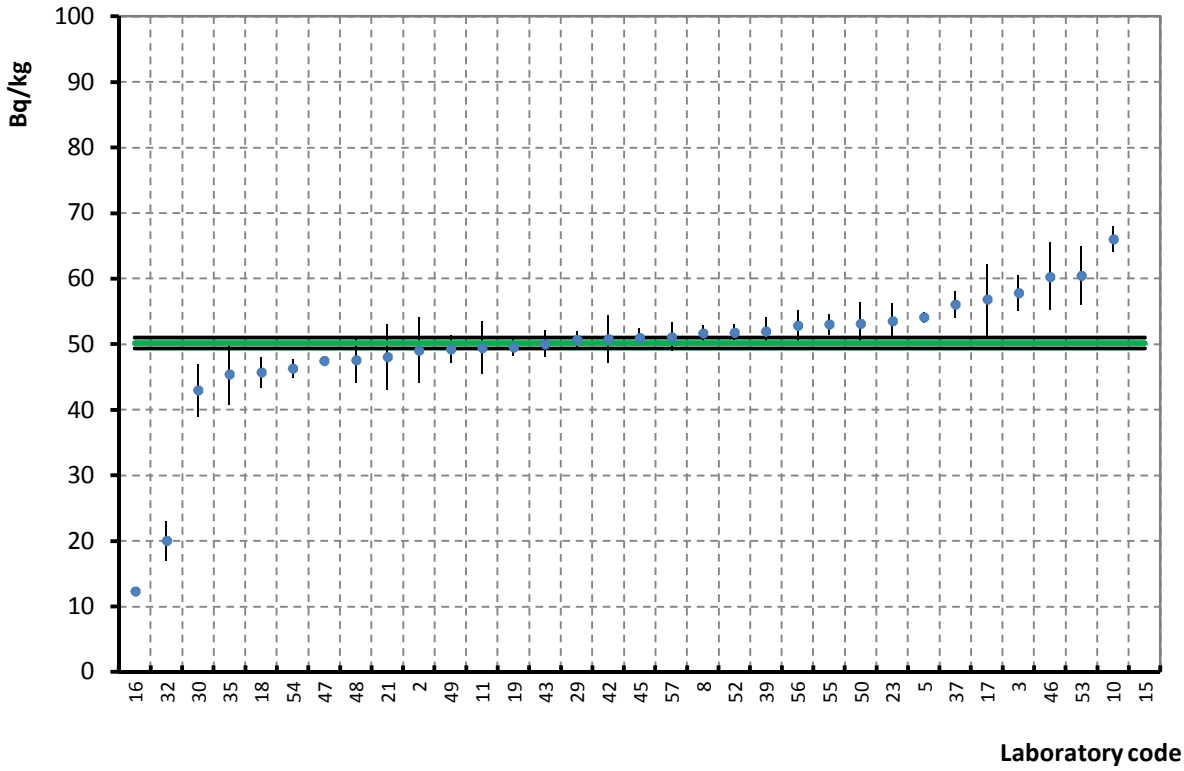

FIG. 12. Reported results and their uncertainties for H-3 in water (sample 01).

TABLE 9. PERFORMANCE EVALUATION OF DETERMINATION OF H-3 IN WATER (SAMPLE 01)

Target value: 50.2 ± 0.9 Bq/kg
MAB: 20 %
LAP: 20 %

Laboratory code	Reported values		Unc[a]	Bias [%]	Z-Score	U-Score	A1	A2	Score for trueness	Precision	Score for Precision	Final score
	a, Bq/kg	u, Bq/kg	[%]									
2	57.8	3.7	6.4	15.1	1.5	2.0	7.6	9.8	A	6.6	A	A
3	51.6	1.1	2.2	2.8	0.3	1.0	1.4	3.7	A	2.8	A	A
5	51.8	3.9	7.5	3.2	0.3	0.4	1.6	10.3	A	7.7	A	A
8	49.0	6.0	12.2	-2.4	-0.2	-0.2	1.2	15.7	A	12.4	A	A
10	55.0	7.0	12.7	9.6	1.0	0.7	4.8	18.2	A	12.9	A	A
11	62.5	4.4	7.0	24.4	2.4	2.7	12.3	11.6	N	7.3	A	N
15	30.0	0.1	0.4	-40.2	-4.0	-22.2	20.2	2.3	N	1.8	A	N
16	49.3	3.5	7.1	-1.9	-0.2	-0.3	1.0	9.3	A	7.3	A	A
17	47.1	3.8	8.1	-6.2	-0.6	-0.8	3.1	10.1	A	8.3	A	A
18	77.1	3.2	4.2	53.6	5.4	8.1	26.9	8.6	N	4.5	A	N
19	57.2	1.3	2.3	13.9	1.4	4.4	7.0	4.1	N	2.9	A	W
21	63.3	5.9	9.3	26.1	2.6	2.2	13.1	15.4	A	9.5	A	A
23	60.5	3.5	5.7	20.5	2.1	2.9	10.3	9.2	N	6.0	A	N
29	66.2	9.5	14.3	31.9	3.2	1.7	16.0	24.5	A	14.4	A	A
30	55.6	0.3	0.6	10.7	1.1	5.6	5.4	2.5	N	1.9	A	W
32	97.0	11.0	11.3	93.2	9.3	4.2	46.8	28.5	N	11.5	A	N
35	52.3	2.6	5.0	4.2	0.4	0.8	2.1	7.1	A	5.3	A	A
37	52.5	1.8	3.4	4.6	0.5	1.2	2.3	5.1	A	3.8	A	A
39	42.0	1.0	2.4	-16.3	-1.6	-6.1	8.2	3.5	N	3.0	A	W
42	50.0	1.5	3.0	-0.4	0.0	-0.1	0.2	4.5	A	3.5	A	A
43	47.8	3.4	7.0	-4.8	-0.5	-0.7	2.4	8.9	A	7.2	A	A
45	51.2	2.3	4.4	2.0	0.2	0.4	1.0	6.3	A	4.8	A	A
46	69.7	7.0	10.0	38.8	3.9	2.8	19.5	18.2	N	10.2	A	N
47	52.5	1.8	3.4	4.6	0.5	1.1	2.3	5.2	A	3.9	A	A
48	54.1	5.8	10.7	7.8	0.8	0.7	3.9	15.1	A	10.9	A	A
49	70.2	4.7	6.7	39.8	4.0	4.2	20.0	12.3	N	6.9	A	N
50	70.3	11.9	16.9	40.0	4.0	1.7	20.1	30.8	A	17.0	A	A
52	40.8	1.9	4.6	-18.7	-1.9	-4.5	9.4	5.4	N	4.9	A	W
53	52.0	15.0	28.8	3.6	0.4	0.1	1.8	38.8	A	28.9	N	W
54	62.9	3.3	5.2	25.3	2.5	3.7	12.7	8.8	N	5.5	A	N
55	82.5	5.4	6.5	64.3	6.4	5.9	32.3	14.1	N	6.8	A	N
56	51.0	4.0	7.8	1.6	0.2	0.2	0.8	10.6	A	8.0	A	A
57	50.1	2.1	4.2	-0.2	0.0	0.0	0.1	5.9	A	4.6	A	A
2	46.8	2.0	4.3	-6.8	-0.7	-1.6	3.4	5.7	A	4.6	A	A
3	49.0	1.0	2.0	-2.4	-0.2	-0.9	1.2	3.5	A	2.7	A	A
5	50.9	7.7	15.0	1.4	0.1	0.1	0.7	19.9	A	15.1	A	A
8	58.4	2.1	3.6	16.3	1.6	3.6	8.2	5.9	N	4.0	A	W
10	55.4	2.8	5.1	10.4	1.0	1.8	5.2	7.6	A	5.4	A	A
11	38.7	0.5	1.2	-22.9	-2.3	-11.3	11.5	2.6	N	2.2	A	N
15	58.6	3.3	5.6	16.7	1.7	2.5	8.4	8.8	A	5.9	A	A
16	59.8	1.9	3.2	19.1	1.9	4.6	9.6	5.4	N	3.6	A	W
17	71.3	4.4	6.2	42.0	4.2	4.7	21.1	11.6	N	6.4	A	N
18	48.5	3.4	7.0	-3.4	-0.3	-0.5	1.7	9.1	A	7.2	A	A
19	65.8	3.0	4.6	31.1	3.1	5.0	15.6	8.1	N	4.9	A	N
21	62.9	9.3	14.8	25.3	2.5	1.4	12.7	24.1	A	14.9	A	A
23	62.0	5.0	8.1	23.5	2.4	2.3	11.8	13.1	A	8.3	A	A
29	259.0		0.0	415.9	41.6	232.0	208.8	2.3	N	1.8	A	N
30	33.3	3.9	11.7	-33.7	-3.4	-4.2	16.9	10.3	N	11.8	A	N
32	56.5	3.6	6.4	12.5	1.3	1.7	6.3	9.6	A	6.6	A	A
35	45.6	4.1	9.0	-9.2	-0.9	-1.1	4.6	10.8	A	9.2	A	A
37	68.8	10.3	15.0	37.0	3.7	1.8	18.6	26.7	A	15.1	A	A
39	47.4	5.5	11.6	-5.6	-0.6	-0.5	2.8	14.4	A	11.7	A	A
42	47.5	3.8	8.0	-5.4	-0.5	-0.7	2.7	10.1	A	8.2	A	A
43	68.2	14.9	21.8	35.9	3.6	1.2	18.0	38.5	A	21.9	N	N
45	64.6	3.5	5.4	28.7	2.9	4.0	14.4	9.3	N	5.7	A	N
46	46.8	3.4	7.2	-6.8	-0.7	-1.0	3.4	9.0	A	7.4	A	A
47	64.0	6.4	10.0	27.5	2.7	2.1	13.8	16.7	A	10.2	A	A
48	44.2	1.2	2.7	-12.0	-1.2	-4.0	6.0	3.9	N	3.3	A	W
49	46.4	2.4	5.2	-7.6	-0.8	-1.5	3.8	6.6	A	5.5	A	A
50	42.3	1.0	2.4	-15.7	-1.6	-5.9	7.9	3.5	N	3.0	A	W
52	50.5	1.0	2.0	0.6	0.1	0.2	0.3	3.5	A	2.7	A	A
53	59.3	3.9	6.5	18.0	1.8	2.3	9.1	10.2	A	6.7	A	A
54	52.5	2.3	4.3	4.6	0.5	0.9	2.3	6.3	A	4.7	A	A
55	51.2	4.6	9.0	2.0	0.2	0.2	1.0	12.1	A	9.2	A	A
56	47.2	7.6	16.1	-6.0	-0.6	-0.4	3.0	19.7	A	16.2	A	A
57	46.6	3.9	8.3	-7.1	-0.7	-0.9	3.6	10.2	A	8.5	A	A

a Relative uncertainty of the reported result at k = 1 coverage factor

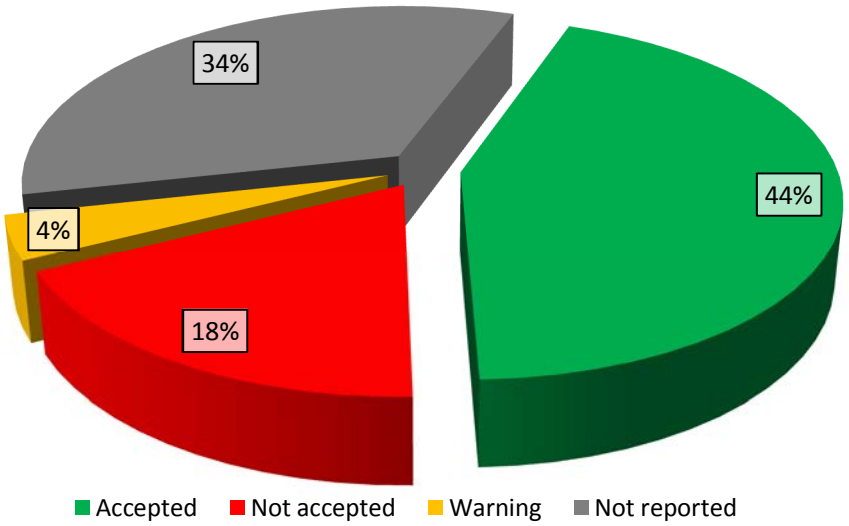

FIG. 13. Distribution of the scores for H-3 in water (sample 02).

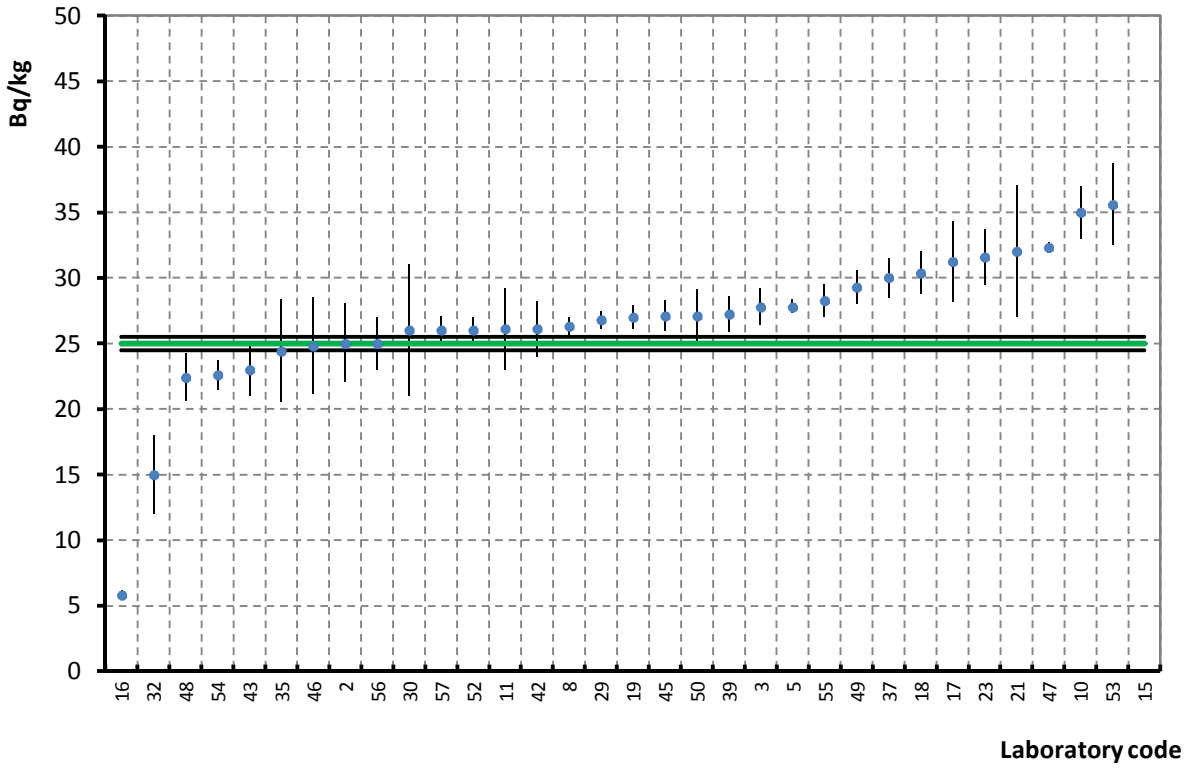

FIG. 14. Reported results and their uncertainties for H-3 in water (sample 02).

TABLE 10. PERFORMANCE EVALUATION OF DETERMINATION OF H-3 IN WATER (SAMPLE 02)

Target value: 25.0 ± 0.5 Bq/kg
MAB: 20 %
LAP: 20 %

Laboratory code	Reported values		Unc[a]	Bias [%]	Z-Score	U-Score	A1	A2	Score for trueness	Precision	Score for Precision	Final score
	a, Bq/kg	u, Bq/kg	[%]									
2	25.0	3.0	12.0	0.0	0.0	0.0	0.0	7.8	A	12.2	A	A
3	27.8	1.4	5.0	11.2	1.1	1.9	2.8	3.8	A	5.4	A	A
5	27.8	0.5	1.8	11.2	1.1	4.0	2.8	1.8	N	2.7	A	W
8	26.3	0.7	2.7	5.2	0.5	1.5	1.3	2.2	A	3.3	A	A
10	35.0	2.0	5.7	40.0	4.0	4.9	10.0	5.3	N	6.1	A	N
11	26.1	3.1	11.9	4.4	0.4	0.4	1.1	8.1	A	12.0	A	A
15	95.0	7.0	7.4	280.0	28.0	10.0	70.0	18.1	N	7.6	A	N
16	5.8	0.4	6.1	-76.8	-7.7	-31.3	19.2	1.6	N	6.4	A	N
17	31.3	3.1	9.9	25.0	2.5	2.0	6.3	8.1	A	10.1	A	A
18	30.4	1.7	5.4	21.5	2.2	3.1	5.4	4.4	N	5.8	A	N
19	27.0	0.9	3.3	8.0	0.8	2.0	2.0	2.6	A	3.8	A	A
21	32.0	5.0	15.6	28.0	2.8	1.4	7.0	13.0	A	15.8	A	A
23	31.6	2.1	6.6	26.4	2.6	3.1	6.6	5.6	N	6.9	A	N
29	26.8	0.7	2.6	7.2	0.7	2.1	1.8	2.2	A	3.3	A	A
30	26.0	5.0	19.2	4.0	0.4	0.2	1.0	13.0	A	19.3	A	A
32	15.0	3.0	20.0	-40.0	-4.0	-3.3	10.0	7.8	N	20.1	N	N
35	24.4	3.9	16.0	-2.4	-0.2	-0.2	0.6	10.1	A	16.1	A	A
37	30.0	1.5	5.0	20.0	2.0	3.2	5.0	4.1	N	5.4	A	N
39	27.2	1.4	5.0	9.0	0.9	1.6	2.2	3.7	A	5.3	A	A
42	26.1	2.1	8.0	4.4	0.4	0.5	1.1	5.6	A	8.3	A	A
43	23.0	2.0	8.7	-8.0	-0.8	-1.0	2.0	5.3	A	8.9	A	A
45	27.1	1.2	4.2	8.4	0.8	1.7	2.1	3.2	A	4.7	A	A
46	24.8	3.7	14.8	-0.8	-0.1	-0.1	0.2	9.6	A	15.0	A	A
47	32.3	0.4	1.2	29.2	2.9	11.4	7.3	1.7	N	2.4	A	N
48	22.4	1.8	8.1	-10.4	-1.0	-1.4	2.6	4.8	A	8.3	A	A
49	29.3	1.3	4.4	17.2	1.7	3.1	4.3	3.6	N	4.9	A	W
50	27.1	2.0	7.4	8.4	0.8	1.0	2.1	5.3	A	7.6	A	A
52	26.0	0.9	3.5	4.2	0.4	1.0	1.0	2.7	A	4.0	A	A
53	35.6	3.1	8.7	42.4	4.2	3.4	10.6	8.1	N	8.9	A	N
54	22.6	1.1	4.9	-9.6	-1.0	-2.0	2.4	3.1	A	5.3	A	A
55	28.3	1.2	4.3	13.1	1.3	2.5	3.3	3.4	A	4.8	A	A
56	25.0	2.0	8.0	0.0	0.0	0.0	0.0	5.3	A	8.2	A	A
57	26.0	1.1	4.2	4.0	0.4	0.8	1.0	3.1	A	4.7	A	A
2	25.0	3.0	12.0	0.0	0.0	0.0	0.0	7.8	A	12.2	A	A
3	27.8	1.4	5.0	11.2	1.1	1.9	2.8	3.8	A	5.4	A	A
5	27.8	0.5	1.8	11.2	1.1	4.0	2.8	1.8	N	2.7	A	W
8	26.3	0.7	2.7	5.2	0.5	1.5	1.3	2.2	A	3.3	A	A
10	35.0	2.0	5.7	40.0	4.0	4.9	10.0	5.3	N	6.1	A	N
11	26.1	3.1	11.9	4.4	0.4	0.4	1.1	8.1	A	12.0	A	A
15	95.0	7.0	7.4	280.0	28.0	10.0	70.0	18.1	N	7.6	A	N
16	5.8	0.4	6.1	-76.8	-7.7	-31.3	19.2	1.6	N	6.4	A	N
17	31.3	3.1	9.9	25.0	2.5	2.0	6.3	8.1	A	10.1	A	A
18	30.4	1.7	5.4	21.5	2.2	3.1	5.4	4.4	N	5.8	A	N
19	27.0	0.9	3.3	8.0	0.8	2.0	2.0	2.6	A	3.8	A	A
21	32.0	5.0	15.6	28.0	2.8	1.4	7.0	13.0	A	15.8	A	A
23	31.6	2.1	6.6	26.4	2.6	3.1	6.6	5.6	N	6.9	A	N
29	26.8	0.7	2.6	7.2	0.7	2.1	1.8	2.2	A	3.3	A	A
30	26.0	5.0	19.2	4.0	0.4	0.2	1.0	13.0	A	19.3	A	A
32	15.0	3.0	20.0	-40.0	-4.0	-3.3	10.0	7.8	N	20.1	N	N
35	24.4	3.9	16.0	-2.4	-0.2	-0.2	0.6	10.1	A	16.1	A	A
37	30.0	1.5	5.0	20.0	2.0	3.2	5.0	4.1	N	5.4	A	N
39	27.2	1.4	5.0	9.0	0.9	1.6	2.2	3.7	A	5.3	A	A
42	26.1	2.1	8.0	4.4	0.4	0.5	1.1	5.6	A	8.3	A	A
43	23.0	2.0	8.7	-8.0	-0.8	-1.0	2.0	5.3	A	8.9	A	A
45	27.1	1.2	4.2	8.4	0.8	1.7	2.1	3.2	A	4.7	A	A
46	24.8	3.7	14.8	-0.8	-0.1	-0.1	0.2	9.6	A	15.0	A	A
47	32.3	0.4	1.2	29.2	2.9	11.4	7.3	1.7	N	2.4	A	N
48	22.4	1.8	8.1	-10.4	-1.0	-1.4	2.6	4.8	A	8.3	A	A
49	29.3	1.3	4.4	17.2	1.7	3.1	4.3	3.6	N	4.9	A	W
50	27.1	2.0	7.4	8.4	0.8	1.0	2.1	5.3	A	7.6	A	A
52	26.0	0.9	3.5	4.2	0.4	1.0	1.0	2.7	A	4.0	A	A
53	35.6	3.1	8.7	42.4	4.2	3.4	10.6	8.1	N	8.9	A	N
54	22.6	1.1	4.9	-9.6	-1.0	-2.0	2.4	3.1	A	5.3	A	A
55	28.3	1.2	4.3	13.1	1.3	2.5	3.3	3.4	A	4.8	A	A
56	25.0	2.0	8.0	0.0	0.0	0.0	0.0	5.3	A	8.2	A	A
57	26.0	1.1	4.2	4.0	0.4	0.8	1.0	3.1	A	4.7	A	A

a Relative uncertainty of the reported result at k = 1 coverage factor

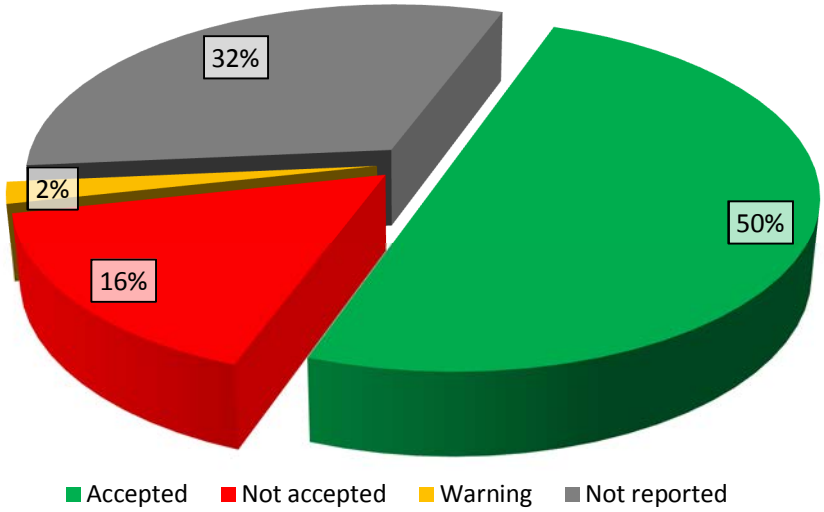

FIG. 15. Distribution of the scores for H-3 in water (sample 03).

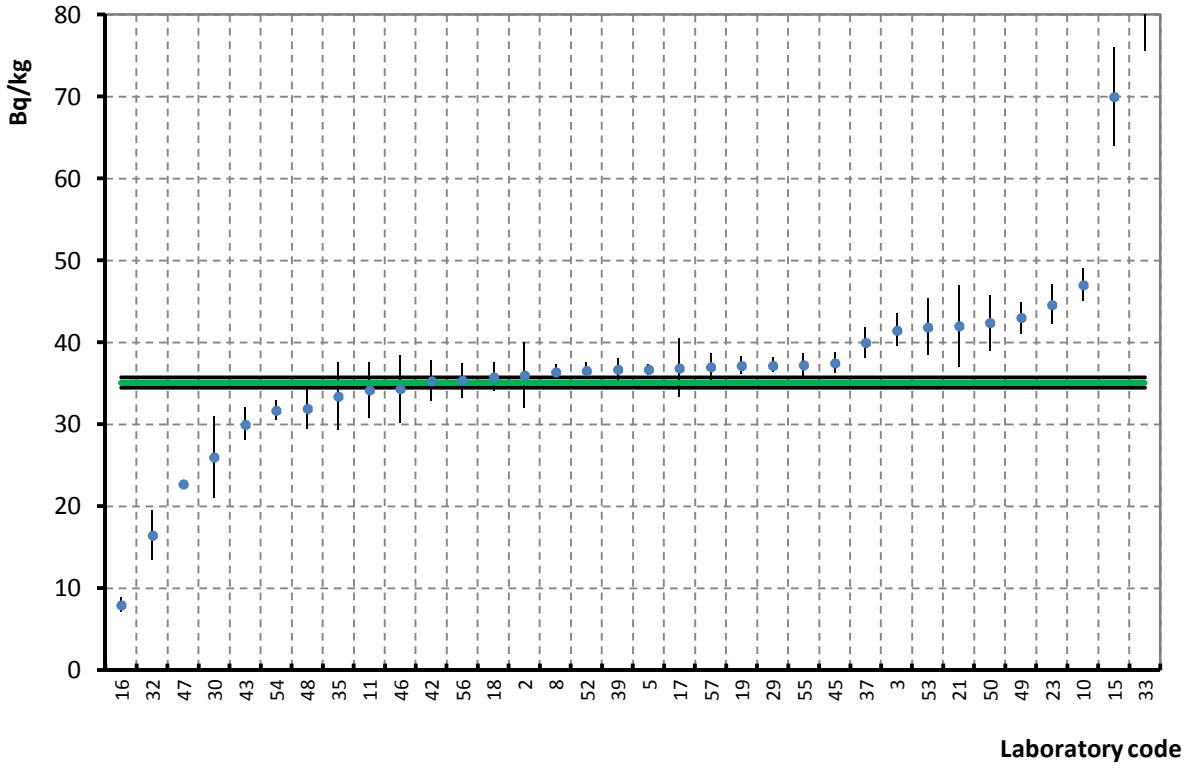

FIG. 16. Reported results and their uncertainties for H-3 in water (sample 03).

TABLE 11. PERFORMANCE EVALUATION OF DETERMINATION OF H-3 IN WATER (SAMPLE 03)

Target value: 35.1 ± 0.6 Bq/kg
MAB: 20 %
LAP: 20 %

Laboratory code	Reported values		Unca [%]	Bias [%]	Z-Score	U-Score	A1	A2	Score for trueness	Precision	Score for Precision	Final score
	a, Bq/kg	u, Bq/kg										
2	36.0	4.0	11.1	2.6	0.3	0.2	0.9	10.4	A	11.2	A	A
3	41.5	2.0	4.8	18.2	1.8	3.1	6.4	5.4	N	5.1	A	W
5	36.7	0.6	1.6	4.6	0.5	1.9	1.6	2.2	A	2.4	A	A
8	36.4	0.9	2.5	3.7	0.4	1.2	1.3	2.8	A	3.0	A	A
10	47.0	2.0	4.3	33.9	3.4	5.7	11.9	5.4	N	4.6	A	N
11	34.2	3.4	9.9	-2.6	-0.3	-0.3	0.9	8.9	A	10.1	A	A
15	70.0	6.0	8.6	99.4	9.9	5.8	34.9	15.6	N	8.7	A	N
16	8.0	0.9	10.8	-77.3	-7.7	-25.8	27.1	2.7	N	11.0	A	N
17	36.9	3.5	9.6	5.1	0.5	0.5	1.8	9.3	A	9.7	A	A
18	35.8	1.8	4.9	1.9	0.2	0.4	0.7	4.8	A	5.2	A	A
19	37.2	1.1	2.8	6.0	0.6	1.7	2.1	3.1	A	3.3	A	A
21	42.0	5.0	11.9	19.7	2.0	1.4	6.9	13.0	A	12.0	A	A
23	44.6	2.4	5.4	27.1	2.7	3.8	9.5	6.4	N	5.6	A	N
29	37.2	0.9	2.4	6.0	0.6	1.9	2.1	2.8	A	3.0	A	A
30	26.0	5.0	19.2	-25.9	-2.6	-1.8	9.1	13.0	A	19.3	A	A
32	16.5	3.0	18.2	-53.0	-5.3	-6.1	18.6	7.9	N	18.3	A	N
33	84.0	8.4	10.0	139.3	13.9	5.8	48.9	21.6	N	10.1	A	N
35	33.4	4.1	12.3	-4.8	-0.5	-0.4	1.7	10.7	A	12.4	A	A
37	40.0	1.9	4.8	14.0	1.4	2.5	4.9	5.1	A	5.0	A	A
39	36.7	1.3	3.6	4.5	0.5	1.1	1.6	3.7	A	4.0	A	A
42	35.3	2.5	7.1	0.6	0.1	0.1	0.2	6.6	A	7.3	A	A
43	30.0	2.0	6.7	-14.5	-1.5	-2.4	5.1	5.4	A	6.9	A	A
45	37.5	1.2	3.3	6.8	0.7	1.7	2.4	3.6	A	3.7	A	A
46	34.3	4.1	11.9	-2.2	-0.2	-0.2	0.8	10.6	A	12.0	A	A
47	22.7	0.3	1.3	-35.3	-3.5	-18.5	12.4	1.7	N	2.2	A	N
48	32.0	2.5	7.8	-8.9	-0.9	-1.2	3.1	6.6	A	8.0	A	A
49	43.0	1.9	4.4	22.5	2.3	4.0	7.9	5.1	N	4.7	A	N
50	42.4	3.4	8.0	20.8	2.1	2.1	7.3	8.9	A	8.2	A	A
52	36.6	1.0	2.8	4.1	0.4	1.2	1.5	3.1	A	3.3	A	A
53	41.9	3.5	8.4	19.4	1.9	1.9	6.8	9.2	A	8.5	A	A
54	31.7	1.2	3.8	-9.7	-1.0	-2.5	3.4	3.5	A	4.2	A	A
55	37.2	1.4	3.7	6.0	0.6	1.4	2.1	3.9	A	4.1	A	A
56	35.4	2.1	5.9	0.9	0.1	0.1	0.3	5.6	A	6.2	A	A
57	37.0	1.6	4.3	5.4	0.5	1.1	1.9	4.4	A	4.6	A	A
2	36.0	4.0	11.1	2.6	0.3	0.2	0.9	10.4	A	11.2	A	A
3	41.5	2.0	4.8	18.2	1.8	3.1	6.4	5.4	N	5.1	A	W
5	36.7	0.6	1.6	4.6	0.5	1.9	1.6	2.2	A	2.4	A	A
8	36.4	0.9	2.5	3.7	0.4	1.2	1.3	2.8	A	3.0	A	A
10	47.0	2.0	4.3	33.9	3.4	5.7	11.9	5.4	N	4.6	A	N
11	34.2	3.4	9.9	-2.6	-0.3	-0.3	0.9	8.9	A	10.1	A	A
15	70.0	6.0	8.6	99.4	9.9	5.8	34.9	15.6	N	8.7	A	N
16	8.0	0.9	10.8	-77.3	-7.7	-25.8	27.1	2.7	N	11.0	A	N
17	36.9	3.5	9.6	5.1	0.5	0.5	1.8	9.3	A	9.7	A	A
18	35.8	1.8	4.9	1.9	0.2	0.4	0.7	4.8	A	5.2	A	A
19	37.2	1.1	2.8	6.0	0.6	1.7	2.1	3.1	A	3.3	A	A
21	42.0	5.0	11.9	19.7	2.0	1.4	6.9	13.0	A	12.0	A	A
23	44.6	2.4	5.4	27.1	2.7	3.8	9.5	6.4	N	5.6	A	N
29	37.2	0.9	2.4	6.0	0.6	1.9	2.1	2.8	A	3.0	A	A
30	26.0	5.0	19.2	-25.9	-2.6	-1.8	9.1	13.0	A	19.3	A	A
32	16.5	3.0	18.2	-53.0	-5.3	-6.1	18.6	7.9	N	18.3	A	N
33	84.0	8.4	10.0	139.3	13.9	5.8	48.9	21.6	N	10.1	A	N
35	33.4	4.1	12.3	-4.8	-0.5	-0.4	1.7	10.7	A	12.4	A	A
37	40.0	1.9	4.8	14.0	1.4	2.5	4.9	5.1	A	5.0	A	A
39	36.7	1.3	3.6	4.5	0.5	1.1	1.6	3.7	A	4.0	A	A
42	35.3	2.5	7.1	0.6	0.1	0.1	0.2	6.6	A	7.3	A	A
43	30.0	2.0	6.7	-14.5	-1.5	-2.4	5.1	5.4	A	6.9	A	A
45	37.5	1.2	3.3	6.8	0.7	1.7	2.4	3.6	A	3.7	A	A
46	34.3	4.1	11.9	-2.2	-0.2	-0.2	0.8	10.6	A	12.0	A	A
47	22.7	0.3	1.3	-35.3	-3.5	-18.5	12.4	1.7	N	2.2	A	N
48	32.0	2.5	7.8	-8.9	-0.9	-1.2	3.1	6.6	A	8.0	A	A
49	43.0	1.9	4.4	22.5	2.3	4.0	7.9	5.1	N	4.7	A	N
50	42.4	3.4	8.0	20.8	2.1	2.1	7.3	8.9	A	8.2	A	A
52	36.6	1.0	2.8	4.1	0.4	1.2	1.5	3.1	A	3.3	A	A
53	41.9	3.5	8.4	19.4	1.9	1.9	6.8	9.2	A	8.5	A	A
54	31.7	1.2	3.8	-9.7	-1.0	-2.5	3.4	3.5	A	4.2	A	A
55	37.2	1.4	3.7	6.0	0.6	1.4	2.1	3.9	A	4.1	A	A
56	35.4	2.1	5.9	0.9	0.1	0.1	0.3	5.6	A	6.2	A	A
57	37.0	1.6	4.3	5.4	0.5	1.1	1.9	4.4	A	4.6	A	A

a Relative uncertainty of the reported result at k = 1 coverage factor

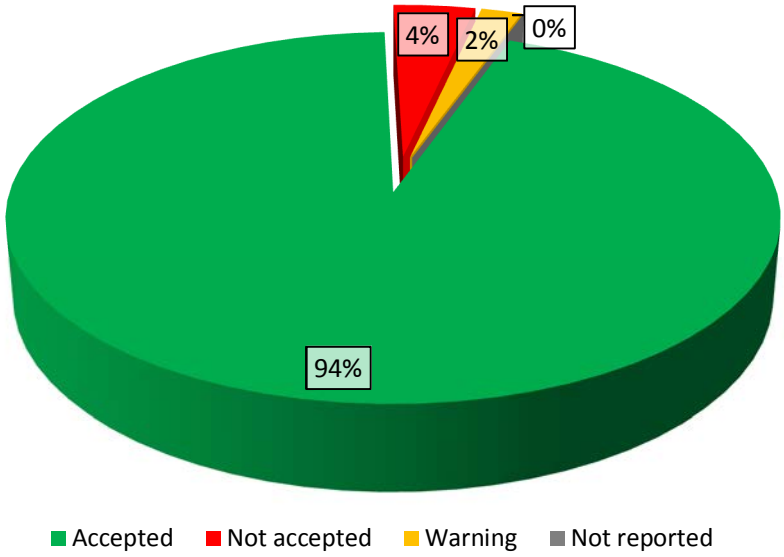

FIG. 17. Distribution of the scores for Cs-137 in water (sample 01).

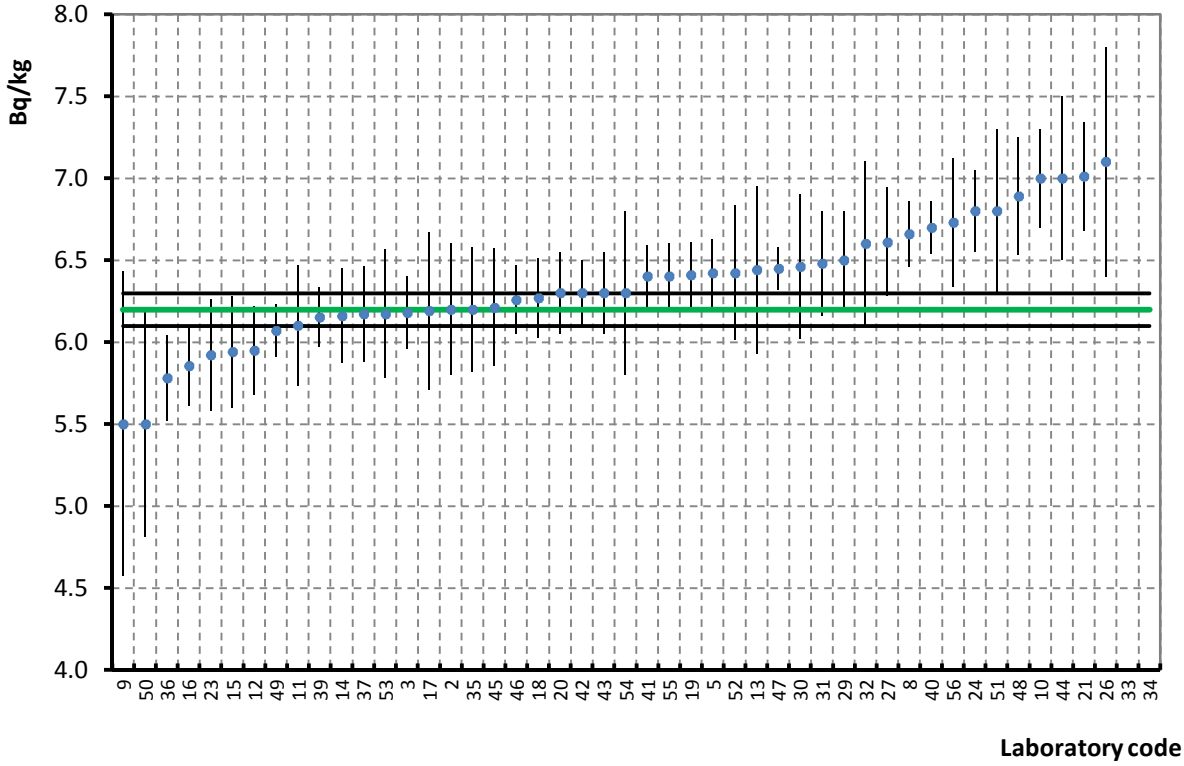

FIG. 18. Reported results and their uncertainties for Cs-137 in water (sample 01).

TABLE 12. PERFORMANCE EVALUATION OF DETERMINATION OF Cs-137 IN WATER (SAMPLE 01)

Target value: 6.2 ± 0.1 Bq/kg
MAB: 20 %
LAP: 20 %

Laboratory code	Reported values		Unc[a]	Bias [%]	Z-Score	U-Score	A1	A2	Score for trueness	Precision	Score for Precision	Final score
	a, Bq/kg	u, Bq/kg	[%]									
1	5.0	0.5	10.0	-19.4	-1.9	-2.4	1.2	1.3	A	10.1	A	A
2	6.2	0.4	6.5	0.0	0.0	0.0	0.0	1.1	A	6.7	A	A
3	6.2	0.2	3.6	-0.3	0.0	-0.1	0.0	0.6	A	3.9	A	A
5	6.4	0.2	3.3	3.5	0.4	0.9	0.2	0.6	A	3.6	A	A
8	6.7	0.2	3.0	7.4	0.7	2.1	0.5	0.6	A	3.4	A	A
9	5.5	0.9	16.9	-11.3	-1.1	-0.7	0.7	2.4	A	17.0	A	A
10	7.0	0.3	4.3	12.9	1.3	2.5	0.8	0.8	A	4.6	A	A
11	6.1	0.4	6.1	-1.6	-0.2	-0.3	0.1	1.0	A	6.3	A	A
12	6.0	0.3	4.5	-4.0	-0.4	-0.9	0.3	0.7	A	4.8	A	A
13	6.4	0.5	7.9	3.9	0.4	0.5	0.2	1.3	A	8.1	A	A
14	6.2	0.3	4.7	-0.6	-0.1	-0.1	0.0	0.8	A	5.0	A	A
15	5.9	0.3	5.7	-4.2	-0.4	-0.7	0.3	0.9	A	5.9	A	A
16	5.9	0.2	4.1	-5.6	-0.6	-1.3	0.3	0.7	A	4.4	A	A
17	6.2	0.5	7.8	-0.2	0.0	0.0	0.0	1.3	A	7.9	A	A
18	6.3	0.2	3.9	1.1	0.1	0.3	0.1	0.7	A	4.2	A	A
19	6.4	0.2	3.1	3.4	0.3	0.9	0.2	0.6	A	3.5	A	A
20	6.3	0.3	4.0	1.6	0.2	0.4	0.1	0.7	A	4.3	A	A
21	7.0	0.3	4.7	13.1	1.3	2.3	0.8	0.9	A	5.0	A	A
23	5.9	0.3	5.7	-4.5	-0.5	-0.8	0.3	0.9	A	6.0	A	A
24	6.8	0.3	3.7	9.7	1.0	2.2	0.6	0.7	A	4.0	A	A
26	7.1	0.7	9.9	14.5	1.5	1.3	0.9	1.8	A	10.0	A	A
27	6.6	0.3	5.0	6.6	0.7	1.2	0.4	0.9	A	5.2	A	A
29	6.5	0.3	4.6	4.8	0.5	0.9	0.3	0.8	A	4.9	A	A
30	6.5	0.4	6.8	4.2	0.4	0.6	0.3	1.2	A	7.0	A	A
31	6.5	0.3	4.9	4.5	0.5	0.8	0.3	0.9	A	5.2	A	A
32	6.6	0.5	7.6	6.5	0.6	0.8	0.4	1.3	A	7.7	A	A
33	11.3	0.7	6.0	82.7	8.3	7.5	5.1	1.8	N	6.2	A	N
34	15.4	0.9	6.1	147.6	14.8	9.8	9.2	2.4	N	6.3	A	N
35	6.2	0.4	6.1	0.0	0.0	0.0	0.0	1.0	A	6.3	A	A
36	5.8	0.3	4.5	-6.8	-0.7	-1.5	0.4	0.7	A	4.8	A	A
37	6.2	0.3	4.7	-0.5	0.0	-0.1	0.0	0.8	A	5.0	A	A
39	6.2	0.2	2.9	-0.8	-0.1	-0.2	0.0	0.5	A	3.3	A	A
40	6.7	0.2	2.4	8.1	0.8	2.6	0.5	0.5	N	2.9	A	W
41	6.4	0.2	3.0	3.2	0.3	0.9	0.2	0.6	A	3.4	A	A
42	6.3	0.2	3.2	1.6	0.2	0.4	0.1	0.6	A	3.6	A	A
43	6.3	0.3	4.0	1.6	0.2	0.4	0.1	0.7	A	4.3	A	A
44	7.0	0.5	7.1	12.9	1.3	1.6	0.8	1.3	A	7.3	A	A
45	6.2	0.4	5.8	0.2	0.0	0.0	0.0	1.0	A	6.0	A	A
46	6.3	0.2	3.3	0.9	0.1	0.3	0.1	0.6	A	3.7	A	A
47	6.5	0.1	2.0	4.0	0.4	1.5	0.3	0.4	A	2.6	A	A
48	6.9	0.4	5.2	11.1	1.1	1.8	0.7	1.0	A	5.5	A	A
49	6.1	0.2	2.6	-2.1	-0.2	-0.7	0.1	0.5	A	3.1	A	A
50	5.5	0.7	12.5	-11.3	-1.1	-1.0	0.7	1.8	A	12.6	A	A
51	6.8	0.5	7.4	9.7	1.0	1.2	0.6	1.3	A	7.5	A	A
52	6.4	0.4	6.4	3.6	0.4	0.5	0.2	1.1	A	6.6	A	A
53	6.2	0.4	6.3	-0.5	0.0	-0.1	0.0	1.0	A	6.5	A	A
54	6.3	0.5	7.9	1.6	0.2	0.2	0.1	1.3	A	8.1	A	A
55	6.4	0.2	3.1	3.2	0.3	0.9	0.2	0.6	A	3.5	A	A
56	6.7	0.4	5.8	8.5	0.9	1.3	0.5	1.0	A	6.0	A	A
57	7.4	0.8	10.9	18.9	1.9	1.5	1.2	2.1	A	11.0	A	A

a Relative uncertainty of the reported result at k = 1 coverage factor

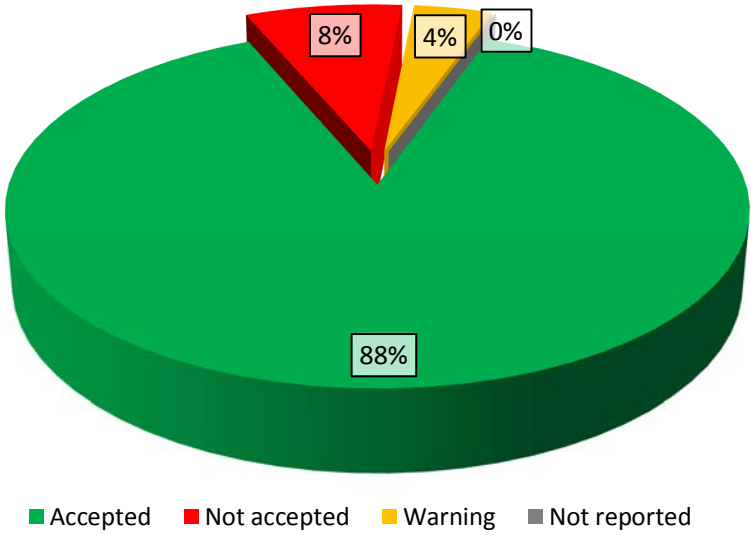

FIG. 19. Distribution of the scores for Cs-137 in water (sample 02).

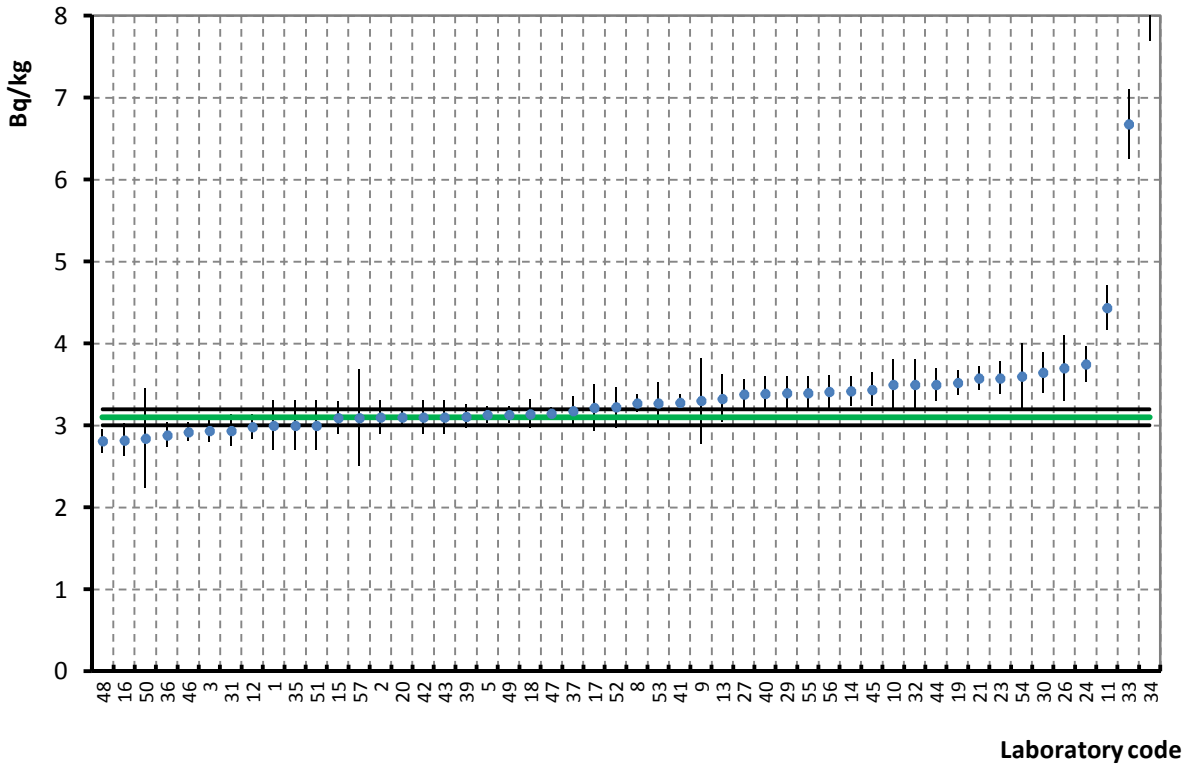

FIG. 20. Reported results and their uncertainties for Cs-137 in water (sample 02).

TABLE 13. PERFORMANCE EVALUATION OF DETERMINATION OF Cs-137 IN WATER (SAMPLE 02)

Target value: 3.1 ± 0.1 Bq/kg
MAB: 20 %
LAP: 20 %

Laboratory code	Reported values		Unc[a]	Bias [%]	Z-Score	U-Score	A1	A2	Score for trueness	Precision	Score for Precision	Final score
	a, Bq/kg	u, Bq/kg	[%]									
1	3.0	0.3	10.0	-3.2	-0.3	-0.3	0.1	0.8	A	10.5	A	A
2	3.1	0.2	6.5	0.0	0.0	0.0	0.0	0.6	A	7.2	A	A
3	2.9	0.1	4.8	-5.2	-0.5	-0.9	0.2	0.4	A	5.8	A	A
5	3.1	0.1	3.2	1.0	0.1	0.2	0.0	0.4	A	4.5	A	A
8	3.3	0.1	3.4	5.5	0.5	1.1	0.2	0.4	A	4.7	A	A
9	3.3	0.5	15.8	6.5	0.6	0.4	0.2	1.4	A	16.1	A	A
10	3.5	0.3	8.6	12.9	1.3	1.3	0.4	0.8	A	9.2	A	A
11	4.4	0.3	6.1	43.2	4.3	4.7	1.3	0.7	N	6.9	A	N
12	3.0	0.2	5.0	-3.9	-0.4	-0.7	0.1	0.5	A	6.0	A	A
13	3.3	0.3	8.7	7.4	0.7	0.7	0.2	0.8	A	9.3	A	A
14	3.4	0.2	5.3	10.3	1.0	1.6	0.3	0.5	A	6.2	A	A
15	3.1	0.2	6.5	-0.3	0.0	0.0	0.0	0.6	A	7.2	A	A
16	2.8	0.2	7.1	-9.0	-0.9	-1.2	0.3	0.6	A	7.8	A	A
17	3.2	0.3	8.7	3.9	0.4	0.4	0.1	0.8	A	9.3	A	A
18	3.1	0.2	5.5	1.3	0.1	0.2	0.0	0.5	A	6.4	A	A
19	3.5	0.2	4.3	13.5	1.4	2.3	0.4	0.5	A	5.3	A	A
20	3.1	0.1	2.9	0.0	0.0	0.0	0.0	0.3	A	4.3	A	A
21	3.6	0.1	3.9	15.5	1.5	2.8	0.5	0.4	N	5.1	A	W
23	3.6	0.2	5.6	15.5	1.5	2.1	0.5	0.6	A	6.5	A	A
24	3.8	0.2	5.9	21.0	2.1	2.7	0.7	0.6	N	6.7	A	N
26	3.7	0.4	10.8	19.4	1.9	1.5	0.6	1.1	A	11.3	A	A
27	3.4	0.2	5.0	9.0	0.9	1.4	0.3	0.5	A	6.0	A	A
29	3.4	0.2	5.9	9.7	1.0	1.3	0.3	0.6	A	6.7	A	A
30	3.7	0.3	6.8	17.7	1.8	2.0	0.6	0.7	A	7.6	A	A
31	2.9	0.2	6.5	-5.2	-0.5	-0.7	0.2	0.6	A	7.2	A	A
32	3.5	0.3	8.6	12.9	1.3	1.3	0.4	0.8	A	9.2	A	A
33	6.7	0.4	6.3	115.5	11.5	8.3	3.6	1.1	N	7.1	A	N
34	8.2	0.5	6.3	164.8	16.5	9.7	5.1	1.4	N	7.1	A	N
35	3.0	0.3	10.0	-3.2	-0.3	-0.3	0.1	0.8	A	10.5	A	A
36	2.9	0.2	5.2	-7.1	-0.7	-1.2	0.2	0.5	A	6.1	A	A
37	3.2	0.2	5.7	2.6	0.3	0.4	0.1	0.5	A	6.5	A	A
39	3.1	0.1	4.5	0.3	0.0	0.1	0.0	0.4	A	5.5	A	A
40	3.4	0.2	6.2	9.4	0.9	1.2	0.3	0.6	A	7.0	A	A
41	3.3	0.1	3.0	5.8	0.6	1.3	0.2	0.4	A	4.4	A	A
42	3.1	0.2	6.5	0.0	0.0	0.0	0.0	0.6	A	7.2	A	A
43	3.1	0.2	6.5	0.0	0.0	0.0	0.0	0.6	A	7.2	A	A
44	3.5	0.2	5.7	12.9	1.3	1.8	0.4	0.6	A	6.6	A	A
45	3.4	0.2	6.1	11.0	1.1	1.5	0.3	0.6	A	6.9	A	A
46	2.9	0.1	3.9	-5.7	-0.6	-1.2	0.2	0.4	A	5.1	A	A
47	3.2	0.1	2.2	1.6	0.2	0.4	0.0	0.3	A	3.9	A	A
48	2.8	0.1	5.0	-9.4	-0.9	-1.7	0.3	0.4	A	5.9	A	A
49	3.1	0.1	3.2	1.0	0.1	0.2	0.0	0.4	A	4.5	A	A
50	2.8	0.6	21.5	-8.4	-0.8	-0.4	0.3	1.6	A	21.7	N	W
51	3.0	0.3	10.0	-3.2	-0.3	-0.3	0.1	0.8	A	10.5	A	A
52	3.2	0.2	7.7	4.0	0.4	0.5	0.1	0.7	A	8.3	A	A
53	3.3	0.3	8.0	5.5	0.5	0.6	0.2	0.7	A	8.6	A	A
54	3.6	0.4	11.1	16.1	1.6	1.2	0.5	1.1	A	11.6	A	A
55	3.4	0.2	5.9	9.7	1.0	1.3	0.3	0.6	A	6.7	A	A
56	3.4	0.2	5.9	10.0	1.0	1.4	0.3	0.6	A	6.7	A	A
57	3.1	0.6	19.1	-0.3	0.0	0.0	0.0	1.5	A	19.4	A	A

a Relative uncertainty of the reported result at k = 1 coverage factor

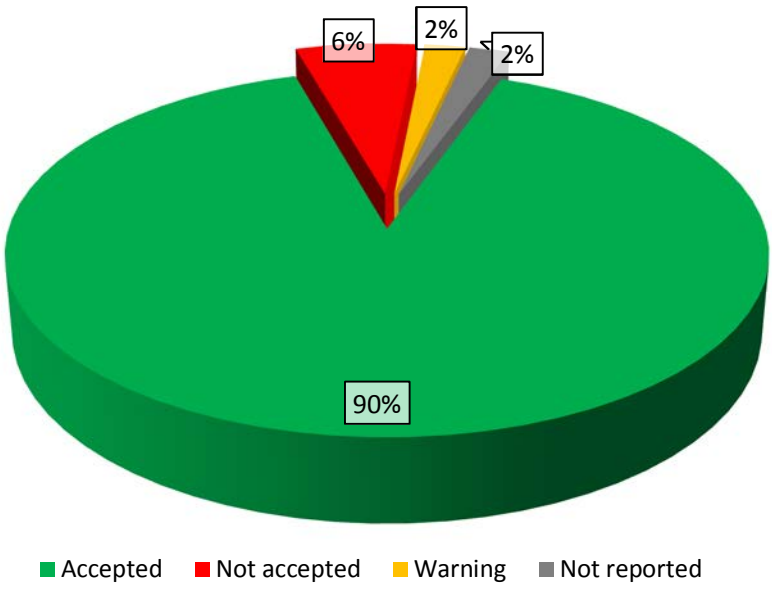

FIG. 21. Distribution of the scores for Cs-137 in water (sample 03).

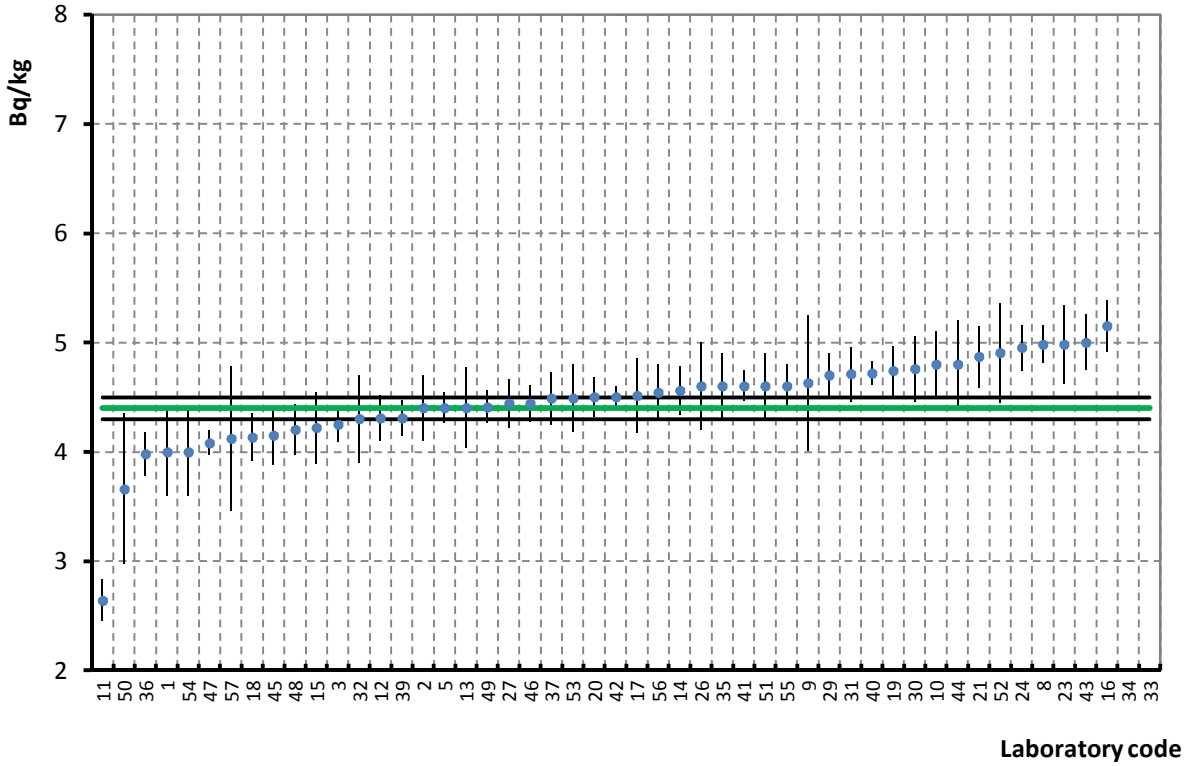

FIG. 22. Reported results and their uncertainties for Cs-137 in water (sample 03).

TABLE 14. PERFORMANCE EVALUATION OF DETERMINATION OF Cs-137 IN WATER (SAMPLE 03)

Target value: 4.4 ± 0.1 Bq/kg
MAB: 20 %
LAP: 20 %

Laboratory code	Reported values		Unc[a]	Bias [%]	Z-Score	U-Score	A1	A2	Score for trueness	Precision	Score for Precision	Final score
	a, Bq/kg	u, Bq/kg	[%]									
1	4.0	0.4	10.0	-9.1	-0.9	-1.0	0.4	1.1	A	10.3	A	A
2	4.4	0.3	6.8	0.0	0.0	0.0	0.0	0.8	A	7.2	A	A
3	4.3	0.2	3.8	-3.4	-0.3	-0.8	0.2	0.5	A	4.4	A	A
5	4.4	0.1	3.2	0.0	0.0	0.0	0.0	0.4	A	3.9	A	A
8	5.0	0.2	3.4	13.2	1.3	2.9	0.6	0.5	N	4.1	A	W
9	4.6	0.6	13.4	5.2	0.5	0.4	0.2	1.6	A	13.6	A	A
10	4.8	0.3	6.3	9.1	0.9	1.3	0.4	0.8	A	6.7	A	A
11	2.6	0.2	7.2	-40.0	-4.0	-8.2	1.8	0.6	N	7.5	A	N
12	4.3	0.2	4.9	-2.0	-0.2	-0.4	0.1	0.6	A	5.4	A	A
13	4.4	0.4	8.4	0.0	0.0	0.0	0.0	1.0	A	8.7	A	A
14	4.6	0.2	4.8	3.6	0.4	0.7	0.2	0.6	A	5.3	A	A
15	4.2	0.3	7.8	-4.1	-0.4	-0.5	0.2	0.9	A	8.1	A	A
16	5.2	0.2	4.6	17.0	1.7	2.9	0.8	0.7	N	5.1	A	W
17	4.5	0.3	7.5	2.5	0.2	0.3	0.1	0.9	A	7.9	A	A
18	4.1	0.2	5.2	-6.1	-0.6	-1.1	0.3	0.6	A	5.7	A	A
19	4.7	0.2	4.9	7.7	0.8	1.4	0.3	0.6	A	5.4	A	A
20	4.5	0.2	4.0	2.3	0.2	0.5	0.1	0.5	A	4.6	A	A
21	4.9	0.3	5.7	10.7	1.1	1.6	0.5	0.8	A	6.2	A	A
23	5.0	0.4	7.2	13.2	1.3	1.6	0.6	1.0	A	7.6	A	A
24	5.0	0.2	4.2	12.5	1.3	2.4	0.6	0.6	A	4.8	A	A
26	4.6	0.4	8.7	4.5	0.5	0.5	0.2	1.1	A	9.0	A	A
27	4.4	0.2	5.0	0.9	0.1	0.2	0.0	0.6	A	5.5	A	A
29	4.7	0.2	4.3	6.8	0.7	1.3	0.3	0.6	A	4.8	A	A
30	4.8	0.3	6.3	8.2	0.8	1.1	0.4	0.8	A	6.7	A	A
31	4.7	0.3	5.3	7.0	0.7	1.2	0.3	0.7	A	5.8	A	A
32	4.3	0.4	9.3	-2.3	-0.2	-0.2	0.1	1.1	A	9.6	A	A
33	221.0	12.0	5.4	4922.7	492.3	18.0	216.6	31.0	N	5.9	A	N
34	11.7	0.7	5.7	165.0	16.5	10.9	7.3	1.7	N	6.1	A	N
35	4.6	0.3	6.5	4.5	0.5	0.6	0.2	0.8	A	6.9	A	A
36	4.0	0.2	5.0	-9.5	-1.0	-1.9	0.4	0.6	A	5.5	A	A
37	4.5	0.2	5.3	2.0	0.2	0.3	0.1	0.7	A	5.8	A	A
39	4.3	0.2	3.7	-2.0	-0.2	-0.5	0.1	0.5	A	4.4	A	A
40	4.7	0.1	2.3	7.3	0.7	2.2	0.3	0.4	A	3.3	A	A
41	4.6	0.1	3.0	4.5	0.5	1.2	0.2	0.4	A	3.8	A	A
42	4.5	0.1	2.2	2.3	0.2	0.7	0.1	0.4	A	3.2	A	A
43	5.0	0.3	5.0	13.6	1.4	2.2	0.6	0.7	A	5.5	A	A
44	4.8	0.4	8.3	9.1	0.9	1.0	0.4	1.1	A	8.6	A	A
45	4.2	0.3	6.5	-5.7	-0.6	-0.9	0.3	0.7	A	6.9	A	A
46	4.4	0.2	3.8	0.9	0.1	0.2	0.0	0.5	A	4.4	A	A
47	4.1	0.1	2.7	-7.3	-0.7	-2.2	0.3	0.4	A	3.5	A	A
48	4.2	0.2	5.5	-4.5	-0.5	-0.8	0.2	0.6	A	5.9	A	A
49	4.4	0.2	3.4	0.2	0.0	0.1	0.0	0.5	A	4.1	A	A
50	3.7	0.7	18.9	-16.8	-1.7	-1.1	0.7	1.8	A	19.0	A	A
51	4.6	0.3	6.5	4.5	0.5	0.6	0.2	0.8	A	6.9	A	A
52	4.9	0.5	9.2	11.5	1.1	1.1	0.5	1.2	A	9.5	A	A
53	4.5	0.3	6.9	2.0	0.2	0.3	0.1	0.8	A	7.3	A	A
54	4.0	0.4	10.0	-9.1	-0.9	-1.0	0.4	1.1	A	10.3	A	A
55	4.6	0.2	4.3	4.5	0.5	0.9	0.2	0.6	A	4.9	A	A
56	4.5	0.3	5.7	3.2	0.3	0.5	0.1	0.7	A	6.2	A	A
57	4.1	0.7	16.0	-6.4	-0.6	-0.4	0.3	1.7	A	16.2	A	A

a Relative uncertainty of the reported result at k = 1 coverage factor

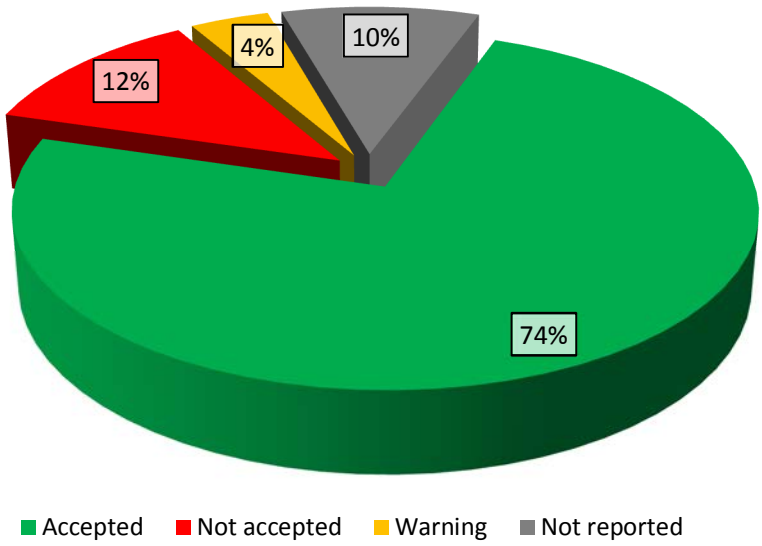

FIG. 23. Distribution of the scores for Am-241 in water (sample 01).

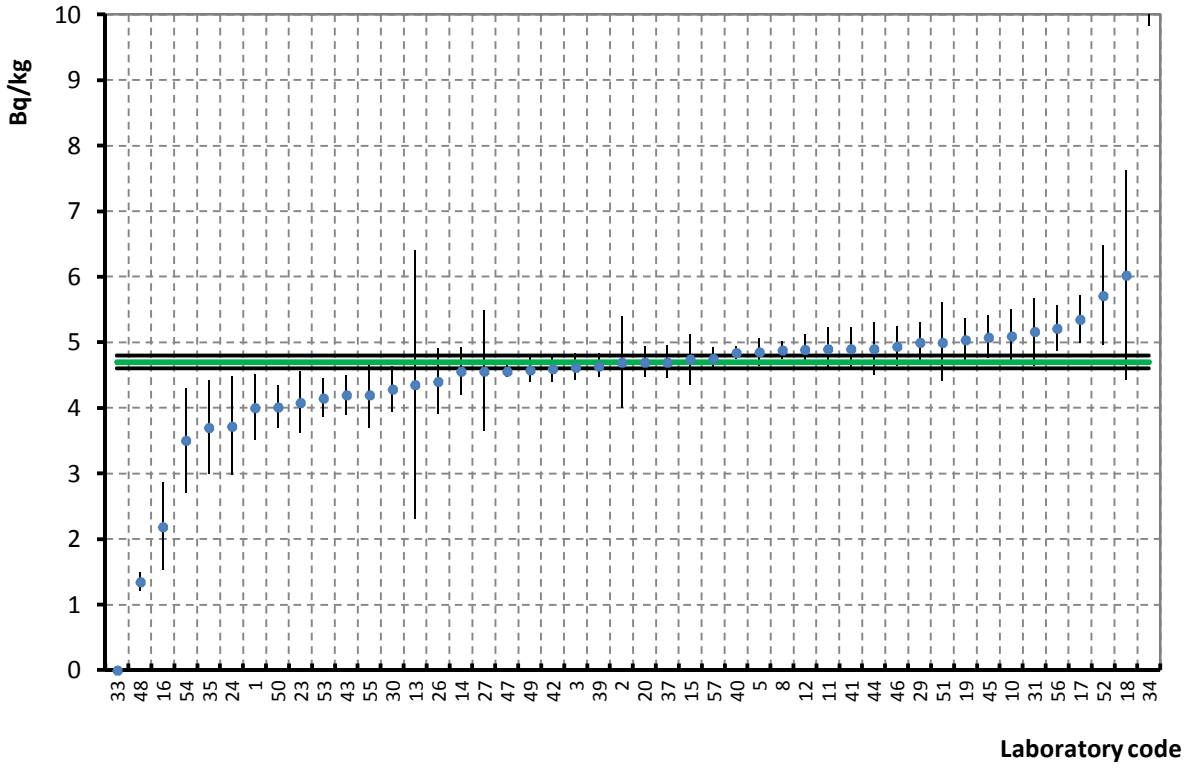

FIG. 24. Reported results and their uncertainties for Am-241 in water (sample 01).

TABLE 15. PERFORMANCE EVALUATION OF DETERMINATION OF Am-241 IN WATER (SAMPLE 01)

Target value: 4.7 ± 0.1 Bq/kg
MAB: 20 %
LAP: 20 %

Laboratory code	Reported values		Unc[a]	Bias [%]	Z-Score	U-Score	A1	A2	Score for trueness	Precision	Score for Precision	Final score
	a, Bq/kg	u, Bq/kg	[%]									
1	4.0	0.5	12.5	-14.9	-1.5	-1.4	0.7	1.3	A	12.7	A	A
2	4.7	0.7	14.9	0.0	0.0	0.0	0.0	1.8	A	15.0	A	A
3	4.6	0.2	4.3	-1.7	-0.2	-0.4	0.1	0.6	A	4.8	A	A
5	4.9	0.2	4.3	3.2	0.3	0.6	0.1	0.6	A	4.8	A	A
8	4.9	0.1	2.9	3.8	0.4	1.0	0.2	0.4	A	3.6	A	A
10	5.1	0.4	7.8	8.5	0.9	1.0	0.4	1.1	A	8.1	A	A
11	4.9	0.3	6.5	4.3	0.4	0.6	0.2	0.9	A	6.9	A	A
12	4.9	0.2	4.7	4.0	0.4	0.8	0.2	0.6	A	5.2	A	A
13	4.4	2.1	47.1	-7.4	-0.7	-0.2	0.4	5.3	A	47.2	N	W
14	4.6	0.4	7.9	-3.0	-0.3	-0.4	0.1	1.0	A	8.2	A	A
15	4.7	0.4	8.2	0.9	0.1	0.1	0.0	1.0	A	8.5	A	A
16	2.2	0.7	30.5	-53.5	-5.3	-3.7	2.5	1.7	N	30.5	N	N
17	5.4	0.4	6.7	13.8	1.4	1.7	0.6	1.0	A	7.1	A	A
18	6.0	1.6	26.6	28.1	2.8	0.8	1.3	4.1	A	26.7	N	N
19	5.0	0.3	6.5	7.2	0.7	1.0	0.3	0.9	A	6.9	A	A
20	4.7	0.2	4.9	0.0	0.0	0.0	0.0	0.6	A	5.3	A	A
23	4.1	0.5	11.5	-13.2	-1.3	-1.3	0.6	1.2	A	11.7	A	A
24	3.7	0.8	20.2	-20.9	-2.1	-1.3	1.0	2.0	A	20.3	N	N
26	4.4	0.5	11.4	-6.4	-0.6	-0.6	0.3	1.3	A	11.6	A	A
27	4.6	0.9	20.2	-3.0	-0.3	-0.2	0.1	2.4	A	20.3	N	W
29	5.0	0.3	6.0	6.4	0.6	0.9	0.3	0.8	A	6.4	A	A
30	4.3	0.4	8.2	-8.7	-0.9	-1.1	0.4	0.9	A	8.4	A	A
31	5.2	0.5	9.9	9.8	1.0	0.9	0.5	1.3	A	10.1	A	A
34	10.5	0.7	6.7	123.8	12.4	8.2	5.8	1.8	N	7.0	A	N
35	3.7	0.7	19.2	-21.3	-2.1	-1.4	1.0	1.8	A	19.3	A	A
37	4.7	0.3	5.3	0.0	0.0	0.0	0.0	0.7	A	5.7	A	A
39	4.6	0.2	3.9	-1.3	-0.1	-0.3	0.1	0.5	A	4.4	A	A
40	4.8	0.1	2.1	3.0	0.3	1.0	0.1	0.4	A	3.0	A	A
41	4.9	0.3	6.5	4.3	0.4	0.6	0.2	0.9	A	6.9	A	A
42	4.6	0.2	4.3	-2.1	-0.2	-0.4	0.1	0.6	A	4.8	A	A
43	4.2	0.3	7.1	-10.6	-1.1	-1.6	0.5	0.8	A	7.5	A	A
44	4.9	0.4	8.2	4.3	0.4	0.5	0.2	1.1	A	8.4	A	A
45	5.1	0.3	6.5	8.1	0.8	1.1	0.4	0.9	A	6.8	A	A
46	4.9	0.3	6.1	5.2	0.5	0.8	0.2	0.8	A	6.4	A	A
47	4.6	0.1	2.0	-3.0	-0.3	-1.0	0.1	0.3	A	2.9	A	A
48	1.4	0.1	10.4	-71.3	-7.1	-19.5	3.4	0.4	N	10.6	A	N
49	4.6	0.2	4.1	-2.6	-0.3	-0.6	0.1	0.6	A	4.7	A	A
50	4.0	0.3	8.0	-14.7	-1.5	-2.1	0.7	0.9	A	8.3	A	A
51	5.0	0.6	12.0	6.4	0.6	0.5	0.3	1.6	A	12.2	A	A
52	5.7	0.8	13.4	21.5	2.1	1.3	1.0	2.0	A	13.5	A	A
53	4.2	0.3	7.0	-11.7	-1.2	-1.8	0.6	0.8	A	7.3	A	A
54	3.5	0.8	22.9	-25.5	-2.6	-1.5	1.2	2.1	A	23.0	N	N
55	4.2	0.5	11.9	-10.6	-1.1	-1.0	0.5	1.3	A	12.1	A	A
56	5.2	0.4	6.7	10.9	1.1	1.4	0.5	0.9	A	7.0	A	A
57	4.8	0.2	3.4	1.1	0.1	0.3	0.0	0.5	A	4.0	A	A

a Relative uncertainty of the reported result at k = 1 coverage factor

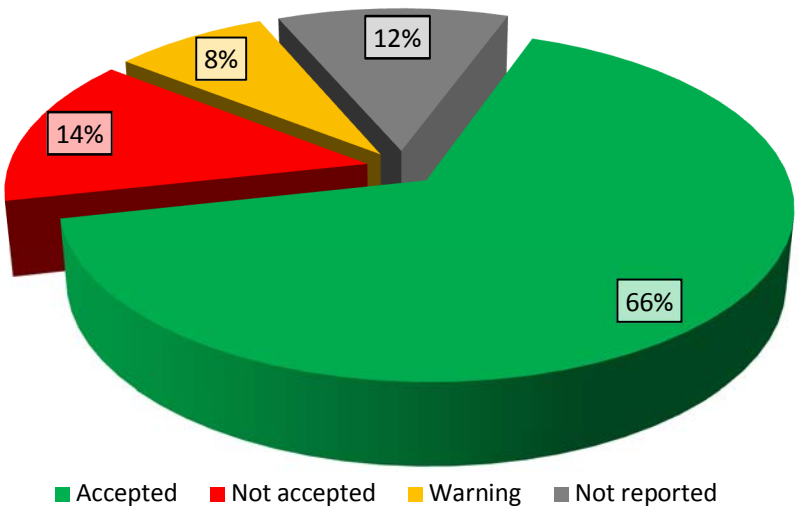

FIG. 25. Distribution of the scores for Am-241 in water (sample 02).

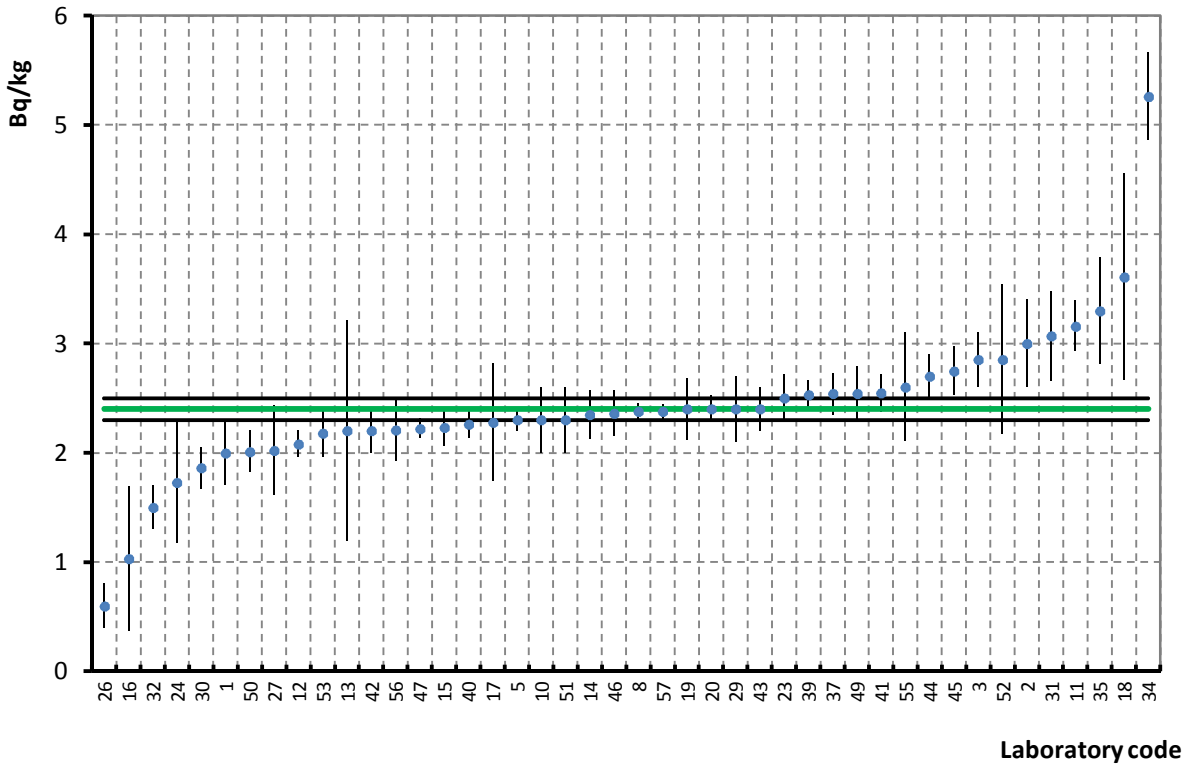

FIG. 26. Reported results and their uncertainties for Am-241 in water (sample 02).

TABLE 16. PERFORMANCE EVALAUTION OF DETERMINATION OF Am-241 IN WATER (SAMPLE 02)

Target value: 2.4 ± 0.1 Bq/kg
MAB: 20 %
LAP: 20 %

Laboratory code	Reported values		Unc[a] [%]	Bias [%]	Z-Score	U-Score	A1	A2	Score for trueness	Precision	Score for Precision	Final score
	a, Bq/kg	u, Bq/kg										
1	2.0	0.3	15.0	-16.7	-1.7	-1.3	0.4	0.8	A	15.6	A	A
2	3.0	0.4	13.3	25.0	2.5	1.5	0.6	1.1	A	14.0	A	A
3	2.9	0.3	8.8	18.8	1.9	1.7	0.5	0.7	A	9.7	A	A
5	2.3	0.1	4.3	-4.2	-0.4	-0.7	0.1	0.4	A	6.0	A	A
8	2.4	0.1	3.0	-0.9	-0.1	-0.2	0.0	0.3	A	5.2	A	A
10	2.3	0.3	13.0	-4.2	-0.4	-0.3	0.1	0.8	A	13.7	A	A
11	3.2	0.2	7.3	31.7	3.2	3.0	0.8	0.6	N	8.4	A	N
12	2.1	0.1	5.8	-13.3	-1.3	-2.0	0.3	0.4	A	7.1	A	A
13	2.2	1.0	45.9	-8.3	-0.8	-0.2	0.2	2.6	A	46.1	N	W
14	2.4	0.2	9.4	-2.1	-0.2	-0.2	0.0	0.6	A	10.2	A	A
15	2.2	0.2	7.6	-7.1	-0.7	-0.9	0.2	0.5	A	8.7	A	A
16	1.0	0.7	64.0	-57.0	-5.7	-2.0	1.4	1.7	A	64.1	N	N
17	2.3	0.5	23.7	-5.0	-0.5	-0.2	0.1	1.4	A	24.0	N	W
18	3.6	0.9	26.2	50.4	5.0	1.3	1.2	2.5	A	26.5	N	N
19	2.4	0.3	11.7	0.0	0.0	0.0	0.0	0.8	A	12.4	A	A
20	2.4	0.1	5.0	0.0	0.0	0.0	0.0	0.4	A	6.5	A	A
23	2.5	0.2	8.4	4.2	0.4	0.4	0.1	0.6	A	9.4	A	A
24	1.7	0.6	31.8	-27.9	-2.8	-1.2	0.7	1.4	A	32.1	N	N
26	0.6	0.2	33.3	-75.0	-7.5	-8.0	1.8	0.6	N	33.6	N	N
27	2.0	0.4	20.3	-15.8	-1.6	-0.9	0.4	1.1	A	20.7	N	W
29	2.4	0.3	12.5	0.0	0.0	0.0	0.0	0.8	A	13.2	A	A
30	1.9	0.2	10.2	-22.5	-2.3	-2.5	0.5	0.6	A	11.0	A	A
31	3.1	0.4	13.4	27.9	2.8	1.6	0.7	1.1	A	14.0	A	A
32	1.5	0.2	13.3	-37.5	-3.8	-4.0	0.9	0.6	N	14.0	A	N
34	5.3	0.4	7.6	119.2	11.9	6.9	2.9	1.1	N	8.7	A	N
35	3.3	0.5	14.8	37.5	3.8	1.8	0.9	1.3	A	15.4	A	A
37	2.5	0.2	7.5	5.8	0.6	0.7	0.1	0.6	A	8.6	A	A
39	2.5	0.1	5.1	5.4	0.5	0.8	0.1	0.4	A	6.6	A	A
40	2.3	0.1	5.3	-5.8	-0.6	-0.9	0.1	0.4	A	6.7	A	A
41	2.6	0.2	6.7	6.3	0.6	0.8	0.2	0.5	A	7.9	A	A
42	2.2	0.2	9.1	-8.3	-0.8	-0.9	0.2	0.6	A	10.0	A	A
43	2.4	0.2	8.3	0.0	0.0	0.0	0.0	0.6	A	9.3	A	A
44	2.7	0.2	7.4	12.5	1.3	1.3	0.3	0.6	A	8.5	A	A
45	2.8	0.2	8.0	14.6	1.5	1.4	0.4	0.6	A	9.0	A	A
46	2.4	0.2	8.8	-1.7	-0.2	-0.2	0.0	0.6	A	9.7	A	A
47	2.2	0.1	4.1	-7.5	-0.7	-1.3	0.2	0.3	A	5.8	A	A
49	2.5	0.3	9.8	5.8	0.6	0.5	0.1	0.7	A	10.7	A	A
50	2.0	0.2	9.5	-16.3	-1.6	-1.8	0.4	0.6	A	10.3	A	A
51	2.3	0.3	13.0	-4.2	-0.4	-0.3	0.1	0.8	A	13.7	A	A
52	2.9	0.7	23.9	18.9	1.9	0.7	0.5	1.8	A	24.3	N	W
53	2.2	0.2	10.1	-9.2	-0.9	-0.9	0.2	0.6	A	10.9	A	A
55	2.6	0.5	19.2	8.3	0.8	0.4	0.2	1.3	A	19.7	A	A
56	2.2	0.3	13.1	-7.9	-0.8	-0.6	0.2	0.8	A	13.8	A	A
57	2.4	0.1	2.7	-0.8	-0.1	-0.2	0.0	0.3	A	5.0	A	A

a Relative uncertainty of the reported result at k = 1 coverage factor

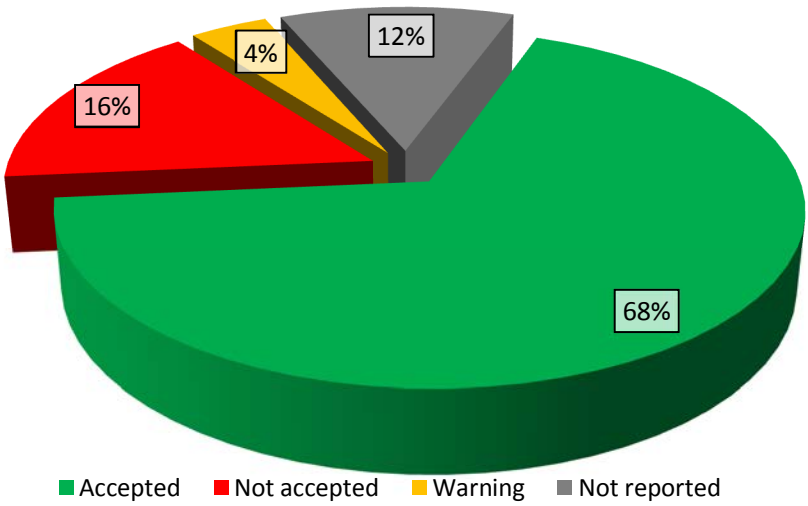

FIG. 27. Distribution of the scores for Am-241 in water (sample 03).

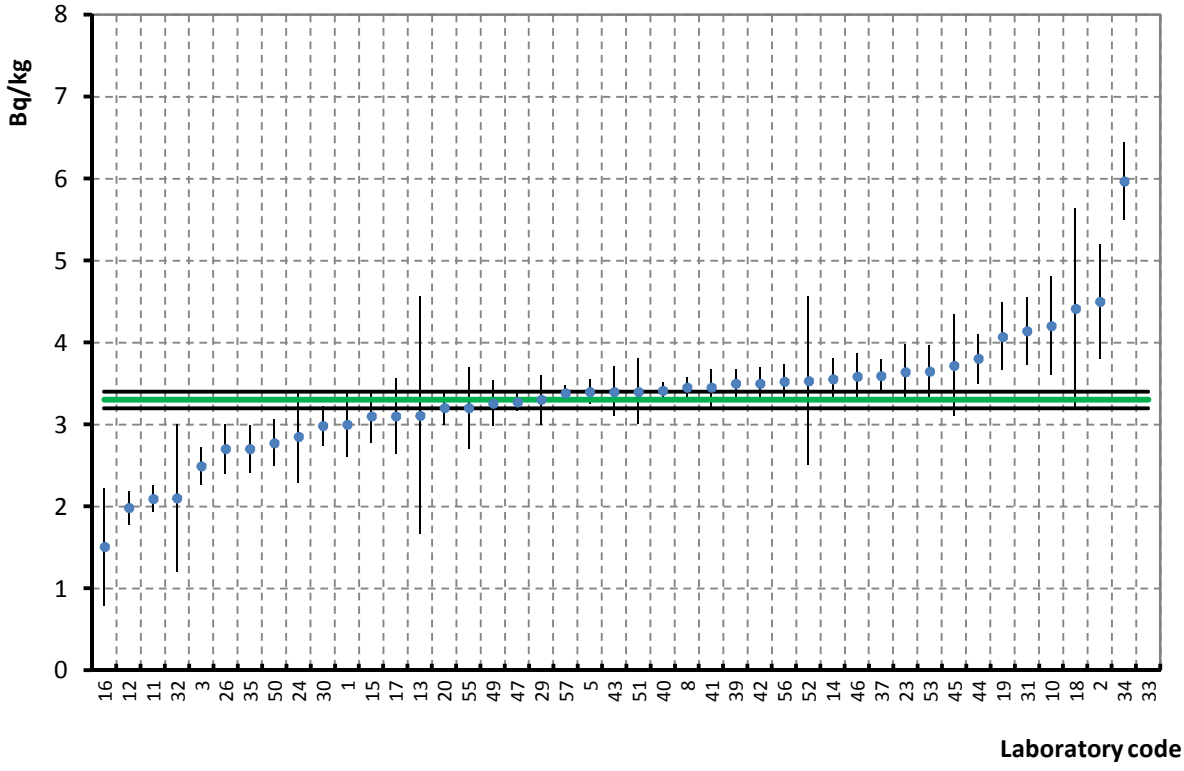

FIG. 28. Reported results and their uncertainties for Am-241 in water (sample 03).

TABLE 17. PERFORMANCE EVALUATION OF DETERMINATION OF Am-241 IN WATER (SAMPLE 03)

Target value: 3.3 ± 0.1 Bq/kg
MAB: 20 %
LAP: 20 %

Laboratory code	Reported values		Unc[a]	Bias [%]	Z-Score	U-Score	A1	A2	Score for trueness	Precision	Score for Precision	Final score
	a, Bq/kg	u, Bq/kg	[%]									
1	3.0	0.4	13.3	-9.1	-0.9	-0.7	0.3	1.1	A	13.7	A	A
2	4.5	0.7	15.6	36.4	3.6	1.7	1.2	1.8	A	15.8	A	A
3	2.5	0.2	9.2	-24.5	-2.5	-3.2	0.8	0.6	N	9.7	A	N
5	3.4	0.2	4.4	3.0	0.3	0.6	0.1	0.5	A	5.4	A	A
8	3.5	0.1	3.8	4.5	0.5	0.9	0.2	0.4	A	4.8	A	A
10	4.2	0.6	14.3	27.3	2.7	1.5	0.9	1.6	A	14.6	A	A
11	2.1	0.2	7.7	-36.7	-3.7	-6.4	1.2	0.5	N	8.2	A	N
12	2.0	0.2	10.6	-40.0	-4.0	-5.7	1.3	0.6	N	11.0	A	N
13	3.1	1.5	46.6	-5.8	-0.6	-0.1	0.2	3.7	A	46.7	N	W
14	3.6	0.3	7.3	7.6	0.8	0.9	0.3	0.7	A	7.9	A	A
15	3.1	0.3	10.3	-6.1	-0.6	-0.6	0.2	0.9	A	10.8	A	A
16	1.5	0.7	47.5	-54.3	-5.4	-2.5	1.8	1.9	A	47.6	N	N
17	3.1	0.5	14.8	-6.1	-0.6	-0.4	0.2	1.2	A	15.1	A	A
18	4.4	1.2	27.9	33.6	3.4	0.9	1.1	3.2	A	28.1	N	N
19	4.1	0.4	10.1	23.3	2.3	1.8	0.8	1.1	A	10.5	A	A
20	3.2	0.2	6.6	-3.0	-0.3	-0.4	0.1	0.6	A	7.2	A	A
23	3.6	0.3	9.3	10.3	1.0	1.0	0.3	0.9	A	9.8	A	A
24	2.9	0.6	19.6	-13.6	-1.4	-0.8	0.5	1.5	A	19.9	A	A
26	2.7	0.3	11.1	-18.2	-1.8	-1.9	0.6	0.8	A	11.5	A	A
29	3.3	0.3	9.1	0.0	0.0	0.0	0.0	0.8	A	9.6	A	A
30	3.0	0.2	8.1	-9.7	-1.0	-1.2	0.3	0.7	A	8.6	A	A
31	4.1	0.4	9.9	25.5	2.5	2.0	0.8	1.1	A	10.4	A	A
32	2.1	0.9	42.9	-36.4	-3.6	-1.3	1.2	2.3	A	43.0	N	N
33	39.9	3.9	9.8	1108.2	110.8	9.4	36.6	10.0	N	10.2	A	N
34	6.0	0.5	7.9	80.9	8.1	5.6	2.7	1.2	N	8.4	A	N
35	2.7	0.3	10.7	-18.2	-1.8	-2.0	0.6	0.8	A	11.2	A	A
37	3.6	0.2	5.6	8.8	0.9	1.3	0.3	0.6	A	6.3	A	A
39	3.5	0.2	4.9	6.1	0.6	1.0	0.2	0.5	A	5.7	A	A
40	3.4	0.1	2.9	3.3	0.3	0.8	0.1	0.4	A	4.2	A	A
41	3.5	0.2	6.7	4.5	0.5	0.6	0.2	0.6	A	7.3	A	A
42	3.5	0.2	5.7	6.1	0.6	0.9	0.2	0.6	A	6.5	A	A
43	3.4	0.3	8.8	3.0	0.3	0.3	0.1	0.8	A	9.3	A	A
44	3.8	0.3	7.9	15.2	1.5	1.6	0.5	0.8	A	8.5	A	A
45	3.7	0.6	16.7	12.7	1.3	0.7	0.4	1.6	A	16.9	A	A
46	3.6	0.3	7.8	8.7	0.9	1.0	0.3	0.8	A	8.3	A	A
47	3.3	0.1	3.4	-0.9	-0.1	-0.2	0.0	0.4	A	4.5	A	A
49	3.3	0.3	8.6	-1.2	-0.1	-0.1	0.0	0.8	A	9.1	A	A
50	2.8	0.3	10.1	-16.1	-1.6	-1.8	0.5	0.8	A	10.6	A	A
51	3.4	0.4	11.8	3.0	0.3	0.2	0.1	1.1	A	12.1	A	A
52	3.5	1.0	29.1	7.0	0.7	0.2	0.2	2.7	A	29.2	N	W
53	3.7	0.3	8.8	10.6	1.1	1.0	0.4	0.9	A	9.3	A	A
55	3.2	0.5	15.6	-3.0	-0.3	-0.2	0.1	1.3	A	15.9	A	A
56	3.5	0.2	6.0	6.7	0.7	0.9	0.2	0.6	A	6.7	A	A
57	3.4	0.1	2.8	2.4	0.2	0.6	0.1	0.4	A	4.1	A	A

a Relative uncertainty of the reported result at k = 1 coverage factor

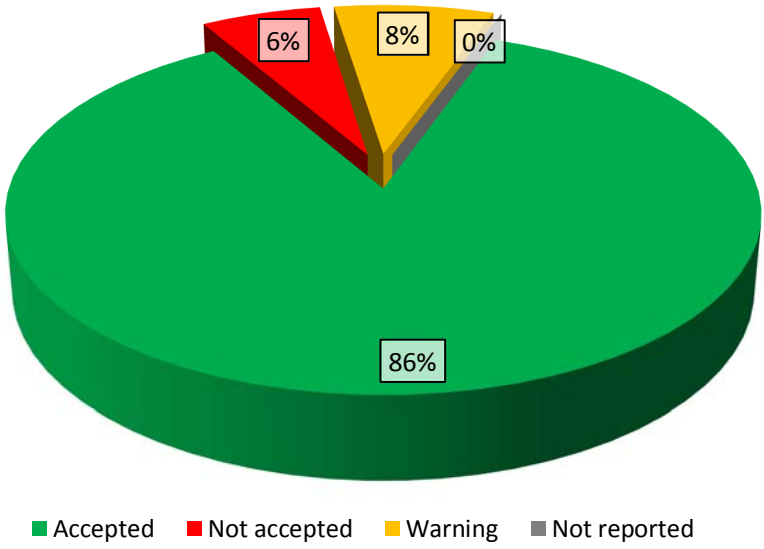

FIG. 29. Distribution of the scores for Co-60 in water (sample 01).

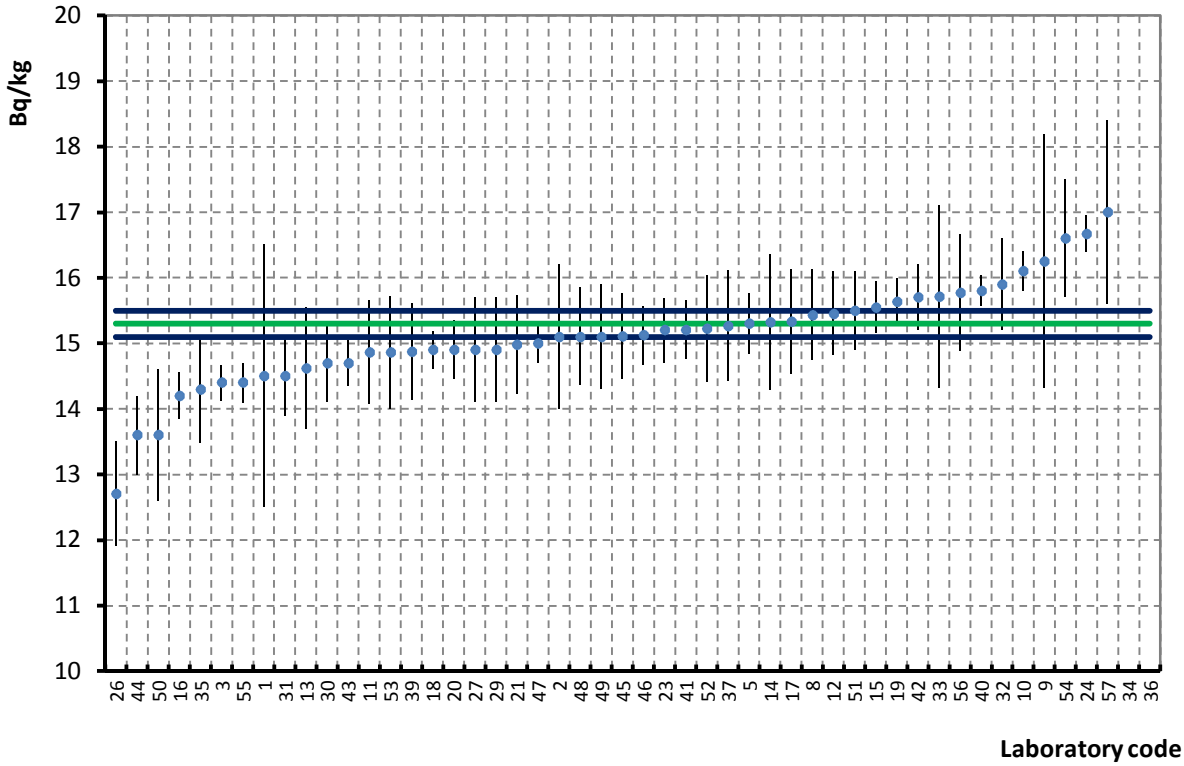

FIG. 30. Reported results and their uncertainties for Co-60 in water (sample 01).

TABLE 18. PERFORMANCE EVALUATION OF DETERMINATION OF Co-60 IN WATER (SAMPLE 01)

Target value: 15.3 ± 0.2 Bq/kg
MAB: 15 %
LAP: 15 %

Laboratory code	Reported values		Unc[a]	Bias [%]	Z-Score	U-Score	A1	A2	Score for trueness	Precision	Score for Precision	Final score
	a, Bq/kg	u, Bq/kg	[%]									
1	14.5	2.0	13.8	-5.2	-0.5	-0.4	0.8	5.2	A	13.9	A	A
2	15.1	1.1	7.3	-1.3	-0.1	-0.2	0.2	2.9	A	7.4	A	A
3	14.4	0.3	1.9	-5.9	-0.6	-2.7	0.9	0.9	N	2.3	A	W
5	15.3	0.5	3.0	0.0	0.0	0.0	0.0	1.3	A	3.3	A	A
8	15.4	0.7	4.5	0.8	0.1	0.2	0.1	1.9	A	4.7	A	A
9	16.3	1.9	11.9	6.2	0.6	0.5	0.9	5.0	A	11.9	A	A
10	16.1	0.3	1.9	5.2	0.5	2.2	0.8	0.9	A	2.3	A	A
11	14.9	0.8	5.3	-2.9	-0.3	-0.5	0.4	2.1	A	5.5	A	A
12	15.5	0.6	4.1	1.0	0.1	0.2	0.1	1.7	A	4.3	A	A
13	14.6	0.9	6.4	-4.4	-0.4	-0.7	0.7	2.5	A	6.5	A	A
14	15.3	1.0	6.7	0.1	0.0	0.0	0.0	2.7	A	6.8	A	A
15	15.6	0.4	2.6	1.6	0.2	0.6	0.3	1.2	A	2.9	A	A
16	14.2	0.4	2.5	-7.2	-0.7	-2.7	1.1	1.1	N	2.9	A	W
17	15.3	0.8	5.2	0.2	0.0	0.0	0.0	2.1	A	5.4	A	A
18	14.9	0.3	1.9	-2.6	-0.3	-1.1	0.4	0.9	A	2.3	A	A
19	15.6	0.4	2.2	2.2	0.2	0.8	0.3	1.0	A	2.6	A	A
20	14.9	0.5	3.0	-2.6	-0.3	-0.8	0.4	1.3	A	3.3	A	A
21	15.0	0.8	5.0	-2.1	-0.2	-0.4	0.3	2.0	A	5.2	A	A
23	15.2	0.5	3.2	-0.7	-0.1	-0.2	0.1	1.4	A	3.5	A	A
24	16.7	0.3	1.7	9.0	0.9	4.0	1.4	0.9	N	2.1	A	W
26	12.7	0.8	6.3	-17.0	-1.7	-3.2	2.6	2.1	N	6.4	A	N
27	14.9	0.8	5.4	-2.6	-0.3	-0.5	0.4	2.1	A	5.5	A	A
29	14.9	0.8	5.4	-2.6	-0.3	-0.5	0.4	2.1	A	5.5	A	A
30	14.7	0.6	4.1	-3.9	-0.4	-0.9	0.6	1.6	A	4.3	A	A
31	14.5	0.6	4.1	-5.2	-0.5	-1.3	0.8	1.6	A	4.3	A	A
32	15.9	0.7	4.4	3.9	0.4	0.8	0.6	1.9	A	4.6	A	A
33	15.7	1.4	8.8	2.7	0.3	0.3	0.4	3.6	A	8.9	A	A
34	30.4	0.9	3.1	98.6	9.9	15.7	15.1	2.5	N	3.4	A	N
35	14.3	0.8	5.7	-6.5	-0.7	-1.2	1.0	2.2	A	5.9	A	A
36	129.3	4.1	3.2	745.0	74.5	27.9	114.0	10.5	N	3.4	A	N
37	15.3	0.8	5.5	-0.3	0.0	0.0	0.0	2.2	A	5.7	A	A
39	14.9	0.7	4.9	-2.8	-0.3	-0.6	0.4	2.0	A	5.1	A	A
40	15.8	0.2	1.5	3.3	0.3	1.6	0.5	0.8	A	2.0	A	A
41	15.2	0.5	3.0	-0.7	-0.1	-0.2	0.1	1.3	A	3.2	A	A
42	15.7	0.5	3.2	2.6	0.3	0.7	0.4	1.4	A	3.4	A	A
43	14.7	0.4	2.4	-3.9	-0.4	-1.5	0.6	1.0	A	2.7	A	A
44	13.6	0.6	4.4	-11.1	-1.1	-2.7	1.7	1.6	N	4.6	A	W
45	15.1	0.7	4.3	-1.2	-0.1	-0.3	0.2	1.8	A	4.5	A	A
46	15.1	0.4	2.9	-1.2	-0.1	-0.4	0.2	1.3	A	3.2	A	A
47	15.0	0.3	2.0	-2.0	-0.2	-0.8	0.3	0.9	A	2.4	A	A
48	15.1	0.8	5.0	-1.3	-0.1	-0.3	0.2	2.0	A	5.1	A	A
49	15.1	0.8	5.3	-1.3	-0.1	-0.2	0.2	2.1	A	5.5	A	A
50	13.6	1.0	7.4	-11.1	-1.1	-1.7	1.7	2.6	A	7.5	A	A
51	15.5	0.6	3.9	1.3	0.1	0.3	0.2	1.6	A	4.1	A	A
52	15.2	0.8	5.3	-0.5	-0.1	-0.1	0.1	2.1	A	5.5	A	A
53	14.9	0.9	5.8	-2.9	-0.3	-0.5	0.4	2.3	A	5.9	A	A
54	16.6	0.9	5.4	8.5	0.8	1.4	1.3	2.4	A	5.6	A	A
55	14.4	0.3	2.1	-5.9	-0.6	-2.5	0.9	0.9	A	2.5	A	A
56	15.8	0.9	5.6	3.1	0.3	0.5	0.5	2.4	A	5.8	A	A
57	17.0	1.4	8.2	11.1	1.1	1.2	1.7	3.6	A	8.3	A	A

a Relative uncertainty of the reported result at k = 1 coverage factor

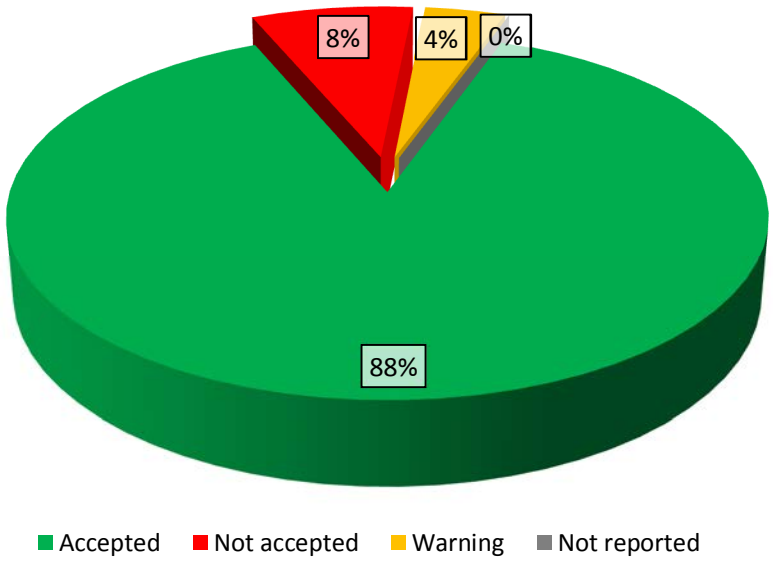

FIG. 31. Distribution of the scores for Co-60 in water (sample 02).

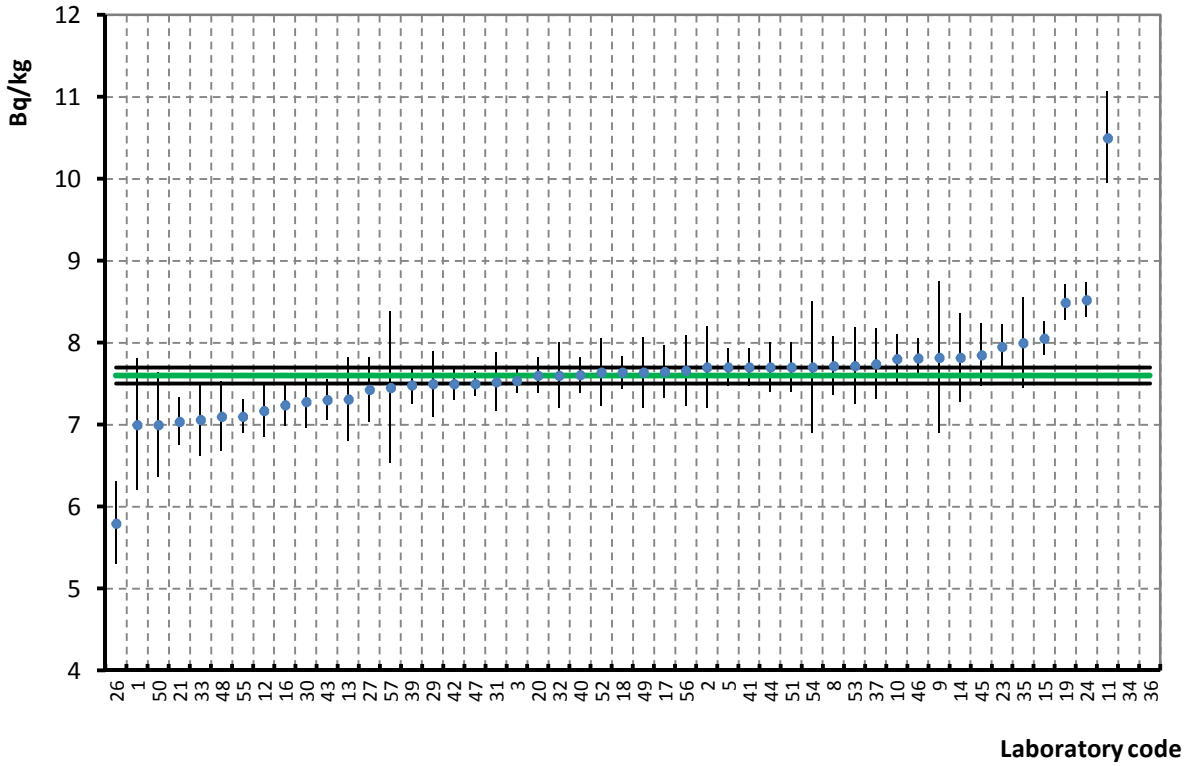

FIG. 32. Reported results and their uncertainties for Co-60 in water (sample 02).

TABLE 19. PERFORMANCE EVALUATION OF DETERMINATION OF Co-60 IN WATER (SAMPLE 02)

Target value: 7.6 ± 0.2 Bq/kg
MAB: 15 %
LAP: 15 %

Laboratory code	Reported values		Unc[a]	Bias [%]	Z-Score	U-Score	A1	A2	Score for trueness	Precision	Score for Precision	Final score
	a, Bq/kg	u, Bq/kg	[%]									
1	7.0	0.8	11.4	-7.9	-0.8	-0.7	0.6	2.1	A	11.5	A	A
2	7.7	0.5	6.5	1.3	0.1	0.2	0.1	1.3	A	6.6	A	A
3	7.5	0.2	2.0	-0.8	-0.1	-0.3	0.1	0.5	A	2.4	A	A
5	7.7	0.2	3.0	1.3	0.1	0.4	0.1	0.6	A	3.3	A	A
8	7.7	0.4	4.7	1.6	0.2	0.3	0.1	1.0	A	4.8	A	A
9	7.8	0.9	11.8	2.9	0.3	0.2	0.2	2.4	A	11.8	A	A
10	7.8	0.3	3.8	2.6	0.3	0.6	0.2	0.8	A	4.1	A	A
11	10.5	0.6	5.3	38.2	3.8	5.1	2.9	1.5	N	5.5	A	N
12	7.2	0.3	4.5	-5.7	-0.6	-1.3	0.4	0.9	A	4.7	A	A
13	7.3	0.5	7.0	-3.8	-0.4	-0.6	0.3	1.3	A	7.1	A	A
14	7.8	0.5	6.9	2.9	0.3	0.4	0.2	1.4	A	7.0	A	A
15	8.1	0.2	2.6	5.9	0.6	1.9	0.5	0.6	A	2.9	A	A
16	7.2	0.3	3.6	-4.7	-0.5	-1.3	0.4	0.7	A	3.8	A	A
17	7.7	0.3	4.2	0.7	0.1	0.1	0.1	0.9	A	4.4	A	A
18	7.6	0.2	2.6	0.5	0.1	0.2	0.0	0.6	A	2.9	A	A
19	8.5	0.2	2.6	11.7	1.2	3.7	0.9	0.6	N	2.9	A	W
20	7.6	0.2	2.9	0.0	0.0	0.0	0.0	0.6	A	3.2	A	A
21	7.0	0.3	4.1	-7.4	-0.7	-1.8	0.6	0.8	A	4.3	A	A
23	8.0	0.3	3.4	4.6	0.5	1.2	0.4	0.7	A	3.6	A	A
24	8.5	0.2	2.5	12.1	1.2	4.0	0.9	0.6	N	2.8	A	W
26	5.8	0.5	8.6	-23.7	-2.4	-3.5	1.8	1.3	N	8.7	A	N
27	7.4	0.4	5.2	-2.2	-0.2	-0.4	0.2	1.0	A	5.4	A	A
29	7.5	0.4	5.3	-1.3	-0.1	-0.2	0.1	1.1	A	5.5	A	A
30	7.3	0.3	4.5	-4.2	-0.4	-0.9	0.3	0.9	A	4.7	A	A
31	7.5	0.4	4.8	-1.1	-0.1	-0.2	0.1	1.0	A	5.0	A	A
32	7.6	0.4	5.3	0.0	0.0	0.0	0.0	1.1	A	5.4	A	A
33	7.1	0.4	6.2	-7.1	-0.7	-1.2	0.5	1.2	A	6.4	A	A
34	14.8	0.5	3.3	94.9	9.5	14.4	7.2	1.3	N	3.6	A	N
35	8.0	0.6	6.9	5.3	0.5	0.7	0.4	1.4	A	7.0	A	A
36	689.8	32.6	4.7	8976.2	897.6	20.9	682.2	84.2	N	4.9	A	N
37	7.7	0.4	5.6	1.8	0.2	0.3	0.1	1.1	A	5.7	A	A
39	7.5	0.2	2.9	-1.6	-0.2	-0.5	0.1	0.6	A	3.2	A	A
40	7.6	0.2	2.9	0.1	0.0	0.0	0.0	0.6	A	3.2	A	A
41	7.7	0.2	3.0	1.3	0.1	0.4	0.1	0.6	A	3.3	A	A
42	7.5	0.2	2.7	-1.3	-0.1	-0.4	0.1	0.6	A	3.0	A	A
43	7.3	0.3	3.4	-3.9	-0.4	-1.1	0.3	0.7	A	3.7	A	A
44	7.7	0.3	3.9	1.3	0.1	0.3	0.1	0.8	A	4.1	A	A
45	7.9	0.4	4.8	3.3	0.3	0.6	0.3	1.0	A	5.0	A	A
46	7.8	0.2	3.1	2.8	0.3	0.8	0.2	0.7	A	3.4	A	A
47	7.5	0.2	2.0	-1.3	-0.1	-0.6	0.1	0.5	A	2.4	A	A
48	7.1	0.4	5.9	-6.6	-0.7	-1.2	0.5	1.1	A	6.1	A	A
49	7.6	0.4	5.6	0.5	0.1	0.1	0.0	1.1	A	5.8	A	A
50	7.0	0.6	9.1	-7.9	-0.8	-0.9	0.6	1.7	A	9.2	A	A
51	7.7	0.3	3.9	1.3	0.1	0.3	0.1	0.8	A	4.1	A	A
52	7.6	0.4	5.4	0.5	0.0	0.1	0.0	1.1	A	5.6	A	A
53	7.7	0.5	6.1	1.6	0.2	0.2	0.1	1.2	A	6.2	A	A
54	7.7	0.8	10.4	1.3	0.1	0.1	0.1	2.1	A	10.5	A	A
55	7.1	0.2	2.8	-6.6	-0.7	-2.2	0.5	0.6	A	3.1	A	A
56	7.7	0.4	5.6	0.8	0.1	0.1	0.1	1.1	A	5.8	A	A
57	7.5	0.9	12.3	-2.0	-0.2	-0.2	0.1	2.4	A	12.4	A	A

a Relative uncertainty of the reported result at k = 1 coverage factor

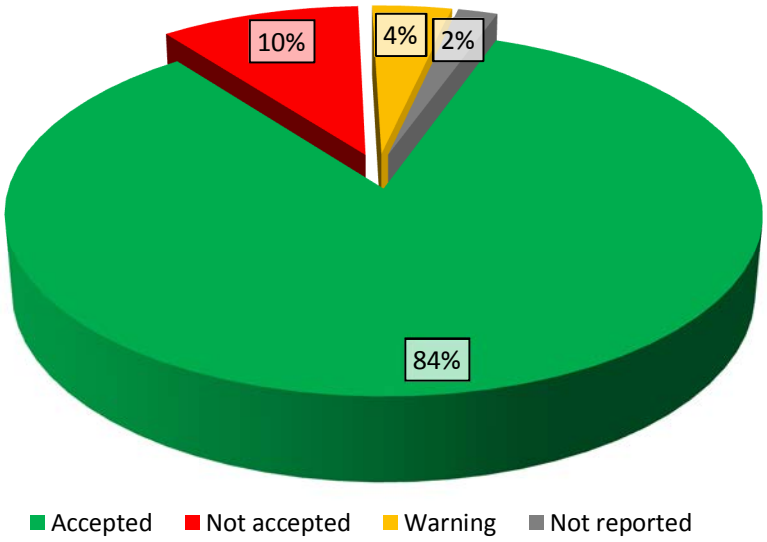

FIG. 33. Distribution of the scores for Co-60 in water (sample 03).

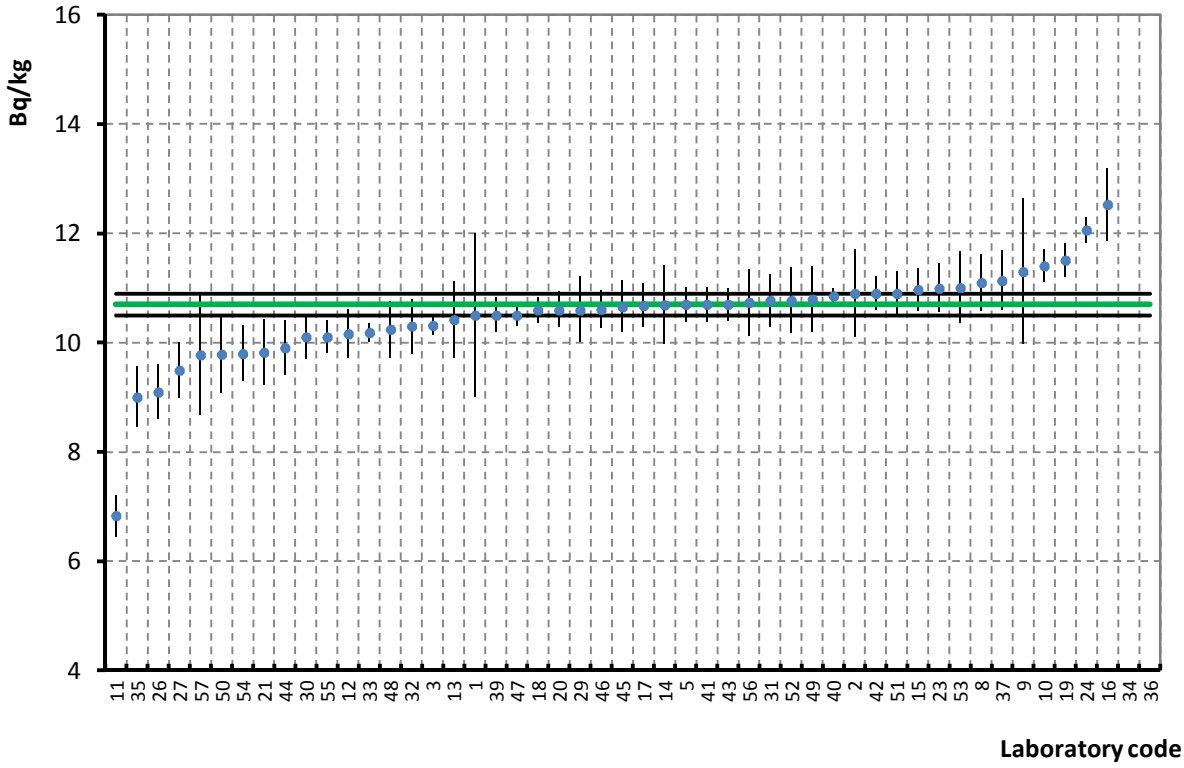

FIG. 34. Reported results and their uncertainties for Co-60 in water (sample 03).

TABLE 20. PERFORMANCE EVALUATION OF DETERMINATION OF Co-60 IN WATER (SAMPLE 03)

Target value: 10.7 ± 0.2 Bq/kg
MAB: 15 %
LAP: 15 %

Laboratory code	Reported values		Unc[a]	Bias [%]	Z-Score	U-Score	A1	A2	Score for trueness	Precision	Score for Precision	Final score
	a, Bq/kg	u, Bq/kg	[%]									
1	10.5	1.5	14.3	-1.9	-0.2	-0.1	0.2	3.9	A	14.4	A	A
2	10.9	0.8	7.3	1.9	0.2	0.2	0.2	2.1	A	7.6	A	A
3	10.3	0.2	1.7	-3.6	-0.4	-1.4	0.4	0.7	A	2.6	A	A
5	10.7	0.3	3.0	0.0	0.0	0.0	0.0	1.0	A	3.5	A	A
8	11.1	0.5	4.7	3.7	0.4	0.7	0.4	1.4	A	5.0	A	A
9	11.3	1.3	11.8	5.6	0.6	0.4	0.6	3.5	A	11.9	A	A
10	11.4	0.3	2.6	6.5	0.7	1.9	0.7	0.9	A	3.2	A	A
11	6.8	0.4	5.6	-36.2	-3.6	-9.0	3.9	1.1	N	5.9	A	N
12	10.2	0.4	4.3	-5.0	-0.5	-1.1	0.5	1.2	A	4.7	A	A
13	10.4	0.7	6.7	-2.6	-0.3	-0.4	0.3	1.9	A	7.0	A	A
14	10.7	0.7	6.7	-0.1	0.0	0.0	0.0	1.9	A	7.0	A	A
15	11.0	0.4	3.6	2.5	0.3	0.6	0.3	1.1	A	4.0	A	A
16	12.5	0.7	5.3	17.1	1.7	2.6	1.8	1.8	N	5.7	A	N
17	10.7	0.4	3.7	-0.2	0.0	0.0	0.0	1.2	A	4.2	A	A
18	10.6	0.2	2.2	-0.9	-0.1	-0.3	0.1	0.8	A	2.9	A	A
19	11.5	0.3	2.7	7.6	0.8	2.2	0.8	1.0	A	3.3	A	A
20	10.6	0.3	3.0	-0.9	-0.1	-0.3	0.1	1.0	A	3.6	A	A
21	9.8	0.6	6.1	-8.2	-0.8	-1.4	0.9	1.6	A	6.4	A	A
23	11.0	0.4	4.0	2.8	0.3	0.6	0.3	1.2	A	4.4	A	A
24	12.1	0.2	1.9	12.7	1.3	4.5	1.4	0.8	N	2.7	A	W
26	9.1	0.5	5.5	-15.0	-1.5	-3.0	1.6	1.4	N	5.8	A	W
27	9.5	0.5	5.4	-11.2	-1.1	-2.2	1.2	1.4	A	5.7	A	A
29	10.6	0.6	5.7	-0.9	-0.1	-0.2	0.1	1.6	A	6.0	A	A
30	10.1	0.4	4.0	-5.6	-0.6	-1.3	0.6	1.2	A	4.4	A	A
31	10.8	0.5	4.5	0.7	0.1	0.1	0.1	1.3	A	4.8	A	A
32	10.3	0.5	4.9	-3.7	-0.4	-0.7	0.4	1.4	A	5.2	A	A
33	10.2	0.2	1.7	-4.9	-0.5	-2.0	0.5	0.7	A	2.5	A	A
34	20.7	0.6	3.0	93.3	9.3	15.3	10.0	1.7	N	3.5	A	N
35	9.0	0.6	6.1	-15.9	-1.6	-2.9	1.7	1.5	N	6.4	A	N
36	1023.6	34.4	3.4	9466.7	946.7	29.5	1012.9	88.7	N	3.8	A	N
37	11.1	0.6	4.9	4.1	0.4	0.8	0.4	1.5	A	5.3	A	A
39	10.5	0.3	3.0	-1.9	-0.2	-0.5	0.2	1.0	A	3.6	A	A
40	10.9	0.2	1.4	1.4	0.1	0.6	0.2	0.6	A	2.3	A	A
41	10.7	0.3	3.0	0.0	0.0	0.0	0.0	1.0	A	3.5	A	A
42	10.9	0.3	2.8	1.9	0.2	0.6	0.2	0.9	A	3.3	A	A
43	10.7	0.3	2.8	0.0	0.0	0.0	0.0	0.9	A	3.4	A	A
44	9.9	0.5	5.1	-7.5	-0.7	-1.5	0.8	1.4	A	5.4	A	A
45	10.7	0.5	4.4	-0.4	0.0	-0.1	0.0	1.3	A	4.8	A	A
46	10.6	0.3	3.2	-0.9	-0.1	-0.2	0.1	1.0	A	3.7	A	A
47	10.5	0.2	1.9	-1.9	-0.2	-0.7	0.2	0.7	A	2.7	A	A
48	10.2	0.5	5.1	-4.3	-0.4	-0.8	0.5	1.4	A	5.4	A	A
49	10.8	0.6	5.6	0.9	0.1	0.2	0.1	1.6	A	5.9	A	A
50	9.8	0.7	7.3	-8.5	-0.9	-1.2	0.9	1.9	A	7.5	A	A
51	10.9	0.4	3.7	1.9	0.2	0.4	0.2	1.2	A	4.1	A	A
52	10.8	0.6	5.6	0.7	0.1	0.1	0.1	1.6	A	5.9	A	A
53	11.0	0.7	5.9	2.9	0.3	0.5	0.3	1.8	A	6.2	A	A
54	9.8	0.5	5.1	-8.4	-0.8	-1.7	0.9	1.4	A	5.4	A	A
55	10.1	0.3	3.0	-5.6	-0.6	-1.7	0.6	0.9	A	3.5	A	A
56	10.7	0.6	5.7	0.4	0.0	0.1	0.0	1.7	A	6.0	A	A
57	9.8	1.1	11.3	-8.7	-0.9	-0.8	0.9	2.9	A	11.4	A	A

a Relative uncertainty of the reported result at k = 1 coverage factor

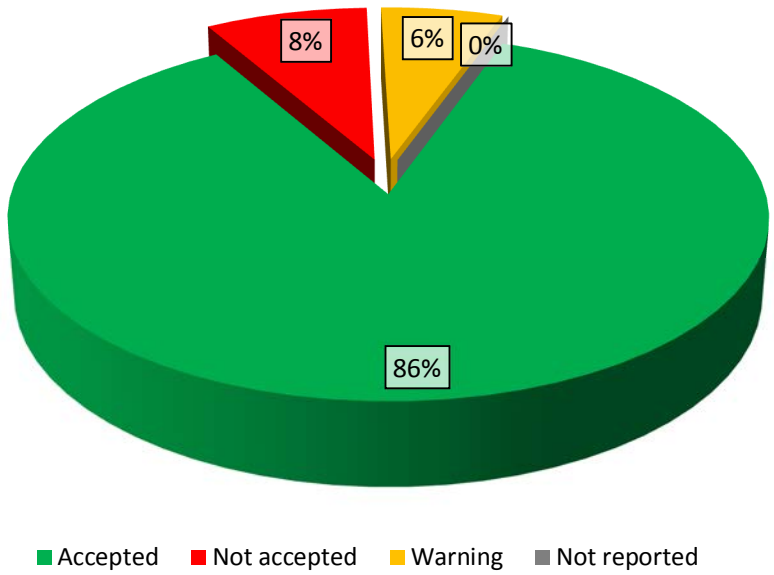

FIG. 35. Distribution of the scores for Ba-133 in water (sample 01).

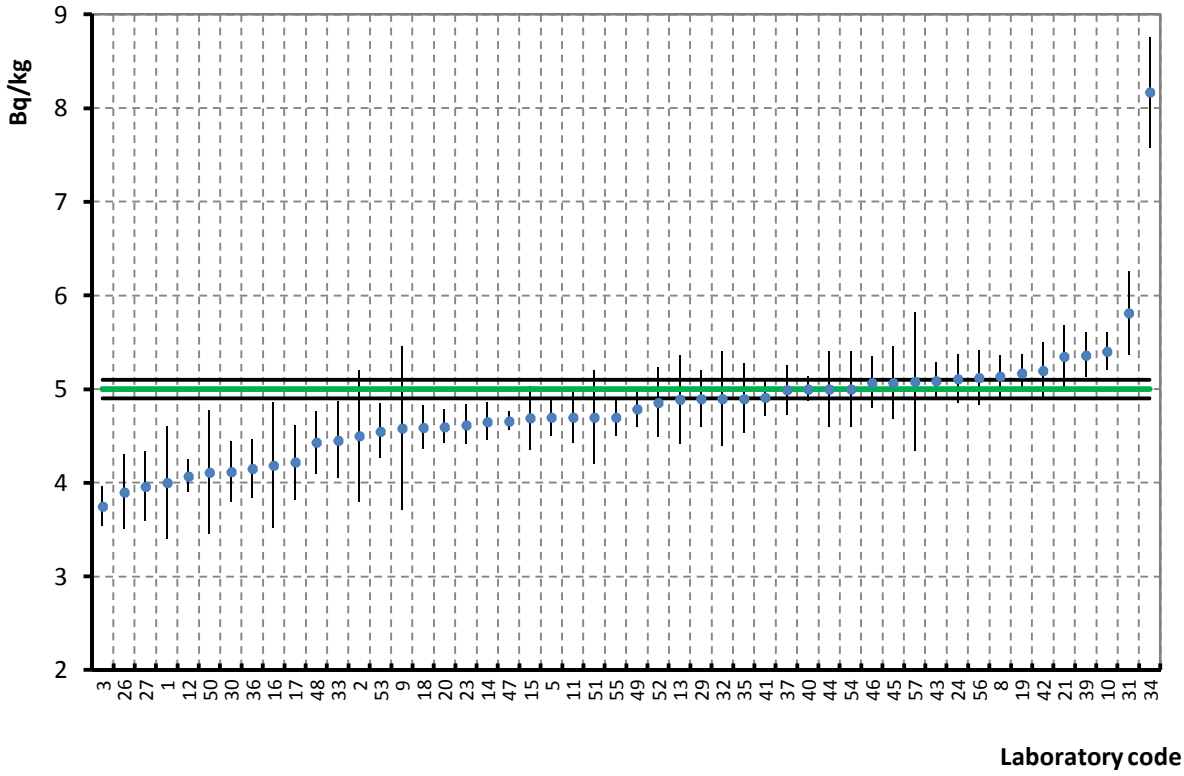

FIG. 36. Reported results and their uncertainties for Ba-133 in water (sample 01).

TABLE 21. PERFORMANCE EVALAUTION OF DETERMINATION OF Ba-133 IN WATER (SAMPLE 01)

Target value: 5.0 ± 0.1 Bq/kg
MAB: 20 %
LAP: 20 %

Laboratory code	Reported values		Unc[a]	Bias [%]	Z-Score	U-Score	A1	A2	Score for trueness	Precision	Score for Precision	Final score
	a, Bq/kg	u, Bq/kg	[%]									
1	4.0	0.6	15.0	-20.0	-2.0	-1.6	1.0	1.6	A	15.1	A	A
2	4.5	0.7	15.6	-10.0	-1.0	-0.7	0.5	1.8	A	15.7	A	A
3	3.8	0.2	5.6	-25.0	-2.5	-5.4	1.3	0.6	N	5.9	A	N
5	4.7	0.2	4.3	-6.0	-0.6	-1.3	0.3	0.6	A	4.7	A	A
8	5.1	0.2	4.3	2.8	0.3	0.6	0.1	0.6	A	4.7	A	A
9	4.6	0.9	19.0	-8.4	-0.8	-0.5	0.4	2.3	A	19.1	A	A
10	5.4	0.2	3.7	8.0	0.8	1.8	0.4	0.6	A	4.2	A	A
11	4.7	0.3	6.0	-6.0	-0.6	-1.0	0.3	0.8	A	6.3	A	A
12	4.1	0.2	4.2	-18.6	-1.9	-4.7	0.9	0.5	N	4.6	A	W
13	4.9	0.5	9.6	-2.2	-0.2	-0.2	0.1	1.2	A	9.8	A	A
14	4.7	0.2	4.3	-7.0	-0.7	-1.6	0.4	0.6	A	4.7	A	A
15	4.7	0.3	7.2	-6.2	-0.6	-0.9	0.3	0.9	A	7.5	A	A
16	4.2	0.7	16.0	-16.3	-1.6	-1.2	0.8	1.7	A	16.1	A	A
17	4.2	0.4	9.5	-15.6	-1.6	-1.9	0.8	1.1	A	9.7	A	A
18	4.6	0.2	5.0	-8.2	-0.8	-1.6	0.4	0.6	A	5.4	A	A
19	5.2	0.2	3.9	3.4	0.3	0.8	0.2	0.6	A	4.4	A	A
20	4.6	0.2	3.9	-8.0	-0.8	-1.9	0.4	0.5	A	4.4	A	A
21	5.4	0.3	6.2	7.0	0.7	1.0	0.4	0.9	A	6.5	A	A
23	4.6	0.2	4.5	-7.6	-0.8	-1.6	0.4	0.6	A	5.0	A	A
24	5.1	0.3	5.1	2.2	0.2	0.4	0.1	0.7	A	5.5	A	A
26	3.9	0.4	10.3	-22.0	-2.2	-2.7	1.1	1.1	N	10.4	A	N
27	4.0	0.4	9.3	-20.8	-2.1	-2.7	1.0	1.0	N	9.6	A	N
29	4.9	0.3	6.1	-2.0	-0.2	-0.3	0.1	0.8	A	6.4	A	A
30	4.1	0.3	7.8	-17.6	-1.8	-2.6	0.9	0.9	N	8.0	A	W
31	5.8	0.5	7.7	16.2	1.6	1.8	0.8	1.2	A	8.0	A	A
32	4.9	0.5	10.2	-2.0	-0.2	-0.2	0.1	1.3	A	10.4	A	A
33	4.5	0.4	9.2	-11.0	-1.1	-1.3	0.6	1.1	A	9.4	A	A
34	8.2	0.6	7.2	63.4	6.3	5.3	3.2	1.5	N	7.5	A	N
35	4.9	0.4	7.6	-2.0	-0.2	-0.3	0.1	1.0	A	7.8	A	A
36	4.2	0.3	7.5	-17.0	-1.7	-2.6	0.9	0.8	N	7.7	A	W
37	5.0	0.3	5.2	-0.2	0.0	0.0	0.0	0.7	A	5.6	A	A
39	5.4	0.2	4.5	7.2	0.7	1.4	0.4	0.7	A	4.9	A	A
40	5.0	0.1	2.6	0.0	0.0	0.0	0.0	0.4	A	3.3	A	A
41	4.9	0.2	4.1	-1.8	-0.2	-0.4	0.1	0.6	A	4.5	A	A
42	5.2	0.3	5.8	4.0	0.4	0.6	0.2	0.8	A	6.1	A	A
43	5.1	0.2	3.7	1.8	0.2	0.4	0.1	0.6	A	4.2	A	A
44	5.0	0.4	8.0	0.0	0.0	0.0	0.0	1.1	A	8.2	A	A
45	5.1	0.4	7.7	1.4	0.1	0.2	0.1	1.0	A	7.9	A	A
46	5.1	0.3	5.4	1.3	0.1	0.2	0.1	0.8	A	5.8	A	A
47	4.7	0.1	2.1	-6.8	-0.7	-2.4	0.3	0.4	A	2.9	A	A
48	4.4	0.3	7.4	-11.4	-1.1	-1.7	0.6	0.9	A	7.7	A	A
49	4.8	0.2	4.2	-4.2	-0.4	-0.9	0.2	0.6	A	4.6	A	A
50	4.1	0.7	16.1	-17.8	-1.8	-1.3	0.9	1.7	A	16.2	A	A
51	4.7	0.5	10.6	-6.0	-0.6	-0.6	0.3	1.3	A	10.8	A	A
52	4.9	0.4	7.6	-2.9	-0.3	-0.4	0.1	1.0	A	7.9	A	A
53	4.6	0.3	6.4	-9.0	-0.9	-1.5	0.5	0.8	A	6.7	A	A
54	5.0	0.4	8.0	0.0	0.0	0.0	0.0	1.1	A	8.2	A	A
55	4.7	0.2	4.3	-6.0	-0.6	-1.3	0.3	0.6	A	4.7	A	A
56	5.1	0.3	5.7	2.4	0.2	0.4	0.1	0.8	A	6.0	A	A
57	5.1	0.7	14.6	1.6	0.2	0.1	0.1	1.9	A	14.7	A	A

a Relative uncertainty of the reported result at k = 1 coverage factor

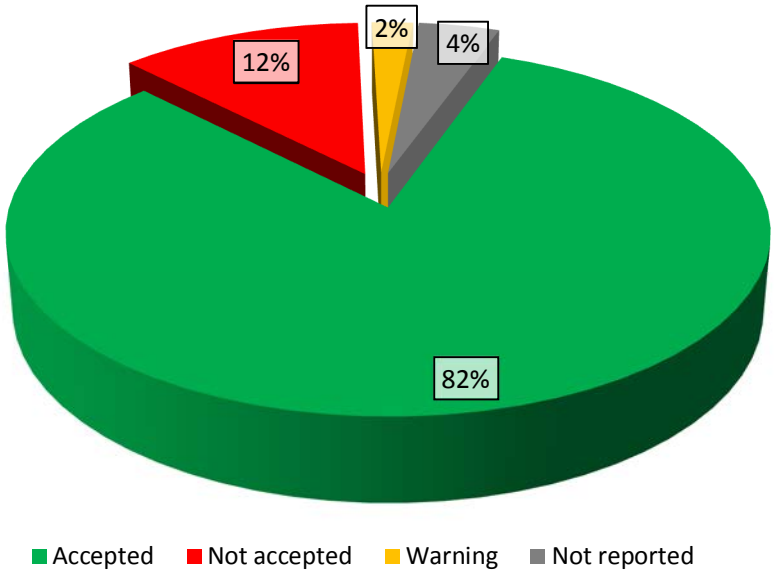

FIG. 37. Distribution of the scores for Ba-133 in water (sample 02).

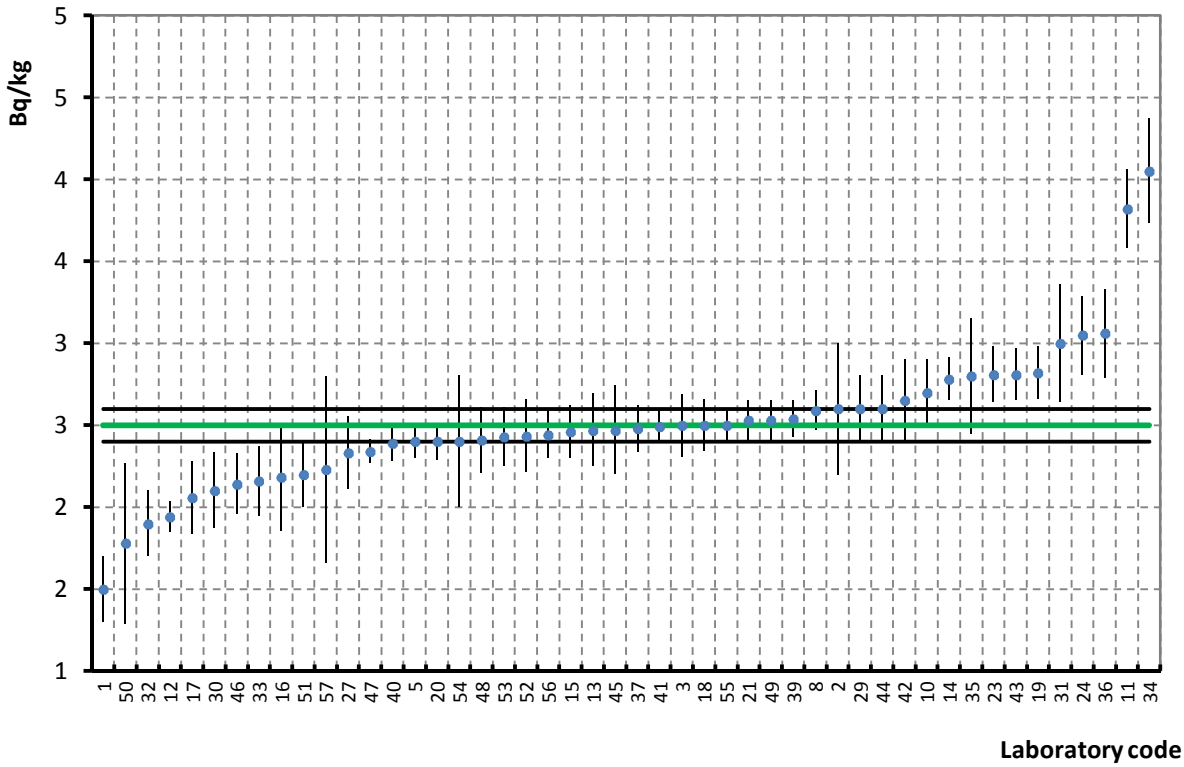

FIG. 38. Reported results and their uncertainties for Ba-133 in water (sample 02).

TABLE 22. PERFORMANCE EVALUATION OF DETERMIANTIONOF Ba-133 IN WATER (SAMPLE 02)

Target value: 2.5 ± 0.1 Bq/kg
MAB: 20 %
LAP: 20 %

Laboratory code	Reported values		Unc[a]	Bias [%]	Z-Score	U-Score	A1	A2	Score for trueness	Precision	Score for Precision	Final score
	a, Bq/kg	u, Bq/kg	[%]									
1	1.5	0.2	13.3	-40.0	-4.0	-4.5	1.0	0.6	N	13.9	A	N
2	2.6	0.4	15.4	4.0	0.4	0.2	0.1	1.1	A	15.9	A	A
3	2.5	0.2	7.6	0.0	0.0	0.0	0.0	0.6	A	8.6	A	A
5	2.4	0.1	4.2	-4.0	-0.4	-0.7	0.1	0.4	A	5.8	A	A
8	2.6	0.1	4.6	3.6	0.4	0.6	0.1	0.4	A	6.1	A	A
10	2.7	0.2	7.4	8.0	0.8	0.9	0.2	0.6	A	8.4	A	A
11	3.8	0.2	6.3	52.8	5.3	5.1	1.3	0.7	N	7.4	A	N
12	1.9	0.1	4.7	-22.4	-2.2	-4.1	0.6	0.4	N	6.2	A	N
13	2.5	0.2	8.9	-1.2	-0.1	-0.1	0.0	0.6	A	9.8	A	A
14	2.8	0.1	4.7	11.2	1.1	1.7	0.3	0.4	A	6.2	A	A
15	2.5	0.2	6.5	-1.6	-0.2	-0.2	0.0	0.5	A	7.6	A	A
16	2.2	0.3	15.0	-12.7	-1.3	-0.9	0.3	0.9	A	15.5	A	A
17	2.1	0.2	10.7	-17.6	-1.8	-1.8	0.4	0.6	A	11.4	A	A
18	2.5	0.2	6.3	0.0	0.0	0.0	0.0	0.5	A	7.5	A	A
19	2.8	0.2	5.7	12.8	1.3	1.7	0.3	0.5	A	6.9	A	A
20	2.4	0.1	4.6	-4.0	-0.4	-0.7	0.1	0.4	A	6.1	A	A
21	2.5	0.1	4.7	1.2	0.1	0.2	0.0	0.4	A	6.2	A	A
23	2.8	0.2	6.0	12.4	1.2	1.6	0.3	0.5	A	7.3	A	A
24	3.1	0.2	7.9	22.0	2.2	2.1	0.6	0.7	A	8.8	A	A
27	2.3	0.2	9.4	-6.8	-0.7	-0.7	0.2	0.6	A	10.3	A	A
29	2.6	0.2	7.7	4.0	0.4	0.4	0.1	0.6	A	8.7	A	A
30	2.1	0.2	11.0	-16.0	-1.6	-1.6	0.4	0.6	A	11.7	A	A
31	3.0	0.4	12.0	20.0	2.0	1.3	0.5	1.0	A	12.6	A	A
32	1.9	0.2	10.5	-24.0	-2.4	-2.7	0.6	0.6	N	11.3	A	N
33	2.2	0.2	9.7	-13.6	-1.4	-1.5	0.3	0.6	A	10.5	A	A
34	4.1	0.3	7.9	62.0	6.2	4.6	1.6	0.9	N	8.9	A	N
35	2.8	0.4	12.5	12.0	1.2	0.8	0.3	0.9	A	13.1	A	A
36	3.1	0.3	8.8	22.4	2.2	1.9	0.6	0.7	A	9.7	A	A
37	2.5	0.1	5.6	-0.8	-0.1	-0.1	0.0	0.4	A	6.9	A	A
39	2.5	0.1	4.3	1.6	0.2	0.3	0.0	0.4	A	5.9	A	A
40	2.4	0.1	4.6	-4.4	-0.4	-0.7	0.1	0.4	A	6.1	A	A
41	2.5	0.1	4.0	-0.4	0.0	-0.1	0.0	0.4	A	5.7	A	A
42	2.7	0.3	9.4	6.0	0.6	0.6	0.2	0.7	A	10.2	A	A
43	2.8	0.2	5.7	12.4	1.2	1.6	0.3	0.5	A	7.0	A	A
44	2.6	0.2	7.7	4.0	0.4	0.4	0.1	0.6	A	8.7	A	A
45	2.5	0.3	10.9	-1.2	-0.1	-0.1	0.0	0.7	A	11.6	A	A
46	2.1	0.2	8.6	-14.4	-1.4	-1.7	0.4	0.5	A	9.4	A	A
47	2.3	0.1	3.0	-6.4	-0.6	-1.3	0.2	0.3	A	5.0	A	A
48	2.4	0.2	8.3	-3.6	-0.4	-0.4	0.1	0.6	A	9.2	A	A
49	2.5	0.1	4.7	1.2	0.1	0.2	0.0	0.4	A	6.2	A	A
50	1.8	0.5	27.5	-28.8	-2.9	-1.4	0.7	1.3	A	27.8	N	N
51	2.2	0.2	9.1	-12.0	-1.2	-1.3	0.3	0.6	A	9.9	A	A
52	2.4	0.2	9.0	-2.6	-0.3	-0.3	0.1	0.6	A	9.9	A	A
53	2.4	0.2	7.4	-2.8	-0.3	-0.3	0.1	0.5	A	8.4	A	A
54	2.4	0.4	16.7	-4.0	-0.4	-0.2	0.1	1.1	A	17.1	A	A
55	2.5	0.1	4.0	0.0	0.0	0.0	0.0	0.4	A	5.7	A	A
56	2.4	0.1	5.7	-2.4	-0.2	-0.3	0.1	0.4	A	7.0	A	A
57	2.2	0.6	25.6	-10.8	-1.1	-0.5	0.3	1.5	A	25.9	N	W

a Relative uncertainty of the reported result at k = 1 coverage factor

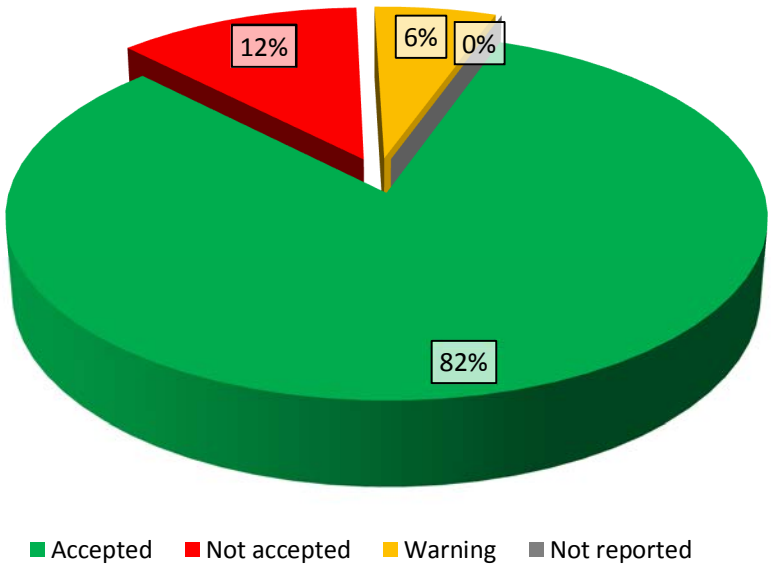

FIG. 39. Distribution of the scores for Ba-133 in water (sample 03).

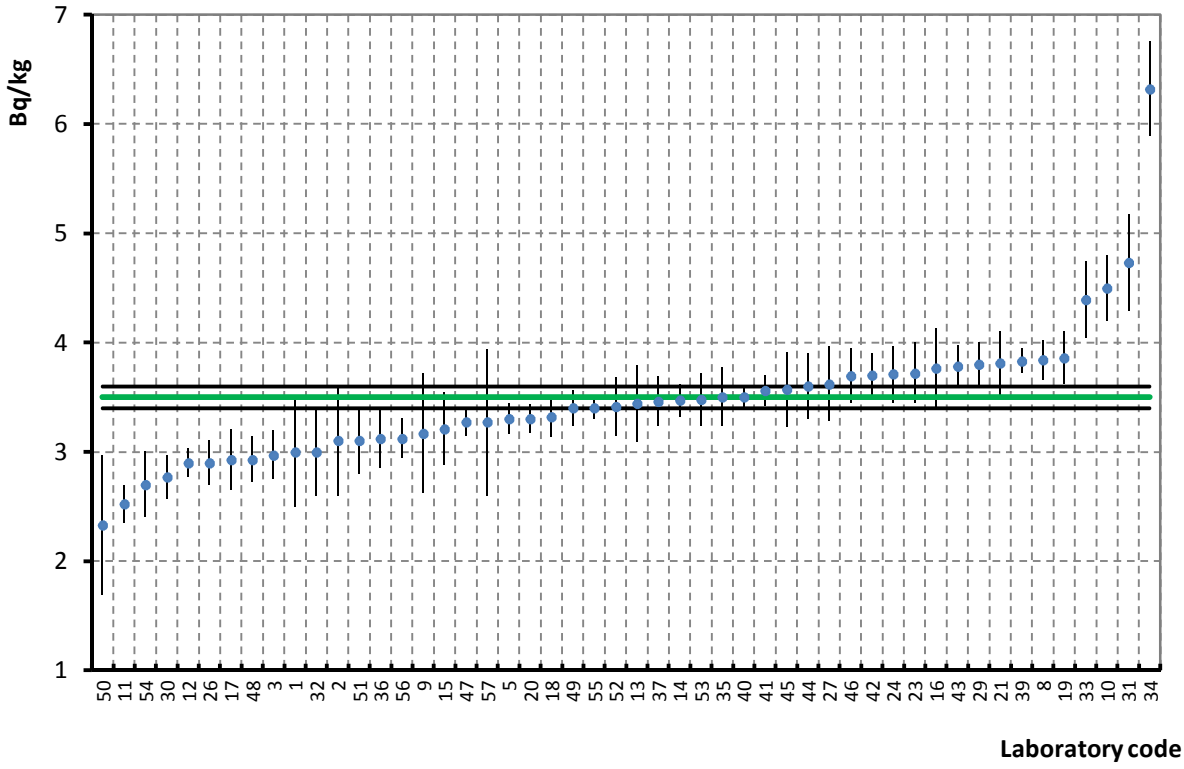

FIG. 40. Reported results and their uncertainties for Ba-133 in water (sample 03).

TABLE 23. PERFORMANCE EVALUATION OF DETERMINATION OF Ba-133 IN WATER (SAMPLE 03)

Target value: 3.5 ± 0.1 Bq/kg
MAB: 20 %
LAP: 20 %

Laboratory code	Reported values		Unc[a]	Bias [%]	Z-Score	U-Score	A1	A2	Score for trueness	Precision	Score for Precision	Final score
	a, Bq/kg	u, Bq/kg	[%]									
1	3.0	0.5	16.7	-14.3	-1.4	-1.0	0.5	1.3	A	16.9	A	A
2	3.1	0.5	16.1	-11.4	-1.1	-0.8	0.4	1.3	A	16.4	A	A
3	3.0	0.2	7.4	-15.1	-1.5	-2.2	0.5	0.6	A	7.9	A	A
5	3.3	0.1	4.2	-5.7	-0.6	-1.2	0.2	0.4	A	5.1	A	A
8	3.8	0.2	4.7	9.7	1.0	1.7	0.3	0.5	A	5.5	A	A
9	3.2	0.6	17.4	-9.4	-0.9	-0.6	0.3	1.4	A	17.6	A	A
10	4.5	0.3	6.7	28.6	2.9	3.2	1.0	0.8	N	7.3	A	N
11	2.5	0.2	6.7	-28.0	-2.8	-5.0	1.0	0.5	N	7.3	A	N
12	2.9	0.1	4.5	-17.1	-1.7	-3.7	0.6	0.4	N	5.3	A	W
13	3.4	0.4	10.2	-1.7	-0.2	-0.2	0.1	0.9	A	10.6	A	A
14	3.5	0.2	4.3	-0.9	-0.1	-0.2	0.0	0.5	A	5.2	A	A
15	3.2	0.3	10.3	-8.3	-0.8	-0.8	0.3	0.9	A	10.7	A	A
16	3.8	0.4	9.6	7.6	0.8	0.7	0.3	1.0	A	10.1	A	A
17	2.9	0.3	9.6	-16.3	-1.6	-1.9	0.6	0.8	A	10.0	A	A
18	3.3	0.2	5.6	-5.1	-0.5	-0.9	0.2	0.5	A	6.3	A	A
19	3.9	0.2	6.2	10.3	1.0	1.4	0.4	0.7	A	6.8	A	A
20	3.3	0.1	3.9	-5.7	-0.6	-1.2	0.2	0.4	A	4.9	A	A
21	3.8	0.3	7.6	8.9	0.9	1.0	0.3	0.8	A	8.1	A	A
23	3.7	0.3	7.5	6.3	0.6	0.7	0.2	0.8	A	8.1	A	A
24	3.7	0.3	7.0	6.0	0.6	0.8	0.2	0.7	A	7.6	A	A
26	2.9	0.2	6.9	-17.1	-1.7	-2.7	0.6	0.6	N	7.5	A	W
27	3.6	0.3	9.4	3.4	0.3	0.3	0.1	0.9	A	9.8	A	A
29	3.8	0.2	5.3	8.6	0.9	1.3	0.3	0.6	A	6.0	A	A
30	2.8	0.2	7.2	-20.9	-2.1	-3.3	0.7	0.6	N	7.8	A	N
31	4.7	0.4	9.3	35.1	3.5	2.7	1.2	1.2	N	9.7	A	N
32	3.0	0.4	13.3	-14.3	-1.4	-1.2	0.5	1.1	A	13.6	A	A
33	4.4	0.4	8.0	25.4	2.5	2.4	0.9	0.9	A	8.5	A	A
34	6.3	0.4	6.8	80.6	8.1	6.4	2.8	1.1	N	7.4	A	N
35	3.5	0.3	7.7	0.0	0.0	0.0	0.0	0.7	A	8.2	A	A
36	3.1	0.3	8.7	-10.9	-1.1	-1.3	0.4	0.7	A	9.1	A	A
37	3.5	0.2	6.6	-1.1	-0.1	-0.2	0.0	0.6	A	7.2	A	A
39	3.8	0.1	2.9	9.4	0.9	2.2	0.3	0.4	A	4.1	A	A
40	3.5	0.1	2.9	0.0	0.0	0.0	0.0	0.4	A	4.0	A	A
41	3.6	0.1	3.9	1.7	0.2	0.3	0.1	0.4	A	4.9	A	A
42	3.7	0.2	5.4	5.7	0.6	0.9	0.2	0.6	A	6.1	A	A
43	3.8	0.2	5.0	8.0	0.8	1.3	0.3	0.6	A	5.8	A	A
44	3.6	0.3	8.3	2.9	0.3	0.3	0.1	0.8	A	8.8	A	A
45	3.6	0.3	9.5	2.0	0.2	0.2	0.1	0.9	A	9.9	A	A
46	3.7	0.3	6.8	5.5	0.5	0.7	0.2	0.7	A	7.3	A	A
47	3.3	0.1	3.7	-6.6	-0.7	-1.5	0.2	0.4	A	4.7	A	A
48	2.9	0.2	7.2	-16.3	-1.6	-2.5	0.6	0.6	A	7.7	A	A
49	3.4	0.2	4.7	-2.9	-0.3	-0.5	0.1	0.5	A	5.5	A	A
50	2.3	0.6	27.5	-33.4	-3.3	-1.8	1.2	1.7	A	27.6	N	N
51	3.1	0.3	9.7	-11.4	-1.1	-1.3	0.4	0.8	A	10.1	A	A
52	3.4	0.3	7.9	-2.5	-0.2	-0.3	0.1	0.7	A	8.4	A	A
53	3.5	0.2	6.9	-0.6	-0.1	-0.1	0.0	0.7	A	7.5	A	A
54	2.7	0.3	11.1	-22.9	-2.3	-2.5	0.8	0.8	A	11.5	A	A
55	3.4	0.1	2.9	-2.9	-0.3	-0.7	0.1	0.4	A	4.1	A	A
56	3.1	0.2	5.8	-10.9	-1.1	-1.8	0.4	0.5	A	6.4	A	A
57	3.3	0.7	20.5	-6.6	-0.7	-0.3	0.2	1.7	A	20.7	N	W

a Relative uncertainty of the reported result at k = 1 coverage factor

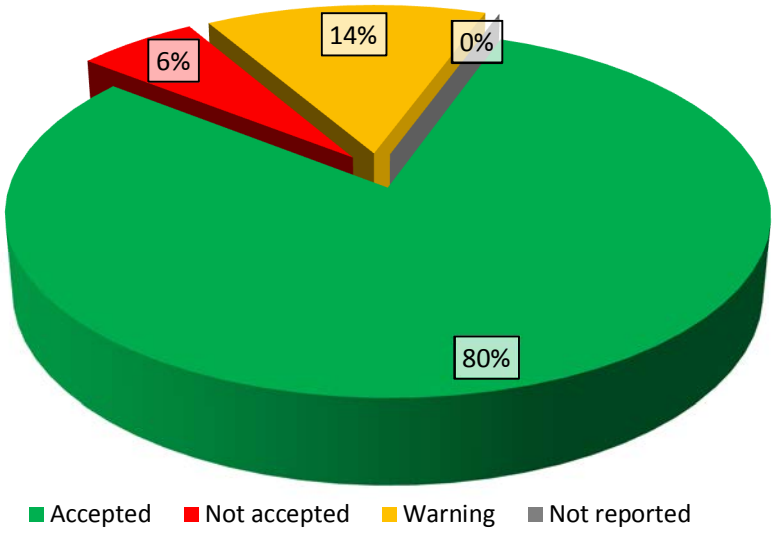

FIG. 41. Distribution of the scores for Cs-134 in water (sample 01).

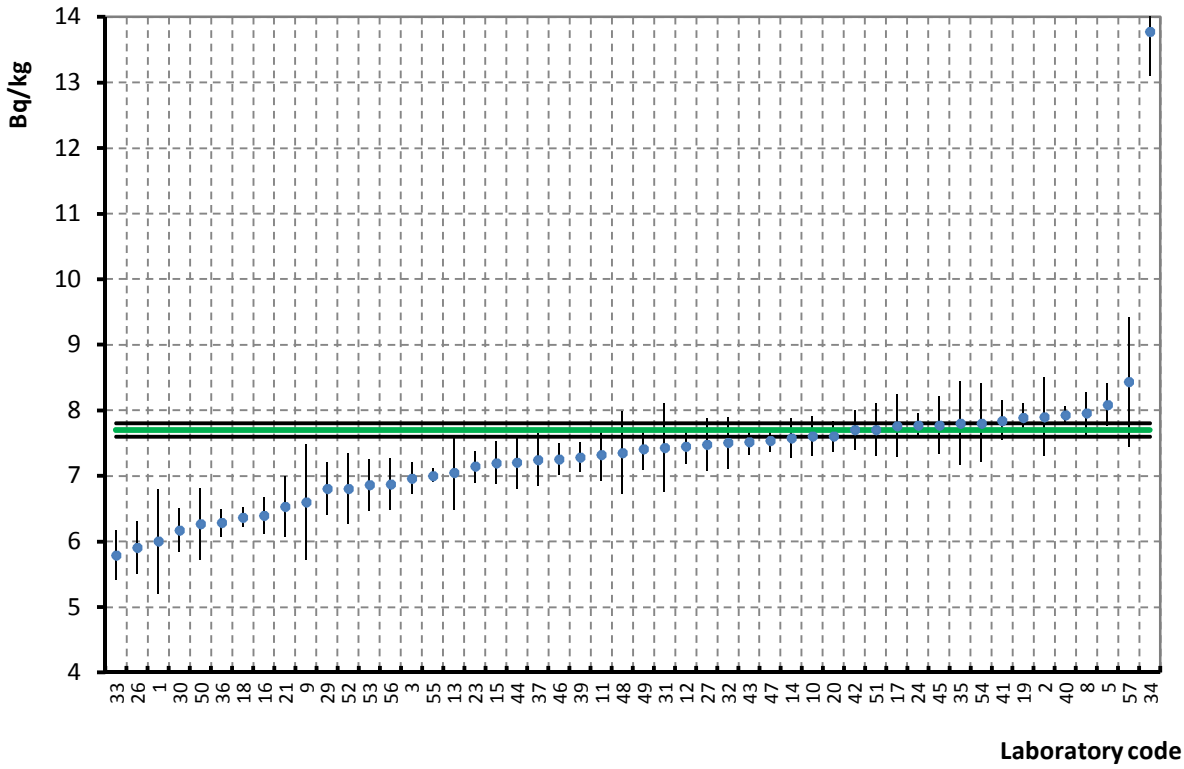

FIG. 42. Reported results and their uncertainties for Cs-134 in water (sample 01).

TABLE 24. PERFORMANCE EVALUATION OF DETERMINATION OF Cs-134 IN WATER (SAMPLE 01)

Target value: 7.7 ± 0.1 Bq/kg
MAB: 20 %
LAP: 20 %

Laboratory code	Reported values		Unc[a]	Bias [%]	Z-Score	U-Score	A1	A2	Score for trueness	Precision	Score for Precision	Final score
	a, Bq/kg	u, Bq/kg	[%]									
1	6.0	0.8	13.3	-22.1	-2.2	-2.1	1.7	2.1	A	13.4	A	A
2	7.9	0.6	7.6	2.6	0.3	0.3	0.2	1.6	A	7.7	A	A
3	7.0	0.2	3.4	-9.6	-1.0	-2.8	0.7	0.7	N	3.7	A	W
5	8.1	0.3	4.0	4.9	0.5	1.1	0.4	0.9	A	4.2	A	A
8	8.0	0.3	4.2	3.2	0.3	0.7	0.3	0.9	A	4.3	A	A
9	6.6	0.9	13.3	-14.3	-1.4	-1.2	1.1	2.3	A	13.4	A	A
10	7.6	0.3	3.9	-1.3	-0.1	-0.3	0.1	0.8	A	4.2	A	A
11	7.3	0.4	5.3	-4.9	-0.5	-0.9	0.4	1.0	A	5.5	A	A
12	7.5	0.3	3.6	-3.2	-0.3	-0.9	0.3	0.7	A	3.8	A	A
13	7.1	0.6	8.1	-8.4	-0.8	-1.1	0.7	1.5	A	8.2	A	A
14	7.6	0.3	4.0	-1.7	-0.2	-0.4	0.1	0.8	A	4.2	A	A
15	7.2	0.3	4.5	-6.6	-0.7	-1.5	0.5	0.9	A	4.6	A	A
16	6.4	0.3	4.3	-17.1	-1.7	-4.5	1.3	0.8	N	4.5	A	W
17	7.8	0.5	6.2	0.8	0.1	0.1	0.1	1.3	A	6.3	A	A
18	6.4	0.1	2.3	-17.4	-1.7	-7.6	1.3	0.5	N	2.6	A	W
19	7.9	0.2	2.8	2.5	0.2	0.8	0.2	0.6	A	3.1	A	A
20	7.6	0.2	3.0	-1.3	-0.1	-0.4	0.1	0.6	A	3.3	A	A
21	6.5	0.5	7.0	-15.2	-1.5	-2.5	1.2	1.2	A	7.2	A	A
23	7.1	0.2	3.4	-7.3	-0.7	-2.2	0.6	0.7	A	3.6	A	A
24	7.8	0.2	2.3	0.9	0.1	0.3	0.1	0.5	A	2.7	A	A
26	5.9	0.4	6.8	-23.4	-2.3	-4.4	1.8	1.1	N	6.9	A	N
27	7.5	0.4	5.3	-2.9	-0.3	-0.5	0.2	1.1	A	5.5	A	A
29	6.8	0.4	5.9	-11.7	-1.2	-2.2	0.9	1.1	A	6.0	A	A
30	6.2	0.3	5.3	-19.9	-2.0	-4.4	1.5	0.9	N	5.5	A	W
31	7.4	0.7	9.2	-3.5	-0.4	-0.4	0.3	1.8	A	9.2	A	A
32	7.5	0.4	5.3	-2.6	-0.3	-0.5	0.2	1.1	A	5.5	A	A
33	5.8	0.4	6.6	-24.8	-2.5	-4.9	1.9	1.0	N	6.7	A	N
34	13.8	0.7	4.9	78.8	7.9	8.8	6.1	1.8	N	5.1	A	N
35	7.8	0.6	8.2	1.3	0.1	0.2	0.1	1.7	A	8.3	A	A
36	6.3	0.2	3.3	-18.4	-1.8	-6.1	1.4	0.6	N	3.6	A	W
37	7.2	0.4	5.5	-6.0	-0.6	-1.1	0.5	1.1	A	5.7	A	A
39	7.3	0.2	3.0	-5.5	-0.5	-1.7	0.4	0.6	A	3.3	A	A
40	7.9	0.1	1.8	2.9	0.3	1.3	0.2	0.4	A	2.2	A	A
41	7.8	0.3	3.8	1.8	0.2	0.4	0.1	0.8	A	4.0	A	A
42	7.7	0.3	3.9	0.0	0.0	0.0	0.0	0.8	A	4.1	A	A
43	7.5	0.2	2.5	-2.5	-0.2	-0.9	0.2	0.6	A	2.8	A	A
44	7.2	0.4	5.6	-6.5	-0.6	-1.2	0.5	1.1	A	5.7	A	A
45	7.8	0.4	5.7	0.9	0.1	0.2	0.1	1.2	A	5.8	A	A
46	7.2	0.2	3.3	-5.9	-0.6	-1.8	0.5	0.7	A	3.5	A	A
47	7.5	0.2	2.1	-2.2	-0.2	-0.9	0.2	0.5	A	2.5	A	A
48	7.4	0.6	8.6	-4.5	-0.5	-0.5	0.4	1.6	A	8.7	A	A
49	7.4	0.3	4.3	-3.8	-0.4	-0.9	0.3	0.9	A	4.5	A	A
50	6.3	0.5	8.6	-18.7	-1.9	-2.6	1.4	1.4	N	8.7	A	W
51	7.7	0.4	5.2	0.0	0.0	0.0	0.0	1.1	A	5.4	A	A
52	6.8	0.5	7.9	-11.6	-1.2	-1.6	0.9	1.4	A	8.0	A	A
53	6.9	0.4	5.7	-10.9	-1.1	-2.1	0.8	1.0	A	5.8	A	A
54	7.8	0.6	7.7	1.3	0.1	0.2	0.1	1.6	A	7.8	A	A
55	7.0	0.1	1.4	-9.1	-0.9	-4.9	0.7	0.4	N	1.9	A	W
56	6.9	0.4	5.7	-10.8	-1.1	-2.1	0.8	1.0	A	5.8	A	A
57	8.4	1.0	11.7	9.5	0.9	0.7	0.7	2.6	A	11.8	A	A

a Relative uncertainty of the reported result at k = 1 coverage factor

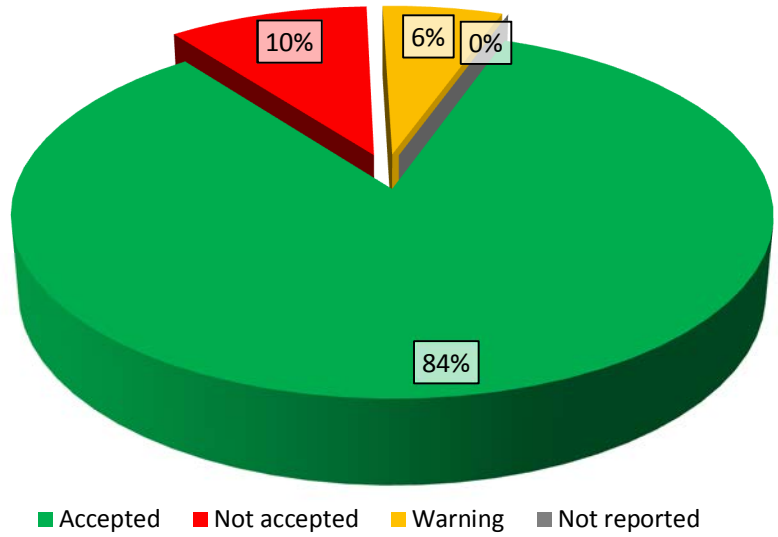

FIG. 43. Distribution of the scores for Cs-134 in water (sample 02).

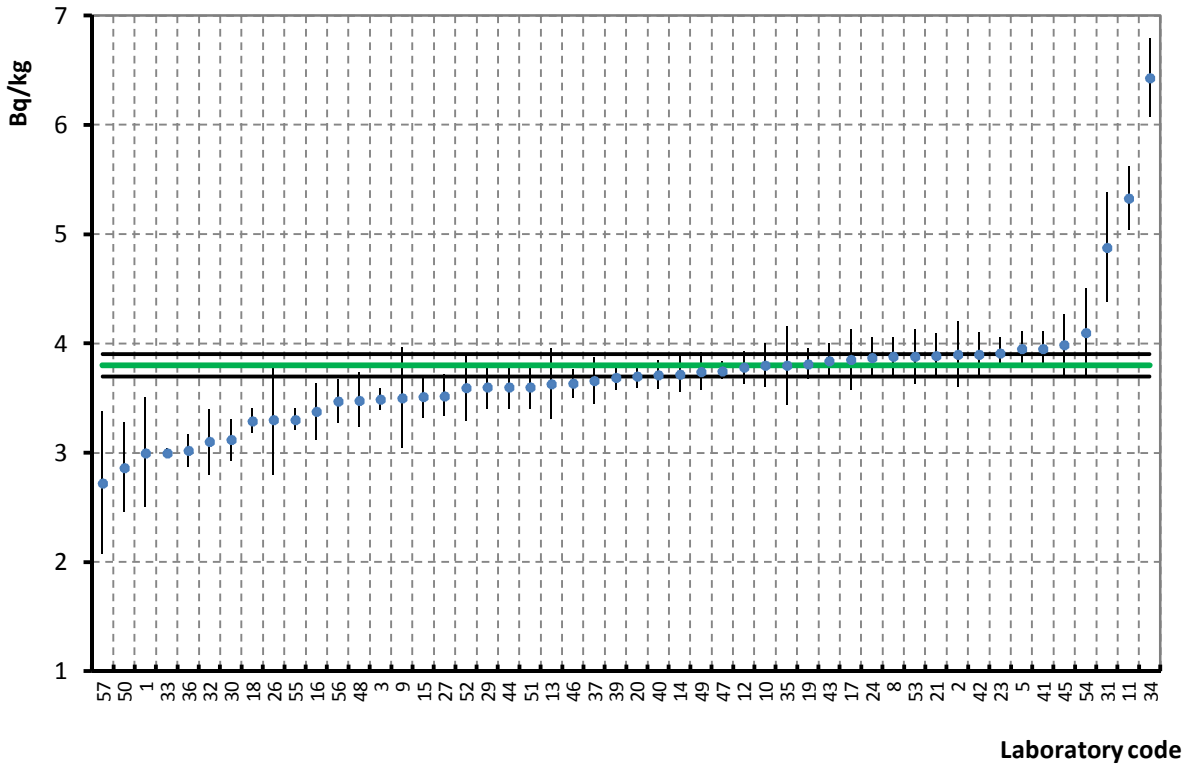

FIG. 44. Reported results and their uncertainties for Cs-134 in water (sample 02).

TABLE 25. PERFORMANCE EVALUATION OF DETERMINATION OF Cs-134 IN WATER (SAMPLE 02)

Target value: 3.8 ± 0.1 Bq/kg
MAB: 20 %
LAP: 20 %

Laboratory code	Reported values		Unc[a]	Bias [%]	Z-Score	U-Score	A1	A2	Score for trueness	Precision	Score for Precision	Final score
	a, Bq/kg	u, Bq/kg	[%]									
1	3.0	0.5	16.7	-21.1	-2.1	-1.6	0.8	1.3	A	16.9	A	A
2	3.9	0.3	7.7	2.6	0.3	0.3	0.1	0.8	A	8.1	A	A
3	3.5	0.1	2.8	-8.2	-0.8	-2.2	0.3	0.4	A	3.8	A	A
5	4.0	0.2	4.1	3.9	0.4	0.8	0.2	0.5	A	4.8	A	A
8	3.9	0.2	4.4	2.1	0.2	0.4	0.1	0.5	A	5.1	A	A
9	3.5	0.5	13.1	-7.9	-0.8	-0.6	0.3	1.2	A	13.4	A	A
10	3.8	0.2	5.3	0.0	0.0	0.0	0.0	0.6	A	5.9	A	A
11	5.3	0.3	5.4	40.3	4.0	5.0	1.5	0.8	N	6.0	A	N
12	3.8	0.2	4.0	-0.5	-0.1	-0.1	0.0	0.5	A	4.8	A	A
13	3.6	0.3	8.8	-4.5	-0.4	-0.5	0.2	0.9	A	9.2	A	A
14	3.7	0.2	4.3	-2.1	-0.2	-0.4	0.1	0.5	A	5.0	A	A
15	3.5	0.2	5.4	-7.6	-0.8	-1.4	0.3	0.6	A	6.0	A	A
16	3.4	0.3	7.7	-11.2	-1.1	-1.5	0.4	0.7	A	8.2	A	A
17	3.9	0.3	7.3	1.3	0.1	0.2	0.1	0.8	A	7.7	A	A
18	3.3	0.1	3.3	-13.4	-1.3	-3.4	0.5	0.4	N	4.3	A	W
19	3.8	0.1	3.7	0.3	0.0	0.1	0.0	0.4	A	4.5	A	A
20	3.7	0.1	3.0	-2.6	-0.3	-0.7	0.1	0.4	A	4.0	A	A
21	3.9	0.2	5.1	2.4	0.2	0.4	0.1	0.6	A	5.8	A	A
23	3.9	0.1	3.6	2.9	0.3	0.6	0.1	0.4	A	4.4	A	A
24	3.9	0.2	4.9	1.8	0.2	0.3	0.1	0.6	A	5.6	A	A
26	3.3	0.5	15.2	-13.2	-1.3	-1.0	0.5	1.3	A	15.4	A	A
27	3.5	0.2	5.4	-7.4	-0.7	-1.3	0.3	0.6	A	6.0	A	A
29	3.6	0.2	5.6	-5.3	-0.5	-0.9	0.2	0.6	A	6.1	A	A
30	3.1	0.2	6.1	-17.9	-1.8	-3.2	0.7	0.6	N	6.6	A	W
31	4.9	0.5	10.2	28.4	2.8	2.1	1.1	1.3	A	10.6	A	A
32	3.1	0.3	9.7	-18.4	-1.8	-2.2	0.7	0.8	A	10.0	A	A
33	3.0	0.0	1.0	-21.1	-2.1	-7.7	0.8	0.3	N	2.8	A	N
34	6.4	0.4	5.6	69.2	6.9	7.0	2.6	1.0	N	6.2	A	N
35	3.8	0.4	9.5	0.0	0.0	0.0	0.0	1.0	A	9.8	A	A
36	3.0	0.2	5.0	-20.5	-2.1	-4.3	0.8	0.5	N	5.6	A	N
37	3.7	0.2	5.7	-3.7	-0.4	-0.6	0.1	0.6	A	6.3	A	A
39	3.7	0.1	3.3	-2.9	-0.3	-0.7	0.1	0.4	A	4.2	A	A
40	3.7	0.1	3.5	-2.4	-0.2	-0.5	0.1	0.4	A	4.4	A	A
41	4.0	0.2	4.1	3.9	0.4	0.8	0.2	0.5	A	4.8	A	A
42	3.9	0.2	5.1	2.6	0.3	0.4	0.1	0.6	A	5.8	A	A
43	3.8	0.2	4.2	1.1	0.1	0.2	0.0	0.5	A	4.9	A	A
44	3.6	0.2	5.6	-5.3	-0.5	-0.9	0.2	0.6	A	6.1	A	A
45	4.0	0.3	7.0	5.0	0.5	0.6	0.2	0.8	A	7.5	A	A
46	3.6	0.1	3.7	-4.4	-0.4	-1.0	0.2	0.4	A	4.5	A	A
47	3.8	0.1	2.1	-1.3	-0.1	-0.4	0.0	0.3	A	3.4	A	A
48	3.5	0.3	7.2	-8.4	-0.8	-1.2	0.3	0.7	A	7.7	A	A
49	3.7	0.2	4.5	-1.6	-0.2	-0.3	0.1	0.5	A	5.3	A	A
50	2.9	0.4	14.3	-24.7	-2.5	-2.2	0.9	1.1	A	14.6	A	A
51	3.6	0.2	5.6	-5.3	-0.5	-0.9	0.2	0.6	A	6.1	A	A
52	3.6	0.3	8.5	-5.3	-0.5	-0.6	0.2	0.8	A	8.9	A	A
53	3.9	0.3	6.4	2.1	0.2	0.3	0.1	0.7	A	7.0	A	A
54	4.1	0.4	9.8	7.9	0.8	0.7	0.3	1.1	A	10.1	A	A
55	3.3	0.1	3.0	-13.2	-1.3	-3.5	0.5	0.4	N	4.0	A	W
56	3.5	0.2	5.8	-8.7	-0.9	-1.5	0.3	0.6	A	6.3	A	A
57	2.7	0.7	23.9	-28.4	-2.8	-1.6	1.1	1.7	A	24.0	N	N

a Relative uncertainty of the reported result at k = 1 coverage factor

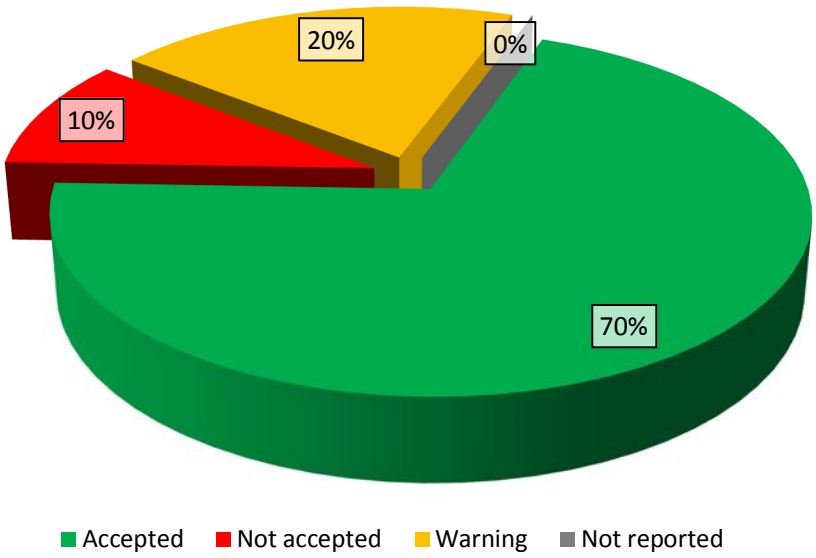

FIG. 45. Distribution of the scores for Cs-134 in water (sample 03).

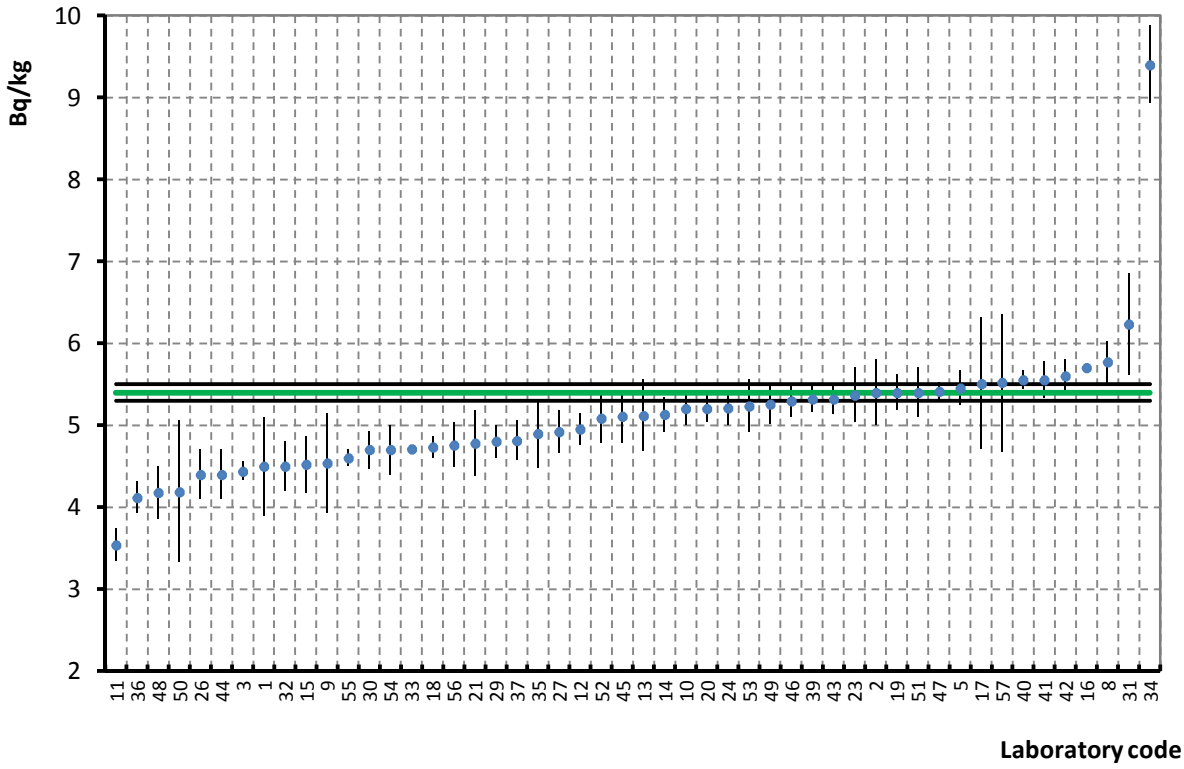

FIG. 46. Reported results and their uncertainties for Cs-134 in water (sample 03).

TABLE 26. PERFORMANCE EVALUATION OF DETERMINATION OF Cs-134 IN WATER (SAMPLE 03)

Target value: 5,4 ± 0.1 Bq/kg
MAB: 20 %
LAP: 20 %

Laboratory code	Reported values		Unc[a]	Bias [%]	Z-Score	U-Score	A1	A2	Score for trueness	Precision	Score for Precision	Final score
	a, Bq/kg	u, Bq/kg	[%]									
1	4.5	0.6	13.3	-16.7	-1.7	-1.5	0.9	1.6	A	13.5	A	A
2	5.4	0.4	7.4	0.0	0.0	0.0	0.0	1.1	A	7.6	A	A
3	4.4	0.1	2.5	-17.8	-1.8	-6.5	1.0	0.4	N	3.1	A	W
5	5.5	0.2	3.9	0.9	0.1	0.2	0.0	0.6	A	4.3	A	A
8	5.8	0.3	4.5	6.9	0.7	1.3	0.4	0.7	A	4.9	A	A
9	4.5	0.6	13.4	-15.9	-1.6	-1.4	0.9	1.6	A	13.6	A	A
10	5.2	0.2	3.8	-3.7	-0.4	-0.9	0.2	0.6	A	4.3	A	A
11	3.5	0.2	5.6	-34.4	-3.4	-8.3	1.9	0.6	N	5.9	A	N
12	5.0	0.2	3.8	-8.3	-0.8	-2.1	0.5	0.6	A	4.3	A	A
13	5.1	0.4	8.4	-5.2	-0.5	-0.6	0.3	1.1	A	8.6	A	A
14	5.1	0.2	4.1	-5.0	-0.5	-1.2	0.3	0.6	A	4.5	A	A
15	4.5	0.4	7.7	-16.3	-1.6	-2.4	0.9	0.9	A	8.0	A	A
16	5.7	0.0	0.4	5.6	0.6	2.9	0.3	0.3	N	1.9	A	W
17	5.5	0.8	14.5	2.0	0.2	0.1	0.1	2.1	A	14.6	A	A
18	4.7	0.1	2.7	-12.4	-1.2	-4.1	0.7	0.4	N	3.3	A	W
19	5.4	0.2	4.1	0.0	0.0	0.0	0.0	0.6	A	4.5	A	A
20	5.2	0.2	3.1	-3.7	-0.4	-1.1	0.2	0.5	A	3.6	A	A
21	4.8	0.4	8.4	-11.5	-1.1	-1.5	0.6	1.1	A	8.6	A	A
23	5.4	0.3	6.1	-0.6	-0.1	-0.1	0.0	0.9	A	6.4	A	A
24	5.2	0.2	3.8	-3.5	-0.4	-0.8	0.2	0.6	A	4.3	A	A
26	4.4	0.3	6.8	-18.5	-1.9	-3.2	1.0	0.8	N	7.1	A	W
27	4.9	0.3	5.3	-8.9	-0.9	-1.7	0.5	0.7	A	5.6	A	A
29	4.8	0.2	4.2	-11.1	-1.1	-2.7	0.6	0.6	N	4.6	A	W
30	4.7	0.2	4.9	-13.0	-1.3	-2.8	0.7	0.6	N	5.2	A	W
31	6.2	0.6	10.0	15.4	1.5	1.3	0.8	1.6	A	10.1	A	A
32	4.5	0.3	6.7	-16.7	-1.7	-2.8	0.9	0.8	N	6.9	A	W
33	4.7	0.0	0.8	-12.8	-1.3	-6.4	0.7	0.3	N	2.0	A	W
34	9.4	0.5	5.0	74.1	7.4	8.3	4.0	1.2	N	5.3	A	N
35	4.9	0.4	8.6	-9.3	-0.9	-1.2	0.5	1.1	A	8.8	A	A
36	4.1	0.2	4.6	-23.7	-2.4	-6.0	1.3	0.6	N	5.0	A	N
37	4.8	0.2	5.0	-10.9	-1.1	-2.3	0.6	0.7	A	5.3	A	A
39	5.3	0.2	3.0	-1.5	-0.1	-0.4	0.1	0.5	A	3.5	A	A
40	5.6	0.1	2.0	2.8	0.3	1.0	0.1	0.4	A	2.7	A	A
41	5.6	0.2	4.0	2.8	0.3	0.6	0.1	0.6	A	4.4	A	A
42	5.6	0.2	3.6	3.7	0.4	0.9	0.2	0.6	A	4.0	A	A
43	5.3	0.2	3.6	-1.5	-0.1	-0.4	0.1	0.6	A	4.0	A	A
44	4.4	0.3	6.8	-18.5	-1.9	-3.2	1.0	0.8	N	7.1	A	W
45	5.1	0.3	6.3	-5.4	-0.5	-0.9	0.3	0.9	A	6.5	A	A
46	5.3	0.2	3.7	-1.9	-0.2	-0.5	0.1	0.6	A	4.1	A	A
47	5.4	0.1	2.2	0.2	0.0	0.1	0.0	0.4	A	2.9	A	A
48	4.2	0.3	7.7	-22.6	-2.3	-3.6	1.2	0.9	N	7.9	A	N
49	5.3	0.2	4.6	-2.6	-0.3	-0.5	0.1	0.7	A	4.9	A	A
50	4.2	0.9	20.5	-22.4	-2.2	-1.4	1.2	2.2	A	20.6	N	N
51	5.4	0.3	5.6	0.0	0.0	0.0	0.0	0.8	A	5.9	A	A
52	5.1	0.3	6.0	-5.8	-0.6	-1.0	0.3	0.8	A	6.3	A	A
53	5.2	0.3	6.1	-3.1	-0.3	-0.5	0.2	0.9	A	6.4	A	A
54	4.7	0.3	6.4	-13.0	-1.3	-2.2	0.7	0.8	A	6.6	A	A
55	4.6	0.1	2.2	-14.8	-1.5	-5.7	0.8	0.4	N	2.9	A	W
56	4.8	0.3	5.7	-11.9	-1.2	-2.2	0.6	0.7	A	6.0	A	A
57	5.5	0.8	15.2	2.2	0.2	0.1	0.1	2.2	A	15.3	A	A

a Relative uncertainty of the reported result at k = 1 coverage factor

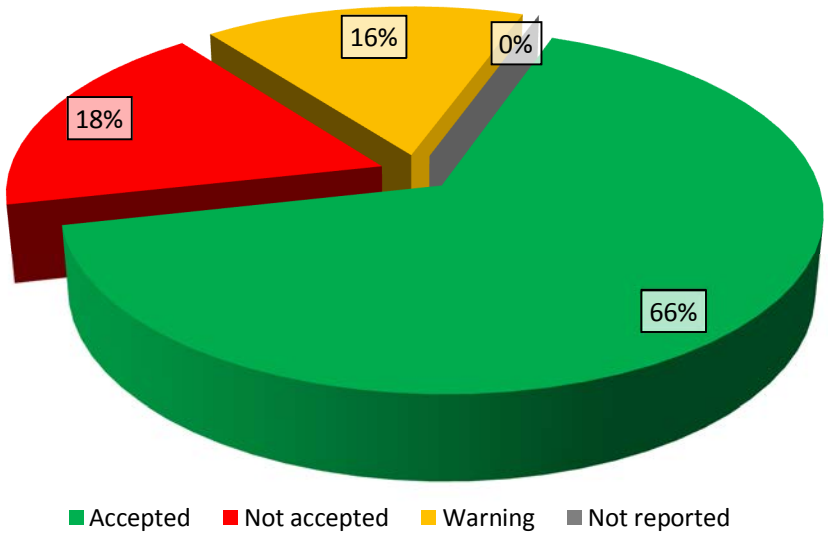

FIG. 47. Distribution of the scores for Eu-152 in water (sample 01).

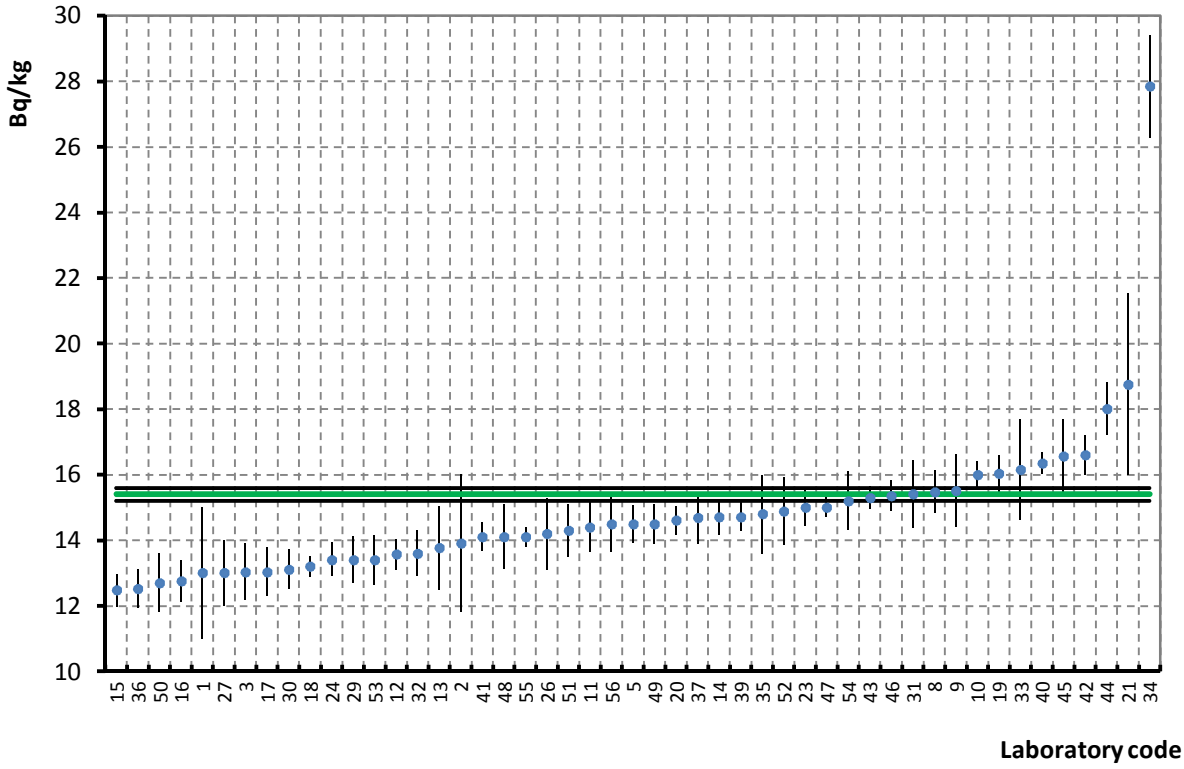

FIG. 48. Reported results and their uncertainties for Eu-152 in water (sample 01).

TABLE 27. PERFORMANCE EVALUATION OF DETERMINATION OF Eu-152 IN WATER (SAMPLE 01)

Target value: 15.4 ± 0.1 Bq/kg
MAB: 15 %
LAP: 15 %

Laboratory code	Reported values		Unc[a]	Bias [%]	Z-Score	U-Score	A1	A2	Score for trueness	Precision	Score for Precision	Final score
	a, Bq/kg	u, Bq/kg	[%]									
1	13.0	2.0	15.4	-15.6	-1.6	-1.2	2.4	5.2	A	15.4	N	N
2	13.9	2.1	15.1	-9.7	-1.0	-0.7	1.5	5.4	A	15.2	N	W
3	13.0	0.9	6.6	-15.5	-1.5	-2.7	2.4	2.3	N	6.7	A	N
5	14.5	0.6	4.0	-5.8	-0.6	-1.5	0.9	1.6	A	4.2	A	A
8	15.5	0.6	4.1	0.5	0.0	0.1	0.1	1.7	A	4.3	A	A
9	15.5	1.1	7.1	0.6	0.1	0.1	0.1	2.9	A	7.2	A	A
10	16.0	0.4	2.5	3.9	0.4	1.3	0.6	1.2	A	2.8	A	A
11	14.4	0.8	5.3	-6.5	-0.6	-1.3	1.0	2.1	A	5.5	A	A
12	13.6	0.5	3.4	-11.9	-1.2	-3.6	1.8	1.3	N	3.6	A	W
13	13.8	1.3	9.3	-10.6	-1.1	-1.3	1.6	3.3	A	9.4	A	A
14	14.7	0.6	3.7	-4.5	-0.4	-1.2	0.7	1.5	A	4.0	A	A
15	12.5	0.5	4.0	-19.0	-1.9	-5.4	2.9	1.4	N	4.2	A	N
16	12.7	0.6	5.0	-17.2	-1.7	-4.0	2.7	1.7	N	5.1	A	N
17	13.0	0.7	5.7	-15.5	-1.5	-3.1	2.4	2.0	N	5.8	A	N
18	13.2	0.3	2.4	-14.3	-1.4	-5.9	2.2	1.0	N	2.7	A	W
19	16.0	0.6	3.4	4.2	0.4	1.1	0.6	1.5	A	3.7	A	A
20	14.6	0.4	2.9	-5.2	-0.5	-1.7	0.8	1.2	A	3.2	A	A
21	18.8	2.8	14.8	21.8	2.2	1.2	3.4	7.2	A	14.8	A	A
23	15.0	0.6	3.7	-2.6	-0.3	-0.7	0.4	1.5	A	4.0	A	A
24	13.4	0.5	3.9	-13.0	-1.3	-3.6	2.0	1.4	N	4.1	A	W
26	14.2	1.1	7.7	-7.8	-0.8	-1.1	1.2	2.9	A	7.9	A	A
27	13.0	1.0	7.7	-15.6	-1.6	-2.4	2.4	2.6	A	7.8	A	A
29	13.4	0.7	5.2	-13.0	-1.3	-2.7	2.0	1.9	N	5.4	A	W
30	13.1	0.6	4.6	-14.9	-1.5	-3.6	2.3	1.6	N	4.8	A	W
31	15.4	1.0	6.7	0.1	0.0	0.0	0.0	2.7	A	6.8	A	A
32	13.6	0.7	5.1	-11.7	-1.2	-2.5	1.8	1.9	A	5.3	A	A
33	16.2	1.5	9.5	4.9	0.5	0.5	0.8	4.0	A	9.6	A	A
34	27.8	1.6	5.6	80.8	8.1	7.9	12.4	4.1	N	5.8	A	N
35	14.8	1.2	8.1	-3.9	-0.4	-0.5	0.6	3.1	A	8.2	A	A
36	12.5	0.6	4.6	-18.7	-1.9	-4.7	2.9	1.6	N	4.8	A	N
37	14.7	0.8	5.3	-4.7	-0.5	-0.9	0.7	2.1	A	5.5	A	A
39	14.7	0.4	3.0	-4.5	-0.4	-1.4	0.7	1.2	A	3.3	A	A
40	16.4	0.3	2.0	6.2	0.6	2.5	1.0	1.0	A	2.4	A	A
41	14.1	0.4	3.0	-8.4	-0.8	-2.8	1.3	1.2	N	3.2	A	W
42	16.6	0.6	3.6	7.8	0.8	1.9	1.2	1.6	A	3.8	A	A
43	15.3	0.4	2.3	-0.6	-0.1	-0.2	0.1	1.0	A	2.6	A	A
44	18.0	0.8	4.4	16.9	1.7	3.2	2.6	2.1	N	4.6	A	N
45	16.6	1.1	6.9	7.5	0.8	1.0	1.2	3.0	A	7.0	A	A
46	15.3	0.5	3.1	-0.4	0.0	-0.1	0.1	1.3	A	3.3	A	A
47	15.0	0.3	2.0	-2.6	-0.3	-1.1	0.4	0.9	A	2.4	A	A
48	14.1	1.0	7.0	-8.4	-0.8	-1.3	1.3	2.6	A	7.1	A	A
49	14.5	0.6	4.1	-5.8	-0.6	-1.4	0.9	1.6	A	4.3	A	A
50	12.7	0.9	7.1	-17.5	-1.8	-2.9	2.7	2.4	N	7.2	A	N
51	14.3	0.8	5.6	-7.1	-0.7	-1.3	1.1	2.1	A	5.7	A	A
52	14.9	1.0	6.9	-3.4	-0.3	-0.5	0.5	2.7	A	7.0	A	A
53	13.4	0.8	5.7	-13.0	-1.3	-2.5	2.0	2.0	A	5.8	A	A
54	15.2	0.9	5.9	-1.3	-0.1	-0.2	0.2	2.4	A	6.1	A	A
55	14.1	0.3	2.1	-8.4	-0.8	-3.6	1.3	0.9	N	2.5	A	W
56	14.5	0.8	5.7	-5.9	-0.6	-1.1	0.9	2.2	A	5.9	A	A
57	16.5	1.9	11.5	7.1	0.7	0.6	1.1	4.9	A	11.6	A	A

a Relative uncertainty of the reported result at k = 1 coverage factor

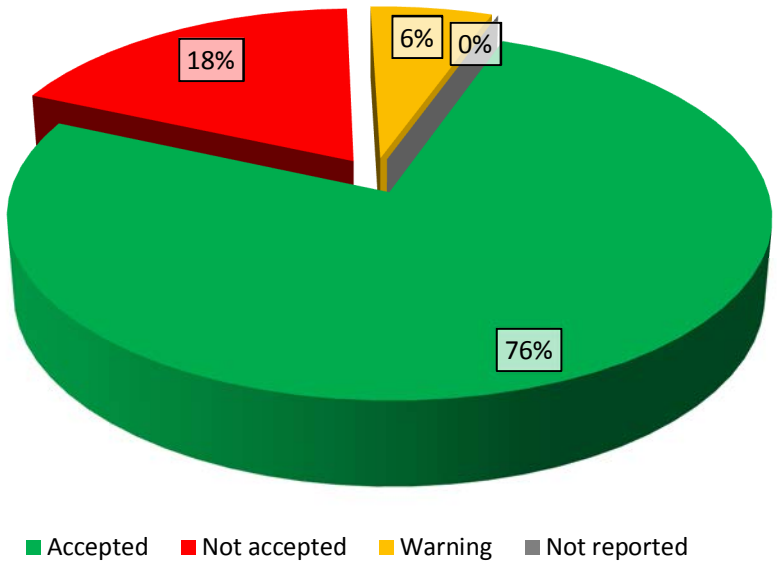

FIG. 49. Distribution of the scores for Eu-152 in water (sample 02).

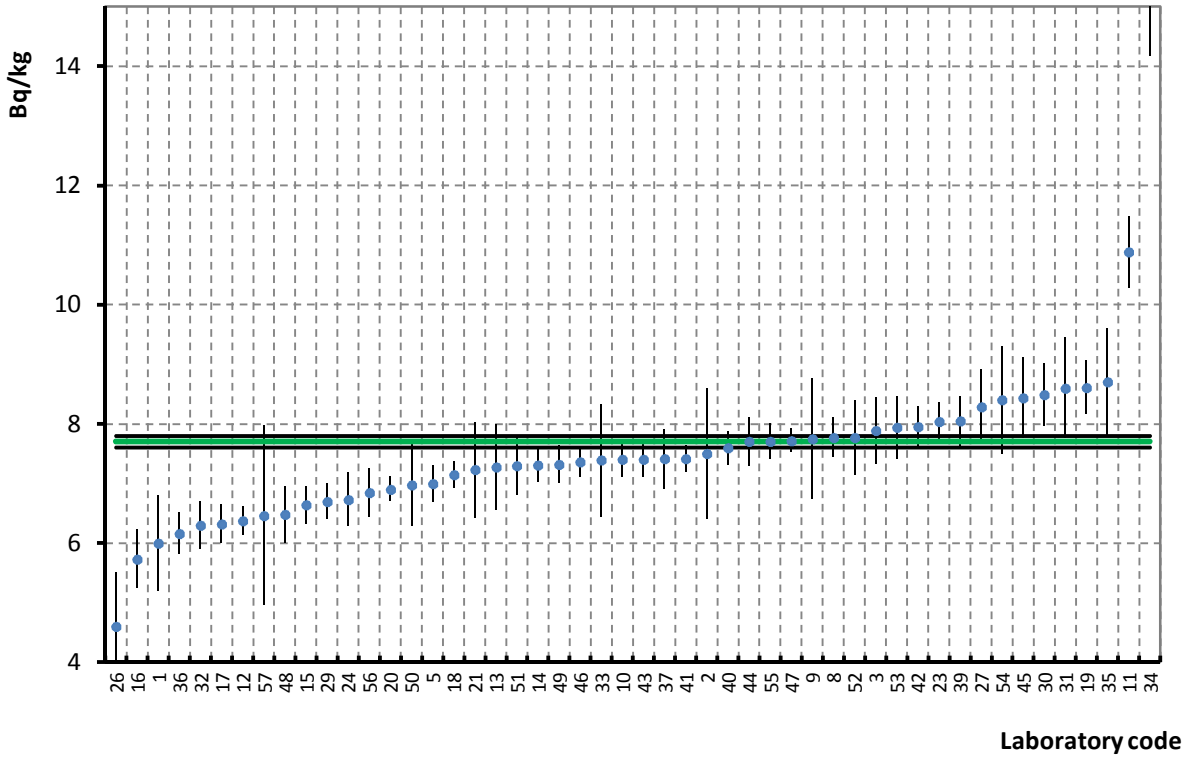

FIG. 50. Reported results and their uncertainties for Eu-152 in water (sample 02).

TABLE 28. PERFORMANCE EVALUATION OF DETERMINATION OF Eu-152 IN WATER (SAMPLE 02)

Target value: 7.7 ± 0.1 Bq/kg
MAB: 15 %
LAP: 15 %

Laboratory code	Reported values		Unc[a]	Bias [%]	Z-Score	U-Score	A1	A2	Score for trueness	Precision	Score for Precision	Final score
	a, Bq/kg	u, Bq/kg	[%]									
1	6.0	0.8	13.3	-22.1	-2.2	-2.1	1.7	2.1	A	13.4	A	A
2	7.5	1.1	14.7	-2.6	-0.3	-0.2	0.2	2.8	A	14.7	A	A
3	7.9	0.6	7.1	2.5	0.2	0.3	0.2	1.5	A	7.2	A	A
5	7.0	0.3	4.4	-9.1	-0.9	-2.1	0.7	0.8	A	4.6	A	A
8	7.8	0.3	4.2	0.9	0.1	0.2	0.1	0.9	A	4.4	A	A
9	7.8	1.0	13.0	0.6	0.1	0.0	0.0	2.6	A	13.1	A	A
10	7.4	0.3	4.1	-3.9	-0.4	-0.9	0.3	0.8	A	4.3	A	A
11	10.9	0.6	5.5	41.3	4.1	5.2	3.2	1.6	N	5.7	A	N
12	6.4	0.2	3.8	-17.3	-1.7	-5.1	1.3	0.7	N	4.0	A	N
13	7.3	0.7	9.9	-5.5	-0.5	-0.6	0.4	1.9	A	10.0	A	A
14	7.3	0.3	4.0	-5.1	-0.5	-1.3	0.4	0.8	A	4.2	A	A
15	6.6	0.3	4.7	-13.8	-1.4	-3.3	1.1	0.8	N	4.8	A	W
16	5.7	0.5	8.6	-25.6	-2.6	-3.9	2.0	1.3	N	8.7	A	N
17	6.3	0.3	5.1	-17.9	-1.8	-4.1	1.4	0.9	N	5.2	A	N
18	7.2	0.2	3.2	-7.1	-0.7	-2.2	0.6	0.6	A	3.4	A	A
19	8.6	0.5	5.2	11.8	1.2	2.0	0.9	1.2	A	5.4	A	A
20	6.9	0.2	3.0	-10.4	-1.0	-3.4	0.8	0.6	N	3.3	A	W
21	7.2	0.8	11.1	-6.1	-0.6	-0.6	0.5	2.1	A	11.1	A	A
23	8.0	0.3	4.0	4.4	0.4	1.0	0.3	0.9	A	4.2	A	A
24	6.7	0.5	6.7	-12.6	-1.3	-2.1	1.0	1.2	A	6.8	A	A
26	4.6	0.9	19.6	-40.3	-4.0	-3.4	3.1	2.3	N	19.6	N	N
27	8.3	0.6	7.6	7.7	0.8	0.9	0.6	1.6	A	7.7	A	A
29	6.7	0.3	4.5	-13.0	-1.3	-3.2	1.0	0.8	N	4.7	A	W
30	8.5	0.5	6.1	10.3	1.0	1.5	0.8	1.4	A	6.3	A	A
31	8.6	0.8	9.8	11.7	1.2	1.1	0.9	2.2	A	9.9	A	A
32	6.3	0.4	6.3	-18.2	-1.8	-3.4	1.4	1.1	N	6.5	A	N
33	7.4	0.9	12.7	-4.0	-0.4	-0.3	0.3	2.4	A	12.8	A	A
34	15.0	0.9	5.8	95.3	9.5	8.4	7.3	2.3	N	5.9	A	N
35	8.7	0.9	10.3	13.0	1.3	1.1	1.0	2.3	A	10.4	A	A
36	6.2	0.4	5.7	-20.0	-2.0	-4.2	1.5	0.9	N	5.8	A	N
37	7.4	0.5	6.7	-3.8	-0.4	-0.6	0.3	1.3	A	6.9	A	A
39	8.1	0.4	5.2	4.5	0.5	0.8	0.4	1.1	A	5.4	A	A
40	7.6	0.3	3.7	-1.3	-0.1	-0.3	0.1	0.8	A	3.9	A	A
41	7.4	0.2	3.0	-3.8	-0.4	-1.2	0.3	0.6	A	3.2	A	A
42	8.0	0.4	4.4	3.2	0.3	0.7	0.3	0.9	A	4.6	A	A
43	7.4	0.3	4.1	-3.9	-0.4	-0.9	0.3	0.8	A	4.3	A	A
44	7.7	0.4	5.2	0.0	0.0	0.0	0.0	1.1	A	5.4	A	A
45	8.4	0.7	7.9	9.5	0.9	1.1	0.7	1.7	A	8.1	A	A
46	7.4	0.3	3.5	-4.4	-0.4	-1.2	0.3	0.7	A	3.8	A	A
47	7.7	0.2	2.6	0.3	0.0	0.1	0.0	0.6	A	2.9	A	A
48	6.5	0.5	7.3	-15.8	-1.6	-2.5	1.2	1.2	A	7.4	A	A
49	7.3	0.3	4.2	-4.9	-0.5	-1.2	0.4	0.8	A	4.4	A	A
50	7.0	0.7	9.8	-9.5	-0.9	-1.1	0.7	1.8	A	9.8	A	A
51	7.3	0.5	6.8	-5.2	-0.5	-0.8	0.4	1.3	A	7.0	A	A
52	7.8	0.6	8.0	0.9	0.1	0.1	0.1	1.6	A	8.1	A	A
53	7.9	0.5	6.7	3.1	0.3	0.4	0.2	1.4	A	6.8	A	A
54	8.4	0.9	10.7	9.1	0.9	0.8	0.7	2.3	A	10.8	A	A
55	7.7	0.3	3.9	0.0	0.0	0.0	0.0	0.8	A	4.1	A	A
56	6.9	0.4	5.8	-11.0	-1.1	-2.1	0.9	1.1	A	6.0	A	A
57	6.5	1.5	23.2	-16.1	-1.6	-0.8	1.2	3.9	A	23.3	N	N

a Relative uncertainty of the reported result at k = 1 coverage factor

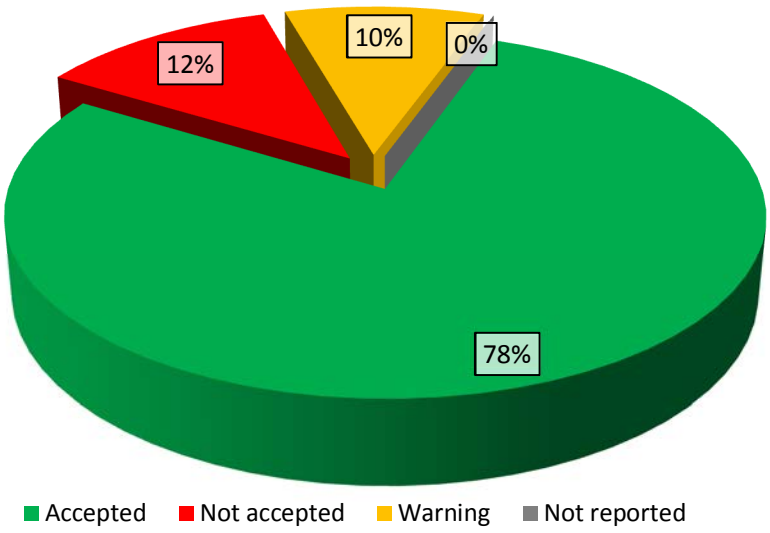

FIG. 51. Distribution of the scores for Eu-152 in water (sample 03).

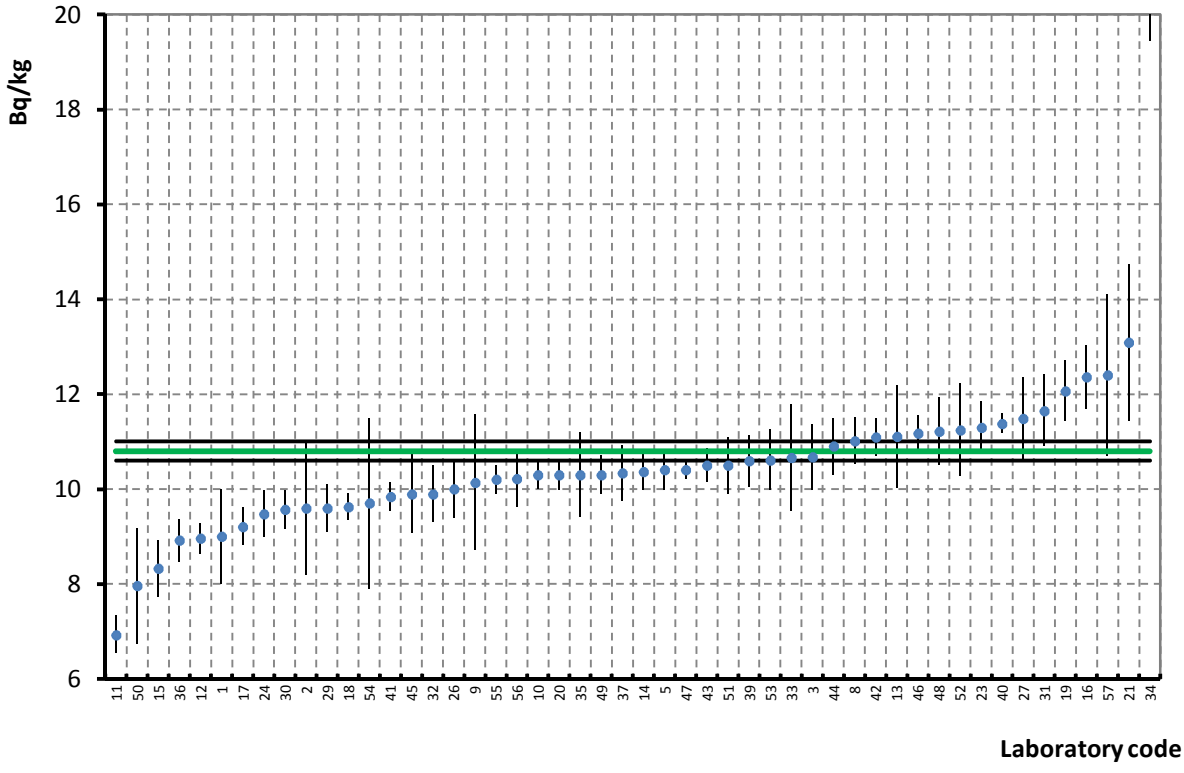

FIG. 52. Reported results and their uncertainties for Eu-152 in water (sample 03).

TABLE 29. PERFORMANCE EVALUATION OF DETERMINATION OF Eu-152 IN WATER (SAMPLE 03)

Target value: 10.8 ± 0.2 Bq/kg
MAB: 15 %
LAP: 15 %

Laboratory code	Reported values		Unc[a]	Bias [%]	Z-Score	U-Score	A1	A2	Score for trueness	Precision	Score for Precision	Final score
	a, Bq/kg	u, Bq/kg	[%]									
1	9.0	1.0	11.1	-16.7	-1.7	-1.8	1.8	2.6	A	11.3	A	A
2	9.6	1.4	14.6	-11.1	-1.1	-0.8	1.2	3.6	A	14.7	A	A
3	10.7	0.7	6.5	-1.2	-0.1	-0.2	0.1	1.9	A	6.7	A	A
5	10.4	0.4	4.0	-3.7	-0.4	-0.9	0.4	1.2	A	4.4	A	A
8	11.0	0.5	4.4	2.0	0.2	0.4	0.2	1.4	A	4.8	A	A
9	10.1	1.4	14.0	-6.1	-0.6	-0.5	0.7	3.7	A	14.1	A	A
10	10.3	0.3	2.9	-4.6	-0.5	-1.4	0.5	0.9	A	3.5	A	A
11	6.9	0.4	5.8	-35.8	-3.6	-8.7	3.9	1.2	N	6.1	A	N
12	9.0	0.3	3.6	-17.0	-1.7	-4.9	1.8	1.0	N	4.0	A	N
13	11.1	1.1	9.7	2.9	0.3	0.3	0.3	2.8	A	9.9	A	A
14	10.4	0.4	3.8	-4.0	-0.4	-1.0	0.4	1.1	A	4.2	A	A
15	8.3	0.6	7.1	-22.9	-2.3	-4.0	2.5	1.6	N	7.3	A	N
16	12.4	0.7	5.4	14.5	1.4	2.2	1.6	1.8	A	5.7	A	A
17	9.2	0.4	4.3	-14.7	-1.5	-3.6	1.6	1.2	N	4.7	A	W
18	9.6	0.3	2.9	-10.8	-1.1	-3.4	1.2	0.9	N	3.4	A	W
19	12.1	0.6	5.3	11.8	1.2	1.9	1.3	1.7	A	5.6	A	A
20	10.3	0.3	3.0	-4.6	-0.5	-1.4	0.5	1.0	A	3.5	A	A
21	13.1	1.6	12.5	21.2	2.1	1.4	2.3	4.3	A	12.7	A	A
23	11.3	0.5	4.8	4.6	0.5	0.9	0.5	1.5	A	5.1	A	A
24	9.5	0.5	5.2	-12.2	-1.2	-2.5	1.3	1.4	A	5.5	A	A
26	10.0	0.6	6.0	-7.4	-0.7	-1.3	0.8	1.6	A	6.3	A	A
27	11.5	0.9	7.6	6.4	0.6	0.8	0.7	2.3	A	7.8	A	A
29	9.6	0.5	5.2	-11.1	-1.1	-2.2	1.2	1.4	A	5.5	A	A
30	9.6	0.4	4.3	-11.4	-1.1	-2.7	1.2	1.2	N	4.7	A	W
31	11.7	0.8	6.4	7.9	0.8	1.1	0.9	2.0	A	6.7	A	A
32	9.9	0.6	6.1	-8.3	-0.8	-1.4	0.9	1.6	A	6.3	A	A
33	10.7	1.1	10.5	-1.3	-0.1	-0.1	0.1	2.9	A	10.7	A	A
34	20.6	1.1	5.5	90.5	9.0	8.5	9.8	3.0	N	5.8	A	N
35	10.3	0.9	8.6	-4.6	-0.5	-0.5	0.5	2.4	A	8.8	A	A
36	8.9	0.5	5.0	-17.4	-1.7	-3.8	1.9	1.3	N	5.4	A	N
37	10.3	0.6	5.6	-4.3	-0.4	-0.7	0.5	1.6	A	5.9	A	A
39	10.6	0.5	5.1	-1.9	-0.2	-0.3	0.2	1.5	A	5.4	A	A
40	11.4	0.2	1.8	5.4	0.5	2.0	0.6	0.7	A	2.6	A	A
41	9.8	0.3	3.0	-8.9	-0.9	-2.7	1.0	0.9	N	3.6	A	W
42	11.1	0.4	3.6	2.8	0.3	0.7	0.3	1.2	A	4.1	A	A
43	10.5	0.4	3.3	-2.8	-0.3	-0.7	0.3	1.0	A	3.8	A	A
44	10.9	0.6	5.5	0.9	0.1	0.2	0.1	1.6	A	5.8	A	A
45	9.9	0.8	8.3	-8.4	-0.8	-1.1	0.9	2.2	A	8.5	A	A
46	11.2	0.4	3.4	3.4	0.3	0.9	0.4	1.1	A	3.9	A	A
47	10.4	0.2	1.9	-3.7	-0.4	-1.4	0.4	0.7	A	2.7	A	A
48	11.2	0.7	6.3	3.9	0.4	0.6	0.4	1.9	A	6.6	A	A
49	10.3	0.4	3.9	-4.6	-0.5	-1.1	0.5	1.2	A	4.3	A	A
50	8.0	1.2	15.3	-26.3	-2.6	-2.3	2.8	3.2	A	15.4	N	N
51	10.5	0.6	5.7	-2.8	-0.3	-0.5	0.3	1.6	A	6.0	A	A
52	11.2	1.0	8.6	4.1	0.4	0.5	0.4	2.6	A	8.8	A	A
53	10.6	0.6	5.9	-1.8	-0.2	-0.3	0.2	1.7	A	6.2	A	A
54	9.7	1.8	18.6	-10.2	-1.0	-0.6	1.1	4.7	A	18.6	N	W
55	10.2	0.3	2.9	-5.6	-0.6	-1.7	0.6	0.9	A	3.5	A	A
56	10.2	0.6	5.7	-5.4	-0.5	-0.9	0.6	1.6	A	6.0	A	A
57	12.4	1.7	13.7	14.8	1.5	0.9	1.6	4.4	A	13.8	A	A

a Relative uncertainty of the reported result at k = 1 coverage factor

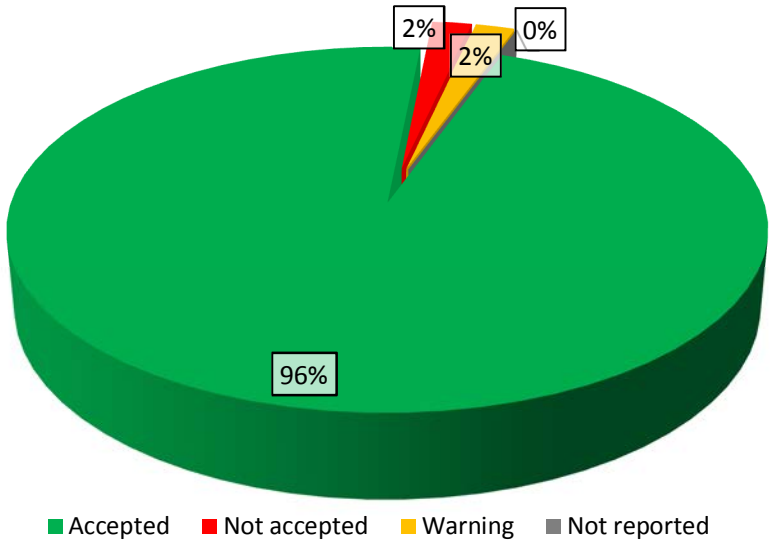

FIG. 53. Distribution of the scores for Cs-137 in soil (sample 04).

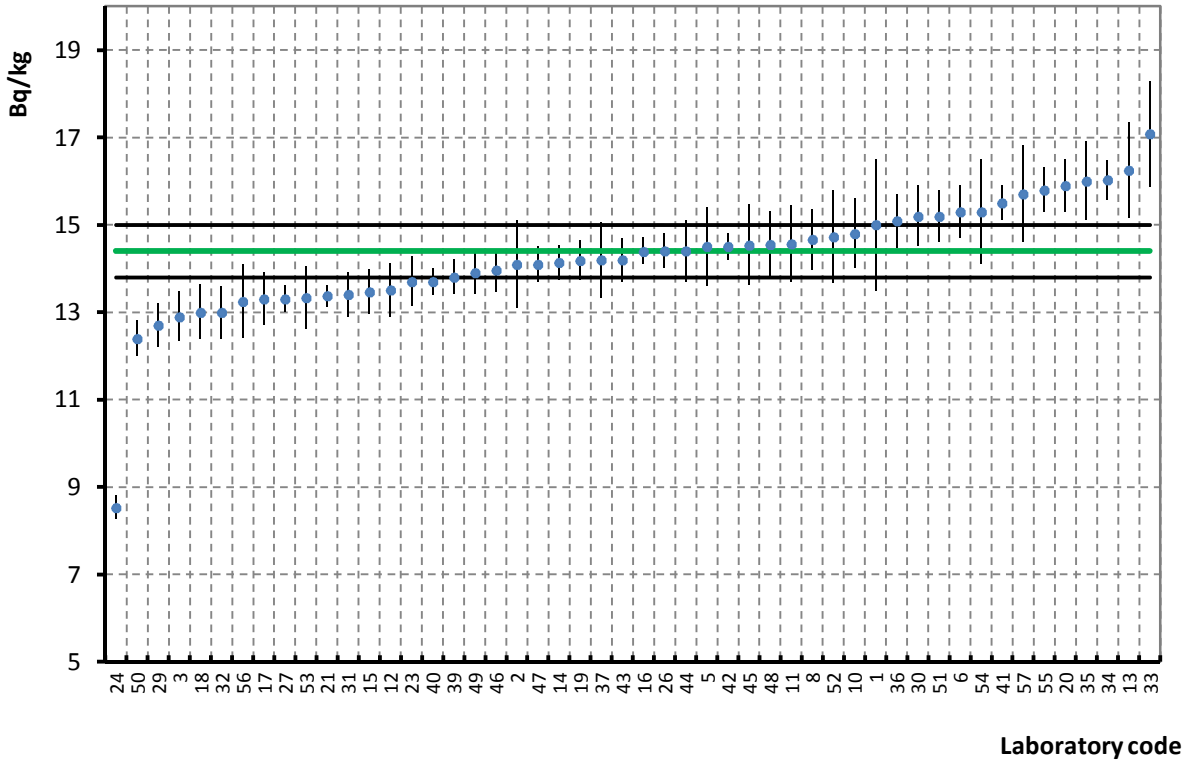

FIG. 54. Reported results and their uncertainties for Cs-137 in soil (sample 04).

TABLE 30. PERFORMANCE EVALUATION OF DETERMINATION OF Cs-137 IN SOIL (SAMPLE 04)

Target value: 14.0 ± 0.6 Bq/kg
MAB: 20 %
LAP: 20 %

Laboratory code	Reported values		Unca [%]	Bias [%]	Z-Score	U-Score	A1	A2	Score for trueness	Precision	Score for Precision	Final score
	a, Bq/kg	u, Bq/kg										
1	15.0	1.5	10.0	7.1	0.7	0.6	1.0	4.2	A	10.9	A	A
2	14.1	1.0	7.1	0.7	0.1	0.1	0.1	3.0	A	8.3	A	A
3	12.9	0.6	4.3	-7.9	-0.8	-1.3	1.1	2.1	A	6.1	A	A
5	14.5	0.9	6.2	3.6	0.4	0.5	0.5	2.8	A	7.5	A	A
6	15.3	0.6	3.9	9.3	0.9	1.5	1.3	2.2	A	5.8	A	A
8	14.7	0.7	4.7	4.7	0.5	0.7	0.7	2.4	A	6.4	A	A
10	14.8	0.8	5.4	5.7	0.6	0.8	0.8	2.6	A	6.9	A	A
11	14.6	0.9	6.0	4.1	0.4	0.5	0.6	2.7	A	7.3	A	A
12	13.5	0.6	4.5	-3.5	-0.4	-0.6	0.5	2.2	A	6.2	A	A
13	16.2	1.1	6.7	16.0	1.6	1.8	2.2	3.2	A	8.0	A	A
14	14.1	0.4	2.8	1.0	0.1	0.2	0.1	1.8	A	5.1	A	A
15	13.5	0.5	3.8	-3.9	-0.4	-0.7	0.5	2.0	A	5.7	A	A
16	14.4	0.3	2.1	2.8	0.3	0.6	0.4	1.7	A	4.8	A	A
17	13.3	0.6	4.5	-5.0	-0.5	-0.8	0.7	2.2	A	6.2	A	A
18	13.0	0.6	4.8	-7.1	-0.7	-1.2	1.0	2.2	A	6.4	A	A
19	14.2	0.5	3.2	1.3	0.1	0.2	0.2	1.9	A	5.3	A	A
20	15.9	0.6	3.8	13.6	1.4	2.2	1.9	2.2	A	5.7	A	A
21	13.4	0.2	1.8	-4.5	-0.5	-1.0	0.6	1.7	A	4.6	A	A
23	13.7	0.6	4.2	-2.1	-0.2	-0.4	0.3	2.1	A	6.0	A	A
24	8.5	0.3	3.0	-39.1	-3.9	-8.4	5.5	1.7	N	5.3	A	N
26	14.4	0.4	2.8	2.9	0.3	0.6	0.4	1.9	A	5.1	A	A
27	13.3	0.3	2.3	-5.0	-0.5	-1.0	0.7	1.7	A	4.8	A	A
29	12.7	0.5	3.9	-9.3	-0.9	-1.7	1.3	2.0	A	5.8	A	A
30	15.2	0.7	4.6	8.6	0.9	1.3	1.2	2.4	A	6.3	A	A
31	13.4	0.5	3.7	-4.3	-0.4	-0.8	0.6	2.0	A	5.7	A	A
32	13.0	0.6	4.6	-7.1	-0.7	-1.2	1.0	2.2	A	6.3	A	A
33	17.1	1.2	7.1	22.0	2.2	2.3	3.1	3.5	A	8.3	A	A
34	16.0	0.5	2.8	14.5	1.5	2.7	2.0	1.9	N	5.1	A	W
35	16.0	0.9	5.6	14.3	1.4	1.8	2.0	2.8	A	7.1	A	A
36	15.1	0.6	4.0	7.8	0.8	1.3	1.1	2.2	A	5.9	A	A
37	14.2	0.9	6.1	1.4	0.1	0.2	0.2	2.7	A	7.4	A	A
39	13.8	0.4	2.9	-1.4	-0.1	-0.3	0.2	1.9	A	5.2	A	A
40	13.7	0.3	2.2	-2.1	-0.2	-0.4	0.3	1.7	A	4.8	A	A
41	15.5	0.4	2.6	10.7	1.1	2.1	1.5	1.9	A	5.0	A	A
42	14.5	0.3	2.1	3.6	0.4	0.7	0.5	1.7	A	4.8	A	A
43	14.2	0.5	3.5	1.4	0.1	0.3	0.2	2.0	A	5.5	A	A
44	14.4	0.7	4.9	2.9	0.3	0.4	0.4	2.4	A	6.5	A	A
45	14.5	0.9	6.3	3.8	0.4	0.5	0.5	2.8	A	7.6	A	A
46	14.0	0.5	3.5	-0.3	0.0	-0.1	0.0	2.0	A	5.5	A	A
47	14.1	0.4	2.8	0.7	0.1	0.1	0.1	1.9	A	5.1	A	A
48	14.6	0.8	5.2	3.9	0.4	0.6	0.6	2.5	A	6.7	A	A
49	13.9	0.5	3.6	-0.7	-0.1	-0.1	0.1	2.0	A	5.6	A	A
50	12.4	0.4	3.2	-11.4	-1.1	-2.2	1.6	1.9	A	5.4	A	A
51	15.2	0.6	3.9	8.6	0.9	1.4	1.2	2.2	A	5.8	A	A
52	14.7	1.1	7.2	5.2	0.5	0.6	0.7	3.1	A	8.3	A	A
53	13.3	0.7	5.3	-4.7	-0.5	-0.7	0.7	2.4	A	6.8	A	A
54	15.3	1.2	7.8	9.3	0.9	1.0	1.3	3.5	A	8.9	A	A
55	15.8	0.5	3.2	12.9	1.3	2.3	1.8	2.0	A	5.3	A	A
56	13.3	0.8	6.3	-5.4	-0.5	-0.7	0.8	2.7	A	7.7	A	A
57	15.7	1.1	7.0	12.1	1.2	1.4	1.7	3.2	A	8.2	A	A

a Relative uncertainty of the reported result at k = 1 coverage factor

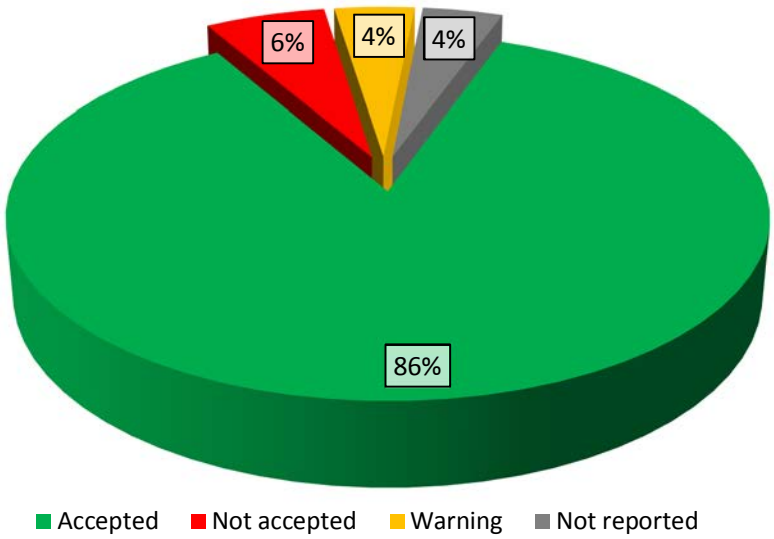

FIG. 55. Distribution of the scores for K-40 in soil (sample 04).

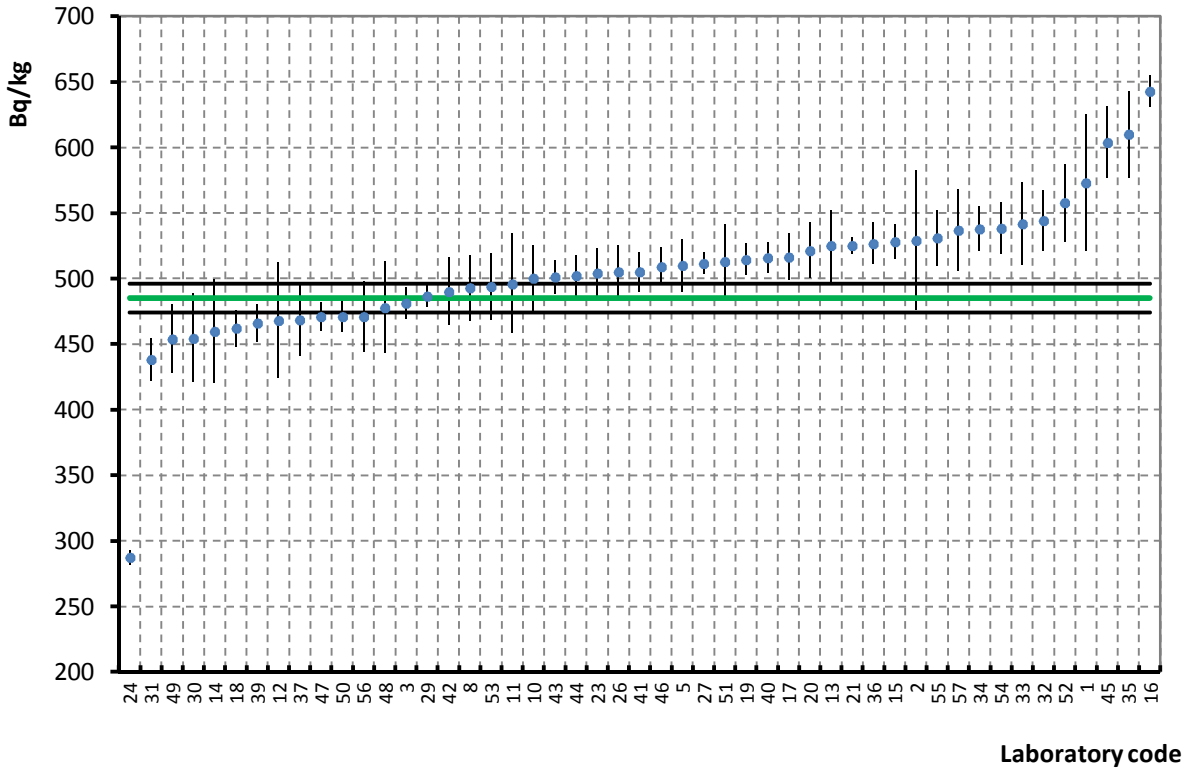

FIG. 56. Reported results and their uncertainties for K-40 in soil (sample 04).

TABLE 31. PERFORMANCE EVALUATION OF DETERMINATION OF K-40 IN SOIL (SAMPLE 04)

Target value: 485 ± 11 Bq/kg
MAB: 20 %
LAP: 20 %

Laboratory code	Reported values		Unc[a]	Bias [%]	Z-Score	U-Score	A1	A2	Score for trueness	Precision	Score for Precision	Final score
	a, Bq/kg	u, Bq/kg	[%]									
1	573	52	9.1	18.1	1.8	1.7	88.0	137.1	A	9.4	A	A
2	529	53	10.0	9.1	0.9	0.8	44.0	139.7	A	10.3	A	A
3	481	12	2.5	-0.8	-0.1	-0.2	4.0	42.0	A	3.4	A	A
5	510	20	3.9	5.2	0.5	1.1	25.0	58.9	A	4.5	A	A
8	493	25	5.1	1.6	0.2	0.3	8.0	70.5	A	5.6	A	A
10	500	25	5.0	3.1	0.3	0.5	15.0	70.5	A	5.5	A	A
11	496	38	7.7	2.3	0.2	0.3	11.0	102.1	A	8.0	A	A
12	468	44	9.4	-3.5	-0.4	-0.4	17.0	117.0	A	9.7	A	A
13	525	27	5.2	8.2	0.8	1.4	40.0	75.4	A	5.6	A	A
14	460	39	8.5	-5.2	-0.5	-0.6	25.2	105.3	A	8.8	A	A
15	528	13	2.5	8.9	0.9	2.5	43.0	43.9	A	3.3	A	A
16	643	12	1.8	32.6	3.3	9.8	158.0	41.8	N	2.9	A	N
17	516	18	3.4	6.5	0.6	1.5	31.5	53.8	A	4.1	A	A
18	462	14	3.0	-4.7	-0.5	-1.3	23.0	45.7	A	3.8	A	A
19	515	12	2.3	6.1	0.6	1.8	29.5	41.8	A	3.2	A	A
20	521	21	4.0	7.4	0.7	1.5	36.0	61.2	A	4.6	A	A
21	525	6	1.2	8.3	0.8	3.2	40.2	32.9	N	2.6	A	W
23	504	19	3.8	3.9	0.4	0.9	19.0	56.6	A	4.4	A	A
24	287	5	1.9	-40.8	-4.1	-16.2	197.8	31.6	N	2.9	A	N
26	505	20	4.0	4.1	0.4	0.9	20.0	58.9	A	4.6	A	A
27	511	8	1.6	5.4	0.5	1.9	26.4	35.2	A	2.8	A	A
29	487	8	1.7	0.4	0.0	0.1	1.7	35.7	A	2.9	A	A
30	455	34	7.5	-6.3	-0.6	-0.9	30.5	92.0	A	7.8	A	A
31	438	16	3.7	-9.6	-1.0	-2.4	46.8	50.1	A	4.3	A	A
32	544	23	4.2	12.2	1.2	2.3	59.0	65.8	A	4.8	A	A
33	542	31	5.8	11.7	1.2	1.7	56.7	85.9	A	6.2	A	A
34	538	17	3.2	10.9	1.1	2.6	53.0	52.2	N	3.9	A	W
35	610	33	5.4	25.8	2.6	3.6	125.0	89.7	N	5.9	A	N
36	527	16	3.0	8.6	0.9	2.1	41.7	50.1	A	3.8	A	A
37	469	28	6.0	-3.4	-0.3	-0.5	16.3	77.6	A	6.4	A	A
39	466	14	3.0	-3.9	-0.4	-1.1	19.0	45.9	A	3.8	A	A
40	516	11	2.2	6.3	0.6	1.9	30.6	40.9	A	3.2	A	A
41	505	15	3.0	4.1	0.4	1.1	20.0	48.0	A	3.7	A	A
42	490	26	5.3	1.0	0.1	0.2	5.0	72.8	A	5.8	A	A
43	501	13	2.6	3.3	0.3	0.9	16.0	43.9	A	3.4	A	A
44	502	16	3.2	3.5	0.4	0.9	17.0	50.1	A	3.9	A	A
45	604	27	4.5	24.5	2.5	4.1	118.9	75.5	N	5.0	A	N
46	509	14	2.8	5.0	0.5	1.3	24.1	46.4	A	3.6	A	A
47	471	11	2.3	-2.9	-0.3	-0.9	14.0	40.1	A	3.3	A	A
48	478	35	7.3	-1.4	-0.1	-0.2	7.0	94.7	A	7.7	A	A
49	454	26	5.7	-6.4	-0.6	-1.1	31.0	72.8	A	6.2	A	A
50	471	12	2.5	-2.9	-0.3	-0.9	14.0	42.0	A	3.4	A	A
51	513	28	5.5	5.8	0.6	0.9	28.0	77.6	A	5.9	A	A
52	558	29	5.3	15.0	1.5	2.3	72.7	81.1	A	5.7	A	A
53	494	25	5.1	1.9	0.2	0.3	9.0	71.4	A	5.6	A	A
54	539	20	3.7	11.0	1.1	2.4	53.5	58.2	A	4.3	A	A
55	531	21	4.0	9.5	0.9	1.9	46.0	61.2	A	4.6	A	A
56	471	27	5.7	-2.9	-0.3	-0.5	14.0	75.2	A	6.2	A	A
57	537	31	5.8	10.7	1.1	1.6	52.0	84.9	A	6.2	A	A

a Relative uncertainty of the reported result at k = 1 coverage factor

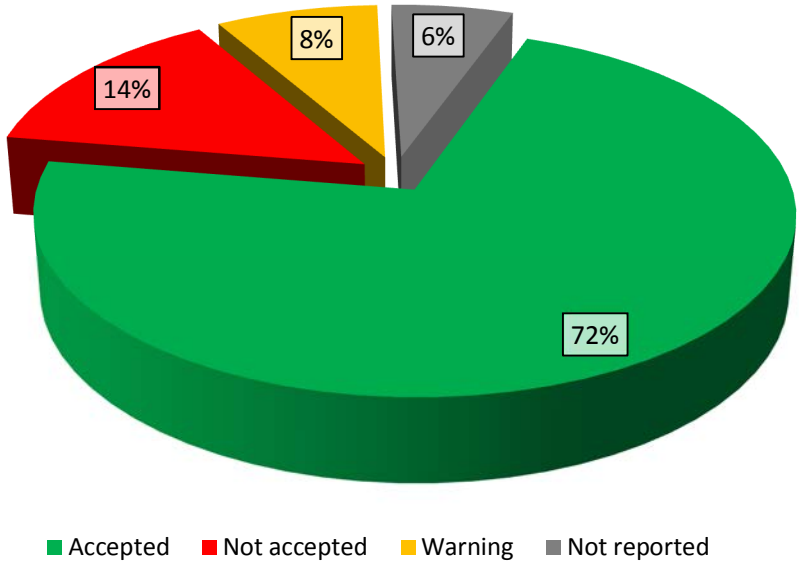

FIG. 57. Distribution of the scores for Ac-228 in soil (sample 04).

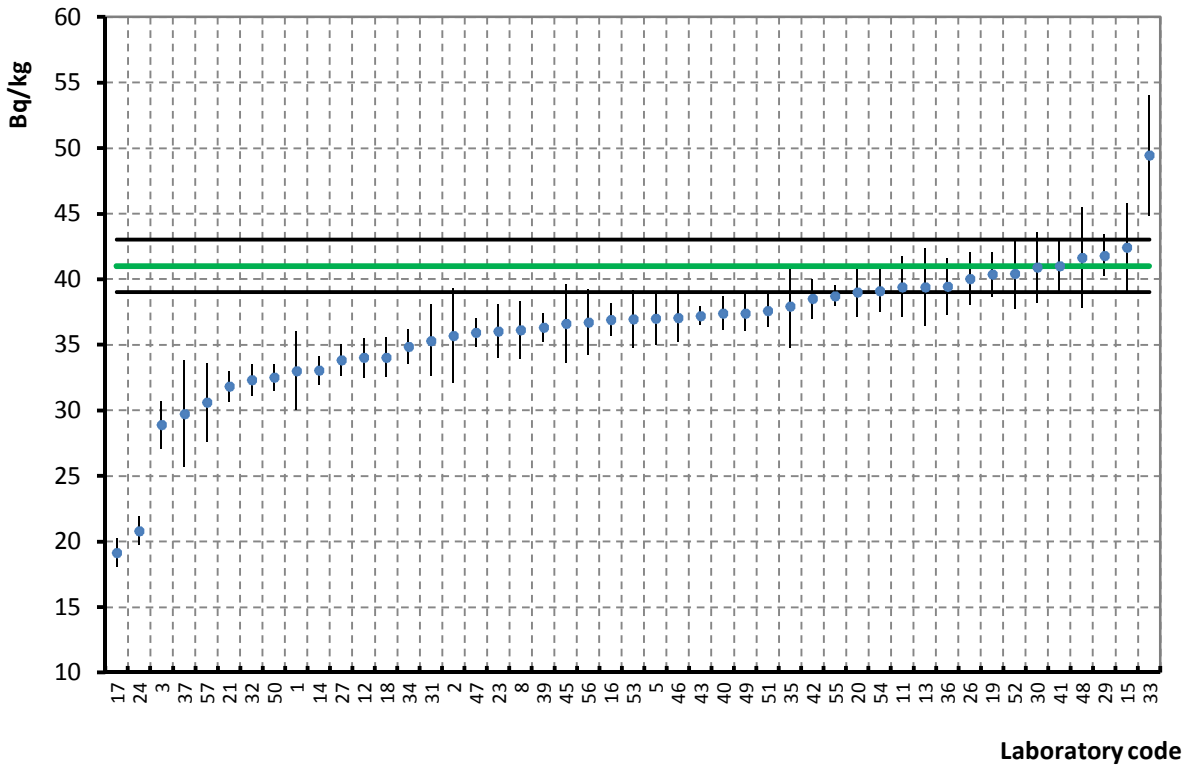

FIG. 58. Reported results and their uncertainties for Ac-228 in soil (sample 04).

TABLE 32. PERFORMANCE EVALAUTION OF DETERMINATION OF Ac-228 IN SOIL (SAMPLE 04)

Target value: 41 ± 2 Bq/kg
MAB: 20 %
LAP: 20 %

Laboratory code	Reported values		Unc[a] [%]	Bias [%]	Z-Score	U-Score	A1	A2	Score for trueness	Precision	Score for Precision	Final score
	a, Bq/kg	u, Bq/kg										
1	33.0	3.0	9.1	-19.5	-2.0	-2.2	8.0	9.3	A	10.3	A	A
2	35.7	3.6	10.1	-12.9	-1.3	-1.3	5.3	10.6	A	11.2	A	A
3	28.9	1.8	6.2	-29.5	-3.0	-4.5	12.1	6.9	N	7.9	A	N
5	37.0	2.0	5.4	-9.8	-1.0	-1.4	4.0	7.3	A	7.3	A	A
8	36.1	2.2	6.1	-12.0	-1.2	-1.6	4.9	7.7	A	7.8	A	A
11	39.4	2.3	5.8	-3.9	-0.4	-0.5	1.6	7.9	A	7.6	A	A
12	34.0	1.5	4.4	-17.1	-1.7	-2.8	7.0	6.5	N	6.6	A	W
13	39.4	3.0	7.5	-3.9	-0.4	-0.4	1.6	9.2	A	8.9	A	A
14	33.0	1.1	3.3	-19.5	-1.9	-3.5	8.0	5.9	N	5.9	A	W
15	42.4	3.4	8.0	3.4	0.3	0.4	1.4	10.2	A	9.4	A	A
16	36.9	1.2	3.3	-10.0	-1.0	-1.8	4.1	6.1	A	5.9	A	A
17	19.2	1.1	5.7	-53.3	-5.3	-9.6	21.9	5.9	N	7.5	A	N
18	34.0	1.5	4.5	-17.1	-1.7	-2.8	7.0	6.5	N	6.6	A	W
19	40.3	1.7	4.2	-1.6	-0.2	-0.3	0.7	6.8	A	6.5	A	A
20	39.0	1.9	4.9	-4.9	-0.5	-0.7	2.0	7.1	A	6.9	A	A
21	31.8	1.2	3.7	-22.4	-2.2	-4.0	9.2	6.0	N	6.1	A	N
23	36.0	2.0	5.6	-12.2	-1.2	-1.8	5.0	7.4	A	7.5	A	A
24	20.8	1.1	5.4	-49.2	-4.9	-8.8	20.2	5.9	N	7.3	A	N
26	40.0	2.0	5.0	-2.4	-0.2	-0.4	1.0	7.3	A	7.0	A	A
27	33.8	1.2	3.6	-17.6	-1.8	-3.1	7.2	6.0	N	6.0	A	W
29	41.8	1.6	3.8	2.0	0.2	0.3	0.8	6.6	A	6.2	A	A
30	40.9	2.7	6.6	-0.2	0.0	0.0	0.1	8.7	A	8.2	A	A
31	35.3	2.7	7.6	-13.9	-1.4	-1.7	5.7	8.7	A	9.1	A	A
32	32.3	1.2	3.7	-21.2	-2.1	-3.7	8.7	6.0	N	6.1	A	N
33	49.4	4.6	9.3	20.5	2.1	1.7	8.4	12.9	A	10.5	A	A
34	34.9	1.3	3.8	-15.0	-1.5	-2.6	6.2	6.2	A	6.2	A	A
35	37.9	3.2	8.3	-7.6	-0.8	-0.8	3.1	9.6	A	9.6	A	A
36	39.4	2.2	5.5	-3.8	-0.4	-0.5	1.6	7.6	A	7.3	A	A
37	29.7	4.1	13.6	-27.6	-2.8	-2.5	11.3	11.7	A	14.5	A	A
39	36.3	1.1	3.0	-11.5	-1.1	-2.1	4.7	5.9	A	5.7	A	A
40	37.4	1.3	3.5	-8.8	-0.9	-1.5	3.6	6.2	A	6.0	A	A
41	41.0	2.0	4.9	0.0	0.0	0.0	0.0	7.3	A	6.9	A	A
42	38.5	1.5	3.9	-6.1	-0.6	-1.0	2.5	6.5	A	6.2	A	A
43	37.2	0.7	1.9	-9.3	-0.9	-1.8	3.8	5.5	A	5.2	A	A
45	36.6	3.0	8.1	-10.8	-1.1	-1.2	4.4	9.3	A	9.5	A	A
46	37.0	1.9	5.0	-9.7	-1.0	-1.4	4.0	7.1	A	7.0	A	A
47	35.9	1.1	3.1	-12.4	-1.2	-2.2	5.1	5.9	A	5.8	A	A
48	41.6	3.8	9.2	1.5	0.1	0.1	0.6	11.1	A	10.4	A	A
49	37.4	1.4	3.7	-8.8	-0.9	-1.5	3.6	6.3	A	6.1	A	A
50	32.5	1.0	3.1	-20.7	-2.1	-3.8	8.5	5.8	N	5.8	A	N
51	37.6	1.3	3.5	-8.3	-0.8	-1.4	3.4	6.2	A	6.0	A	A
52	40.4	2.7	6.6	-1.4	-0.1	-0.2	0.6	8.6	A	8.2	A	A
53	36.9	2.2	6.0	-9.9	-1.0	-1.4	4.1	7.7	A	7.7	A	A
54	39.1	1.6	4.1	-4.6	-0.5	-0.7	1.9	6.6	A	6.4	A	A
55	38.7	0.8	2.1	-5.6	-0.6	-1.1	2.3	5.6	A	5.3	A	A
56	36.7	2.5	6.8	-10.5	-1.0	-1.3	4.3	8.3	A	8.4	A	A
57	30.6	3.0	9.8	-25.4	-2.5	-2.9	10.4	9.3	N	11.0	A	N

a Relative uncertainty of the reported result at k = 1 coverage factor

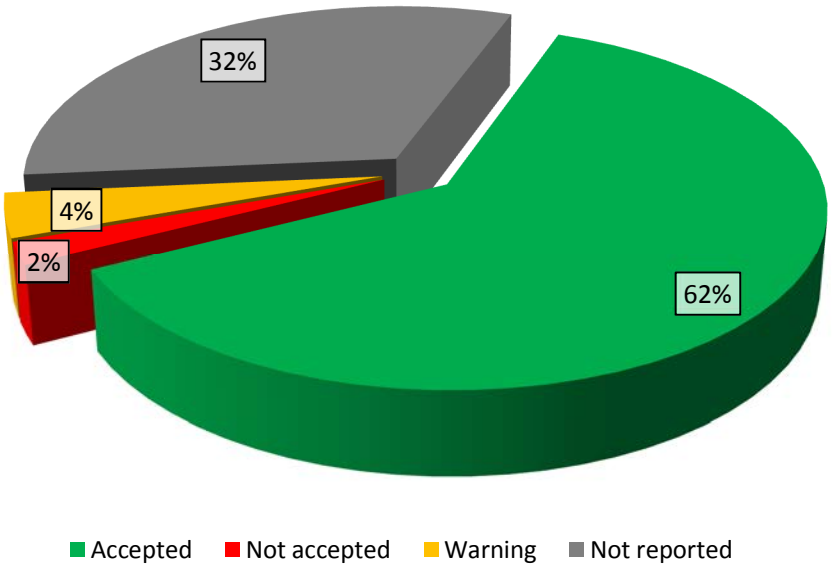

FIG. 59. Distribution of the scores for Pb-212 in soil (sample 04).

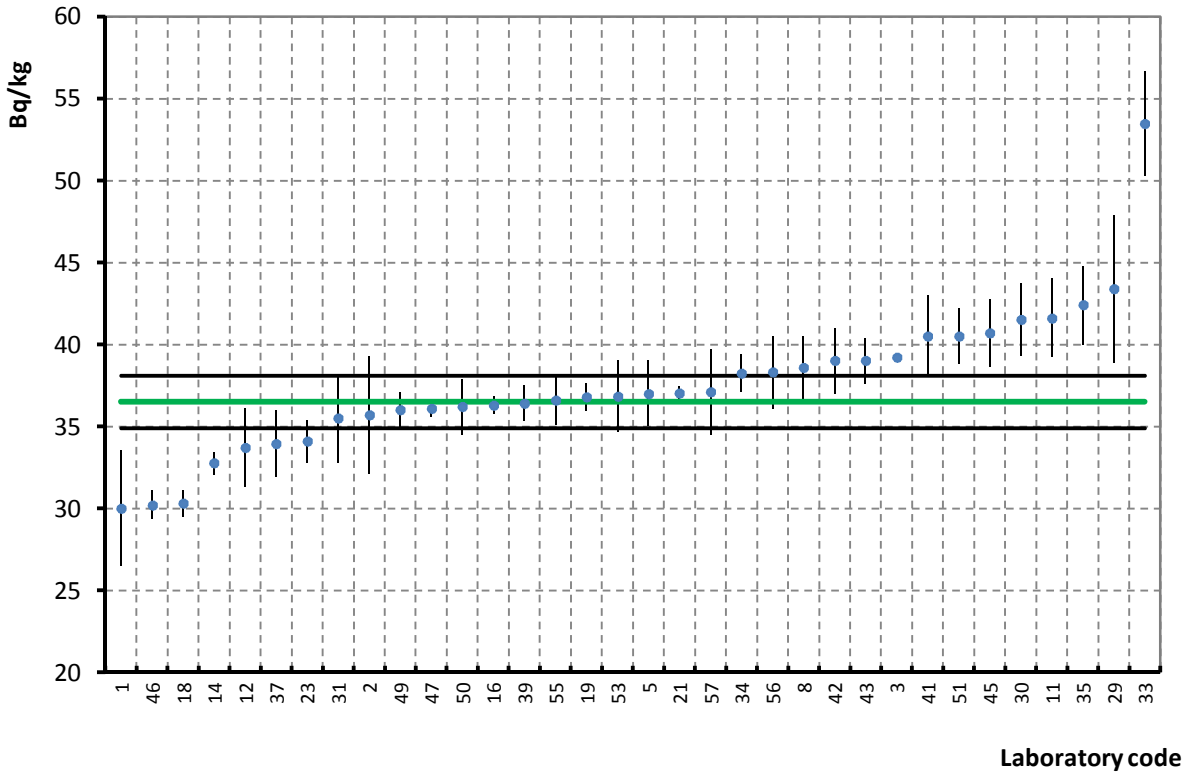

FIG. 60. Reported results and their uncertainties for Pb-212 in soil (sample 04).

TABLE 33. PERFORMANCE EVALUATION OF DETERMINATION OF Pb-212 IN SOIL (SAMPLE 04)

Target value: 36.5 ± 1.6 Bq/kg
MAB: 20 %
LAP: 20 %

Laboratory code	Reported values		Unc[a]	Bias [%]	Z-Score	U-Score	A1	A2	Score for trueness	Precision	Score for Precision	Final score
	a, Bq/kg	u, Bq/kg	[%]									
1	30.0	3.5	11.7	-17.8	-1.8	-1.7	6.5	9.9	A	12.5	A	A
2	35.7	3.6	10.1	-2.2	-0.2	-0.2	0.8	10.2	A	11.0	A	A
3	39.2	0.1	0.3	7.4	0.7	1.7	2.7	4.1	A	4.4	A	A
5	37.0	2.0	5.4	1.4	0.1	0.2	0.5	6.6	A	7.0	A	A
8	38.6	1.9	4.9	5.8	0.6	0.8	2.1	6.4	A	6.6	A	A
11	41.6	2.4	5.8	14.0	1.4	1.8	5.1	7.4	A	7.2	A	A
12	33.7	2.4	7.1	-7.7	-0.8	-1.0	2.8	7.4	A	8.4	A	A
14	32.8	0.7	2.1	-10.3	-1.0	-2.2	3.8	4.5	A	4.9	A	A
16	36.3	0.6	1.5	-0.6	-0.1	-0.1	0.2	4.4	A	4.6	A	A
18	30.3	0.8	2.7	-17.0	-1.7	-3.5	6.2	4.6	N	5.1	A	W
19	36.8	0.8	2.3	0.8	0.1	0.2	0.3	4.7	A	4.9	A	A
21	37.0	0.5	1.2	1.4	0.1	0.3	0.5	4.3	A	4.5	A	A
23	34.1	1.3	3.8	-6.6	-0.7	-1.2	2.4	5.3	A	5.8	A	A
29	43.4	4.5	10.4	18.9	1.9	1.4	6.9	12.3	A	11.3	A	A
30	41.5	2.2	5.3	13.7	1.4	1.8	5.0	7.0	A	6.9	A	A
31	35.5	2.7	7.6	-2.7	-0.3	-0.3	1.0	8.1	A	8.8	A	A
33	53.5	3.2	6.0	46.5	4.6	4.7	17.0	9.3	N	7.4	A	N
34	38.2	1.1	2.9	4.7	0.5	0.9	1.7	5.0	A	5.3	A	A
35	42.4	2.4	5.6	16.2	1.6	2.1	5.9	7.4	A	7.1	A	A
37	34.0	2.0	6.0	-7.0	-0.7	-1.0	2.6	6.7	A	7.4	A	A
39	36.4	1.1	3.0	-0.3	0.0	-0.1	0.1	5.0	A	5.3	A	A
41	40.5	2.5	6.2	11.0	1.1	1.3	4.0	7.7	A	7.6	A	A
42	39.0	2.0	5.1	6.8	0.7	1.0	2.5	6.6	A	6.7	A	A
43	39.0	1.4	3.6	6.8	0.7	1.2	2.5	5.5	A	5.7	A	A
45	40.7	2.1	5.1	11.5	1.2	1.6	4.2	6.7	A	6.7	A	A
46	30.2	0.9	2.9	-17.3	-1.7	-3.4	6.3	4.7	N	5.3	A	W
47	36.1	0.5	1.4	-1.1	-0.1	-0.2	0.4	4.3	A	4.6	A	A
49	36.0	1.1	3.1	-1.4	-0.1	-0.3	0.5	5.0	A	5.3	A	A
50	36.2	1.7	4.7	-0.8	-0.1	-0.1	0.3	6.0	A	6.4	A	A
51	40.5	1.7	4.2	11.0	1.1	1.7	4.0	6.0	A	6.1	A	A
53	36.8	2.2	5.9	0.9	0.1	0.1	0.3	7.0	A	7.4	A	A
55	36.6	1.5	4.1	0.3	0.0	0.0	0.1	5.7	A	6.0	A	A
56	38.3	2.2	5.7	4.9	0.5	0.7	1.8	7.0	A	7.2	A	A
57	37.1	2.6	7.0	1.6	0.2	0.2	0.6	7.9	A	8.3	A	A

a Relative uncertainty of the reported result at k = 1 coverage factor

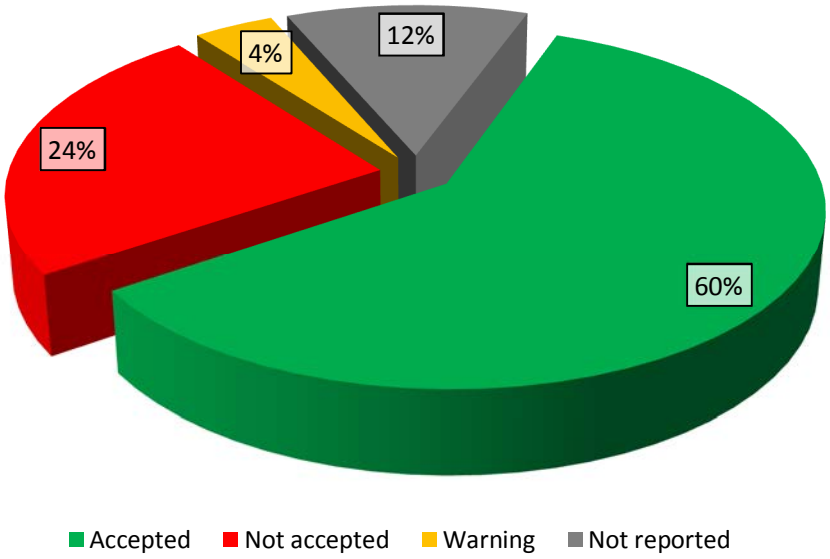

FIG. 61. Distribution of the scores for Tl-208 in soil (sample 04).

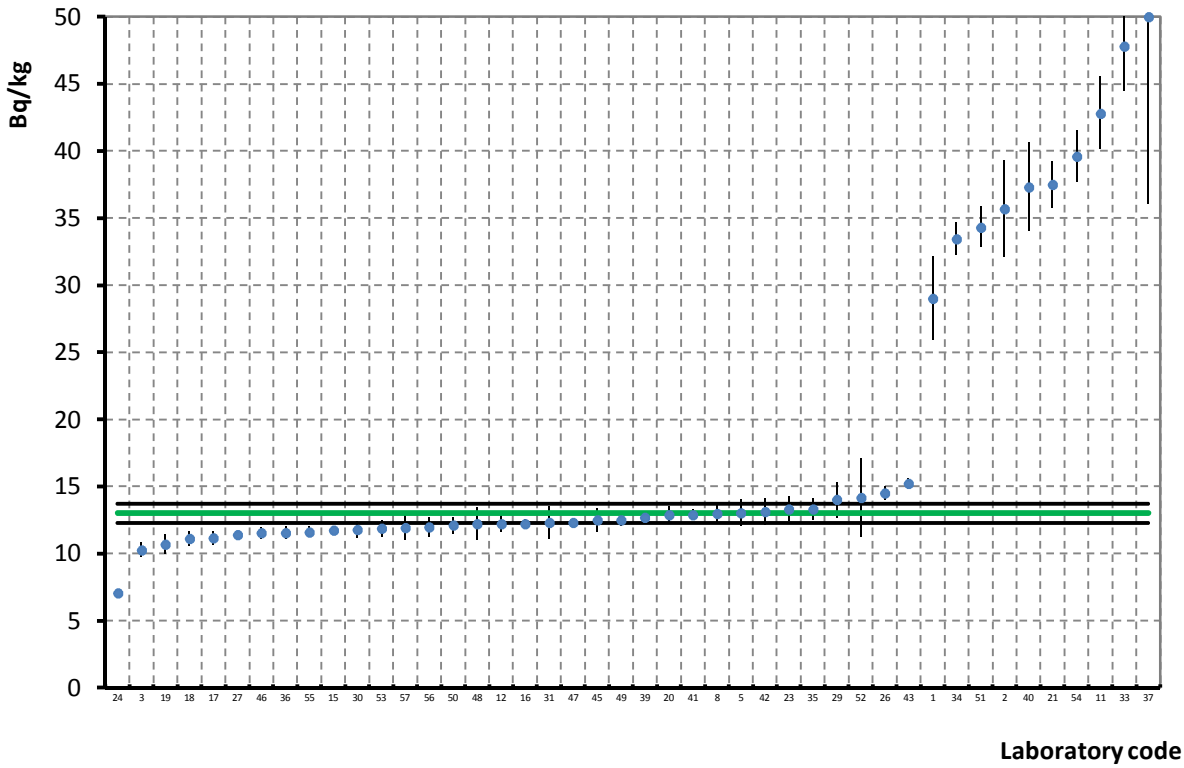

FIG. 62. Reported results and their uncertainties for Tl-208 in soil (sample 04).

TABLE 34. PERFORMANCE EVALUATION OF DETERMINATION OF Tl-208 IN SOIL (SAMPLE 04)

Target value: 13.0 ± 0.7 Bq/kg
MAB: 20 %
LAP: 20 %

Laboratory code	Reported values		Unc[a]	Bias [%]	Z-Score	U-Score	A1	A2	Score for trueness	Precision	Score for Precision	Final score
	a, Bq/kg	u, Bq/kg	[%]									
1	29.0	3.1	10.7	123.1	12.3	5.0	16.0	8.2	N	12.0	A	N
2	35.7	3.6	10.1	174.6	17.5	6.2	22.7	9.5	N	11.4	A	N
3	10.2	0.5	5.1	-21.2	-2.1	-3.2	2.8	2.2	N	7.4	A	N
5	13.0	1.0	7.7	0.0	0.0	0.0	0.0	3.1	A	9.4	A	A
8	13.0	0.7	5.6	-0.2	0.0	0.0	0.0	2.6	A	7.7	A	A
11	42.8	2.7	6.3	229.2	22.9	10.7	29.8	7.2	N	8.3	A	N
12	12.2	0.6	5.0	-5.9	-0.6	-0.8	0.8	2.4	A	7.3	A	A
15	11.7	0.3	2.8	-9.8	-1.0	-1.6	1.3	2.0	A	6.1	A	A
16	12.2	0.3	2.6	-5.9	-0.6	-1.0	0.8	2.0	A	6.0	A	A
17	11.2	0.5	4.5	-14.2	-1.4	-2.2	1.9	2.2	A	7.0	A	A
18	11.1	0.5	4.8	-14.6	-1.5	-2.2	1.9	2.3	A	7.2	A	A
19	10.7	0.7	6.6	-17.8	-1.8	-2.3	2.3	2.6	A	8.6	A	A
20	12.9	0.6	4.7	-0.8	-0.1	-0.1	0.1	2.4	A	7.1	A	A
21	37.5	1.7	4.6	188.4	18.8	13.3	24.5	4.8	N	7.1	A	N
23	13.3	0.9	6.8	2.3	0.2	0.3	0.3	2.9	A	8.6	A	A
24	7.1	0.3	3.7	-45.8	-4.6	-8.0	6.0	1.9	N	6.5	A	N
26	14.5	0.5	3.4	11.5	1.2	1.7	1.5	2.2	A	6.4	A	A
27	11.4	0.3	2.6	-12.3	-1.2	-2.1	1.6	2.0	A	6.0	A	A
29	14.0	1.3	9.3	7.7	0.8	0.7	1.0	3.8	A	10.7	A	A
30	11.8	0.6	5.1	-9.2	-0.9	-1.3	1.2	2.4	A	7.4	A	A
31	12.3	1.2	9.8	-5.4	-0.5	-0.5	0.7	3.6	A	11.1	A	A
33	47.8	3.3	7.0	267.7	26.8	10.2	34.8	8.8	N	8.8	A	N
34	33.5	1.2	3.6	157.3	15.7	14.7	20.5	3.6	N	6.5	A	N
35	13.3	0.8	6.1	2.3	0.2	0.3	0.3	2.8	A	8.1	A	A
36	11.6	0.5	4.2	-11.1	-1.1	-1.7	1.4	2.2	A	6.8	A	A
37	50.0	14.0	28.0	284.6	28.5	2.6	37.0	36.2	N	28.5	N	N
39	12.7	0.4	3.1	-2.3	-0.2	-0.4	0.3	2.1	A	6.2	A	A
40	37.3	3.3	8.8	186.9	18.7	7.2	24.3	8.7	N	10.4	A	N
41	12.9	0.4	3.1	-0.8	-0.1	-0.1	0.1	2.1	A	6.2	A	A
42	13.1	1.0	7.6	0.8	0.1	0.1	0.1	3.1	A	9.3	A	A
43	15.2	0.4	2.6	16.9	1.7	2.7	2.2	2.1	N	6.0	A	W
45	12.5	0.9	7.1	-4.0	-0.4	-0.5	0.5	2.9	A	8.9	A	A
46	11.5	0.4	3.8	-11.2	-1.1	-1.8	1.5	2.1	A	6.6	A	A
47	12.3	0.3	2.4	-5.4	-0.5	-0.9	0.7	2.0	A	5.9	A	A
48	12.2	1.2	9.7	-6.2	-0.6	-0.6	0.8	3.5	A	11.1	A	A
49	12.5	0.5	4.0	-3.8	-0.4	-0.6	0.5	2.2	A	6.7	A	A
50	12.1	0.6	5.0	-6.9	-0.7	-1.0	0.9	2.4	A	7.3	A	A
51	34.3	1.5	4.4	163.8	16.4	12.9	21.3	4.3	N	6.9	A	N
52	14.2	2.9	20.7	9.1	0.9	0.4	1.2	7.8	A	21.4	N	W
53	11.9	0.6	5.3	-8.7	-0.9	-1.2	1.1	2.4	A	7.6	A	A
54	39.6	1.9	4.8	204.6	20.5	13.1	26.6	5.2	N	7.2	A	N
55	11.6	0.4	3.4	-10.8	-1.1	-1.7	1.4	2.1	A	6.4	A	A
56	12.0	0.7	6.1	-8.0	-0.8	-1.0	1.0	2.6	A	8.1	A	A
57	11.9	0.9	7.8	-8.5	-0.8	-0.9	1.1	3.0	A	9.5	A	A

a Relative uncertainty of the reported result at k = 1 coverage factor

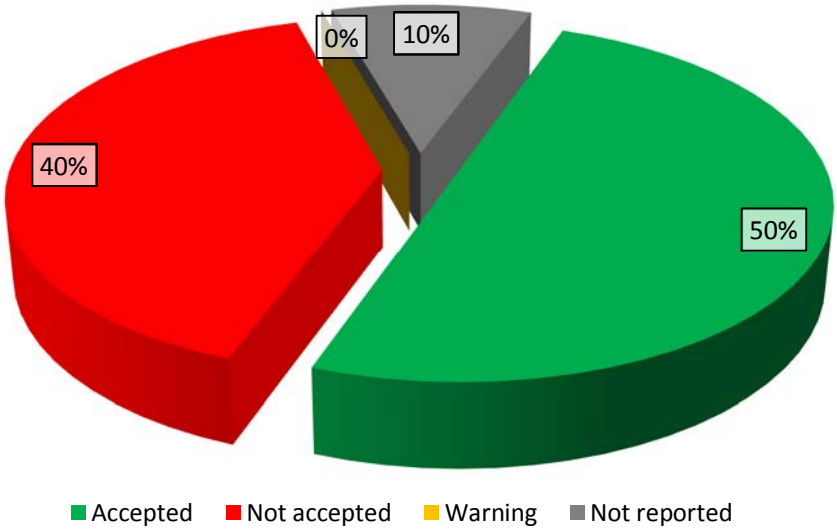

FIG. 63. Distribution of the scores for Pb-214 in soil (sample 04).

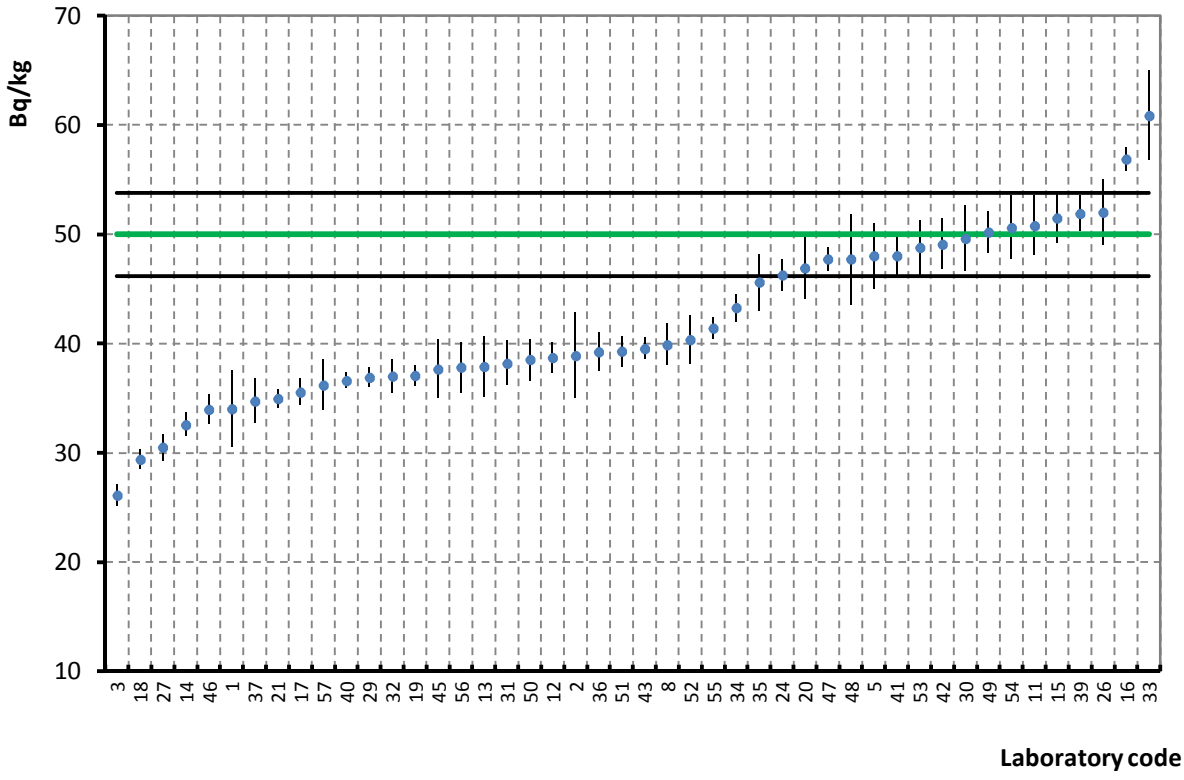

FIG. 64. Reported results and their uncertainties for Pb-214 in soil (sample 04).

TABLE 35. PERFORMANCE EVALUATION OF DETERMINATION OF Pb-214 IN SOIL (SAMPLE 04)

Target value: 50.0 ± 3.8 Bq/kg
MAB: 20 %
LAP: 20 %

Laboratory code	Reported values		Unc[a]	Bias [%]	Z-Score	U-Score	A1	A2	Score for trueness	Precision	Score for Precision	Final score
	a, Bq/kg	u, Bq/kg	[%]									
1	34.0	3.5	10.3	-32.0	-3.2	-3.1	16.0	13.3	N	12.8	A	N
2	38.9	3.9	10.0	-22.2	-2.2	-2.0	11.1	14.0	A	12.6	A	A
3	26.1	1.0	3.8	-47.8	-4.8	-6.1	23.9	10.1	N	8.5	A	N
5	48.0	3.0	6.3	-4.0	-0.4	-0.4	2.0	12.5	A	9.8	A	A
8	39.9	1.9	4.8	-20.2	-2.0	-2.4	10.1	11.0	A	9.0	A	A
11	50.8	2.7	5.3	1.6	0.2	0.2	0.8	12.0	A	9.3	A	A
12	38.7	1.4	3.6	-22.6	-2.3	-2.8	11.3	10.4	N	8.4	A	N
13	37.9	2.8	7.4	-24.3	-2.4	-2.6	12.1	12.2	A	10.6	A	A
14	32.6	1.1	3.3	-34.9	-3.5	-4.4	17.4	10.2	N	8.3	A	N
15	51.5	2.3	4.5	3.0	0.3	0.3	1.5	11.5	A	8.8	A	A
16	56.9	1.1	1.9	13.8	1.4	1.7	6.9	10.2	A	7.8	A	A
17	35.6	1.2	3.4	-28.9	-2.9	-3.6	14.5	10.3	N	8.3	A	N
18	29.4	0.9	3.0	-41.2	-4.1	-5.3	20.6	10.1	N	8.2	A	N
19	37.1	0.9	2.5	-25.9	-2.6	-3.3	12.9	10.1	N	8.0	A	N
20	46.9	2.8	6.0	-6.2	-0.6	-0.7	3.1	12.2	A	9.7	A	A
21	35.0	0.9	2.4	-30.1	-3.0	-3.9	15.0	10.0	N	8.0	A	N
24	46.3	1.4	3.1	-7.4	-0.7	-0.9	3.7	10.5	A	8.2	A	A
26	52.0	3.0	5.8	4.0	0.4	0.4	2.0	12.5	A	9.5	A	A
27	30.5	1.2	3.9	-39.0	-3.9	-4.9	19.5	10.3	N	8.6	A	N
29	36.9	0.9	2.4	-26.2	-2.6	-3.4	13.1	10.1	N	8.0	A	N
30	49.6	3.0	6.0	-0.8	-0.1	-0.1	0.4	12.5	A	9.7	A	A
31	38.2	2.0	5.2	-23.6	-2.4	-2.7	11.8	11.1	N	9.2	A	N
32	37.0	1.5	4.1	-26.0	-2.6	-3.2	13.0	10.5	N	8.6	A	N
33	60.9	4.1	6.7	21.7	2.2	1.9	10.9	14.4	A	10.2	A	A
34	43.3	1.3	2.9	-13.5	-1.3	-1.7	6.7	10.3	A	8.1	A	A
35	45.6	2.6	5.7	-8.8	-0.9	-1.0	4.4	11.9	A	9.5	A	A
36	39.2	1.8	4.5	-21.5	-2.2	-2.6	10.8	10.8	A	8.8	A	A
37	34.7	2.1	5.9	-30.6	-3.1	-3.5	15.3	11.1	N	9.6	A	N
39	51.9	1.6	3.1	3.8	0.4	0.5	1.9	10.6	A	8.2	A	A
40	36.6	0.7	1.9	-26.8	-2.7	-3.5	13.4	10.0	N	7.8	A	N
41	48.0	2.0	4.2	-4.0	-0.4	-0.5	2.0	11.1	A	8.7	A	A
42	49.1	2.3	4.7	-1.8	-0.2	-0.2	0.9	11.5	A	8.9	A	A
43	39.5	1.0	2.5	-21.0	-2.1	-2.7	10.5	10.1	N	8.0	A	N
45	37.7	2.7	7.1	-24.7	-2.5	-2.7	12.4	12.0	N	10.4	A	N
46	34.0	1.4	4.0	-32.1	-3.2	-4.0	16.0	10.4	N	8.6	A	N
47	47.7	1.1	2.3	-4.6	-0.5	-0.6	2.3	10.2	A	7.9	A	A
48	47.7	4.1	8.6	-4.6	-0.5	-0.4	2.3	14.4	A	11.5	A	A
49	50.2	1.9	3.8	0.4	0.0	0.0	0.2	11.0	A	8.5	A	A
50	38.5	1.9	4.9	-23.0	-2.3	-2.7	11.5	11.0	N	9.1	A	N
51	39.3	1.4	3.6	-21.4	-2.1	-2.6	10.7	10.4	N	8.4	A	N
52	40.3	2.2	5.4	-19.3	-1.9	-2.2	9.7	11.3	A	9.3	A	A
53	48.8	2.6	5.2	-2.5	-0.2	-0.3	1.2	11.8	A	9.2	A	A
54	50.6	2.9	5.7	1.2	0.1	0.1	0.6	12.3	A	9.5	A	A
55	41.4	1.0	2.4	-17.2	-1.7	-2.2	8.6	10.1	A	8.0	A	A
56	37.8	2.3	6.1	-24.4	-2.4	-2.7	12.2	11.5	N	9.7	A	N
57	36.2	2.3	6.4	-27.6	-2.8	-3.1	13.8	11.5	N	9.9	A	N

a Relative uncertainty of the reported result at k = 1 coverage factor

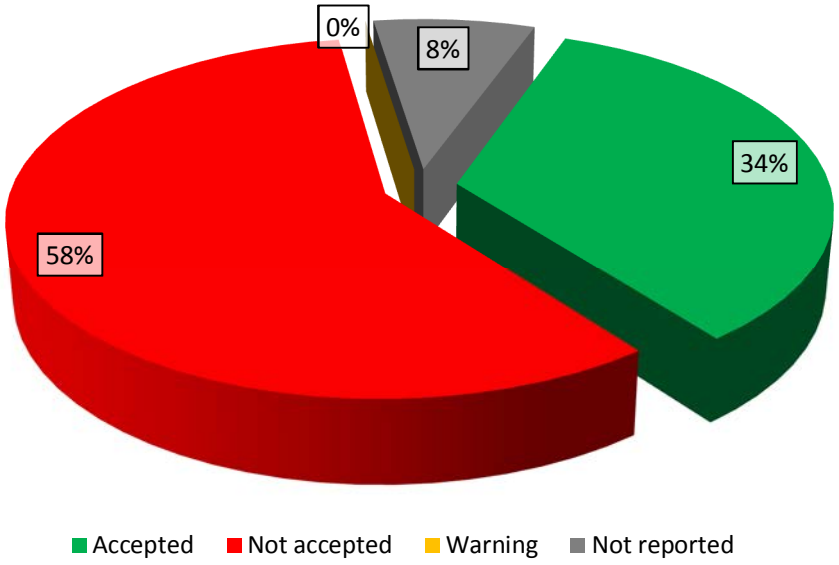

FIG. 65. Distribution of the scores for Bi-214 in soil (sample 04).

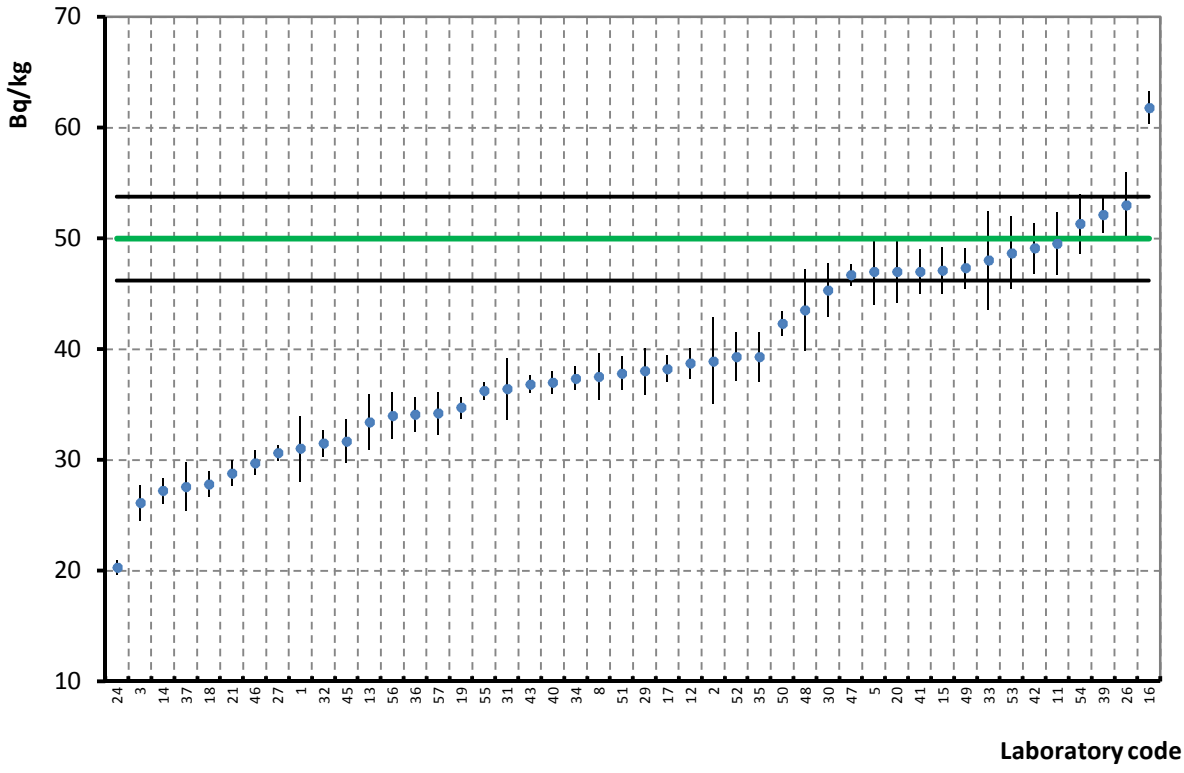

FIG. 66. Reported results and their uncertainties for Bi-214 in soil (sample 04).

TABLE 36. PERFORMANCE EVALUATION OF DETERMINATION OF Bi-214 IN SOIL (SAMPLE 04)

Target value: 50.0 ± 2.8 Bq/kg
MAB: 20 %
LAP: 20 %

Laboratory code	Reported values		Unc[a]	Bias [%]	Z-Score	U-Score	A1	A2	Score for trueness	Precision	Score for Precision	Final score
	a, Bq/kg	u, Bq/kg	[%]									
1	31.0	3.0	9.7	-38.0	-3.8	-4.6	19.0	10.6	N	11.2	A	N
2	38.9	3.9	10.0	-22.2	-2.2	-2.3	11.1	12.4	A	11.5	A	A
3	26.1	1.6	6.1	-47.8	-4.8	-7.4	23.9	8.3	N	8.3	A	N
5	47.0	3.0	6.4	-6.0	-0.6	-0.7	3.0	10.6	A	8.5	A	A
8	37.5	2.1	5.6	-25.0	-2.5	-3.6	12.5	9.0	N	7.9	A	N
11	49.5	2.8	5.7	-1.0	-0.1	-0.1	0.5	10.2	A	8.0	A	A
12	38.7	1.4	3.6	-22.6	-2.3	-3.6	11.3	8.1	N	6.7	A	N
13	33.4	2.5	7.5	-33.2	-3.3	-4.4	16.6	9.7	N	9.3	A	N
14	27.2	1.2	4.3	-45.6	-4.6	-7.5	22.8	7.8	N	7.0	A	N
15	47.1	2.1	4.5	-5.8	-0.6	-0.8	2.9	9.0	A	7.2	A	A
16	61.8	1.5	2.4	23.6	2.4	3.7	11.8	8.2	N	6.1	A	N
17	38.2	1.2	3.1	-23.6	-2.4	-3.9	11.8	7.9	N	6.4	A	N
18	27.8	1.2	4.2	-44.4	-4.4	-7.3	22.2	7.8	N	7.0	A	N
19	34.7	1.0	2.8	-30.6	-3.1	-5.2	15.3	7.6	N	6.3	A	N
20	47.0	2.8	6.0	-6.0	-0.6	-0.8	3.0	10.2	A	8.2	A	A
21	28.8	1.2	4.0	-42.4	-4.2	-7.0	21.2	7.8	N	6.9	A	N
24	20.3	0.6	3.2	-59.4	-5.9	-10.3	29.7	7.4	N	6.4	A	N
26	53.0	3.0	5.7	6.0	0.6	0.7	3.0	10.6	A	8.0	A	A
27	30.6	0.7	2.3	-38.8	-3.9	-6.7	19.4	7.4	N	6.0	A	N
29	38.0	2.1	5.5	-24.0	-2.4	-3.4	12.0	9.0	N	7.9	A	N
30	45.3	2.4	5.3	-9.4	-0.9	-1.3	4.7	9.5	A	7.7	A	A
31	36.4	2.8	7.7	-27.2	-2.7	-3.4	13.6	10.2	N	9.5	A	N
32	31.5	1.2	3.8	-37.0	-3.7	-6.1	18.5	7.9	N	6.8	A	N
33	48.0	4.5	9.3	-4.0	-0.4	-0.4	2.0	13.6	A	10.8	A	A
34	37.3	1.0	2.8	-25.3	-2.5	-4.2	12.7	7.7	N	6.3	A	N
35	39.3	2.2	5.7	-21.4	-2.1	-3.0	10.7	9.3	N	8.0	A	N
36	34.1	1.6	4.6	-31.8	-3.2	-5.0	15.9	8.3	N	7.2	A	N
37	27.5	2.2	8.0	-44.9	-4.5	-6.3	22.5	9.2	N	9.8	A	N
39	52.1	1.6	3.1	4.2	0.4	0.7	2.1	8.3	A	6.4	A	A
40	37.0	1.0	2.7	-26.0	-2.6	-4.4	13.0	7.7	N	6.2	A	N
41	47.0	2.0	4.3	-6.0	-0.6	-0.9	3.0	8.9	A	7.0	A	A
42	49.1	2.3	4.7	-1.8	-0.2	-0.2	0.9	9.3	A	7.3	A	A
43	36.8	0.8	2.2	-26.4	-2.6	-4.5	13.2	7.5	N	6.0	A	N
45	31.7	2.0	6.3	-36.7	-3.7	-5.3	18.3	8.9	N	8.4	A	N
46	29.7	1.1	3.8	-40.6	-4.1	-6.7	20.3	7.8	N	6.8	A	N
47	46.7	1.0	2.1	-6.6	-0.7	-1.1	3.3	7.7	A	6.0	A	A
48	43.5	3.7	8.5	-13.0	-1.3	-1.4	6.5	12.0	A	10.2	A	A
49	47.3	1.8	3.8	-5.4	-0.5	-0.8	2.7	8.6	A	6.8	A	A
50	42.3	1.1	2.6	-15.4	-1.5	-2.6	7.7	7.8	A	6.2	A	A
51	37.8	1.5	4.0	-24.4	-2.4	-3.8	12.2	8.2	N	6.9	A	N
52	39.3	2.2	5.6	-21.4	-2.1	-3.0	10.7	9.2	N	7.9	A	N
53	48.7	3.3	6.7	-2.6	-0.3	-0.3	1.3	11.1	A	8.8	A	A
54	51.3	2.7	5.3	2.6	0.3	0.3	1.3	10.0	A	7.7	A	A
55	36.2	0.8	2.2	-27.6	-2.8	-4.7	13.8	7.5	N	6.0	A	N
56	34.0	2.1	6.2	-32.0	-3.2	-4.6	16.0	9.0	N	8.3	A	N
57	34.2	1.9	5.6	-31.6	-3.2	-4.7	15.8	8.7	N	7.9	A	N

a Relative uncertainty of the reported result at k = 1 coverage factor

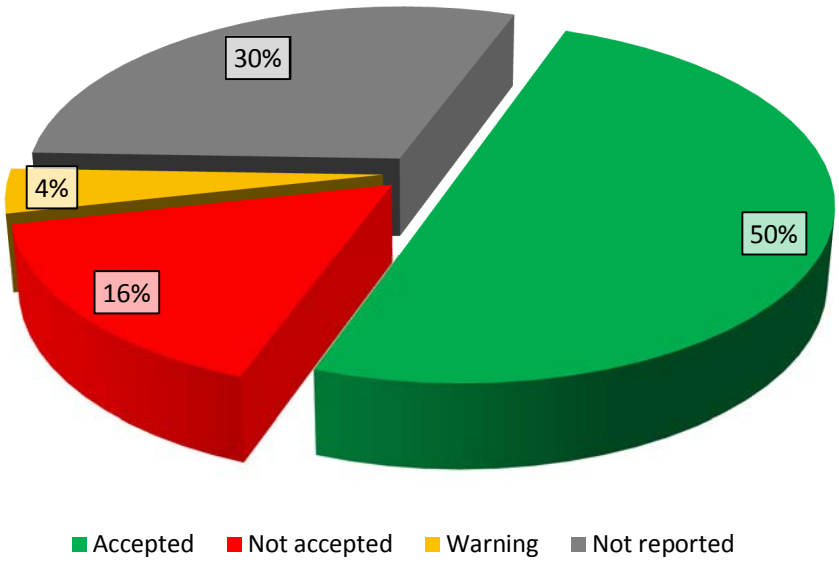

FIG. 67. Distribution of the scores for Pb-210 in soil (sample 04).

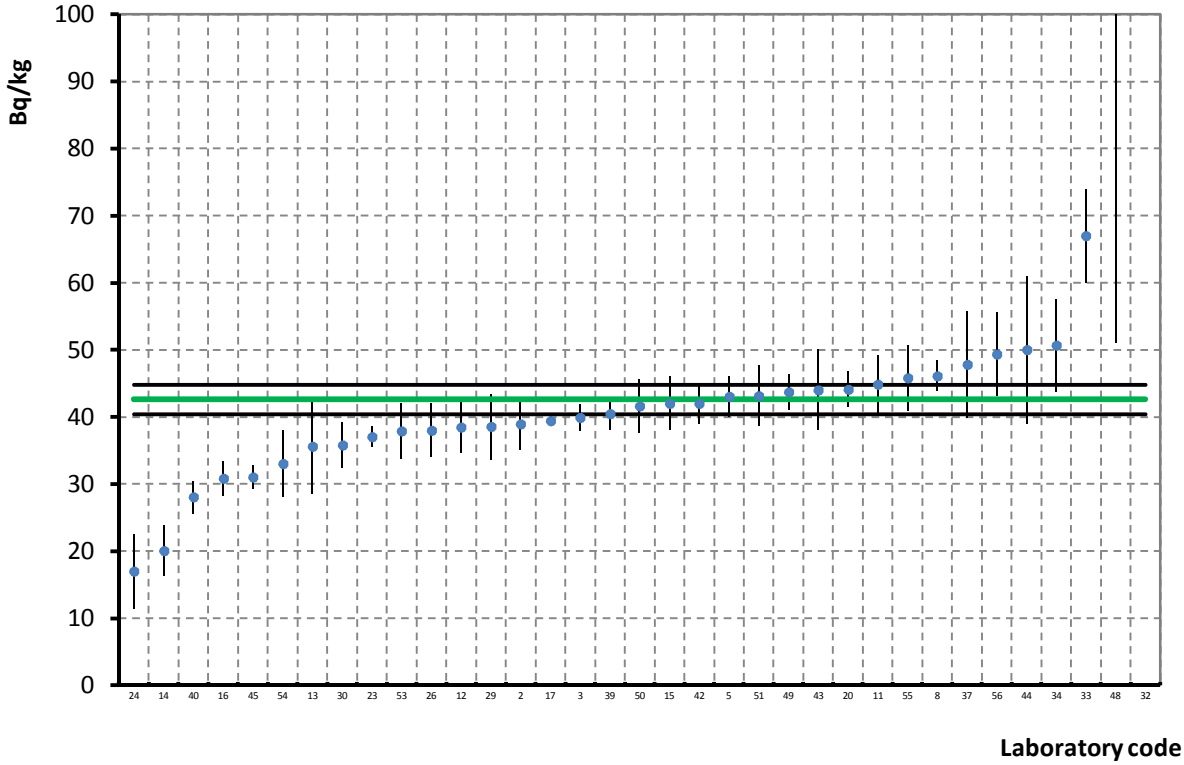

FIG. 68. Reported results and their uncertainties for Pb-210 in soil (sample 04).

TABLE 37. PERFORMANCE EVALUATION OF DETERMINATION OF Pb-210 IN SOIL (SAMPLE 04)

Target value: 42.6 ± 2.2 Bq/kg
MAB: 20 %
LAP: 20 %

Laboratory code	Reported values		Unc[a]	Bias [%]	Z-Score	U-Score	A1	A2	Score for trueness	Precision	Score for Precision	Final score
	a, Bq/kg	u, Bq/kg	[%]									
3	50.0	5.0	10.0	17.4	1.7	1.4	7.4	14.1	A	11.3	A	A
4	39.0	6.0	15.4	-8.5	-0.8	-0.6	3.6	16.5	A	16.2	A	A
6	43.6	3.1	7.1	2.3	0.2	0.3	1.0	9.8	A	8.8	A	A
9	164.5	45.1	27.4	286.2	28.6	2.7	121.9	116.5	N	27.9	N	N
14	30.0	10.0	33.3	-29.6	-3.0	-1.2	12.6	26.4	A	33.7	N	N
15	37.0	8.0	21.6	-13.1	-1.3	-0.7	5.6	21.4	A	22.2	N	W
16	45.1	6.8	15.0	5.8	0.6	0.3	2.5	18.4	A	15.9	A	A
17	53.7	2.2	4.0	26.1	2.6	3.6	11.1	7.9	N	6.5	A	N
20	41.1	2.0	4.9	-3.5	-0.4	-0.5	1.5	7.7	A	7.1	A	A
25	52.6	4.2	8.0	23.5	2.3	2.1	10.0	12.2	A	9.5	A	A
26	46.1	6.5	14.1	8.2	0.8	0.5	3.5	17.7	A	15.0	A	A
27	34.2	5.1	14.9	-19.7	-2.0	-1.5	8.4	14.3	A	15.8	A	A
29	56.2	1.8	3.2	31.9	3.2	4.8	13.6	7.3	N	6.1	A	N
30	27.5	1.8	6.5	-35.4	-3.5	-5.3	15.1	7.3	N	8.3	A	N
31	44.4	4.1	9.3	4.2	0.4	0.4	1.8	12.1	A	10.7	A	A
35	40.8	6.0	14.7	-4.2	-0.4	-0.3	1.8	16.5	A	15.6	A	A
36	38.0	3.0	7.9	-10.8	-1.1	-1.2	4.6	9.6	A	9.4	A	A
38	45.0	4.9	10.9	5.6	0.6	0.4	2.4	13.9	A	12.1	A	A
41	53.6	19.0	35.4	25.7	2.6	0.6	11.0	49.2	A	35.8	N	N
43	49.9	1.6	3.3	17.0	1.7	2.7	7.3	7.1	N	6.1	A	W
45	41.3	3.7	9.0	-3.1	-0.3	-0.3	1.3	11.1	A	10.3	A	A
46	44.0	11.0	25.0	3.3	0.3	0.1	1.4	28.9	A	25.5	N	W
48	41.3	2.5	6.1	-3.1	-0.3	-0.4	1.3	8.6	A	8.0	A	A
49	56.0	3.6	6.4	31.4	3.1	3.2	13.4	10.8	N	8.2	A	N
50	36.3	2.9	8.0	-14.8	-1.5	-1.7	6.3	9.4	A	9.5	A	A
52	35.4	3.4	9.6	-17.0	-1.7	-1.8	7.2	10.4	A	10.9	A	A
53	49.5	8.3	16.8	16.2	1.6	0.8	6.9	22.2	A	17.5	A	A
55	38.0	5.0	13.2	-10.8	-1.1	-0.8	4.6	14.1	A	14.1	A	A
56	23.4	3.1	13.2	-45.1	-4.5	-5.1	19.2	9.8	N	14.2	A	N

a Relative uncertainty of the reported result at k = 1 coverage factor

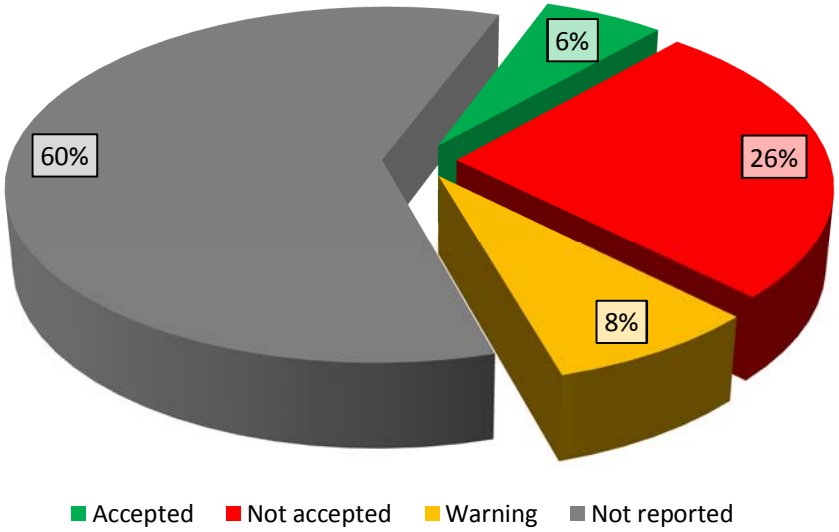

FIG. 69. Distribution of the scores for U-235 in soil (sample 04).

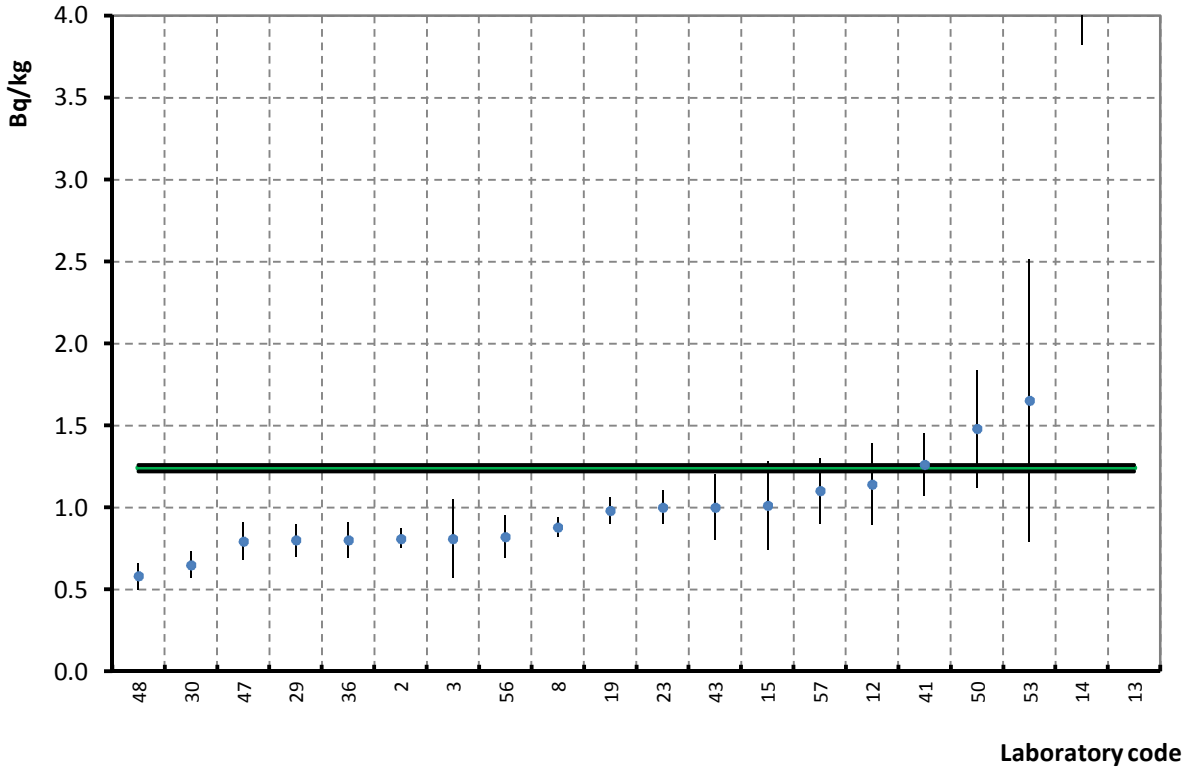

FIG. 70. Reported results and their uncertainties for U-235 in soil (sample 04).

TABLE 38. PERFORMANCE EVALUATION OF DETERMINATION OF U-235 IN SOIL (SAMPLE 04)

Target value: 1.24 ± 0.02 Bq/kg
MAB: 20 %
LAP: 20 %

Laboratory code	Reported values		Unc[a]	Bias [%]	Z-Score	U-Score	A1	A2	Score for trueness	Precision	Score for Precision	Final score
	a, Bq/kg	u, Bq/kg	[%]									
2	0.81	0.06	7.4	-34.7	-3.5	-6.8	0.4	0.2	N	7.6	A	N
3	0.81	0.24	29.6	-34.7	-3.5	-1.8	0.4	0.6	A	29.7	N	N
8	0.88	0.06	6.8	-29.0	-2.9	-5.7	0.4	0.2	N	7.0	A	N
12	1.14	0.25	21.9	-8.1	-0.8	-0.4	0.1	0.6	A	22.0	N	W
13	6.80	0.61	9.0	448.4	44.8	9.1	5.6	1.6	N	9.1	A	N
14	4.18	0.36	8.6	237.1	23.7	8.2	2.9	0.9	N	8.8	A	N
15	1.01	0.27	26.7	-18.5	-1.9	-0.8	0.2	0.7	A	26.8	N	W
19	0.98	0.08	8.2	-21.0	-2.1	-3.2	0.3	0.2	N	8.3	A	N
23	1.00	0.10	10.0	-19.4	-1.9	-2.4	0.2	0.3	A	10.1	A	A
29	0.80	0.10	12.5	-35.5	-3.5	-4.3	0.4	0.3	N	12.6	A	N
30	0.65	0.08	12.3	-47.6	-4.8	-7.2	0.6	0.2	N	12.4	A	N
36	0.80	0.11	13.8	-35.5	-3.5	-3.9	0.4	0.3	N	13.8	A	N
41	1.26	0.19	15.1	1.6	0.2	0.1	0.0	0.5	A	15.2	A	A
43	1.00	0.20	20.0	-19.4	-1.9	-1.2	0.2	0.5	A	20.1	N	W
47	0.79	0.11	14.2	-36.0	-3.6	-3.9	0.4	0.3	N	14.3	A	N
48	0.58	0.08	13.8	-53.2	-5.3	-8.0	0.7	0.2	N	13.9	A	N
50	1.48	0.36	24.3	19.4	1.9	0.7	0.2	0.9	A	24.4	N	W
53	1.65	0.86	52.1	33.1	3.3	0.5	0.4	2.2	A	52.1	N	N
56	0.82	0.13	15.9	-33.9	-3.4	-3.2	0.4	0.3	N	15.9	A	N
57	1.10	0.20	18.2	-11.3	-1.1	-0.7	0.1	0.5	A	18.3	A	A

a Relative uncertainty of the reported result at k = 1 coverage factor

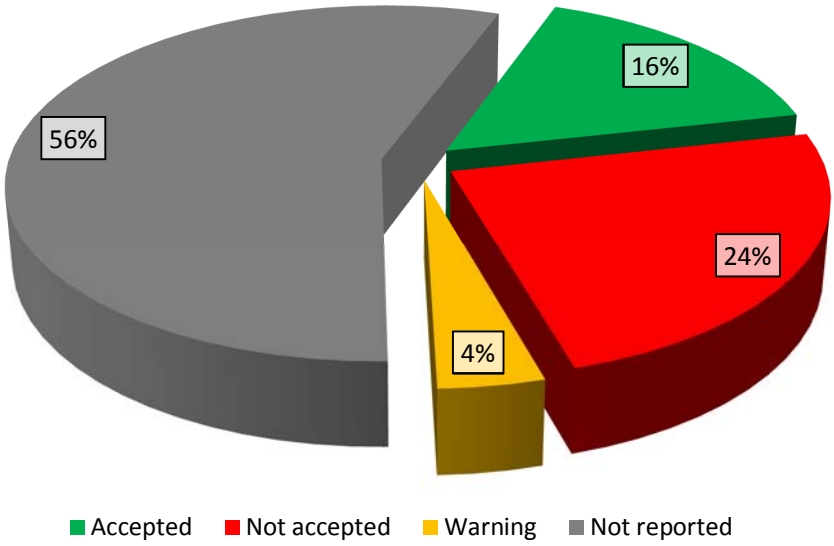

FIG. 71. Distribution of the scores for U-234 in soil (sample 04).

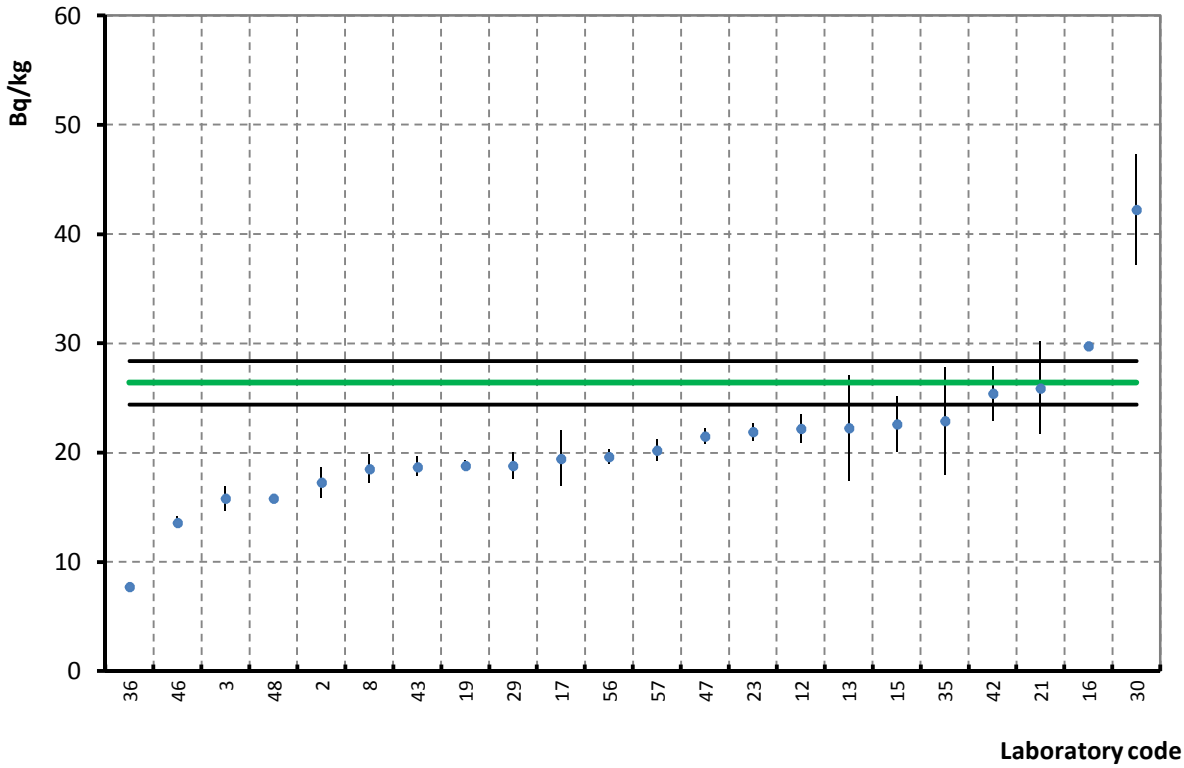

FIG. 72. Reported results and their uncertainties for U-234 in soil (sample 04).

TABLE 39. PERFORMANCE EVALUATION OF DETERMINATION OF U-234 IN SOIL (SAMPLE 04)

Target value: 26.4 ± 2.0Bq/kg
MAB: 20 %
LAP: 20 %

Laboratory code	Reported values		Unc[a] [%]	Bias [%]	Z-Score	U-Score	A1	A2	Score for trueness	Precision	Score for Precision	Final score
	a, Bq/kg	u, Bq/kg										
2	17.3	1.4	8.1	-34.5	-3.4	-3.7	9.1	6.3	N	11.1	A	N
3	15.8	1.1	7.0	-40.2	-4.0	-4.6	10.6	5.9	N	10.3	A	N
8	18.5	1.3	7.0	-29.9	-3.0	-3.3	7.9	6.2	N	10.3	A	N
12	22.2	1.3	5.9	-15.9	-1.6	-1.8	4.2	6.2	A	9.6	A	A
13	22.2	4.9	21.9	-15.8	-1.6	-0.8	4.2	13.6	A	23.1	N	W
15	22.6	2.5	11.1	-14.4	-1.4	-1.2	3.8	8.3	A	13.4	A	A
16	29.7	0.2	0.7	12.7	1.3	1.7	3.3	5.2	A	7.6	A	A
17	19.5	2.5	12.9	-26.3	-2.6	-2.2	7.0	8.3	A	14.9	A	A
19	18.8	0.5	2.7	-28.8	-2.9	-3.7	7.6	5.3	N	8.0	A	N
21	25.9	4.2	16.2	-1.9	-0.2	-0.1	0.5	12.0	A	17.9	A	A
23	21.9	0.8	3.7	-17.0	-1.7	-2.1	4.5	5.6	A	8.4	A	A
29	18.8	1.2	6.4	-28.8	-2.9	-3.3	7.6	6.0	N	9.9	A	N
30	42.2	5.1	12.0	60.0	6.0	2.9	15.8	14.1	N	14.2	A	N
35	22.9	4.9	21.5	-13.3	-1.3	-0.7	3.5	13.7	A	22.8	N	W
36	7.7	0.2	2.3	-70.7	-7.1	-9.3	18.7	5.2	N	7.9	A	N
42	25.4	2.5	9.8	-3.8	-0.4	-0.3	1.0	8.3	A	12.4	A	A
43	18.7	0.9	4.8	-29.2	-2.9	-3.5	7.7	5.7	N	9.0	A	N
46	13.6	0.5	3.8	-48.5	-4.8	-6.2	12.8	5.3	N	8.5	A	N
47	21.5	0.7	3.3	-18.6	-1.9	-2.3	4.9	5.5	A	8.2	A	A
48	15.8	0.4	2.5	-40.2	-4.0	-5.2	10.6	5.3	N	8.0	A	N
56	19.6	0.7	3.5	-25.7	-2.6	-3.2	6.8	5.5	N	8.3	A	N
57	20.2	1.0	5.0	-23.5	-2.3	-2.8	6.2	5.8	N	9.0	A	N

a Relative uncertainty of the reported result at k = 1 coverage factor

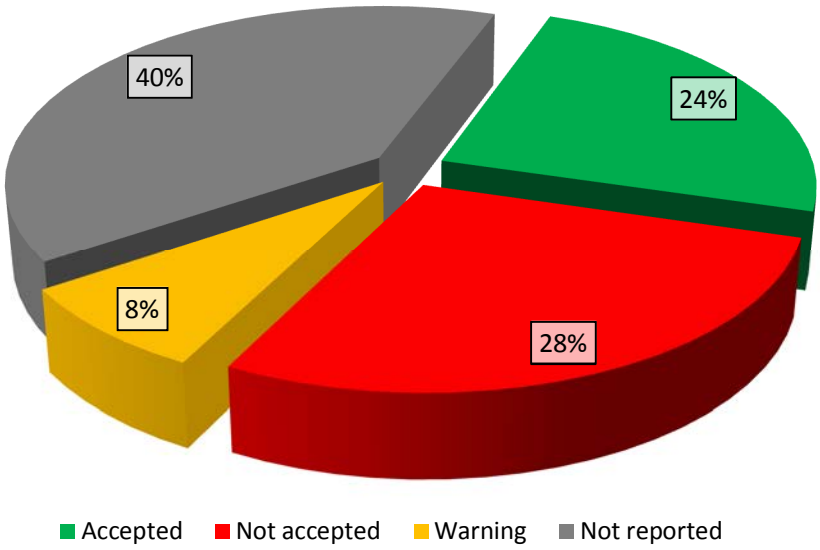

FIG. 73. Distribution of the scores for U-238 in soil (sample 04).

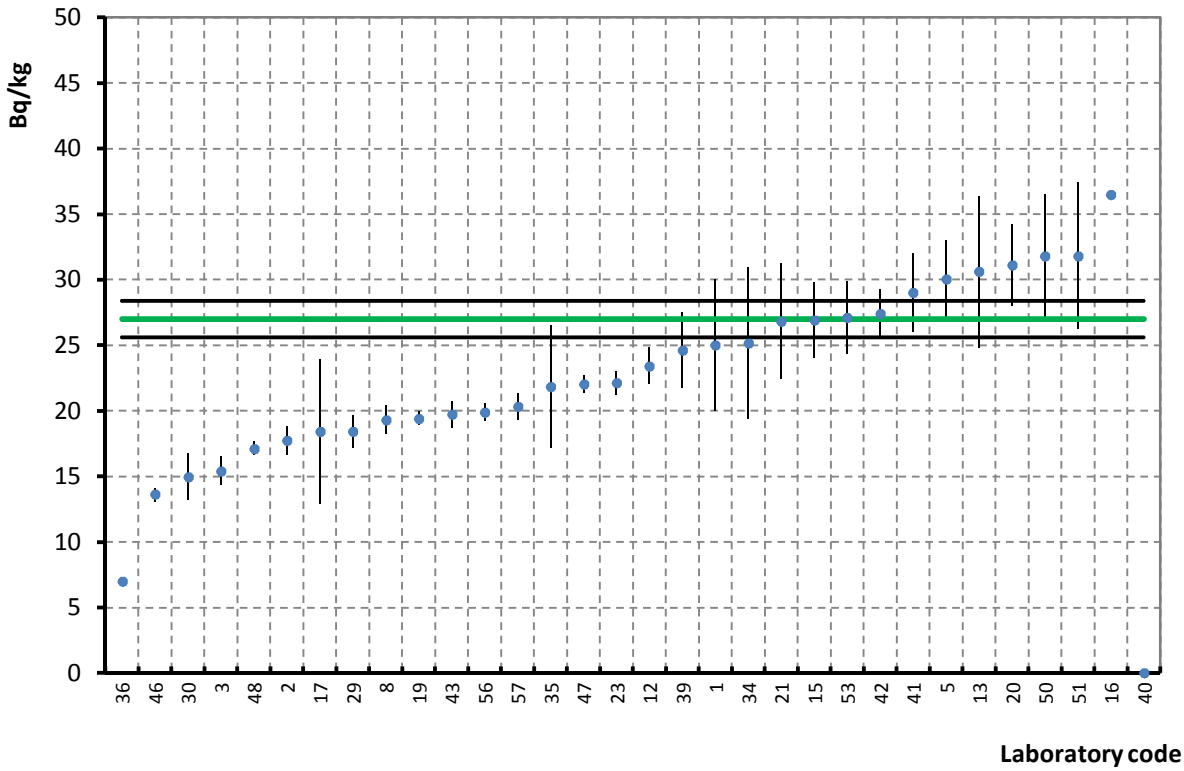

FIG. 74. Reported results and their uncertainties for U-238 in soil (sample 04).

TABLE 40. PERFORMANCE EVALUATION OF DETERMINATION OF U-238 IN SOIL (SAMPLE 04)

Target value: 27.0 ± 1.4 Bq/kg
MAB: 20 %
LAP: 20 %

Laboratory code	Reported values		Unc[a]	Bias [%]	Z-Score	U-Score	A1	A2	Score for trueness	Precision	Score for Precision	Final score
	a, Bq/kg	u, Bq/kg	[%]									
1	25.0	5.0	20.0	-7.4	-0.7	-0.4	2.0	13.4	A	20.7	N	W
2	17.7	1.1	6.2	-34.4	-3.4	-5.2	9.3	4.6	N	8.1	A	N
3	15.4	1.1	7.1	-43.0	-4.3	-6.5	11.6	4.6	N	8.8	A	N
5	30.0	3.0	10.0	11.1	1.1	0.9	3.0	8.5	A	11.3	A	A
8	19.3	1.1	5.7	-28.5	-2.9	-4.3	7.7	4.6	N	7.7	A	N
12	23.4	1.4	6.0	-13.3	-1.3	-1.8	3.6	5.1	A	7.9	A	A
13	30.6	5.8	18.9	13.3	1.3	0.6	3.6	15.4	A	19.6	A	A
15	26.9	2.9	10.8	-0.4	0.0	0.0	0.1	8.3	A	12.0	A	A
16	36.5	0.3	0.8	35.1	3.5	6.6	9.5	3.7	N	5.2	A	N
17	18.4	5.5	29.9	-31.9	-3.2	-1.5	8.6	14.6	A	30.3	N	N
19	19.4	0.5	2.7	-28.1	-2.8	-5.1	7.6	3.9	N	5.8	A	N
20	31.1	3.1	10.0	15.2	1.5	1.2	4.1	8.8	A	11.2	A	A
21	26.8	4.4	16.4	-0.7	-0.1	0.0	0.2	11.9	A	17.2	A	A
23	22.1	0.9	4.1	-18.1	-1.8	-2.9	4.9	4.3	N	6.6	A	W
29	18.4	1.2	6.5	-31.9	-3.2	-4.7	8.6	4.8	N	8.3	A	N
30	15.0	1.8	12.0	-44.6	-4.5	-5.3	12.0	5.9	N	13.1	A	N
34	25.2	5.8	22.9	-6.9	-0.7	-0.3	1.9	15.3	A	23.5	N	W
35	21.8	4.7	21.5	-19.3	-1.9	-1.1	5.2	12.6	A	22.1	N	W
36	7.0	0.3	4.9	-74.1	-7.4	-13.9	20.0	3.7	N	7.1	A	N
39	24.6	2.9	11.8	-8.9	-0.9	-0.7	2.4	8.3	A	12.9	A	A
41	29.0	3.0	10.3	7.4	0.7	0.6	2.0	8.5	A	11.6	A	A
42	27.4	1.9	6.9	1.5	0.1	0.2	0.4	6.1	A	8.7	A	A
43	19.7	1.0	5.1	-27.0	-2.7	-4.2	7.3	4.4	N	7.3	A	N
46	13.6	0.5	3.8	-49.6	-5.0	-9.0	13.4	3.9	N	6.4	A	N
47	22.0	0.7	3.0	-18.5	-1.9	-3.2	5.0	4.0	N	6.0	A	W
48	17.1	0.5	2.9	-36.7	-3.7	-6.7	9.9	3.8	N	6.0	A	N
50	31.8	4.7	14.8	17.8	1.8	1.0	4.8	12.7	A	15.7	A	A
51	31.8	5.6	17.6	17.8	1.8	0.8	4.8	14.9	A	18.4	A	A
53	27.1	2.8	10.3	0.4	0.0	0.0	0.1	8.0	A	11.5	A	A
56	19.9	0.7	3.4	-26.4	-2.6	-4.6	7.1	4.0	N	6.2	A	N
57	20.3	1.0	4.9	-24.8	-2.5	-3.9	6.7	4.4	N	7.2	A	N

a Relative uncertainty of the reported result at k = 1 coverage factor

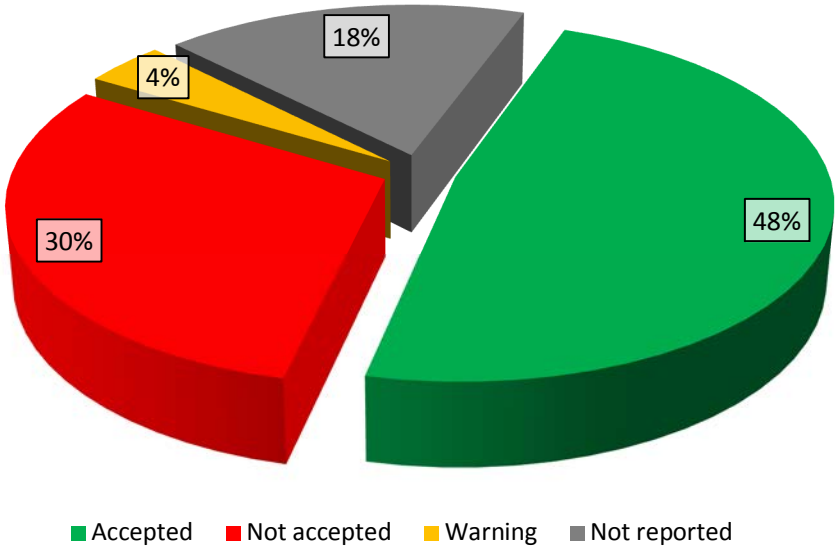

FIG. 75. Distribution of the scores for Ra-226 in soil (sample 04).

FIG. 76. Reported results and their uncertainties for Ra-226 in soil (sample 04).

TABLE 41. PERFORMANCE EVALUATION OF DETERMINATION OF Ra-226 IN SOIL (SAMPLE 04)

Target value: 50.2 ± 2.0 Bq/kg
MAB: 20 %
LAP: 20 %

Laboratory code	Reported values		Unc[a]	Bias [%]	Z-Score	U-Score	A1	A2	Score for trueness	Precision	Score for Precision	Final score
	a, Bq/kg	u, Bq/kg	[%]									
1	47.0	7.0	14.9	-6.4	-0.6	-0.4	3.2	18.8	A	15.4	A	A
2	38.9	3.9	10.0	-22.5	-2.3	-2.6	11.3	11.3	A	10.8	A	A
3	26.1	1.0	3.7	-48.0	-4.8	-10.8	24.1	5.7	N	5.4	A	N
5	50.0	5.0	10.0	-0.4	0.0	0.0	0.2	13.9	A	10.8	A	A
8	50.7	4.6	9.1	1.0	0.1	0.1	0.5	12.9	A	9.9	A	A
10	40.0	2.0	5.0	-20.3	-2.0	-3.6	10.2	7.3	N	6.4	A	N
11	52.2	2.8	5.4	4.0	0.4	0.6	2.0	8.9	A	6.7	A	A
12	47.4	3.6	7.6	-5.6	-0.6	-0.7	2.8	10.6	A	8.6	A	A
13	35.9	2.7	7.4	-28.4	-2.8	-4.3	14.3	8.6	N	8.4	A	N
15	49.3	3.1	6.3	-1.8	-0.2	-0.2	0.9	9.5	A	7.4	A	A
16	15.1	0.1	0.5	-70.0	-7.0	-17.6	35.1	5.2	N	4.0	A	N
17	44.7	13.5	30.2	-11.0	-1.1	-0.4	5.5	35.2	A	30.5	N	W
18	74.2	8.3	11.2	47.8	4.8	2.8	24.0	22.1	N	11.9	A	N
19	37.1	0.9	2.5	-26.2	-2.6	-5.9	13.1	5.7	N	4.7	A	N
20	51.0	6.1	12.0	1.6	0.2	0.1	0.8	16.6	A	12.6	A	A
24	51.3	4.2	8.1	2.1	0.2	0.2	1.1	11.9	A	9.0	A	A
29	40.6	2.6	6.4	-19.1	-1.9	-2.9	9.6	8.5	N	7.5	A	W
30	47.1	1.3	2.8	-6.2	-0.6	-1.3	3.1	6.2	A	4.8	A	A
31	34.7	1.5	4.3	-30.9	-3.1	-6.2	15.5	6.5	N	5.9	A	N
32	99.0	16.0	16.2	97.2	9.7	3.0	48.8	41.6	N	16.6	A	N
34	39.1	1.0	2.5	-22.1	-2.2	-5.0	11.1	5.7	N	4.7	A	N
35	62.8	5.1	8.1	25.1	2.5	2.3	12.6	14.0	A	9.0	A	A
36	16.9	1.2	7.2	-66.4	-6.6	-14.2	33.3	6.0	N	8.3	A	N
37	34.9	8.0	22.9	-30.6	-3.1	-1.9	15.3	21.3	A	23.3	N	N
39	52.7	3.5	6.6	5.0	0.5	0.6	2.5	10.4	A	7.7	A	A
40	38.2	1.5	3.9	-23.9	-2.4	-4.8	12.0	6.5	N	5.6	A	N
41	50.0	4.0	8.0	-0.4	0.0	0.0	0.2	11.5	A	8.9	A	A
42	49.1	2.3	4.7	-2.2	-0.2	-0.4	1.1	7.9	A	6.1	A	A
43	57.0	3.0	5.3	13.5	1.4	1.9	6.8	9.3	A	6.6	A	A
44	53.0	4.0	7.5	5.6	0.6	0.6	2.8	11.5	A	8.5	A	A
46	86.7	6.0	7.0	72.7	7.3	5.7	36.5	16.4	N	8.0	A	N
48	45.4	1.8	4.0	-9.6	-1.0	-1.8	4.8	6.9	A	5.6	A	A
49	47.6	4.3	9.0	-5.2	-0.5	-0.5	2.6	12.2	A	9.9	A	A
50	41.3	3.9	9.4	-17.7	-1.8	-2.0	8.9	11.3	A	10.2	A	A
51	38.9	1.0	2.6	-22.5	-2.3	-5.1	11.3	5.8	N	4.7	A	N
52	69.9	6.5	9.3	39.2	3.9	2.9	19.7	17.6	N	10.2	A	N
53	48.3	4.5	9.4	-3.8	-0.4	-0.4	1.9	12.8	A	10.2	A	A
54	51.0	2.8	5.5	1.6	0.2	0.2	0.8	8.9	A	6.8	A	A
55	65.0	6.0	9.2	29.5	2.9	2.3	14.8	16.3	A	10.1	A	A
56	63.2	5.7	9.0	25.9	2.6	2.2	13.0	15.6	A	9.9	A	A
57	48.2	2.5	5.2	-4.0	-0.4	-0.6	2.0	8.3	A	6.5	A	A

a Relative uncertainty of the reported result at k = 1 coverage factor

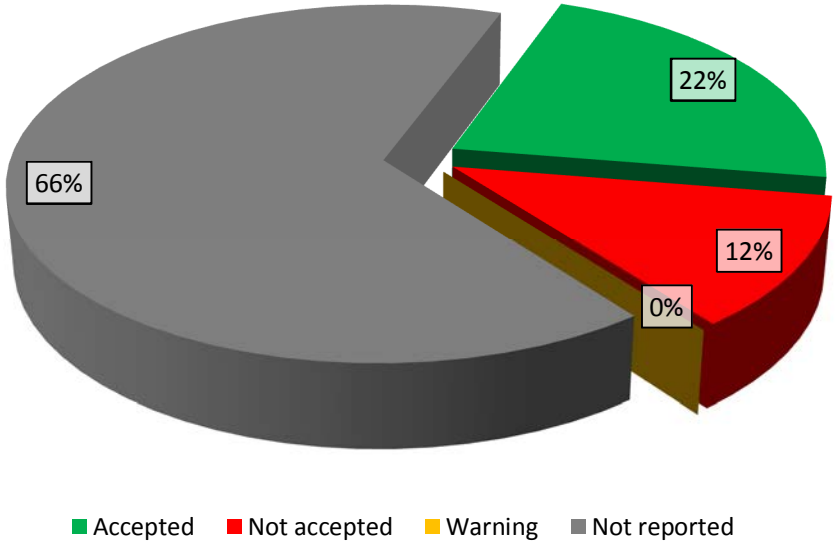

FIG. 77. Distribution of the scores for Po-210 in soil (sample 04).

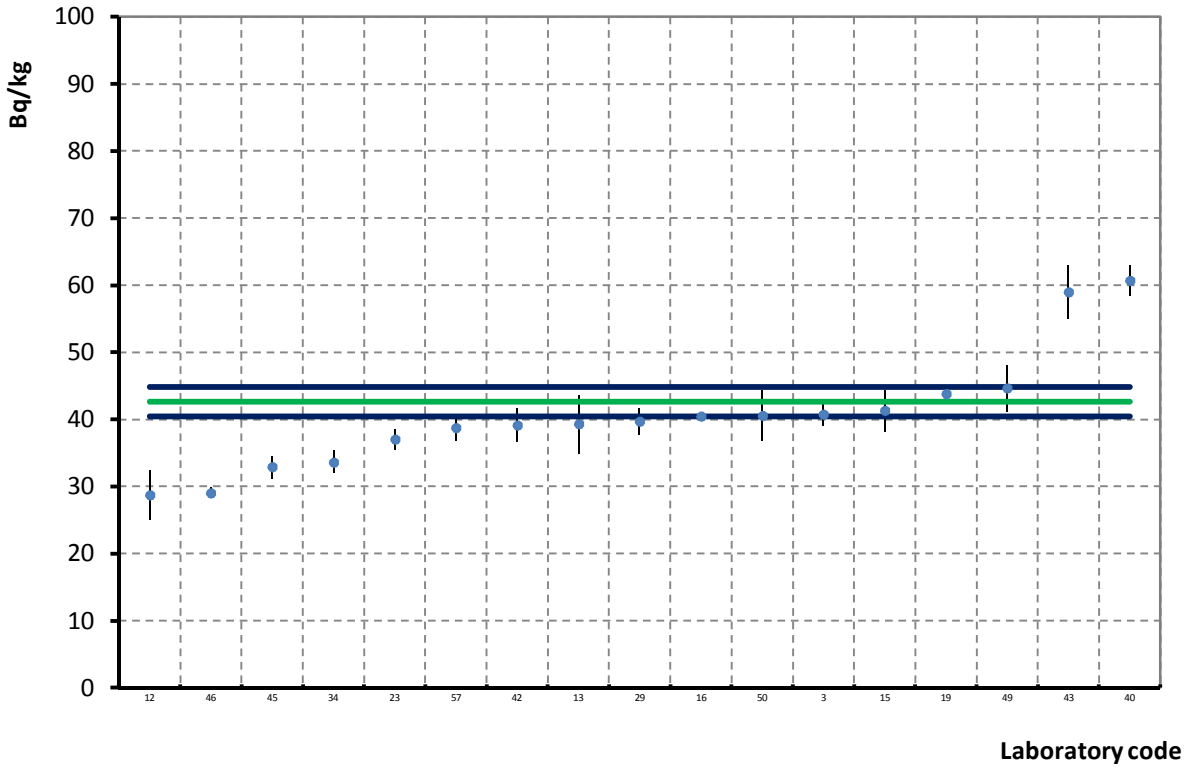

FIG. 78. Reported results and their uncertainties for Po-210 in soil (sample 04).

TABLE 42. PERFORMANCE EVALUATION OF DETERMINATION OF Po-210 IN SOIL (SAMPLE 04)

Target value: 42.6 ± 2.2 Bq/kg
MAB: 20 %
LAP: 20 %

Laboratory code	Reported values		Unc[a] [%]	Bias [%]	Z-Score	U-Score	A1	A2	Score for trueness	Precision	Score for Precision	Final score
	a, Bq/kg	u, Bq/kg										
3	40.7	1.6	3.9	-4.5	-0.4	-0.7	1.9	7.0	A	6.5	A	A
12	28.7	3.7	12.9	-32.6	-3.3	-3.2	13.9	11.1	N	13.9	A	N
13	39.3	4.3	11.1	-7.8	-0.8	-0.7	3.3	12.6	A	12.2	A	A
15	41.3	3.1	7.5	-3.1	-0.3	-0.3	1.3	9.8	A	9.1	A	A
16	40.4	0.2	0.6	-5.2	-0.5	-1.0	2.2	5.7	A	5.2	A	A
19	43.8	1.3	2.9	2.8	0.3	0.5	1.2	6.5	A	5.9	A	A
23	37.0	1.5	4.1	-13.1	-1.3	-2.1	5.6	6.9	A	6.6	A	A
29	39.7	2.0	5.0	-6.8	-0.7	-1.0	2.9	7.7	A	7.2	A	A
34	33.6	1.7	4.9	-21.1	-2.1	-3.3	9.0	7.1	N	7.1	A	N
40	60.7	2.3	3.8	42.5	4.2	5.7	18.1	8.2	N	6.4	A	N
42	39.1	2.5	6.4	-8.2	-0.8	-1.1	3.5	8.6	A	8.2	A	A
43	59.0	4.0	6.8	38.5	3.8	3.6	16.4	11.8	N	8.5	A	N
45	32.9	1.7	5.1	-22.8	-2.3	-3.5	9.7	7.1	N	7.2	A	N
46	29.0	0.8	2.8	-31.9	-3.2	-5.8	13.6	6.1	N	5.9	A	N
49	44.6	3.5	7.8	4.7	0.5	0.5	2.0	10.7	A	9.4	A	A
50	40.5	3.8	9.4	-4.9	-0.5	-0.5	2.1	11.3	A	10.7	A	A
57	38.7	1.9	4.9	-9.2	-0.9	-1.3	3.9	7.5	A	7.1	A	A

a Relative uncertainty of the reported result at k = 1 coverage factor

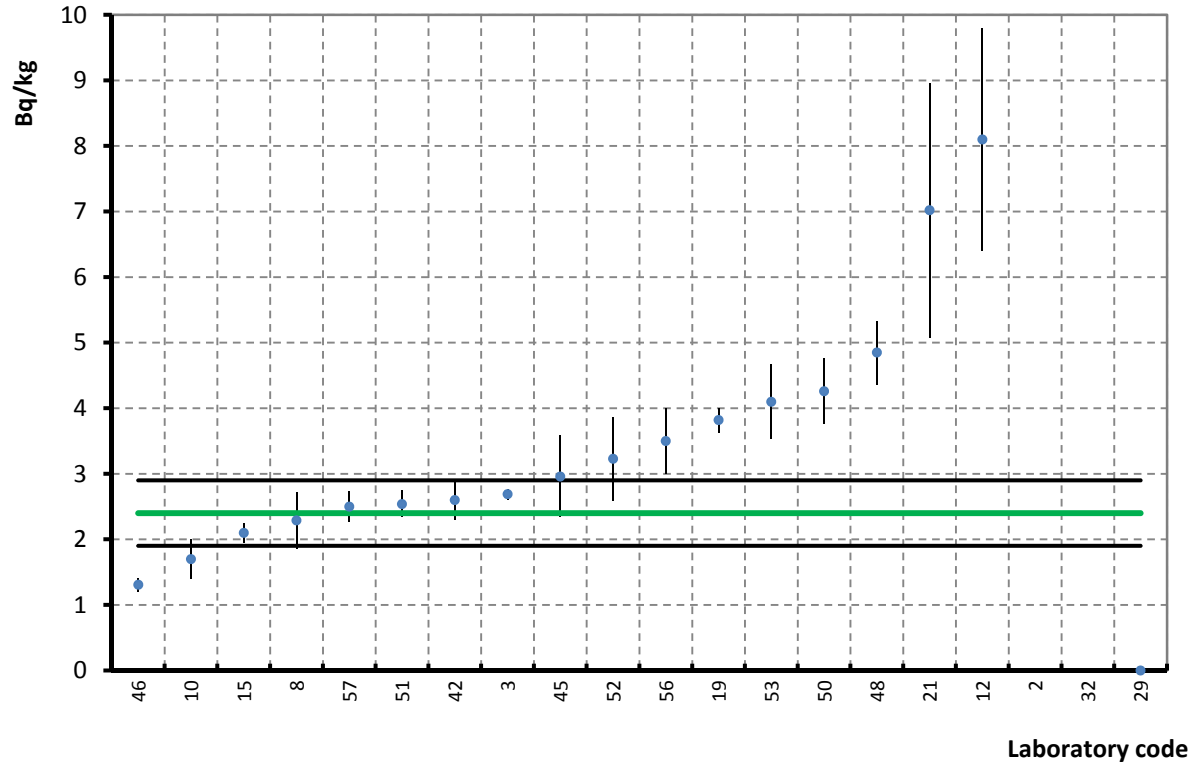

FIG. 79. Reported results and their uncertainties for Sr-90 in soil (sample 04).

TABLE 43. PERFORMANCE EVALUATION OF DETERMINATION OF Sr-90 IN SOIL (SAMPLE 04)

Information value: 2.4 ± 0.5 Bq/kg

Laboratory code	Reported values		Unc[a]	Bias [%]	Z-Score	U-Score	A1	A2	Score for trueness	Precision	Score for Precision	Final score
	a, Bq/kg	u, Bq/kg	[%]									
2	33.6	5	14.88	1300	130.00	6.21	31.20	12.97		26.63		
3	2.6	0.08	2.86	12.08	1.21	0.54	0.29	1.38		22.27		
8	2.2	0.43	18.78	-4.58	-0.46	-0.16	0.11	1.76		28.99		
10	1.7	0.3	17.65	-29.17	-2.92	-1.15	0.70	1.57		28.27		
12	8.1	1.7	20.99	237.50	23.75	3.20	5.70	4.59		30.47		
15	2.1	0.15	7.14	-12.50	-1.25	-0.54	0.30	1.42		23.21		
19	3.8	0.19	4.97	59.17	5.92	2.52	1.42	1.45		22.64		
21	7.0	1.94	27.64	192.50	19.25	2.30	4.62	5.19		35.37		
29	<0.5											
32	45.0	19	42.22	1775	177.50	2.24	42.60	49.04		47.65		
42	2.6	0.3	11.54	8.33	0.83	0.33	0.20	1.57		24.92		
45	2.9	0.62	20.95	23.33	2.33	0.69	0.56	2.10		30.44		
46	1.3	0.1	7.63	-45.42	-4.54	-2.02	1.09	1.39		23.37		
48	4.8	0.48	9.90	102.08	10.21	3.43	2.45	1.84		24.20		
50	4.2	0.5	11.74	77.50	7.75	2.55	1.86	1.88		25.01		
51	2.5	0.2	7.87	5.83	0.58	0.25	0.14	1.46		23.45		
52	3.2	0.6	19.63	34.54	3.45	1.00	0.83	2.13		29.55		
53	4.1	0.6	13.90	70.83	7.08	2.18	1.70	2.01		26.10		
56	3.5	0.5	14.29	45.83	4.58	1.51	1.10	1.88		26.30		
57	2.5	0.23	9.20	4.17	0.42	0.17	0.10	1.49		23.92		

a Relative uncertainty of the reported result at k = 1 coverage factor

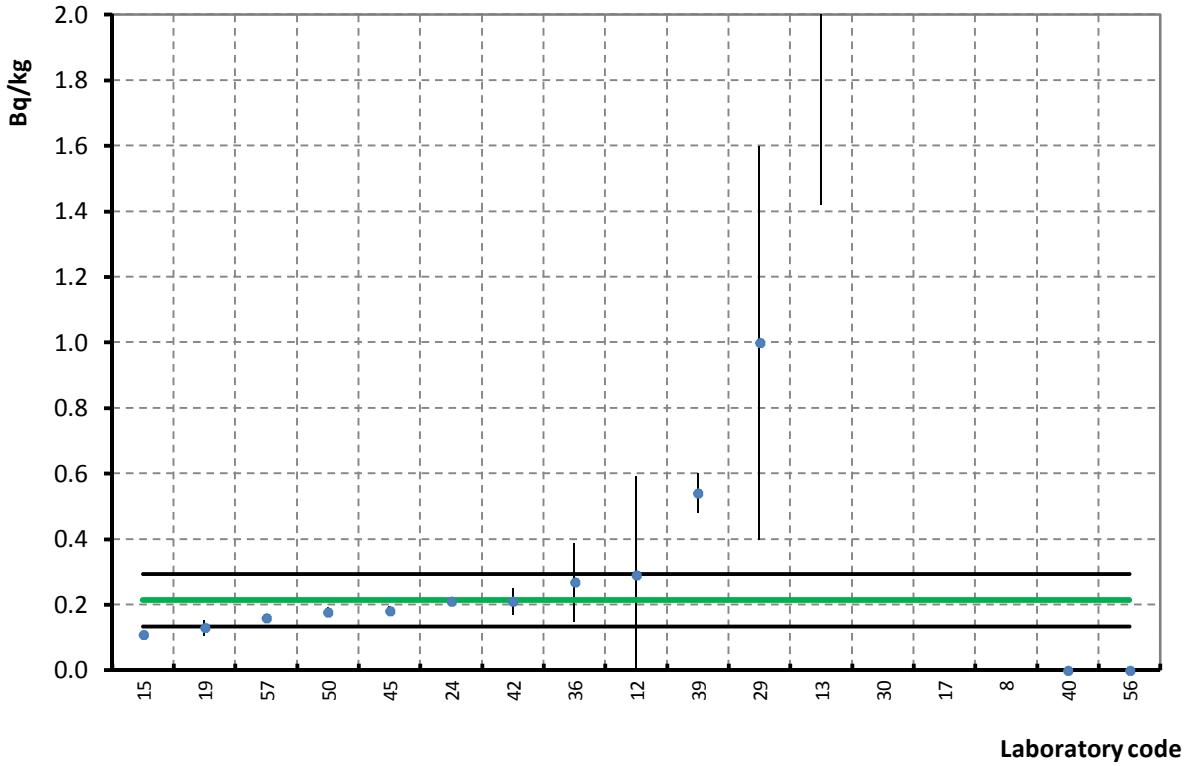

FIG. 80. Reported results and their uncertainties for Am-241 in soil (sample 04).

TABLE 44. PERFORMANCE EVALUATION OF DETERMINATION OF Am-241 IN SOIL (SAMPLE 04)

Information value: 0.21 ± 0.08 Bq/kg

Laboratory code	Reported values		Unc[a]	Bias [%]	Z-Score	U-Score	A1	A2	Score for trueness	Precision	Score for Precision	Final score
	a, Bq/kg	u, Bq/kg	[%]									
8	174.00	11.00	6.3	82757	8275.7	15.8	173.8	28.4		38.6		
12	0.29	0.30	103.4	38.1	3.8	0.3	0.1	0.8		110.2		
13	2.08	0.66	31.7	890.5	89.0	2.8	1.9	1.7		49.6		
15	0.11	0.01	9.1	-47.6	-4.8	-1.2	0.1	0.2		39.2		
17	37.39	4.92	13.2	17704	1770.5	7.6	37.2	12.7		40.3		
19	0.13	0.02	17.7	-38.1	-3.8	-1.0	0.1	0.2		42.0		
24	0.21											
29	1.00	0.60	60.0	376.2	37.6	1.3	0.8	1.6		71.1		
30	7.60	0.50	6.6	3519.0	351.9	14.6	7.4	1.3		38.7		
36	0.27	0.12	44.4	28.6	2.9	0.4	0.1	0.4		58.5		
39	0.54	0.06	11.1	157.1	15.7	3.3	0.3	0.3		39.7		
42	0.21	0.04	19.0	0.0	0.0	0.0	0.0	0.2		42.6		
45	0.18	0.01	7.7	-13.3	-1.3	-0.3	0.0	0.2		38.9		
50	0.18	0.01	7.9	-15.2	-1.5	-0.4	0.0	0.2		38.9		
57	0.16	0.01	6.1	-23.8	-2.4	-0.6	0.1	0.2		38.6		

a Relative uncertainty of the reported result at k = 1 coverage factor

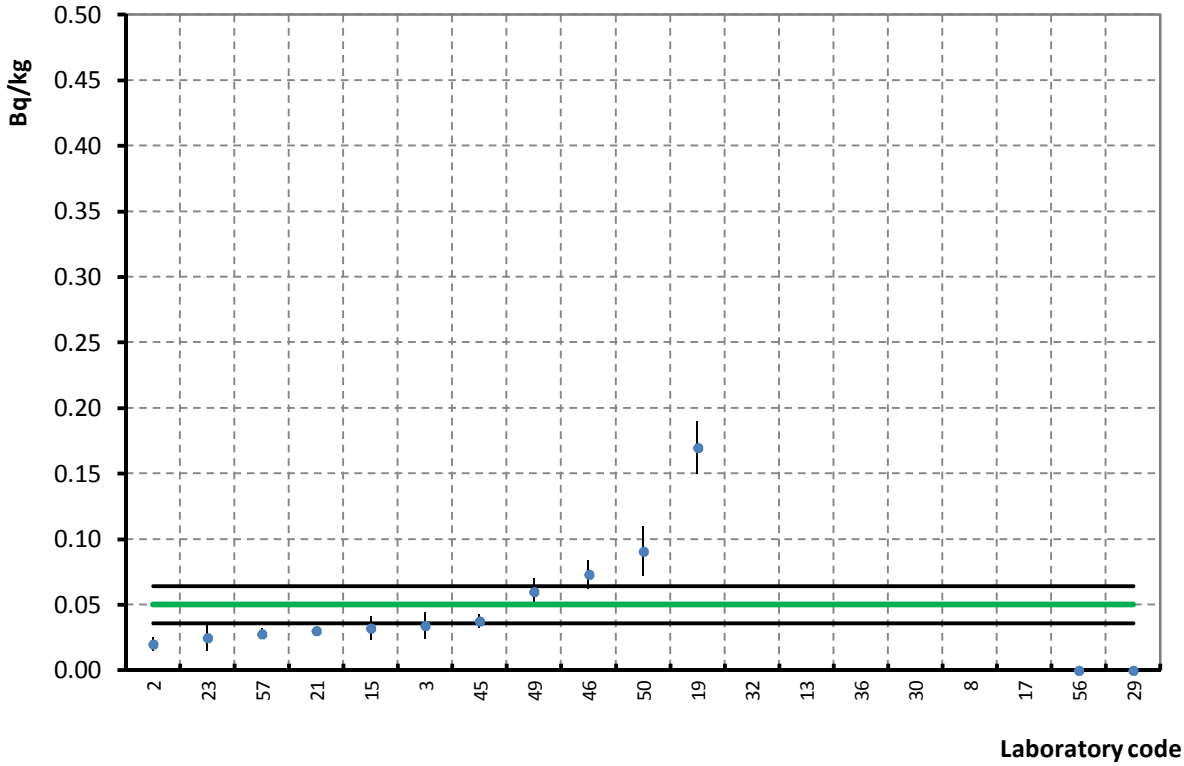

FIG. 81. Reported results and their uncertainties for Pu-238 in soil (sample 04).

TABLE 45. PERFORMANCE EVALUATION OF DETERMINATION OF Pu-238 IN SOIL (SAMPLE 04)

Information value: 0.050 ± 0.014 Bq/kg

Laboratory code	Reported values		Unc[a]	Bias [%]	Z-Score	U-Score	A1	A2	Score for trueness	Precision	Score for Precision	Final score
	a, Bq/kg	u, Bq/kg	[%]									
2	0.020	0.005	25.0	-60.0	-6.0	-2.0	0.0	0.0	A	37.5	N	N
3	0.034	0.010	29.4	-32.0	-3.2	-0.9	0.0	0.0	A	40.6	N	N
8	33.000	4.000	12.1	65900	6590.0	8.2	33.0	10.3	N	30.5	N	N
13	13.810	6.330	45.8	27520	2752.0	2.2	13.8	16.3	A	53.7	N	N
15	0.032	0.009	28.1	-36.0	-3.6	-1.1	0.0	0.0	A	39.7	N	N
17	68.110		0.0	136120	13612	4861.4	68.1	0.0	N	28.0	N	N
19	0.170	0.020	11.8	240.0	24.0	4.9	0.1	0.1	N	30.4	N	N
21	0.030		0.0	-40.0	-4.0	-1.4	0.0	0.0	A	28.0	N	N
23	0.025	0.010	40.0	-50.0	-5.0	-1.5	0.0	0.0	A	48.8	N	N
29	<0.2											
30	24.370	3.660	15.0	48640	4864.0	6.6	24.3	9.4	N	31.8	N	N
32	1.200	0.200	16.7	2300.0	230.0	5.7	1.2	0.5	N	32.6	N	N
36	15.110	2.080	13.8	30120	3012.0	7.2	15.1	5.4	N	31.2	N	N
45	0.038	0.005	13.6	-24.8	-2.5	-0.8	0.0	0.0	A	31.1	N	N
46	0.073	0.011	15.1	46.0	4.6	1.3	0.0	0.0	A	31.8	N	N
49	0.060	0.010	16.7	20.0	2.0	0.6	0.0	0.0	A	32.6	N	N
50	0.091	0.019	20.9	82.0	8.2	1.7	0.0	0.1	A	34.9	N	N
56	<0.12											
57	0.028	0.004	14.3	-44.2	-4.4	-1.5	0.0	0.0	A	31.5	N	N

a Relative uncertainty of the reported result at k = 1 coverage factor

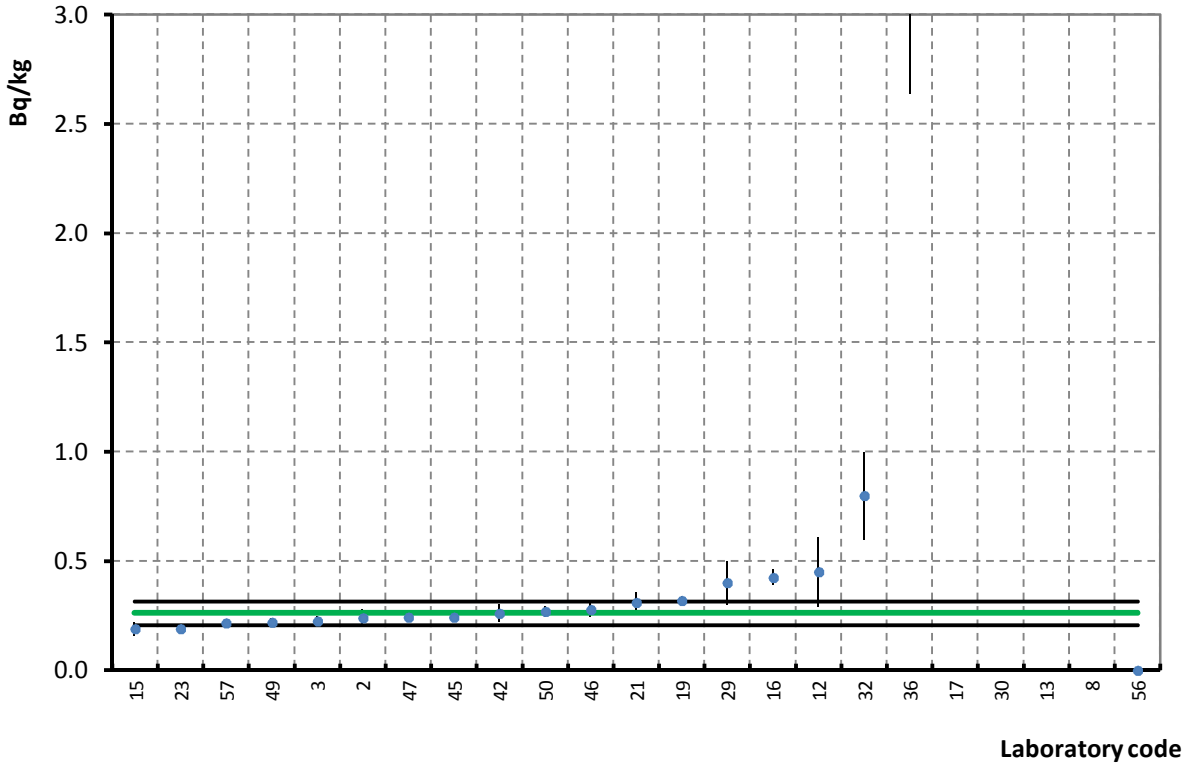

FIG. 82. Reported results and their uncertainties for Pu-239+240 in soil (sample 04).

TABLE 46. PERFORMANCE EVALUATION OF DETERMINATION OF Pu-239+240 IN SOIL (SAMPLE 04)

Information value: 0.261 ± 0.055 Bq/kg

Laboratory code	Reported values		Unc [a]	Bias [%]	Z-Score	U-Score	A1	A2	Score for trueness	Precision	Score for Precision	Final score
	a, Bq/kg	u, Bq/kg	[%]									
2	0.240	0.040	16.7	-8.0	-0.8	-0.3	0.0	0.2		26.9		
3	0.225	0.022	9.8	-13.8	-1.4	-0.6	0.0	0.2		23.2		
8	238.00	10.0	4.2	91087	9108.8	23.8	237.7	25.8		21.5		
12	0.450	0.160	35.6	72.4	7.2	1.1	0.2	0.4		41.3		
13	129.0	55.4	42.9	49359	4936.0	2.3	128.8	143.0		47.8		
15	0.190	0.030	15.8	-27.2	-2.7	-1.1	0.1	0.2		26.3		
16	0.426	0.034	8.0	63.2	6.3	2.6	0.2	0.2		22.5		
17	8.270		0.0	3068.6	306.9	145.6	8.0	0.1		21.1		
19	0.320	0.020	6.3	22.6	2.3	1.0	0.1	0.2		22.0		
21	0.310	0.050	16.1	18.8	1.9	0.7	0.0	0.2		26.5		
23	0.190	0.020	10.5	-27.2	-2.7	-1.2	0.1	0.2		23.6		
29	0.400	0.100	25.0	53.3	5.3	1.2	0.1	0.3		32.7		
30	41.440	6.220	15.0	15777	1577.7	6.6	41.2	16.0		25.9		
32	0.800	0.200	25.0	206.5	20.7	2.6	0.5	0.5		32.7		
36	3.720	1.080	29.0	1325.3	132.5	3.2	3.5	2.8		35.9		
42	0.260	0.040	15.4	-0.4	0.0	0.0	0.0	0.2		26.1		
45	0.244	0.016	6.6	-6.5	-0.7	-0.3	0.0	0.1		22.1		
46	0.279	0.031	11.1	6.9	0.7	0.3	0.0	0.2		23.8		
47	0.243	0.015	6.2	-6.9	-0.7	-0.3	0.0	0.1		22.0		
49	0.220	0.020	9.1	-15.7	-1.6	-0.7	0.0	0.2		23.0		
50	0.269	0.025	9.3	3.1	0.3	0.1	0.0	0.2		23.0		
56	<0.27											
57	0.218	0.012	5.5	-16.5	-1.6	-0.8	0.0	0.1		21.8		

a Relative uncertainty of the reported result at k = 1 coverage factor

APPENDIX II.
INTERNAL ENERGY LEVELS DIAGRAMS.

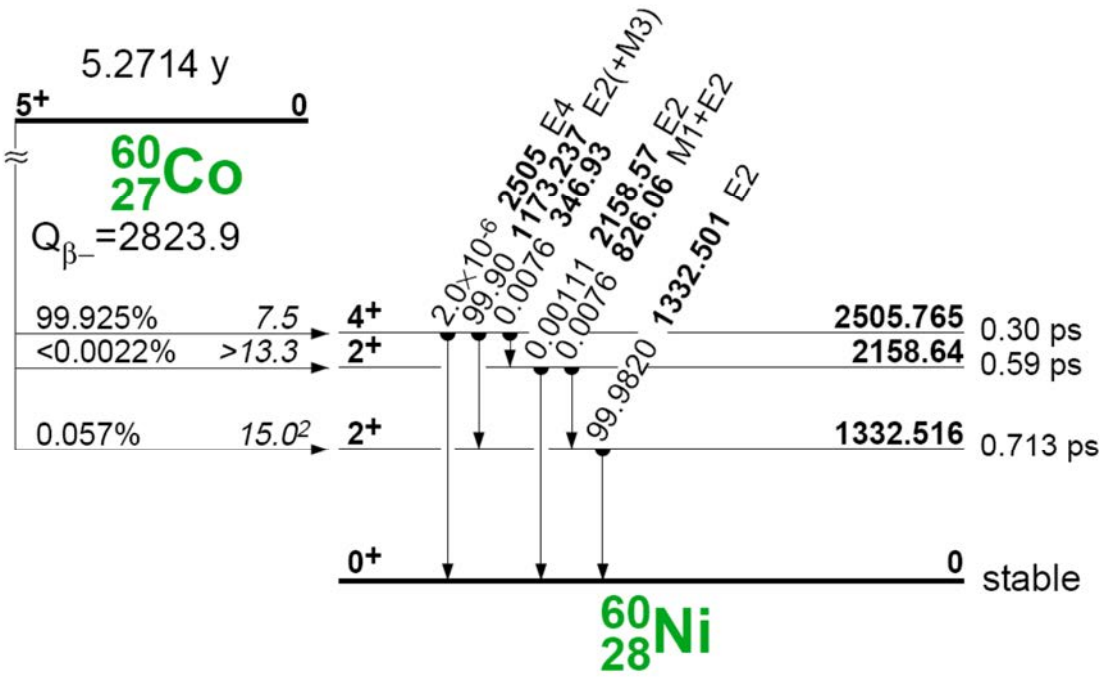

FIG. 83. The internal energy levels diagram of Co-60 (Ni-60).

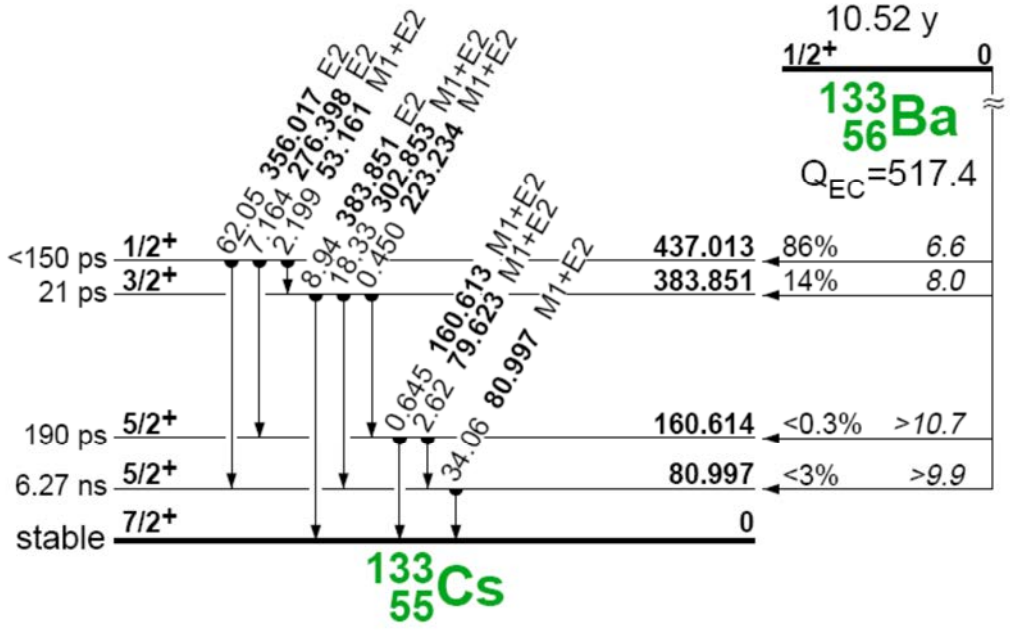

FIG. 84. The internal energy levels diagram of Ba-133 (Cs-133).

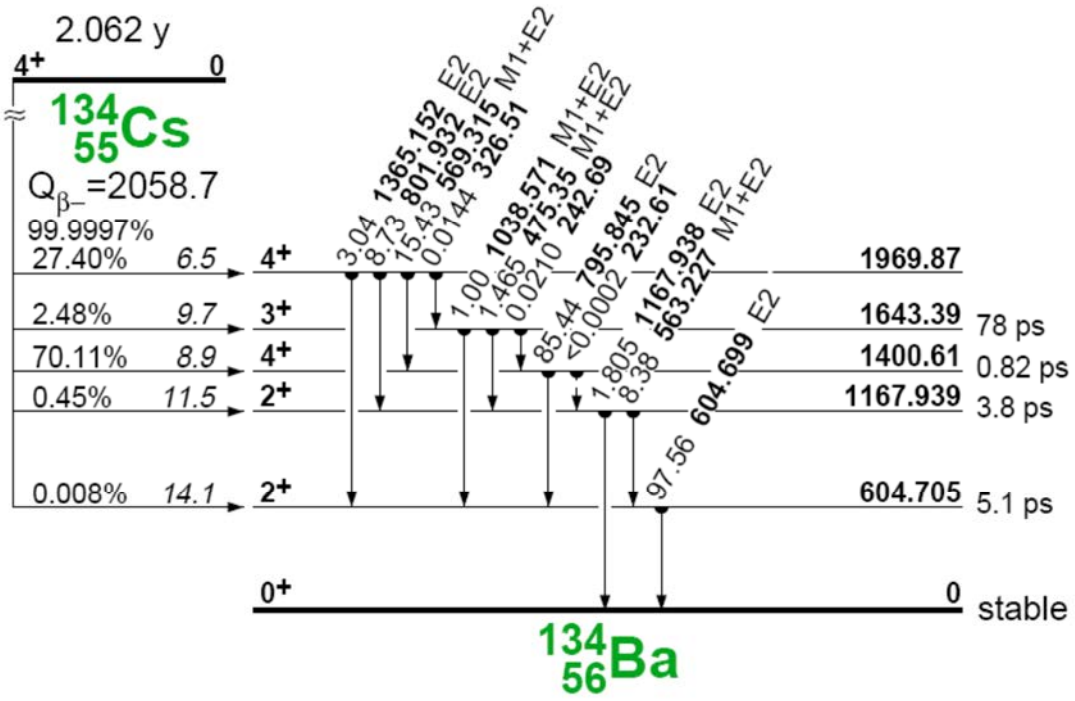

FIG. 85. The internal energy levels diagram of Cs-134 (Ba-134).

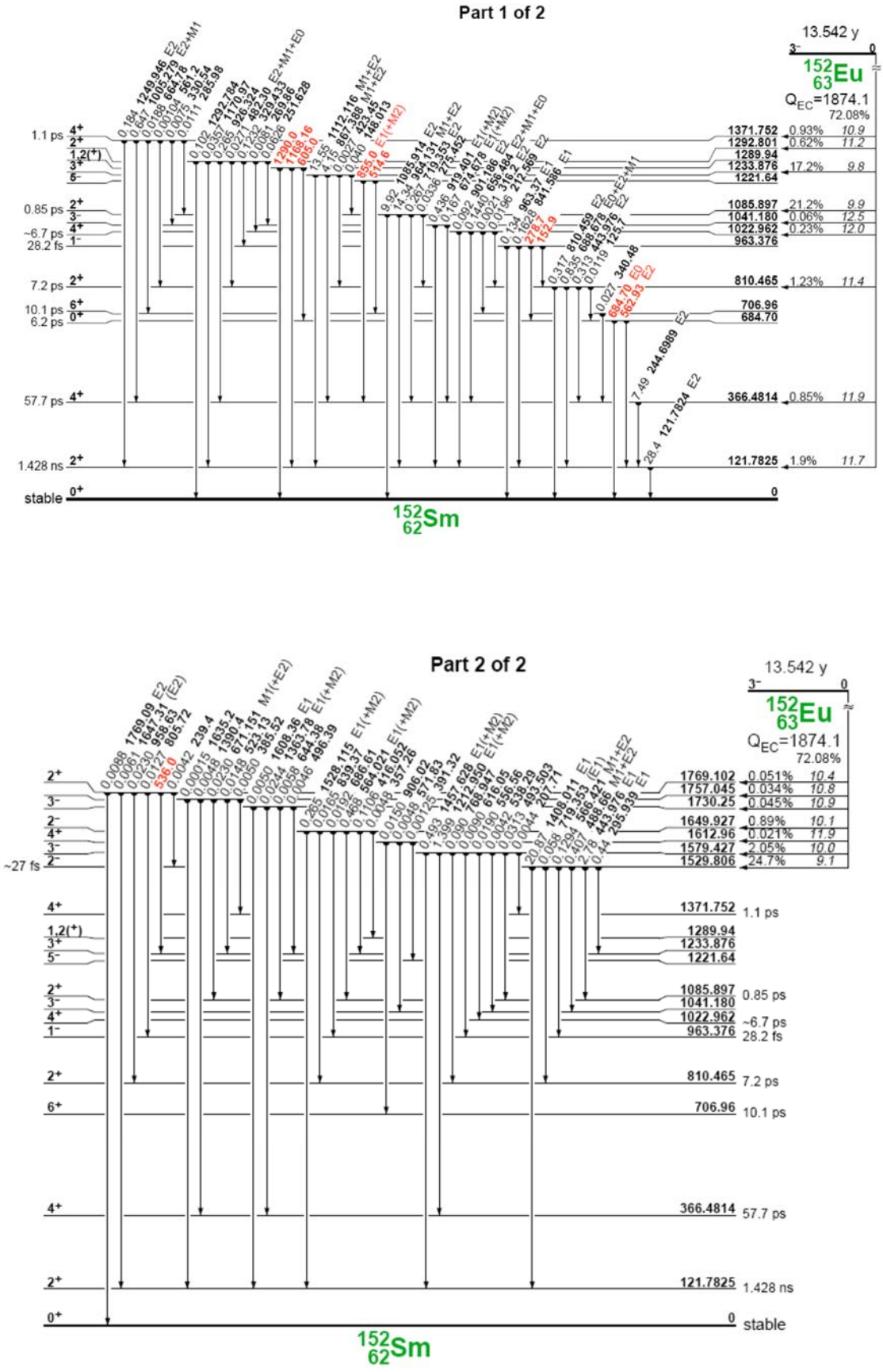

FIG. 86. The internal energy levels diagram of Eu-152 (Sm-152) for electron capture.

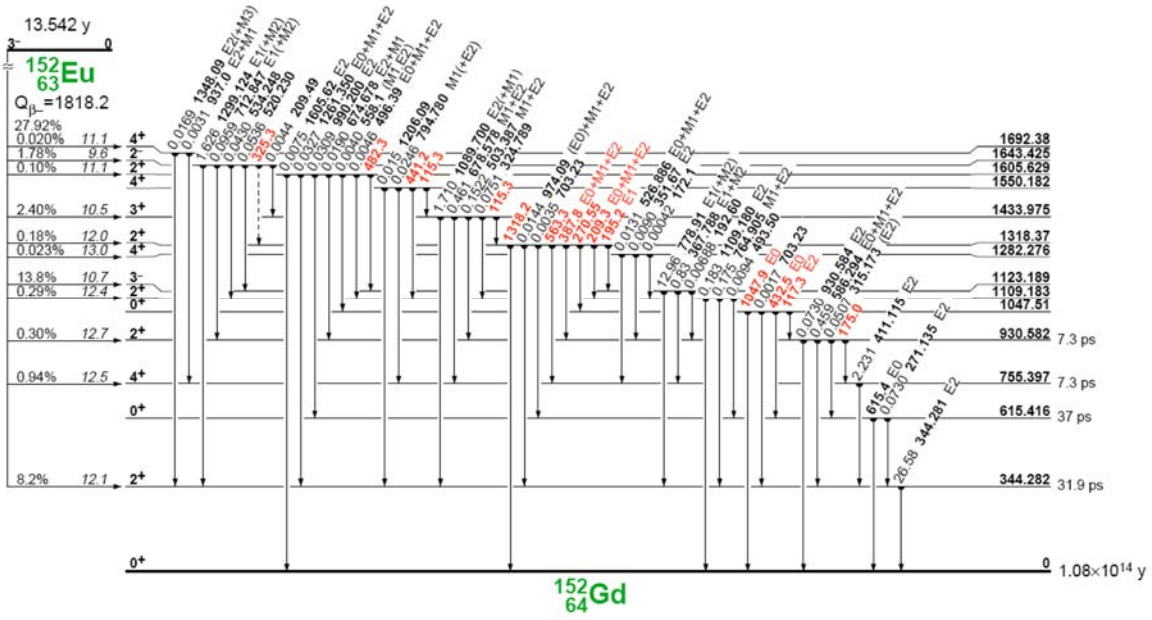

FIG. 87. The internal energy levels diagram of Eu-152 (Gd-152) for beta decay.

APPENDIX III.
LIST OF PARTICIPATING LABORATORIES[1].

[1]Only those laboratories which reported their results were listed in the list of participating laboratories.

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REFERENCES

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