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Emergency Response Proficiency Test for Japanese Laboratories: Determination of Selected Radionuclides in Water, Soil, Vegetation and Aerosol Filters

IAEA
International Atomic Energy Agency

EMERGENCY RESPONSE PROFICIENCY TEST FOR JAPANESE LABORATORIES: DETERMINATION OF SELECTED RADIONUCLIDES IN WATER, SOIL, VEGETATION AND AEROSOL FILTERS

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INTERNATIONAL ATOMIC ENERGY AGENCY
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FOREWORD

Reliable determination of natural and artificial radionuclides in environmental samples is necessary for compliance with radiation protection and environmental regulations. The IAEA assists Member State laboratories in maintaining and improving their readiness in this regard by producing reference materials, by developing standardized analytical methods, and by conducting interlaboratory comparisons and proficiency tests as tools for quality control. To fulfil this obligation and ensure a reliable, rapid and consistent worldwide response, the IAEA Terrestrial Environment Laboratory in Seibersdorf, Austria, organizes interlaboratory comparisons and proficiency tests. In addition, the IAEA coordinates the worldwide network of Analytical Laboratories for the Measurement of Environmental Radioactivity (ALMERA).

After the accident at the Fukushima Daiichi nuclear power plant in March 2011, Japan requested the IAEA to organize an emergency response proficiency test for Japanese laboratories with the aim of assessing their capacity to rapidly and accurately measure radionuclides in environmental samples. The IAEA responded to the request by assembling a special sample set covering the main environmental samples and radionuclides of interest in the case of a nuclear emergency situation. Water, soil, vegetation and aerosol filter samples were made available to Japanese laboratories for analysis by gamma ray spectrometry.

This report presents the results of the IAEA-TEL-2011-08 emergency response proficiency test for Japanese laboratories on the determination of selected radionuclides in water, soil, vegetation and aerosol filters. The report includes descriptions of the methodologies and data evaluation approach used, as well as summary evaluations of each radionuclide and individual evaluation reports of each laboratory.

This proficiency test was designed to identify analytical problems and to support Member State laboratories in their efforts to improve the quality of their analytical results in the event of a nuclear emergency situation, and to provide a regular forum for discussion and technology transfer in this area. The number of samples, their matrix interferences and the concentration levels of the analytes were designed in a way that enables identification of potential analytical problems.

The IAEA would like to express its appreciation to A. Shakhashiro for the design and preparation of this proficiency test, and to S. Tarjan for his valuable assistance in the evaluation of results and report preparation. The support of Yuichi Onda (Japan) in the preparation of, and logistics for, this proficiency test is gratefully acknowledged. The IAEA officer responsible for this publication was A. Pitois of the IAEA Environment Laboratories.

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CONTENTS

1. INTRODUCTION

The Fukushima nuclear reactor accident, which occurred in March 2011, brought into focus the need for rapid and accurate measurement of a number of radionuclides in environmental samples. In case of nuclear emergency situation, gamma ray spectrometry is the radioanalytical method of choice to provide radionuclide selective information within a reasonable short time period. For this reason, a special proficiency test was organised for the Japanese laboratories taking part in the monitoring activities after the Fukushima accident, and a special sample set was assembled, which covers the main radionuclides of interest for this purpose in a wide range of environmental samples, i.e. water, soil, vegetation and aerosol filters.

In this proficiency test, the sample set consisted of 10 samples: 3 water samples, 1 soil sample, 3 grass samples and 3 simulated aerosol filters. The participating laboratories were requested to analyse Co-60, Ba-133, Cs-134, Cs-137, Eu-152 and Am-241 in water, K-40 and Cs-137 in soil, Cs-137 in grass, and Co-57, Cs-134, Cs-137, Eu-152 and Am-241 in simulated aerosol filters.

These samples and radioisotopes for this proficiency test were selected for the following reasons. Shortly after any nuclear emergency situation the radioactive pollutant may migrate into the food chain causing the extra radiation hazard to the inhabitants. During the vegetation period the direct contamination pathway by atmospheric fall-out has the strongest transfer probability; therefore fresh agricultural products which are growing on open cultivated fields or originated from the natural environment have to be included into the radiation monitoring. The pasture and all of the raw materials of the animal feed are as important as the vegetation, which is directly suitable for human consumption or used as foodstuff. The grass samples represent this part of the food chain. The soil has only a secondary importance during that period, but its contamination determines both the long term effects in the food chain and the necessary remediation actions. The contamination of the water and the air points to the main radiation pathway for the inhabitant from the early phase of the nuclear accident. Considering these important facts, the four sample types grass, soil, water and aerosol filters were selected. The selected soil and grass samples were contaminated as a consequence of the Chernobyl accident, so their radioisotope contents were given. In case of the water and aerosol samples, the spiking with ^{134}Cs and ^{137}Cs isotopes simulates the real contamination remaining for a relatively long period of time in the environment. The Co-57, Co-60, Cs-134 and Eu-152 demonstrate the various cascade decaying radionuclides, and the Co-57 and Eu-152 even have a spectral interference due to their overlapping main lines at 122.0 keV and 121.78 keV, respectively. The Am-241 isotope was added to the samples to check the low energy capabilities of the gamma ray spectrometry systems.

The test items were prepared and distributed in January 2012 to 21 Japanese laboratories and the deadline for receiving the results from the participants was set to April 2012, in order to allow time to the laboratories for performing the proficiency test in addition to their heavy workload of monitoring activities.
Nineteen Japanese laboratories from 21 initially registered laboratories reported their results to IAEA. This 90% participation rate is excellent compared with the typical reported rate in other proficiency tests. All those participants who have reported their results are listed at the end of this report in the Appendix III. The identification of the participating laboratories in this proficiency test was however kept anonymous and it was known only by the organiser and the laboratory itself.

2. MATERIALS AND METHODS

2.1. PROFICIENCY TEST OBJECTIVES

A special sample set was prepared for the laboratories covering the most important tasks in case of emergency situations. These included the gamma ray spectrum analysis for samples of water, soil, vegetation and aerosol filters. The water and aerosol filter sets were spiked with artificial radionuclides to demonstrate the most typical radioanalytical difficulties:

- Calibration or efficiency transfer for different geometries;
- True coincidence summing effects and method of correction;
- Spectral interferences.

The soil and the dried vegetation samples were collected from areas contaminated with Cs-137 via fall-out after the Chernobyl accident. The massic activities of these different samples were in the same order of magnitude, but the densities were different both from each other and from the typical calibration solutions. Therefore the participants had to apply the self-attenuation correction to achieve precise measurement results.

This proficiency test aimed to assess the analytical performance of the laboratories in an emergency situation. The reported results were evaluated in a short time frame and the laboratories have been encouraged to take any corrective actions or technical improvements in case of identification of any shortcomings.

2.2. PARTICIPANTS

Nineteen Japanese laboratories from 21 initially registered reported their results to IAEA.
A full listing of the participating laboratories, which reported their results in this proficiency test, is given in Appendix III.

2.3. COMPOSITION OF PROFICIENCY TEST MATERIALS

The proficiency test sample set consisted of 10 samples detailed in the Table 1.

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 and Am-241
02	Water	500 g	Co-60, Ba-133, Cs-134, Cs-137, Eu-152 and Am-241
03	Water	500 g	Co-60, Ba-133, Cs-134, Cs-137, Eu-152 and Am-241
04	Soil (IAEA-377)	150 g	K-40 and Cs-137,
05	Grass (pure nettle)[1]	200 g	Cs-137
06	Grass (diluted IAEA-372)	200 g	Cs-137
07	Grass (IAEA-372)	200 g	Cs-137
08	Simulated aerosol filter	1 pc	Co-57, Cs-134, Cs-137, Eu-152 and Am-241
09	Simulated aerosol filter	1 pc	Co-57, Cs-134, Cs-137, Eu-152 and Am-241
10	Simulated aerosol filter	1 pc	Co-57, Cs-134, Cs-137, Eu-152 and Am-241

[1]Urtica dioica

Fig. 1 shows the proficiency test sample set.

FIG. 1. The distributed sample set.

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 the Table 2.

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

Radionuclide	**Code of the Certificate**	**Manufacturer**
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 preparations applying relative measurement 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 the 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 were produced containing 500 g of water sample.

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. 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 from the same radioisotope prepared by a metrological institute. These 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[1], Bq/kg	Uncertainty[2], Bq/kg	Activity[1], Bq/kg	Uncertainty[2], Bq/kg	Activity[1], Bq/kg	Uncertainty[2], Bq/kg
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

[1]Activity = massic activity
[2]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 treated by the 'Collaboration Centre for Reference Material of Terrestrial Origin (Hungary)'. The preparation included the following steps: drying, milling, sieving below the 150 micron

particle size and the homogenisation of 105 kg of this material. The particle size distribution was determined by the IAEA Terrestrial Environment Laboratory (TEL) in Seibersdorf, Austria and the result is shown on Fig. 2. The material was named IAEA-377.

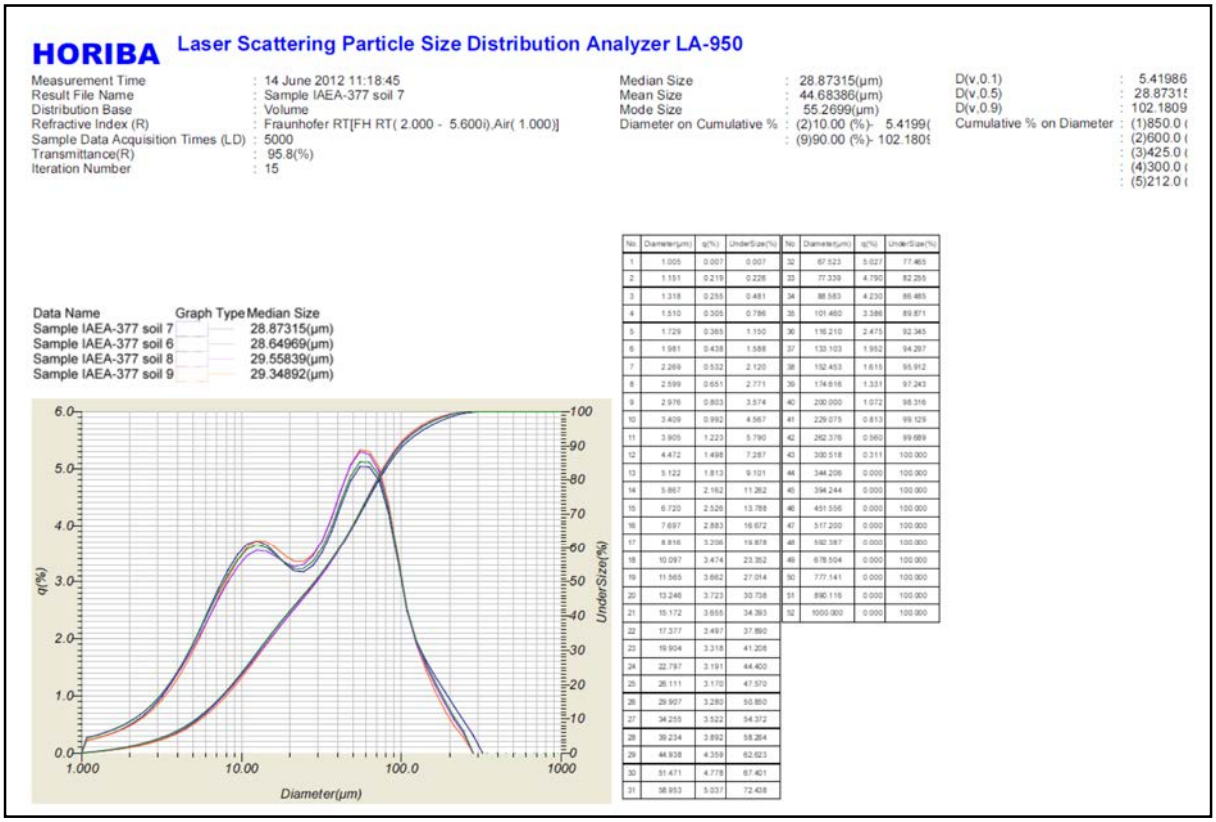

FIG. 2. Particle size distribution of the IAEA-377 soil.

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 done under normal laboratory conditions within one day taking all 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. Altogether 700 packing units were prepared.

The material was sterilized after bottling using gamma 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. Ten bottles were selected using a random number generator and three replicates were analysed from each bottle by gamma ray spectrometry. The sample weight was 50 g of each. The correlation coefficient (r) between the Cs-137 concentration and the bottle number was found to be r = 0.298, and r =0.152 for the K-40 isotope respectively, therefore indicating no significant correlation. Since the bottle number represents the production order, this confirms that there is no significant trend in the activity of these radionuclides during the bottling process of the material. The results of the homogeneity study were evaluated by ANOVA and the material was found homogenous both for the Cs-137 and K-40. The evaluation of the homogeneity study is summarised in the Table 4.

TABLE 4. RESULTS OF THE HOMOGENEITY STUDY FOR THE SOIL SAMPLE

Nuclide	K-40		Cs-137	
F value	0.382		0.600	
F (crit)	2.393		2.393	
Arithmetical mean, Bq/kg	385.7		2595	
SD, Bq/kg	10.3	2.7 %	48	1.85 %
Repeatability within bottles, s_{wb} Bq/kg	10.0	2.6 %	42	1.62 %
Repeatability between bottles, s_{bb} Bq/kg	4.6	1.2 %	14	0.55 %

Determined on 16 June 2009

2.5.2. Target values and associated combined uncertainties

The target values and associated combined uncertainties are given in the Table 5, as characterized in the reference material IAEA-377.

TABLE 5. TARGET VALUES AND ASSOCIATED UNCERTAINTIES FOR THE SOIL SAMPLE AT THE REFERENCE DATE 15 NOVEMBER 2011

Nuclide	Sample 04	
	Activity[1], Bq/kg	Uncertainty[2], Bq/kg
K-40	385	20
Cs-137	2440	30

[1]Activity = massic activity based on dry mass

[2]Uncertainty = standard combined uncertainty (with k = 1 coverage factor)

2.6. GRASS SAMPLES (SAMPLES 05, 06 AND 07)

2.6.1. Preparation and homogeneity study of the grass samples

The grass ‘Sample 05’ was a freshly collected and treated nettle (Urtica dioica). The grass ‘Sample 07’ was the IAEA-372 certified reference material. The characterisation of the IAEA-372 was done as a supplementary comparison involving 7 metrological institutes under the umbrella of CCQM [1]. The grass ‘Sample 06’ was obtained by gravimetrical dilution of the IAEA-372 CRM using the dried, milled and homogenised nettle ‘Sample 05’ with a ratio of 3 parts of IAEA-372 to 7 parts of Sample 05 (per weight).

The distributed vegetation samples were the following:
Sample 05 the pure nettle sample
Sample 06 the diluted IAEA-372
Sample 07 the original IAEA-372.

The nettle sample was collected and treated in Hungary, then the dilution process was performed in one step at TEL, using a big TURBULA mixer. To avoid any segregation between the nettle and the grass during the preparation of the 'Sample 06', the particle size of these materials were adjusted to the same range, i.e. 150-250 micron. The same technological preparation chain was used for the nettle and grass samples. The homogeneity of these samples was tested by gamma ray spectrometry applying an automatic sample changer system. The data were evaluated by ANOVA. The results are summarised in Table 6. The activity value of the Sample 06 (diluted material) was derived from the certified value of the IAEA-372.

TABLE 6. RESULTS OF THE HOMOGENEITY STUDY FOR CS-137 CONCENTRATION OF THE DILUTED GRASS SAMPLE CALCULATED TO THE REFERENCE DATE 15 NOVEMBER 2011

Nuclide	Cs-137	
F value	0.398	
F (crit)	2.393	
Arithmetical mean, Bq/kg	3001	
SD, Bq/kg	40.9	1.36 %
Repeatability within bottles, s_{wb} Bq/kg	39.7	1.32 %
Repeatability between bottles, s_{bb} Bq/kg	17.8	0.59 %

The bottling was performed during normal laboratory condition within one working day into special plastic SECURY boxes as shown on Fig. 1.

2.6.2. Target values and associated combined uncertainties

The target values and associated combined uncertainties for the grass samples are given in the Table 7.

TABLE 7. TARGET VALUES AND ASSOCIATED UNCERTAINTIES FOR GRASS SAMPLES AT THE REFERENCE DATE 15 NOVEMBER 2011

Nuclide	Sample 05		Sample 06		Sample 07	
	Activity[1], Bq/kg	Uncertainty[2], Bq/kg	Activity[1], Bq/kg	Uncertainty[2], Bq/kg	Activity[1], Bq/kg	Uncertainty[2], Bq/kg
Cs-137	2	0.4	3000	120	10000	340

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

2.7. SIMULATED AEROSOL FILTER SAMPLES (SAMPLES 08, 09 AND 10)

2.7.1. Preparation of the spiked simulated aerosol filters

In the frame of this proficiency test three simulated aerosol filters were distributed. The filters were prepared by an expert team in 2009 for a special proficiency test purpose, and each piece was tested by gamma ray spectrometry [2].

The active area on the filter, which was simulated with a symmetric loading pattern, is shown on Fig. 3. The spiking solution was distributed onto the surface of the disk with a high precision 'micro-dispenser'. The spiking process was controlled in three independent ways: by volume, by weight measurement and by gamma ray spectrometry.

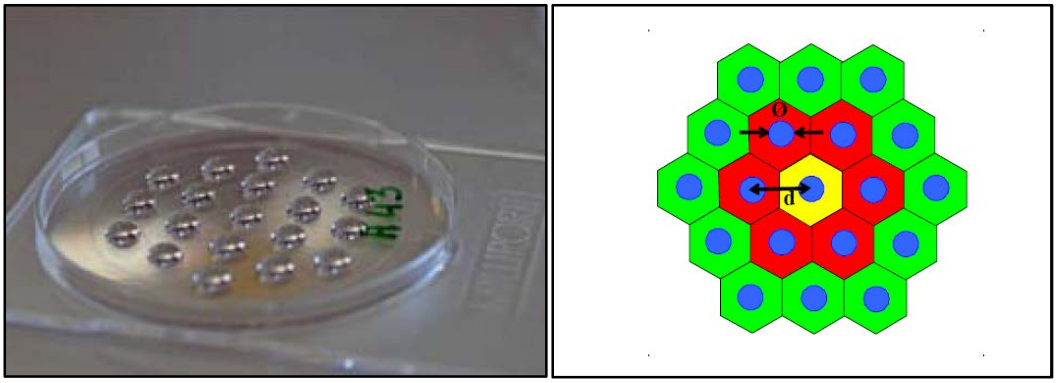

FIG. 3. The pattern of the simulated aerosol filter.

In 2011, still existing spare sets of the previously prepared filters were distributed to the participants. Before dispatching the samples, all of them were re-tested by gamma ray spectrometry. The Sample 08 had a relatively low activity, while the Sample 09 and Sample 10 were identical (belonging to the same filter series) with higher activity values. The task of the laboratories was to identify the isotopes and determine the absolute activity in Bq on the filter.

For the preparation of the filters the same high precision reference solutions as for the water samples were used. Only the Co-57 isotope was added to the composition instead of the Co-60. The identification of the solutions is given in the Table 8.

TABLE 8. THE IDENTIFICATION OF THE REFERENCE SOLUTIONS WHICH WERE USED FOR THE SIMULATED AEROSOL FILTERS

Radionuclide	**Code of the Certificate**	**Manufacturer**
Co-57	9031-OL-090/09	CMI
Cs-134	Cs134ELSR50	CERCA
Cs-137	CDZ64/S4/14/70	Amersham
Eu-152	Eu152-ELMB90	CERCA
Am-241	ER-25/178-18	UVVVR

2.7.2. Target values and associated combined uncertainties

The target values and associated combined uncertainties were derived from the mass of the spiked solution which was dropped to the 'simulated filter' support disk. These data are given in the Table 9.

TABLE 9. TARGET VALUES AND ASSOCIATED UNCERTAINTIES FOR SIMULATED FILTER SAMPLES AT THE REFERENCE DATE 15 NOVEMBER 2011

Nuclide	Sample 08		Sample 09		Sample 10	
	Activity[1], Bq	Uncertainty[2], Bq	Activity[1], Bq	Uncertainty[2], Bq	Activity[1], Bq	Uncertainty[2], Bq
Co-57	0.18	0.02	2.0	0.1	2.0	0.1
Cs-134	0.22	0.02	8.3	0.2	8.3	0.2
Cs-137	0.47	0.04	45.4	1.4	45.4	1.4
Eu-152	0.93	0.06	35.7	1.1	35.7	1.1
Am-241	1.57	0.07	51.7	1.6	51.7	1.6

[1]Activity = absolute activity in Bq
[2]Uncertainty = standard combined uncertainty (with k = 1 coverage factor)

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 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 10. 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 $Bias_{rel}$ ≤ 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 10.

Considering the main work areas of the participants, the occurrence of two different groups of radioanalytical problems may be assumed:

- 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 10 for each analyte.

TABLE 10. THE MAB AND LAP VALUES FOR EACH ANALYTE

Sample ID	Nuclide	MAB	LAP
Sample 01-02-03 (Water)	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
	Cs-137	10	10
Sample 05-06-07 (Grass)	Cs-137	10	10
Sample 08-09-10 (Filter)	Co-57	30	30
	Cs-134	25	25
	Cs-137	15	15
	Eu-152	20	20
	Am-241	20	20

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:

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

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

During the IAEA-TEL-2011-08 proficiency test 21 sample sets were distributed to the participants and 19 of them reported back their measurement results. Altogether 521 measurement results were evaluated for the assessment of the laboratories' performance.

The individual evaluation of each laboratory has been sent shortly after the reporting deadline and closing of the database to give to each laboratory an opportunity to identify any analytical problem and to take any rapid action for necessary improvement. These evaluations are summarised in the Appendix I.

Considering the gamma-emitting radionuclides, the number of the results and obtained scores (Accepted, Warning, Not accepted) are summarised in Fig. 4. The laboratories were ordered according to the decreasing number of 'Accepted' (green) 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, but they were not included into the ordering procedure. The maximum number of results from the gamma ray spectrometry method is 38. 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 to each other.

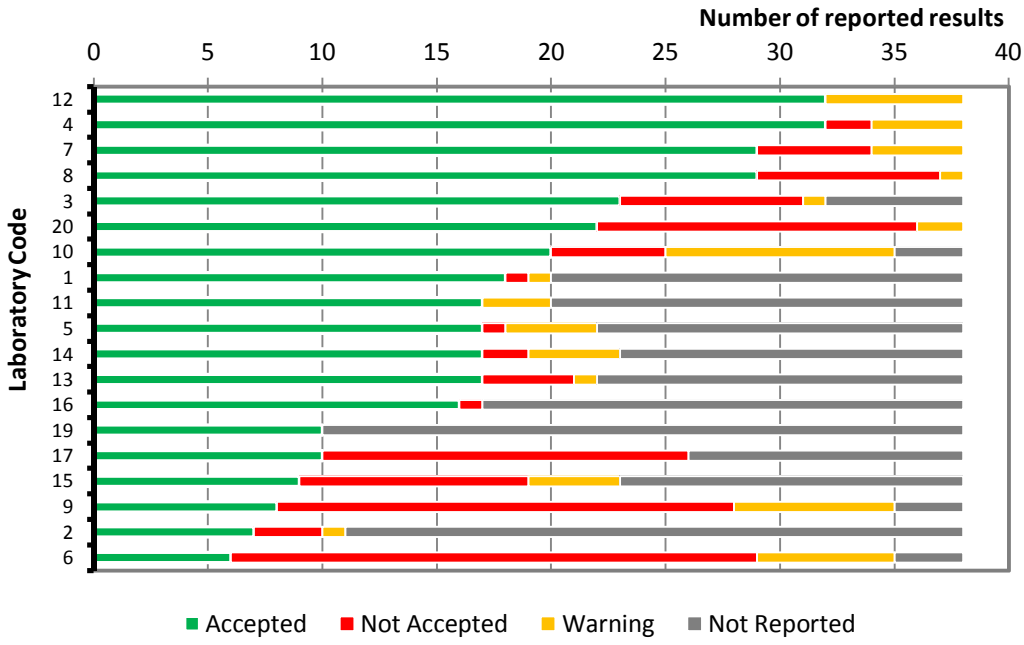

FIG. 4. Overall performance of the laboratories.

The overall distribution of the scores are 47 % 'Accepted', 17 % 'Not accepted', 8 % 'Warning' and 28 % of non-reported results.

This distribution is shown in Fig. 5.

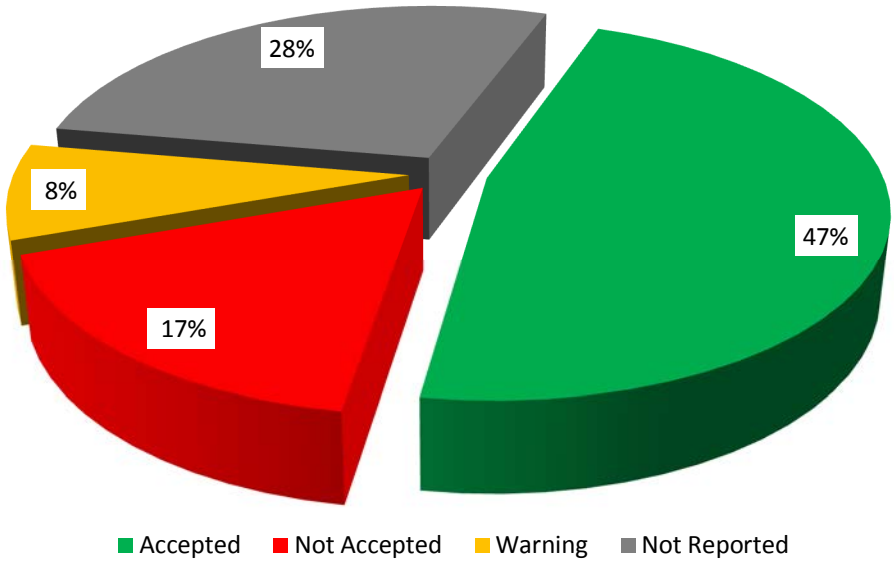

FIG. 5. Overall distribution of the scores.

The detailed scores for the different analytes of each sample in pie diagrams and the ordered reported results with their associated uncertainties (s-curve) are shown in the Appendix II. These graphs could help identifying the most difficult radionuclides and sample combinations in this proficiency test.

4.2. RECOMMENDATION FOR THE CALIBRATED ENERGY RANGE

The reported information about the calibration used by the laboratories is summarised in the Table 11. The calibration source which is available at most of the laboratories contains Cr-51, Mn-54, Co-57, Co-60, Sr-85, Y-88, Cd-109, Cs-137 and Ce-139 isotopes. In this calibration source the Cd-109 represents the lowest energy point at 88.03 keV. If the gamma ray spectrometer system is equipped with a n-type, or XtRA, or BEGe (broad energy) detector, it is sensitive enough for the low energy range down to 15-25 keV, depending on the material of the end-cup, the entrance window, and the internal structure of the detector. If the monitoring task includes the determination of the low energy gamma-emitting isotopes, or if the laboratory wishes to use the full energy range of the detector, the calibration source should contain in addition the Pb-210 (46.54 keV) and Am-241 (59.54 keV) isotopes. Only the laboratories No.4 and 10 had this possibility.

The efficiency calculated by an extrapolation process (out of the calibrated range) may be subject to a serious uncontrolled bias.

TABLE 11. THE LIST OF THE CALIBRANTS USED BY THE PARTICIPANTS

Laboratory Code	Calibration Source(s)	Type of the Detector	Corrections
1	Cr-51, Mn-54, Co-57, Co-60, Sr-85, Y-88, Cd-109, Cs-137, Ce-139	Not specified	Not specified
2	Not specified	Not specified	Not specified
3	Not specified	Not specified	Not specified
4	Co-57, Co-60, Sr-85, Y-88, Cd-109, Sn-113, Cs-137, Ce-139, Hg-203, Am-241	Not specified	Applied
5	MX 005 and MX 033	Not specified	Same geometry used
6	Cr-51, Mn-54, Co-57, Co-60, Sr-85, Y-88, Cd-109, Cs-137, Ce-139, Eu-152 for the filters	Not specified	Not specified
7	Cr-51, Mn-54, Co-57, Co-60, Sr-85, Y-88, Cd-109, Cs-137, Ce-139 and Cs-134+Cs-137, Am-241 in soil sample (IAEA-444)	Not specified	Not specified
8	Not specified	Not specified	Not specified
9	Cr-51, Mn-54, Co-57, Co-60, Sr-85, Y-88, Cd-109, Cs-137, Ce-139	Not specified	Not specified
10	Pb-210, Cd-109, Cs-137, Eu-152, Pb-210, Am-241 in soil and point sources from Co-60, Cs-137, Am-241	N-type, coaxial	Decay corr. Geometry corr.
11	MX033U8PP(0922-0926) isotope mix source	Not specified	Not specified
12	MX421 and MX033U8PP isotope mix source	Not specified	Not specified
13	Multinuclide standards	Not specified	Not specified
14	Cr-51, Mn-54, Co-57, Co-60, Sr-85, Y-88, Cd-109, Cs-137, Ce-139	Not specified	Not specified
15	Multinuclide standards	Not specified	Not specified
16	Cr-51, Mn-54, Co-57, Co-60, Sr-85, Y-88, Cd-109, Cs-137, Ce-139	Not specified	Not specified
17	Not specified	Not specified	Not specified
19	Multinuclide standards	Not specified	Not specified
20	Not specified	Not specified	Not specified

4.3. RECOMMENDATION RELATED TO TRUE COINCIDENCE SUMMING EFFECT

The high energy part of the efficiency calibration is interesting because Co-60 and Y-88 isotopes are in the calibration source. Considering the maximum gamma photon energy (1836.05 keV) of the Y-88 isotope, the interesting energy range especially for the 1460.8 keV gamma ray of K-40 is covered by the calibration. However both of these two isotopes (Co-60 and Y-88) have gamma photon emissions from cascade transitions, 1173.24 keV - 1332.51 keV and 898.04 keV - 1836.05 keV respectively [4]. Without any true coincidence correction during the efficiency calibration procedure the efficiency curve will be

underestimated. The K-40 is a single gamma-emitting radionuclide and the underestimated efficiency resulted in an overestimated activity value as it is demonstrated on Fig. 6.

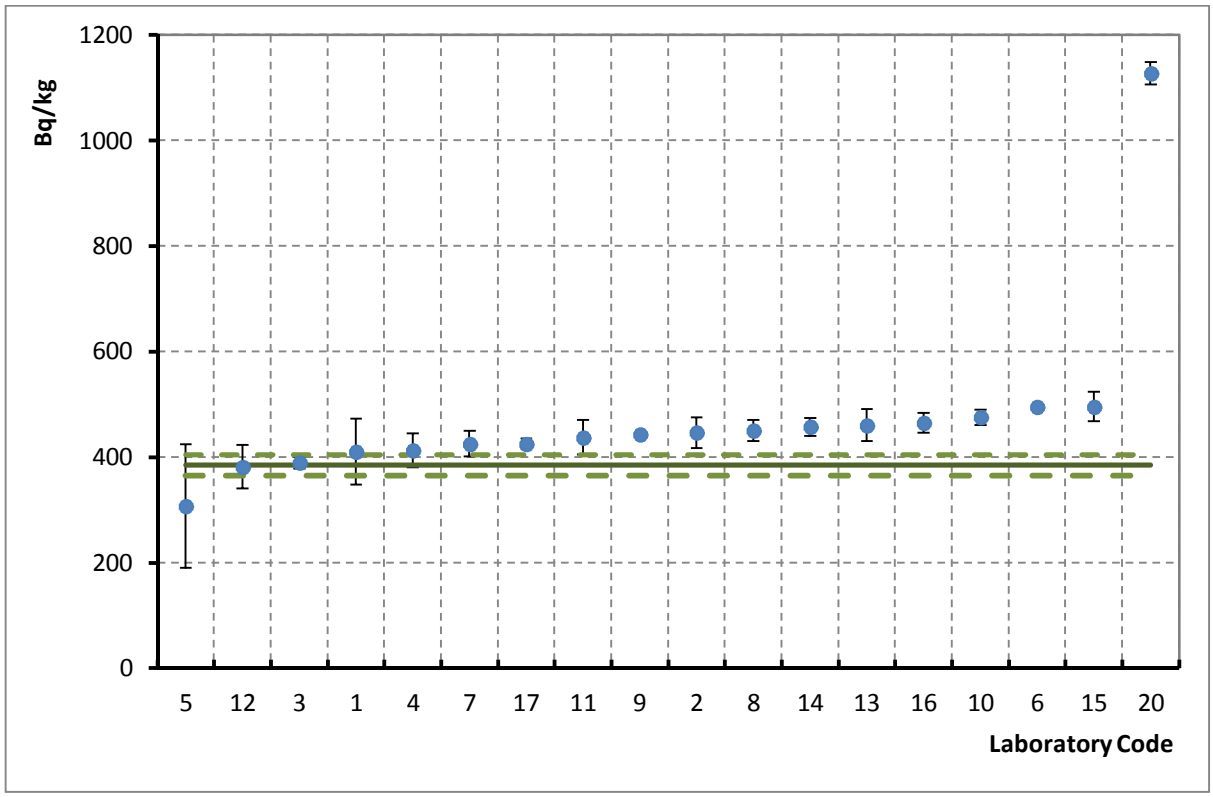

FIG. 6. The reported results of K-40 in soil, for IAEA-377.

Comparing the reported results of the Cs-134 and Cs-137 for both water and simulated aerosol filter samples, the situation is similar. The results of the Cs-134 are mainly around the characterised values, while most of the Cs-137 activities are slightly overestimated. On the other hand, the calculated activity for the cascade decaying Cs-134 is better than for the single gamma-emitting radionuclide Cs-137, as shown in the Appendix II.

It is strongly recommended to use the true coincidence summing correction both for calibration and spectra evaluation, if the used software has this option. To check this correction, it is also recommended to use a reference material containing the isotopes of interest, in the same measurement geometry.

A ‘cascade free’ calibration source could eliminate this analytical problem, but in this case the laboratory has to take into consideration the advantage of improved results against the higher cost and the more time consuming calibration procedure. One reasonable composition for the ‘cascade free’ calibration source is shown in the Table 12.

TABLE 12. ONE EXAMPLE FOR THE ISOTOPE COMPOSITION OF A 'CASCADE FREE' CALIBRATION SOURCE [4]

Nuclide	Half-life	Energy, keV
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
Sn-113	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
Zn-65	244.01 (9) d	1115.54

Of course this series does not cover the full required energy range and it has to be extended with any individual calibration source containing K-40. Theoretically the Co-57 is not completely free from cascade transitions, but it is in the manageable range. The situation is similar with the Am-241; in case the detector is sensitive for the low energy range, then the 26.34 keV line could be visible, resulting in a 'true coincidence in' summing effect with the low intensity 33.195 keV line producing a little surplus contribution to the main line at 59.54 keV.

4.4. RECOMMENDATION RELATED TO UNCERTAINTY BUDGET

A special observation of the evaluation of any proficiency test is that several 'Accepted' results are not obtained because of the over- or under-estimation of uncertainty by the participants. The participants frequently reported a smaller uncertainty than the typical stated uncertainty of the calibration source, which of course by principle is impossible. This phenomenon emphasizes the importance of establishing and using a realistic uncertainty budget.

The Cs-137 is the most common analyte in the samples and it has been selected to demonstrate the variation of the reported uncertainty range. Data are summarised in the Table 13. The assessed combined standard uncertainty is shown in the last column, which was calculated using the following counting conditions:

- Sample volume is 100 cm^3 and the sample holder is cylindrical, or a disk for the filters;
- Detector - sample distance is 5 mm;
- Detector efficiency is 1.55 % for the cylindrical and 3.65 % for the disk geometry at 661.67 keV (for a typical 30 % relative efficiency detector);
- Counting time is 50000 s;
- Gamma yield of the Cs-137 isotope is 0.8499, from the DDEP database [4].

The detection error, the standard deviation from the reproducibility of the geometry (0.5 %), the uncertainty of a typical calibration source (0.7 %) and the uncertainty from the efficiency curve fitting procedure (1.5 %) were propagated into the estimated combined standard uncertainty [5]. All these values were taken from real laboratory practice. The detection error was calculated from the counting conditions for each sample individually.

During the routine monitoring work these factors might be the main contributors for the standard combined uncertainty, but not all possibly relevant uncertainty sources are mentioned. For example the uncertainty from the sample preparation or the uncertainty resulting from the different corrections also may have a considerable contribution.

TABLE 13. THE REPORTED UNCERTAINTY RANGE FOR THE CS-137 ISOTOPE

Sample	Target value for Cs-137, Bq/kg*	Reported minimum uncertainty		Reported maximum uncertainty		Assessed uncertainty, %
		Bq/kg*	%	Bq/kg*	%	
Sample 01	6.2	0.04	0.65	1.55	25.0	5.2
Sample 02	3.1	0.05	1.61	1.37	44.2	7.2
Sample 03	4.4	0.03	0.68	1.37	31.1	6.1
Sample 04	2440	0.8	0.03	256	10.5	1.7
Sample 05	2	0.15	7.50	2.6	130.0	13.1
Sample 06	3000	2	0.07	322	10.7	1.7
Sample 07	10000	3	0.03	1064	10.6	1.7
Sample 08	0.47	0.008	1.70	0.2	42.5	4.1
Sample 09	45.4	0.1	0.22	4.6	10.1	1.7
Sample 10	45.4	0.1	0.22	4.6	10.1	1.7

* In case of the Sample 08, 09 and 10 the unit is Bq/filter.

4.5. RECOMMENDATION RELATED TO THE ROLE OF THE INTERNAL QC

The internal quality control has a really important role for the validity of the reported values. A well organised QC system in the laboratory should take care of the following things:

- Calculation of the final results and associated uncertainty estimation are performed according to state-of-the-art methods;
- Reported unit of analyte value is matching with the requested one;
- Corrections are applied as necessary;
- Appropriate reference material is used during the analytical process to confirm the measurement result.

In the gamma ray spectrometry the calculation and corrections are mainly carried out by the used software, so the user should have at least a control over:

- Input parameters of the sample;
- Selection of the efficiency curve due to both the geometry and the isotope library;
- Logical check of the reported data by the software (expert judgement).

A major goal for the measurement of reference materials is to keep the bias under control. For this purpose, several requirements for suitable reference materials are listed below:

- Both the assigned value and its uncertainty should be stated in the certificate for the analyte;
- Homogeneity and stability of the reference material should be documented;
- Matrix should be similar to the sample (at least the density of the matrix);
- Range of the activity concentration or massic activity should be in the same order of magnitude as for the sample.

The characterised value of the reference material should be independent from the calibration source.

4.6. FINAL MEETING WITH PARTICIPANTS IN JAPAN IN OCTOBER 2012

On 11 October 2012, on invitation of the University of Tsukuba, Japan, one author (S. Tarjan) attended a seminar at their Faculty of Life and Environmental Sciences in Japan and provided a lecture on the results of the proficiency test. The seminar was attended by 45 participants. The participants expressed their strong interest for similar future proficiency tests on special samples originated from Japan, like rice, soil and seafood (seaweed, fish).

5. CONCLUSIONS

The IAEA-TEL-2011-08 proficiency test dedicated to Japanese laboratories on emergency response environmental radioactivity measurements in a wide range of environmental matrices was successfully completed. The laboratories taking part in this proficiency test in general could perform the most important radioanalytical monitoring tasks in emergency situations using gamma ray spectrometry. This is demonstrated by the 70-84 % fraction of accepted results for Cs-134 and Cs-137 in water, grass and soil samples.

One important finding of this proficiency test is the identification of shortcomings of the performance of certain laboratories. Future improvements may include the application of necessary method specific corrections, quality control mechanism, method validation and the implementation of an appropriate uncertainty estimation process.

APPENDIX I

INDIVIDUAL EVALUATIONS

Laboratory Code: 1

Matrix:	Spiked Water	Laboratory Results			Stat-Params			Evaluation Parameters and Scores					
								Trueness			Precision		
Samplecode	Analyte	Value	Unc.	[%]	Z-Score	U-Score	Lab/IAEA	A1	A2	Score	P	Score	Final Score
	Co-60	15.3	1.1	7.19	0.0	0.0	1.00	0.00	2.88	A	7.31	A	A
	Ba-133	4.5	0.7	15.56	-1.0	-0.7	0.90	0.50	1.82	A	15.68	A	A
	Cs-134	6.4	0.7	10.94	-1.7	-1.8	0.83	1.30	1.82	A	11.01	A	A
	Cs-137	6.9	0.7	10.14	1.1	1.0	1.11	0.70	1.82	A	10.27	A	A
	Eu-152	16.9	3.2	18.93	1.0	0.5	1.10	1.50	8.27	A	18.98	N	W
	Am-241	-	-	-	-	-	-	-	-	-	-	-	-
	Co-60	7.9	0.35	4.43	0.4	0.8	1.04	0.30	0.94	A	4.62	A	A
	Ba-133	2.4	0.25	10.42	-0.4	-0.4	0.96	0.10	0.69	A	11.16	A	A
	Cs-134	3.9	0.2	5.13	0.3	0.4	1.03	0.10	0.58	A	5.76	A	A
	Cs-137	3.8	0.3	7.89	2.3	2.2	1.23	0.70	0.82	A	8.53	A	A
	Eu-152	8.6	0.8	9.30	1.2	1.1	1.12	0.90	2.08	A	9.39	A	A
	Am-241	-	-	-	-	-	-	-	-	-	-	-	-
	Co-60	10.6	0.6	5.66	-0.1	-0.2	0.99	0.10	1.63	A	5.96	A	A
	Ba-133	6.8	1.88	27.65	9.4	1.8	1.94	3.30	4.86	A	27.79	N	N
	Cs-134	5.59	0.4	7.16	0.4	0.5	1.04	0.19	1.06	A	7.39	A	A
	Cs-137	5.3	0.4	7.55	2.0	2.2	1.20	0.90	1.06	A	7.88	A	A
	Eu-152	12.6	1.5	11.90	1.7	1.2	1.17	1.80	3.90	A	12.05	A	A
	Am-241	-	-	-	-	-	-	-	-	-	-	-	-

Matrix:	Soil	Laboratory Results			Stat-Params			Evaluation Parameters and Scores					
								Trueness			Precision		
Samplecode	Analyte	Value	Unc.	[%]	Z-Score	U-Score	Lab/IAEA	A1	A2	Score	P	Score	Final Score
Sample 04	K-40	410	62	15.12	0.65	0.38	1.06	25	168.1	A	15.99	A	A
	Cs-137	2366	35	1.48	-0.30	-1.61	0.97	74	118.9	A	1.924	A	A

Matrix:	Grass	Laboratory Results			Stat-Params			Evaluation Parameters and Scores					
								Trueness			Precision		
Samplecode	Analyte	Value	Unc.	[%]	Z-Score	U-Score	Lab/IAEA	A1	A2	Score	P	Score	Final Score
Sample 05	Cs-137	<8	-	-	-	-	-	-	-	-	-	-	A
Sample 06	Cs-137	3109	46	1.48	0.36	0.85	1.04	109	331.6	A	4.265	A	A
Sample 07	Cs-137	10195	146	1.43	0.20	0.53	1.02	195	954.7	A	3.689	A	A

Matrix:	Spiked Filter	Laboratory Results			Stat-Params			Evaluation Parameters and Scores					
								Trueness			Precision		
Samplecode	Analyte	Value	Unc.	[%]	Z-Score	U-Score	Lab/IAEA	A1	A2	Score	P	Score	Final Score
Sample 08	Co-57	-	-	-	-	-	-	-	-	-	-	-	-
	Cs-134	-	-	-	-	-	-	-	-	-	-	-	-
	Cs-137	-	-	-	-	-	-	-	-	-	-	-	-
	Eu-152	-	-	-	-	-	-	-	-	-	-	-	-
	Am-241	-	-	-	-	-	-	-	-	-	-	-	-
Sample 09	Co-57	-	-	-	-	-	-	-	-	-	-	-	-
	Cs-134	-	-	-	-	-	-	-	-	-	-	-	-
	Cs-137	-	-	-	-	-	-	-	-	-	-	-	-
	Eu-152	-	-	-	-	-	-	-	-	-	-	-	-
	Am-241	-	-	-	-	-	-	-	-	-	-	-	-
Sample 10	Co-57	-	-	-	-	-	-	-	-	-	-	-	-
	Cs-134	-	-	-	-	-	-	-	-	-	-	-	-
	Cs-137	-	-	-	-	-	-	-	-	-	-	-	-
	Eu-152	-	-	-	-	-	-	-	-	-	-	-	-
	Am-241	-	-	-	-	-	-	-	-	-	-	-	-

Laboratory Code: 2

Matrix:	Spiked Water	Laboratory Results			Stat-Params			Evaluation Parameters and Scores					
								Trueness			Precision		
Samplecode	Analyte	Value	Unc.	[%]	Z-Score	U-Score	Lab/IAEA	A1	A2	Score	P	Score	Final Score
	Co-60	-	-	-	-	-	-	-	-	-	-	-	-
	Ba-133	-	-	-	-	-	-	-	-	-	-	-	-
	Cs-134	8.5	0.5	5.88	1.0	1.6	1.10	0.80	1.32	A	6.02	A	A
	Cs-137	6.9	0.5	7.25	1.1	1.4	1.11	0.70	1.32	A	7.42	A	A
	Eu-152	-	-	-	-	-	-	-	-	-	-	-	-
	Am-241	-	-	-	-	-	-	-	-	-	-	-	-
	Co-60	-	-	-	-	-	-	-	-	-	-	-	-
	Ba-133	-	-	-	-	-	-	-	-	-	-	-	-
	Cs-134	4.5	0.5	11.11	1.8	1.4	1.18	0.70	1.32	A	11.42	A	A
	Cs-137	4.9	0.6	12.24	5.8	3.0	1.58	1.80	1.57	N	12.66	A	N
	Eu-152	-	-	-	-	-	-	-	-	-	-	-	-
	Am-241	-	-	-	-	-	-	-	-	-	-	-	-
	Co-60	-	-	-	-	-	-	-	-	-	-	-	-
	Ba-133	-	-	-	-	-	-	-	-	-	-	-	-
	Cs-134	6.6	0.5	7.58	2.2	2.4	1.22	1.20	1.32	A	7.80	A	A
	Cs-137	5.9	0.5	8.47	3.4	2.9	1.34	1.50	1.32	N	8.77	A	N
	Eu-152	-	-	-	-	-	-	-	-	-	-	-	-
	Am-241	-	-	-	-	-	-	-	-	-	-	-	-

Matrix:	Soil	Laboratory Results			Stat-Params			Evaluation Parameters and Scores					
								Trueness			Precision		
Samplecode	Analyte	Value	Unc.	[%]	Z-Score	U-Score	Lab/IAEA	A1	A2	Score	P	Score	Final Score
Sample 04	K-40	446	29	6.50	1.58	1.73	1.16	61	90.89	A	8.323	A	A
	Cs-137	2925	18	0.62	1.99	13.86	1.20	485	90.26	N	1.375	A	N

Matrix:	Grass	Laboratory Results			Stat-Params			Evaluation Parameters and Scores					
								Trueness			Precision		
Samplecode	Analyte	Value	Unc.	[%]	Z-Score	U-Score	Lab/IAEA	A1	A2	Score	P	Score	Final Score
Sample 05	Cs-137	<3	0	-	-	-	-	-	-	-	-	-	A
Sample 06	Cs-137	3229	9	0.28	0.76	1.90	1.08	229	310.5	A	4.01	A	A
Sample 07	Cs-137	10990	19	0.17	0.99	2.91	1.10	990	878.6	N	3.404	A	W

Matrix:	Spiked Filter	Laboratory Results			Stat-Params			Evaluation Parameters and Scores					
								Trueness			Precision		
Samplecode	Analyte	Value	Unc.	[%]	Z-Score	U-Score	Lab/IAEA	A1	A2	Score	P	Score	Final Score
	Co-57	-	-	-	-	-	-	-	-	-	-	-	-
	Cs-134	-	-	-	-	-	-	-	-	-	-	-	-
Sample 08	Cs-137	-	-	-	-	-	-	-	-	-	-	-	-
	Eu-152	-	-	-	-	-	-	-	-	-	-	-	-
	Am-241	-	-	-	-	-	-	-	-	-	-	-	-
	Co-57	-	-	-	-	-	-	-	-	-	-	-	-
	Cs-134	-	-	-	-	-	-	-	-	-	-	-	-
Sample 09	Cs-137	-	-	-	-	-	-	-	-	-	-	-	-
	Eu-152	-	-	-	-	-	-	-	-	-	-	-	-
	Am-241	-	-	-	-	-	-	-	-	-	-	-	-
	Co-57	-	-	-	-	-	-	-	-	-	-	-	-
	Cs-134	-	-	-	-	-	-	-	-	-	-	-	-
Sample 10	Cs-137	-	-	-	-	-	-	-	-	-	-	-	-
	Eu-152	-	-	-	-	-	-	-	-	-	-	-	-
	Am-241	-	-	-	-	-	-	-	-	-	-	-	-

Laboratory Code: 3

Matrix:	Spiked Water	Laboratory Results			Stat-Params			Evaluation Parameters and Scores					
								Trueness			Precision		
Samplecode	Analyte	Value	Unc.	[%]	Z-Score	U-Score	Lab/IAEA	A1	A2	Score	P	Score	Final Score
	Co-60	15.2	0.68	4.47	-0.1	-0.1	0.99	0.10	1.83	A	4.66	A	A
	Ba-133	4.47	0.577	12.91	-1.1	-0.9	0.89	0.53	1.51	A	13.06	A	A
	Cs-134	7.81	0.54	6.91	0.1	0.2	1.01	0.11	1.42	A	7.04	A	A
	Cs-137	6.84	0.61	8.92	1.0	1.0	1.10	0.64	1.59	A	9.06	A	A
	Eu-152	16.9	0.88	5.21	1.0	1.7	1.10	1.50	2.33	A	5.37	A	A
	Am-241	-	-	-	-	-	-	-	-	-	-	-	-
	Co-60	9.03	0.44	4.87	1.9	3.2	1.19	1.43	1.16	N	5.05	A	N
	Ba-133	2.71	0.44	16.24	0.8	0.5	1.08	0.21	1.16	A	16.72	A	A
	Cs-134	4.69	0.39	8.32	2.3	2.2	1.23	0.89	1.04	A	8.72	A	A
	Cs-137	3.81	0.41	10.76	2.3	1.7	1.23	0.71	1.09	A	11.23	A	A
	Eu-152	9.9	0.68	6.87	2.9	3.2	1.29	2.20	1.77	N	6.99	A	N
	Am-241	-	-	-	-	-	-	-	-	-	-	-	-
	Co-60	11.2	0.44	3.93	0.5	1.0	1.05	0.50	1.25	A	4.35	A	A
	Ba-133	3.48	0.35	10.06	-0.1	-0.1	0.99	0.02	0.94	A	10.46	A	A
	Cs-134	6.15	0.38	6.18	1.4	1.9	1.14	0.75	1.01	A	6.45	A	A
	Cs-137	5.62	0.43	7.65	2.8	2.8	1.28	1.22	1.14	N	7.98	A	N
	Eu-152	11.7	0.62	5.30	0.8	1.4	1.08	0.90	1.68	A	5.61	A	A
	Am-241	-	-	-	-	-	-	-	-	-	-	-	-

Matrix:	Soil	Laboratory Results			Stat-Params			Evaluation Parameters and Scores					
								Trueness			Precision		
Samplecode	Analyte	Value	Unc.	[%]	Z-Score	U-Score	Lab/IAEA	A1	A2	Score	P	Score	Final Score
Sample 04	K-40	389	11	2.83	0.10	0.18	1.01	4	58.89	A	5.915	A	A
	Cs-137	2560	2.3	0.09	0.49	3.99	1.05	120	77.63	N	1.233	A	W

Matrix:	Grass	Laboratory Results			Stat-Params			Evaluation Parameters and Scores					
								Trueness			Precision		
Samplecode	Analyte	Value	Unc.	[%]	Z-Score	U-Score	Lab/IAEA	A1	A2	Score	P	Score	Final Score
Sample 05	Cs-137	3.79	1.1	29.02	8.95	1.53	1.90	1.79	3.02	A	35.25	N	N
Sample 06	Cs-137	3050	19	0.62	0.17	0.41	1.02	50	313.5	A	4.048	A	A
Sample 07	Cs-137	10200	85	0.83	0.20	0.57	1.02	200	904.2	A	3.501	A	A

Matrix:	Spiked Filter	Laboratory Results			Stat-Params			Evaluation Parameters and Scores					
								Trueness			Precision		
Samplecode	Analyte	Value	Unc.	[%]	Z-Score	U-Score	Lab/IAEA	A1	A2	Score	P	Score	Final Score
	Co-57	0.593	0.11	18.55	22.94	3.69	3.29	0.41	0.29	N	21.62	A	N
	Cs-134	-	-	-	-	-	-	-	-	-	-	-	-
Sample 08	Cs-137	-	-	-	-	-	-	-	-	-	-	-	-
	Eu-152	-	-	-	-	-	-	-	-	-	-	-	-
	Am-241	0.692	0.53	76.59	-5.59	-1.64	0.44	0.88	1.38	A	76.72	N	N
	Co-57	3.9	1.1	28.21	9.50	1.72	1.95	1.90	2.85	A	28.64	A	A
	Cs-134	8.05	0.4	4.97	-0.30	-0.56	0.97	0.25	1.15	A	5.52	A	A
Sample 09	Cs-137	45.3	1.1	2.43	-0.02	-0.06	1.00	0.10	4.59	A	3.93	A	A
	Eu-152	33.8	0.94	2.78	-0.53	-1.31	0.95	1.90	3.73	A	4.15	A	A
	Am-241	27.1	1.3	4.80	-4.76	-11.93	0.52	24.60	5.32	N	5.71	A	N
	Co-57	2.87	0.65	22.65	4.35	1.32	1.44	0.87	1.70	A	23.19	A	A
	Cs-134	8.02	0.4	4.99	-0.34	-0.63	0.97	0.28	1.15	A	5.54	A	A
Sample 10	Cs-137	43.3	1.1	2.54	-0.46	-1.18	0.95	2.10	4.59	A	4.00	A	A
	Eu-152	35.9	0.96	2.67	0.06	0.14	1.01	0.20	3.77	A	4.08	A	A
	Am-241	28.2	1.3	4.61	-4.55	-11.40	0.55	23.50	5.32	N	5.55	A	N

Laboratory Code: 4

Matrix:	Spiked Water	Laboratory Results			Stat-Params			Evaluation Parameters and Scores					
								Trueness			Precision		
Samplecode	Analyte	Value	Unc.	[%]	Z-Score	U-Score	Lab/IAEA	A1	A2	Score	P	Score	Final Score
	Co-60	15.3	0.5	3.27	0.0	0.0	1.00	0.00	1.39	A	3.52	A	A
	Ba-133	5.2	0.3	5.77	0.4	0.6	1.04	0.20	0.82	A	6.11	A	A
	Cs-134	7.5	0.3	4.00	-0.3	-0.6	0.97	0.20	0.82	A	4.21	A	A
	Cs-137	6.2	0.3	4.84	0.0	0.0	1.00	0.00	0.82	A	5.10	A	A
	Eu-152	15.2	1.6	10.53	-0.1	-0.1	0.99	0.20	4.16	A	10.61	A	A
	Am-241	4.5	1.4	31.11	-0.4	-0.1	0.96	0.20	3.62	A	31.18	N	W
	Co-60	7.6	0.3	3.95	0.0	0.0	1.00	0.00	0.82	A	4.16	A	A
	Ba-133	2.7	0.1	3.70	0.8	1.4	1.08	0.20	0.36	A	5.45	A	A
	Cs-134	3.9	0.2	5.13	0.3	0.4	1.03	0.10	0.58	A	5.76	A	A
	Cs-137	3.3	0.2	6.06	0.6	0.9	1.06	0.20	0.58	A	6.87	A	A
	Eu-152	6.1	1	16.39	-2.1	-1.6	0.79	1.60	2.59	A	16.44	N	N
	Am-241	<3.0	-	-	-	-	-	-	-	-	-	-	A
	Co-60	10.9	0.4	3.67	0.2	0.4	1.02	0.20	1.15	A	4.12	A	A
	Ba-133	3.5	0.2	5.71	0.0	0.0	1.00	0.00	0.58	A	6.39	A	A
	Cs-134	4.9	0.2	4.08	-0.9	-2.2	0.91	0.50	0.58	A	4.48	A	A
	Cs-137	3.9	0.2	5.13	-1.1	-2.2	0.89	0.50	0.58	A	5.61	A	A
	Eu-152	11.4	1.3	11.40	0.6	0.5	1.06	0.60	3.39	A	11.55	A	A
	Am-241	<3.7	-	-	-	-	-	-	-	-	-	-	A

Matrix:	Soil	Laboratory Results			Stat-Params			Evaluation Parameters and Scores					
								Trueness			Precision		
Samplecode	Analyte	Value	Unc.	[%]	Z-Score	U-Score	Lab/IAEA	A1	A2	Score	P	Score	Final Score
Sample 04	K-40	412	32	7.77	0.70	0.72	1.07	27	97.36	A	9.344	A	A
	Cs-137	2372	73	3.08	-0.28	-0.86	0.97	68	203.6	A	3.314	A	A

Matrix:	Grass	Laboratory Results			Stat-Params			Evaluation Parameters and Scores					
								Trueness			Precision		
Samplecode	Analyte	Value	Unc.	[%]	Z-Score	U-Score	Lab/IAEA	A1	A2	Score	P	Score	Final Score
Sample 05	Cs-137	<1.0	-	-	-	-	-	-	-	-	-	-	W
Sample 06	Cs-137	3126	93	2.98	0.42	0.83	1.04	126	391.7	A	4.985	A	A
Sample 07	Cs-137	10301	311	3.02	0.30	0.65	1.03	301	1189	A	4.547	A	A

Matrix:	Spiked Filter	Laboratory Results			Stat-Params			Evaluation Parameters and Scores					
								Trueness			Precision		
Samplecode	Analyte	Value	Unc.	[%]	Z-Score	U-Score	Lab/IAEA	A1	A2	Score	P	Score	Final Score
	Co-57	<0.16	-	-	-	-	-	-	-	-	-	-	A
	Cs-134	0.22	0.02	9.09	0.00	0.00	1.00	0.00	0.07	A	12.86	A	A
Sample 08	Cs-137	0.45	0.02	4.44	-0.43	-0.45	0.96	0.02	0.12	A	9.60	A	A
	Eu-152	0.89	0.09	10.11	-0.43	-0.37	0.96	0.04	0.28	A	12.00	A	A
	Am-241	1.9	0.1	5.26	2.10	2.70	1.21	0.33	0.31	N	6.90	A	N
	Co-57	2.9	0.5	17.24	4.50	1.77	1.45	0.90	1.32	A	17.95	A	A
	Cs-134	8.6	0.3	3.49	0.36	0.83	1.04	0.30	0.93	A	4.24	A	A
Sample 09	Cs-137	47.6	1.5	3.15	0.48	1.07	1.05	2.20	5.29	A	4.41	A	A
	Eu-152	39	2	5.13	0.92	1.45	1.09	3.30	5.89	A	5.98	A	A
	Am-241	61	2	3.28	1.80	3.63	1.18	9.30	6.61	N	4.51	A	W
	Co-57	3.3	0.5	15.15	6.50	2.55	1.65	1.30	1.32	A	15.96	A	A
	Cs-134	8.3	0.3	3.61	0.00	0.00	1.00	0.00	0.93	A	4.34	A	A
Sample 10	Cs-137	48.2	1.5	3.11	0.62	1.36	1.06	2.80	5.29	A	4.38	A	A
	Eu-152	39	2	5.13	0.92	1.45	1.09	3.30	5.89	A	5.98	A	A
	Am-241	61	2	3.28	1.80	3.63	1.18	9.30	6.61	N	4.51	A	W

Laboratory Code: 5

Matrix:	Spiked Water	Laboratory Results			Stat-Params			Evaluation Parameters and Scores					
								Trueness			Precision		
Samplecode	Analyte	Value	Unc.	[%]	Z-Score	U-Score	Lab/IAEA	A1	A2	Score	P	Score	Final Score
	Co-60	15.34	2.2	14.34	0.0	0.0	1.00	0.04	5.70	A	14.40	A	A
	Ba-133	-	-	-	-	-	-	-	-	-	-	-	-
	Cs-134	-	-	-	-	-	-	-	-	-	-	-	-
	Cs-137	6.44	0.7	10.87	0.4	0.3	1.04	0.24	1.82	A	10.99	A	A
	Eu-152	-	-	-	-	-	-	-	-	-	-	-	-
	Am-241	-	-	-	-	-	-	-	-	-	-	-	-
	Co-60	7.69	0.83	10.79	0.1	0.1	1.01	0.09	2.16	A	10.87	A	A
	Ba-133	-	-	-	-	-	-	-	-	-	-	-	-
	Cs-134	-	-	-	-	-	-	-	-	-	-	-	-
	Cs-137	3.56	1.1	30.90	1.5	0.4	1.15	0.46	2.85	A	31.07	N	W
	Eu-152	-	-	-	-	-	-	-	-	-	-	-	-
	Am-241	-	-	-	-	-	-	-	-	-	-	-	-
	Co-60	11.21	1.64	14.63	0.5	0.3	1.05	0.51	4.26	A	14.75	A	A
	Ba-133	-	-	-	-	-	-	-	-	-	-	-	-
	Cs-134	-	-	-	-	-	-	-	-	-	-	-	-
	Cs-137	3.95	0.61	15.44	-1.0	-0.7	0.90	0.45	1.59	A	15.61	A	A
	Eu-152	-	-	-	-	-	-	-	-	-	-	-	-
	Am-241	-	-	-	-	-	-	-	-	-	-	-	-

Matrix:	Soil	Laboratory Results			Stat-Params			Evaluation Parameters and Scores					
								Trueness			Precision		
Samplecode	Analyte	Value	Unc.	[%]	Z-Score	U-Score	Lab/IAEA	A1	A2	Score	P	Score	Final Score
Sample 04	K-40	307	117	38.11	-2.03	-0.66	0.80	78	306.2	A	38.46	N	N
	Cs-137	2389	120	5.02	-0.21	-0.41	0.98	51	319.1	A	5.171	A	A

Matrix:	Grass	Laboratory Results			Stat-Params			Evaluation Parameters and Scores					
								Trueness			Precision		
Samplecode	Analyte	Value	Unc.	[%]	Z-Score	U-Score	Lab/IAEA	A1	A2	Score	P	Score	Final Score
Sample 05	Cs-137	<2	-	-	-	-	-	-	-	-	-	-	A
Sample 06	Cs-137	3223	116	3.60	0.74	1.34	1.07	223	430.6	A	5.381	A	A
Sample 07	Cs-137	11072	397	3.59	1.07	2.05	1.11	1072	1349	A	4.941	A	A

Matrix:	Spiked Filter	Laboratory Results			Stat-Params			Evaluation Parameters and Scores					
								Trueness			Precision		
Samplecode	Analyte	Value	Unc.	[%]	Z-Score	U-Score	Lab/IAEA	A1	A2	Score	P	Score	Final Score
	Co-57	0.228	0.069	30.26	2.67	0.67	1.27	0.05	0.19	A	32.24	N	W
	Cs-134	0.247	0.025	10.12	1.23	0.84	1.12	0.03	0.08	A	13.60	A	A
Sample 08	Cs-137	0.502	0.034	6.77	0.68	0.61	1.07	0.03	0.14	A	10.88	A	A
	Eu-152	1.04	0.35	33.65	1.18	0.31	1.12	0.11	0.92	A	34.27	N	W
	Am-241	-	-	-	-	-	-	-	-	-	-	-	-
	Co-57	-	-	-	-	-	-	-	-	-	-	-	-
	Cs-134	8.52	0.53	6.22	0.27	0.39	1.03	0.22	1.46	A	6.67	A	A
Sample 09	Cs-137	49.21	1.41	2.87	0.84	1.92	1.08	3.81	5.13	A	4.21	A	A
	Eu-152	37.13	2.76	7.43	0.40	0.48	1.04	1.43	7.67	A	8.05	A	A
	Am-241	-	-	-	-	-	-	-	-	-	-	-	-
	Co-57	2.51	0.29	11.55	2.55	1.66	1.26	0.51	0.79	A	12.59	A	A
	Cs-134	9.37	0.57	6.08	1.29	1.77	1.13	1.07	1.56	A	6.54	A	A
Sample 10	Cs-137	50.77	1.33	2.62	1.18	2.78	1.12	5.37	4.98	N	4.05	A	W
	Eu-152	39.29	2.82	7.18	1.01	1.19	1.10	3.59	7.81	A	7.81	A	A
	Am-241	-	-	-	-	-	-	-	-	-	-	-	-

Laboratory Code: 6

Matrix:	Spiked Water	Laboratory Results			Stat-Params			Evaluation Parameters and Scores					
								Trueness			Precision		
Samplecode	Analyte	Value	Unc.	[%]	Z-Score	U-Score	Lab/IAEA	A1	A2	Score	P	Score	Final Score
	Co-60	14.8	0.2	1.35	-0.3	-1.8	0.97	0.50	0.73	A	1.88	A	A
	Ba-133	5.6	0.2	3.57	1.2	2.7	1.12	0.60	0.58	N	4.09	A	W
	Cs-134	8.4	0.2	2.38	0.9	3.1	1.09	0.70	0.58	N	2.71	A	W
	Cs-137	9.6	0.2	2.08	5.5	15.2	1.55	3.40	0.58	N	2.63	A	N
	Eu-152	20.5	0.3	1.46	3.3	14.1	1.33	5.10	0.93	N	1.96	A	N
	Am-241	-	-	-	-	-	-	-	-	-	-	-	-
	Co-60	4.66	0.09	1.93	-3.9	-21.9	0.61	2.94	0.35	N	2.34	A	N
	Ba-133	1.28	0.04	3.13	-4.9	-11.3	0.51	1.22	0.28	N	5.08	A	N
	Cs-134	2.22	0.05	2.25	-4.2	-14.1	0.58	1.58	0.29	N	3.46	A	N
	Cs-137	1.89	0.05	2.65	-3.9	-10.8	0.61	1.21	0.29	N	4.17	A	N
	Eu-152	7.3	0.1	1.37	-0.5	-2.8	0.95	0.40	0.36	N	1.89	A	W
	Am-241	-	-	-	-	-	-	-	-	-	-	-	-
	Co-60	11.5	0.5	4.35	0.7	1.5	1.07	0.80	1.39	A	4.73	A	A
	Ba-133	3.8	0.5	13.16	0.9	0.6	1.09	0.30	1.32	A	13.46	A	A
	Cs-134	6.8	0.5	7.35	2.6	2.7	1.26	1.40	1.32	N	7.58	A	N
	Cs-137	5.5	0.3	5.45	2.5	3.5	1.25	1.10	0.82	N	5.91	A	N
	Eu-152	18.9	1.6	8.47	7.5	5.0	1.75	8.10	4.16	N	8.67	A	N
	Am-241	-	-	-	-	-	-	-	-	-	-	-	-

Matrix:	Soil	Laboratory Results			Stat-Params			Evaluation Parameters and Scores					
								Trueness			Precision		
Samplecode	Analyte	Value	Unc.	[%]	Z-Score	U-Score	Lab/IAEA	A1	A2	Score	P	Score	Final Score
Sample 04	K-40	494.5	0.2	0.04	2.84	5.47	1.28	109.5	51.6	N	5.195	A	N
	Cs-137	2435	5	0.21	-0.02	-0.16	1.00	5	78.47	A	1.247	A	A

Matrix:	Grass	Laboratory Results			Stat-Params			Evaluation Parameters and Scores					
								Trueness			Precision		
Samplecode	Analyte	Value	Unc.	[%]	Z-Score	U-Score	Lab/IAEA	A1	A2	Score	P	Score	Final Score
Sample 05	Cs-137	32.4	1	3.09	152.00	28.23	16.20	30.4	2.779	N	20.24	N	N
Sample 06	Cs-137	3489	11	0.32	1.63	4.06	1.16	489	310.9	N	4.012	A	N
Sample 07	Cs-137	12110	13	0.11	2.11	6.20	1.21	2110	877.8	N	3.402	A	N

Matrix:	Spiked Filter	Laboratory Results			Stat-Params			Evaluation Parameters and Scores					
								Trueness			Precision		
Samplecode	Analyte	Value	Unc.	[%]	Z-Score	U-Score	Lab/IAEA	A1	A2	Score	P	Score	Final Score
	Co-57	0.17	0.03	17.65	-0.56	-0.28	0.94	0.01	0.09	A	20.85	A	A
	Cs-134	0.156	0.007	4.49	-2.91	-3.02	0.71	0.06	0.05	N	10.14	A	N
Sample 08	Cs-137	0.61	0.02	3.28	2.98	3.13	1.30	0.14	0.12	N	9.12	A	N
	Eu-152	1.17	0.03	2.56	2.58	3.58	1.26	0.24	0.17	N	6.94	A	N
	Am-241	2.4	0.3	12.50	5.29	2.69	1.53	0.83	0.79	N	13.27	A	N
	Co-57	3.28	0.09	2.74	6.40	9.51	1.64	1.28	0.35	N	5.70	A	N
	Cs-134	6.35	0.05	0.79	-2.35	-9.46	0.77	1.95	0.53	N	2.54	A	W
Sample 09	Cs-137	58.7	0.2	0.34	2.93	9.40	1.29	13.30	3.65	N	3.10	A	N
	Eu-152	42.8	0.2	0.47	1.99	6.35	1.20	7.10	2.88	N	3.12	A	W
	Am-241	87	1.2	1.38	6.83	17.65	1.68	35.30	5.16	N	3.39	A	N
	Co-57	3.96	0.08	2.02	9.80	15.31	1.98	1.96	0.33	N	5.39	A	N
	Cs-134	6.35	0.04	0.63	-2.35	-9.56	0.77	1.95	0.53	N	2.49	A	W
Sample 10	Cs-137	43.4	0.1	0.23	-0.44	-1.42	0.96	2.00	3.62	A	3.09	A	A
	Eu-152	60.8	1	1.64	7.03	16.88	1.70	25.10	3.84	N	3.49	A	N
	Am-241	89.8	1.2	1.34	7.37	19.05	1.74	38.10	5.16	N	3.37	A	N

Laboratory Code: 7

Matrix:	Spiked Water	Laboratory Results			Stat-Params			Evaluation Parameters and Scores					
								Trueness			Precision		
Samplecode	Analyte	Value	Unc.	[%]	Z-Score	U-Score	Lab/IAEA	A1	A2	Score	P	Score	Final Score
	Co-60	15.9	0.59	3.71	0.4	1.0	1.04	0.60	1.61	A	3.93	A	A
	Ba-133	4.93	0.26	5.27	-0.1	-0.3	0.99	0.07	0.72	A	5.64	A	A
	Cs-134	8.07	0.44	5.45	0.5	0.8	1.05	0.37	1.16	A	5.60	A	A
	Cs-137	6.08	0.34	5.59	-0.2	-0.3	0.98	0.12	0.91	A	5.82	A	A
	Eu-152	15.01	0.7	4.66	-0.3	-0.5	0.97	0.39	1.88	A	4.84	A	A
	Am-241	6	1.3	21.67	2.8	1.0	1.28	1.30	3.36	A	21.77	N	N
	Co-60	7.93	0.37	4.67	0.4	0.9	1.04	0.33	0.99	A	4.85	A	A
	Ba-133	3.42	0.23	6.73	3.7	3.7	1.37	0.92	0.65	N	7.82	A	N
	Cs-134	3.9	0.24	6.15	0.3	0.4	1.03	0.10	0.67	A	6.69	A	A
	Cs-137	2.69	0.26	9.67	-1.3	-1.5	0.87	0.41	0.72	A	10.19	A	A
	Eu-152	7.6	0.52	6.84	-0.1	-0.2	0.99	0.10	1.37	A	6.96	A	A
	Am-241	2.4	1.2	50.00	0.0	0.0	1.00	0.00	3.11	A	50.17	N	W
	Co-60	10.61	0.48	4.52	-0.1	-0.2	0.99	0.09	1.34	A	4.89	A	A
	Ba-133	3.66	0.2	5.46	0.5	0.7	1.05	0.16	0.58	A	6.17	A	A
	Cs-134	5.66	0.34	6.01	0.5	0.7	1.05	0.26	0.91	A	6.29	A	A
	Cs-137	3.8	0.29	7.63	-1.4	-2.0	0.86	0.60	0.79	A	7.96	A	A
	Eu-152	9.85	0.48	4.87	-0.9	-1.8	0.91	0.95	1.34	A	5.21	A	A
	Am-241	3.3	1.5	45.45	0.0	0.0	1.00	0.00	3.88	A	45.56	N	W

Matrix:	Soil	Laboratory Results			Stat-Params			Evaluation Parameters and Scores					
								Trueness			Precision		
Samplecode	Analyte	Value	Unc.	[%]	Z-Score	U-Score	Lab/IAEA	A1	A2	Score	P	Score	Final Score
Sample 04	K-40	425	24	5.65	1.04	1.28	1.10	40	80.6	A	7.673	A	A
	Cs-137	2460	110	4.47	0.08	0.18	1.01	20	294.2	A	4.637	A	A

Matrix:	Grass	Laboratory Results			Stat-Params			Evaluation Parameters and Scores					
								Trueness			Precision		
Samplecode	Analyte	Value	Unc.	[%]	Z-Score	U-Score	Lab/IAEA	A1	A2	Score	P	Score	Final Score
Sample 05	Cs-137	<2	-	-	-	-	-	-	-	-	-	-	A
Sample 06	Cs-137	3590	170	4.74	1.97	2.84	1.20	590	536.9	N	6.199	A	N
Sample 07	Cs-137	11350	520	4.58	1.35	2.17	1.14	1350	1603	A	5.705	A	A

Matrix:	Spiked Filter	Laboratory Results			Stat-Params			Evaluation Parameters and Scores					
								Trueness			Precision		
Samplecode	Analyte	Value	Unc.	[%]	Z-Score	U-Score	Lab/IAEA	A1	A2	Score	P	Score	Final Score
	Co-57	0.133	0.042	31.58	-2.61	-1.01	0.74	0.05	0.12	A	33.48	N	W
	Cs-134	0.207	0.023	11.11	-0.59	-0.43	0.94	0.01	0.08	A	14.36	A	A
Sample 08	Cs-137	0.459	0.018	3.92	-0.23	-0.25	0.98	0.01	0.11	A	9.37	A	A
	Eu-152	0.901	0.062	6.88	-0.31	-0.34	0.97	0.03	0.22	A	9.43	A	A
	Am-241	1.247	0.056	4.49	-2.06	-3.60	0.79	0.32	0.23	N	6.33	A	N
	Co-57	2.12	0.14	6.60	0.60	0.70	1.06	0.12	0.44	A	8.28	A	A
	Cs-134	8.34	0.65	7.79	0.05	0.06	1.00	0.04	1.75	A	8.16	A	A
Sample 09	Cs-137	46.9	1.4	2.99	0.33	0.76	1.03	1.50	5.11	A	4.29	A	A
	Eu-152	35.8	2.2	6.15	0.03	0.04	1.00	0.10	6.35	A	6.87	A	A
	Am-241	41.1	1.3	3.16	-2.05	-5.14	0.79	10.60	5.32	N	4.43	A	N
	Co-57	1.98	0.2	10.10	-0.10	-0.09	0.99	0.02	0.58	A	11.27	A	A
	Cs-134	8.18	0.52	6.36	-0.14	-0.22	0.99	0.12	1.44	A	6.80	A	A
Sample 10	Cs-137	46.5	1.4	3.01	0.24	0.56	1.02	1.10	5.11	A	4.31	A	A
	Eu-152	36.7	1.6	4.36	0.28	0.52	1.03	1.00	5.01	A	5.34	A	A
	Am-241	41.6	1.3	3.13	-1.95	-4.90	0.80	10.10	5.32	N	4.40	A	W

Laboratory Code: 8

Matrix:	Spiked Water	Laboratory Results			Stat-Params			Evaluation Parameters and Scores					
								Trueness			Precision		
Samplecode	Analyte	Value	Unc.	[%]	Z-Score	U-Score	Lab/IAEA	A1	A2	Score	P	Score	Final Score
	Co-60	15.4	0.5	3.25	0.1	0.2	1.01	0.10	1.39	A	3.50	A	A
	Ba-133	3.8	0.2	5.26	-2.4	-5.4	0.76	1.20	0.58	N	5.63	A	N
	Cs-134	7.3	0.5	6.85	-0.5	-0.8	0.95	0.40	1.32	A	6.97	A	A
	Cs-137	5.9	0.2	3.39	-0.5	-1.3	0.95	0.30	0.58	A	3.75	A	A
	Eu-152	16.4	1.6	9.76	0.6	0.6	1.06	1.00	4.16	A	9.84	A	A
	Am-241	6.2	1.8	29.03	3.2	0.8	1.32	1.50	4.65	A	29.11	N	N
	Co-60	7.8	0.3	3.85	0.3	0.6	1.03	0.20	0.82	A	4.06	A	A
	Ba-133	2.2	0.2	9.09	-1.2	-1.3	0.88	0.30	0.58	A	9.93	A	A
	Cs-134	3.9	0.3	7.69	0.3	0.3	1.03	0.10	0.82	A	8.13	A	A
	Cs-137	2.8	0.1	3.57	-1.0	-2.1	0.90	0.30	0.36	A	4.81	A	A
	Eu-152	8.2	0.8	9.76	0.6	0.6	1.06	0.50	2.08	A	9.84	A	A
	Am-241	8.6	1.3	15.12	25.8	4.8	3.58	6.20	3.36	N	15.68	A	N
	Co-60	11	0.4	3.64	0.3	0.7	1.03	0.30	1.15	A	4.09	A	A
	Ba-133	4.3	0.3	6.98	2.3	2.5	1.23	0.80	0.82	A	7.54	A	A
	Cs-134	4.9	0.3	6.12	-0.9	-1.6	0.91	0.50	0.82	A	6.40	A	A
	Cs-137	4.1	0.2	4.88	-0.7	-1.3	0.93	0.30	0.58	A	5.38	A	A
	Eu-152	12.6	1.2	9.52	1.7	1.5	1.17	1.80	3.14	A	9.70	A	A
	Am-241	9	1.5	16.67	17.3	3.8	2.73	5.70	3.88	N	16.94	A	N

Matrix:	Soil	Laboratory Results			Stat-Params			Evaluation Parameters and Scores					
								Trueness			Precision		
Samplecode	Analyte	Value	Unc.	[%]	Z-Score	U-Score	Lab/IAEA	A1	A2	Score	P	Score	Final Score
Sample 04	K-40	450	20	4.44	1.69	2.30	1.17	65	72.97	A	6.837	A	A
	Cs-137	2600	200	7.69	0.66	0.79	1.07	160	521.8	A	7.79	A	A

Matrix:	Grass	Laboratory Results			Stat-Params			Evaluation Parameters and Scores					
								Trueness			Precision		
Samplecode	Analyte	Value	Unc.	[%]	Z-Score	U-Score	Lab/IAEA	A1	A2	Score	P	Score	Final Score
Sample 05	Cs-137	1.2	0.2	16.67	-4.00	-1.79	0.60	0.8	1.154	A	26.03	N	N
Sample 06	Cs-137	3000	200	6.67	0.00	0.00	1.00	0	601.8	A	7.775	A	A
Sample 07	Cs-137	10600	800	7.55	0.60	0.69	1.06	600	2243	A	8.278	A	A

Matrix:	Spiked Filter	Laboratory Results			Stat-Params			Evaluation Parameters and Scores					
								Trueness			Precision		
Samplecode	Analyte	Value	Unc.	[%]	Z-Score	U-Score	Lab/IAEA	A1	A2	Score	P	Score	Final Score
	Co-57	0.21	0.04	19.05	1.67	0.67	1.17	0.03	0.12	A	22.05	A	A
	Cs-134	0.34	0.05	14.71	5.45	2.23	1.55	0.12	0.14	A	17.29	A	A
Sample 08	Cs-137	1.03	0.09	8.74	11.91	5.69	2.19	0.56	0.25	N	12.20	A	N
	Eu-152	1.09	0.09	8.26	1.72	1.48	1.17	0.16	0.28	A	10.48	A	A
	Am-241	1.99	0.17	8.54	2.68	2.28	1.27	0.42	0.47	A	9.64	A	A
	Co-57	1.7	0.5	29.41	-1.50	-0.59	0.85	0.30	1.32	A	29.83	A	A
	Cs-134	8.2	0.7	8.54	-0.12	-0.14	0.99	0.10	1.88	A	8.87	A	A
Sample 09	Cs-137	46.3	1.8	3.89	0.20	0.39	1.02	0.90	5.88	A	4.96	A	A
	Eu-152	35.3	1.8	5.10	-0.11	-0.19	0.99	0.40	5.44	A	5.96	A	A
	Am-241	72	3	4.17	3.93	5.97	1.39	20.30	8.77	N	5.19	A	N
	Co-57	2	0.6	30.00	0.00	0.00	1.00	0.00	1.57	A	30.41	N	W
	Cs-134	8	0.7	8.75	-0.36	-0.41	0.96	0.30	1.88	A	9.08	A	A
Sample 10	Cs-137	50.8	2	3.94	1.19	2.21	1.12	5.40	6.30	A	5.00	A	A
	Eu-152	37	2.3	6.22	0.36	0.51	1.04	1.30	6.58	A	6.94	A	A
	Am-241	71.6	3	4.19	3.85	5.85	1.38	19.90	8.77	N	5.21	A	N

Laboratory Code: 9

Matrix:	Spiked Water	Laboratory Results			Stat-Params			Evaluation Parameters and Scores					
								Trueness			Precision		
Samplecode	Analyte	Value	Unc.	[%]	Z-Score	U-Score	Lab/IAEA	A1	A2	Score	P	Score	Final Score
	Co-60	11.5	0.1	0.87	-2.5	-17.0	0.75	3.80	0.58	N	1.57	A	N
	Ba-133	4.41	0.05	1.13	-1.2	-5.3	0.88	0.59	0.29	N	2.30	A	W
	Cs-134	4.06	0.04	0.99	-4.7	-33.8	0.53	3.64	0.28	N	1.63	A	N
	Cs-137	5.15	0.04	0.78	-1.7	-9.7	0.83	1.05	0.28	N	1.79	A	W
	Eu-152	12.5	0.1	0.80	-1.9	-13.0	0.81	2.90	0.58	N	1.53	A	N
	Am-241	-	-	-	-	-	-	-	-	-	-	-	-
	Co-60	7.92	0.05	0.63	0.4	2.9	1.04	0.32	0.29	N	1.46	A	W
	Ba-133	1.63	0.03	1.84	-3.5	-8.3	0.65	0.87	0.27	N	4.40	A	N
	Cs-134	1.75	0.02	1.14	-5.4	-20.1	0.46	2.05	0.26	N	2.87	A	N
	Cs-137	2.82	0.03	1.06	-0.9	-2.7	0.91	0.28	0.27	N	3.40	A	W
	Eu-152	5.98	0.08	1.34	-2.2	-13.4	0.78	1.72	0.33	N	1.86	A	N
	Am-241	-	-	-	-	-	-	-	-	-	-	-	-
	Co-60	9.41	0.05	0.53	-1.2	-6.3	0.88	1.29	0.53	N	1.94	A	W
	Ba-133	2.78	0.04	1.44	-2.1	-6.7	0.79	0.72	0.28	N	3.20	A	N
	Cs-134	3.6	0.03	0.83	-3.3	-17.2	0.67	1.80	0.27	N	2.03	A	N
	Cs-137	2.98	0.03	1.01	-3.2	-13.6	0.68	1.42	0.27	N	2.49	A	N
	Eu-152	9.14	0.1	1.09	-1.5	-7.4	0.85	1.66	0.58	N	2.15	A	N
	Am-241	-	-	-	-	-	-	-	-	-	-	-	-

Matrix:	Soil	Laboratory Results			Stat-Params			Evaluation Parameters and Scores					
								Trueness			Precision		
Samplecode	Analyte	Value	Unc.	[%]	Z-Score	U-Score	Lab/IAEA	A1	A2	Score	P	Score	Final Score
Sample 04	K-40	442.2	0.9	0.20	1.49	2.86	1.15	57.2	51.65	N	5.199	A	W
	Cs-137	2385.3	0.8	0.03	-0.22	-1.82	0.98	54.7	77.43	A	1.23	A	A

Matrix:	Grass	Laboratory Results			Stat-Params			Evaluation Parameters and Scores					
								Trueness			Precision		
Samplecode	Analyte	Value	Unc.	[%]	Z-Score	U-Score	Lab/IAEA	A1	A2	Score	P	Score	Final Score
Sample 05	Cs-137	<1.91	-	-	-	-	-	-	-	-	-	-	A
Sample 06	Cs-137	3004	2	0.07	0.01	0.03	1.00	4	309.6	A	4.001	A	A
Sample 07	Cs-137	10105	3	0.03	0.11	0.31	1.01	105	877.2	A	3.4	A	A

Matrix:	Spiked Filter	Laboratory Results			Stat-Params			Evaluation Parameters and Scores					
								Trueness			Precision		
Samplecode	Analyte	Value	Unc.	[%]	Z-Score	U-Score	Lab/IAEA	A1	A2	Score	P	Score	Final Score
	Co-57	0.358	0.001	0.28	9.89	8.89	1.99	0.18	0.05	N	11.11	A	N
	Cs-134	0.162	0.004	2.47	-2.64	-2.84	0.74	0.06	0.05	N	9.42	A	N
Sample 08	Cs-137	0.485	0.008	1.65	0.32	0.37	1.03	0.02	0.11	A	8.67	A	A
	Eu-152	0.726	0.017	2.34	-2.19	-3.27	0.78	0.20	0.16	N	6.86	A	N
	Am-241	<0.526	-	-	-	-	-	-	-	-	-	-	N
	Co-57	11.6	0.1	0.86	48.00	67.88	5.80	9.60	0.36	N	5.07	A	N
	Cs-134	5.39	0.04	0.74	-3.51	-14.27	0.65	2.91	0.53	N	2.52	A	N
Sample 09	Cs-137	47.5	0.1	0.21	0.46	1.50	1.05	2.10	3.62	A	3.09	A	A
	Eu-152	33.7	0.2	0.59	-0.56	-1.79	0.94	2.00	2.88	A	3.14	A	A
	Am-241	15.8	0.1	0.63	-6.94	-22.39	0.31	35.90	4.14	N	3.16	A	N
	Co-57	12.3	0.1	0.81	51.50	72.83	6.15	10.30	0.36	N	5.07	A	N
	Cs-134	5.61	0.04	0.71	-3.24	-13.19	0.68	2.69	0.53	N	2.51	A	N
Sample 10	Cs-137	51	0.1	0.20	1.23	3.99	1.12	5.60	3.62	N	3.09	A	W
	Eu-152	34	0.2	0.59	-0.48	-1.52	0.95	1.70	2.88	A	3.14	A	A
	Am-241	17.4	0.1	0.57	-6.63	-21.40	0.34	34.30	4.14	N	3.15	A	N

Laboratory Code: 10

Matrix:	Spiked Water	Laboratory Results			Stat-Params			Evaluation Parameters and Scores					
								Trueness			Precision		
Samplecode	Analyte	Value	Unc.	[%]	Z-Score	U-Score	Lab/IAEA	A1	A2	Score	P	Score	Final Score
	Co-60	20.3	1.2	5.91	3.3	4.1	1.33	5.00	3.14	N	6.05	A	N
	Ba-133	5.3	0.7	13.21	0.6	0.4	1.06	0.30	1.82	A	13.36	A	A
	Cs-134	6.1	0.5	8.20	-2.1	-3.1	0.79	1.60	1.32	N	8.30	A	N
	Cs-137	5.9	0.5	8.47	-0.5	-0.6	0.95	0.30	1.32	A	8.63	A	A
	Eu-152	15.8	1.1	6.96	0.3	0.4	1.03	0.40	2.88	A	7.08	A	A
	Am-241	4.2	0.6	14.29	-1.1	-0.8	0.89	0.50	1.57	A	14.44	A	A
	Co-60	9.1	0.9	9.89	2.0	1.7	1.20	1.50	2.34	A	9.98	A	A
	Ba-133	2.6	0.5	19.23	0.4	0.2	1.04	0.10	1.32	A	19.64	A	A
	Cs-134	3.4	0.4	11.76	-1.1	-1.0	0.89	0.40	1.06	A	12.06	A	A
	Cs-137	2.9	0.5	17.24	-0.6	-0.4	0.94	0.20	1.32	A	17.54	A	A
	Eu-152	-	-	-	-	-	-	-	-	-	-	-	-
	Am-241	2.2	0.5	22.73	-0.8	-0.4	0.92	0.20	1.32	A	23.11	N	W
	Co-60	14.1	1	7.09	3.2	3.3	1.32	3.40	2.63	N	7.33	A	N
	Ba-133	4.5	0.7	15.56	2.9	1.4	1.29	1.00	1.82	A	15.82	A	A
	Cs-134	4.6	0.4	8.70	-1.5	-1.9	0.85	0.80	1.06	A	8.89	A	A
	Cs-137	5	0.5	10.00	1.4	1.2	1.14	0.60	1.32	A	10.26	A	A
	Eu-152	-	-	-	-	-	-	-	-	-	-	-	-
	Am-241	2.7	0.5	18.52	-1.8	-1.2	0.82	0.60	1.32	A	18.76	A	A

Matrix:	Soil	Laboratory Results			Stat-Params			Evaluation Parameters and Scores					
								Trueness			Precision		
Samplecode	Analyte	Value	Unc.	[%]	Z-Score	U-Score	Lab/IAEA	A1	A2	Score	P	Score	Final Score
Sample 04	K-40	475.1	14.5	3.05	2.34	3.65	1.23	90.1	63.73	N	6.025	A	N
	Cs-137	2628	6.9	0.26	0.77	6.11	1.08	188	79.42	N	1.257	A	W

Matrix:	Grass	Laboratory Results			Stat-Params			Evaluation Parameters and Scores					
								Trueness			Precision		
Samplecode	Analyte	Value	Unc.	[%]	Z-Score	U-Score	Lab/IAEA	A1	A2	Score	P	Score	Final Score
Sample 05	Cs-137	- -	-		-	-	-	-	-	-	-	-	-
Sample 06	Cs-137	3110	18	0.58	0.37	0.91	1.04	110	313.1	A	4.042	A	A
Sample 07	Cs-137	10325	33	0.32	0.33	0.95	1.03	325	881.3	A	3.415	A	A

Matrix:	Spiked Filter	Laboratory Results			Stat-Params			Evaluation Parameters and Scores					
								Trueness			Precision		
Samplecode	Analyte	Value	Unc.	[%]	Z-Score	U-Score	Lab/IAEA	A1	A2	Score	P	Score	Final Score
	Co-57	0.11	0.07	63.64	-3.89	-0.96	0.61	0.07	0.19	A	64.60	N	N
	Cs-134	0.22	0.02	9.09	0.00	0.00	1.00	0.00	0.07	A	12.86	A	A
Sample 08	Cs-137	0.49	0.03	6.12	0.43	0.40	1.04	0.02	0.13	A	10.48	A	A
	Eu-152	1.22	0.18	14.75	3.12	1.53	1.31	0.29	0.49	A	16.10	A	A
	Am-241	1.79	0.07	3.91	1.40	2.22	1.14	0.22	0.26	A	5.93	A	A
	Co-57	1.31	0.3	22.90	-3.45	-2.18	0.66	0.69	0.82	A	23.44	A	A
	Cs-134	9.06	0.11	1.21	0.92	3.33	1.09	0.76	0.59	N	2.70	A	W
Sample 09	Cs-137	51.1	0.23	0.45	1.26	4.02	1.13	5.70	3.66	N	3.12	A	W
	Eu-152	42.7	0.73	1.71	1.96	5.30	1.20	7.00	3.41	N	3.52	A	W
	Am-241	59.5	0.34	0.57	1.51	4.77	1.15	7.80	4.22	N	3.15	A	W
	Co-57	1.6	0.29	18.13	-2.00	-1.30	0.80	0.40	0.79	A	18.80	A	A
	Cs-134	9.15	0.11	1.20	1.02	3.72	1.10	0.85	0.59	N	2.69	A	W
Sample 10	Cs-137	51	0.23	0.45	1.23	3.95	1.12	5.60	3.66	N	3.12	A	W
	Eu-152	42.1	0.73	1.73	1.79	4.85	1.18	6.40	3.41	N	3.54	A	W
	Am-241	60.4	0.34	0.56	1.68	5.32	1.17	8.70	4.22	N	3.15	A	W

Laboratory Code: 11

Matrix:	Spiked Water	Laboratory Results			Stat-Params			Evaluation Parameters and Scores					
								Trueness			Precision		
Samplecode	Analyte	Value	Unc.	[%]	Z-Score	U-Score	Lab/IAEA	A1	A2	Score	P	Score	Final Score
	Co-60	14	1.8	12.86	-0.8	-0.7	0.92	1.30	4.67	A	12.92	A	A
	Ba-133	-	-	-	-	-	-	-	-	-	-	-	-
	Cs-134	7.95	1.22	15.35	0.3	0.2	1.03	0.25	3.16	A	15.40	A	A
	Cs-137	6.97	1.13	16.21	1.2	0.7	1.12	0.77	2.93	A	16.29	A	A
	Eu-152	-	-	-	-	-	-	-	-	-	-	-	-
	Am-241	-	-	-	-	-	-	-	-	-	-	-	-
	Co-60	7.73	1.27	16.43	0.2	0.1	1.02	0.13	3.29	A	16.48	N	W
	Ba-133	-	-	-	-	-	-	-	-	-	-	-	-
	Cs-134	3.83	0.9	23.50	0.1	0.0	1.01	0.03	2.34	A	23.65	N	W
	Cs-137	3	0.85	28.33	-0.3	-0.1	0.97	0.10	2.21	A	28.52	N	W
	Eu-152	-	-	-	-	-	-	-	-	-	-	-	-
	Am-241	-	-	-	-	-	-	-	-	-	-	-	-
	Co-60	10.8	1.5	13.89	0.1	0.1	1.01	0.10	3.90	A	14.01	A	A
	Ba-133	-	-	-	-	-	-	-	-	-	-	-	-
	Cs-134	5.47	0.99	18.10	0.1	0.1	1.01	0.07	2.57	A	18.19	A	A
	Cs-137	5.4	0.99	18.33	2.3	1.0	1.23	1.00	2.57	A	18.47	A	A
	Eu-152	-	-	-	-	-	-	-	-	-	-	-	-
	Am-241	-	-	-	-	-	-	-	-	-	-	-	-

Matrix:	Soil	Laboratory Results			Stat-Params			Evaluation Parameters and Scores					
								Trueness			Precision		
Samplecode	Analyte	Value	Unc.	[%]	Z-Score	U-Score	Lab/IAEA	A1	A2	Score	P	Score	Final Score
Sample 04	K-40	437	33	7.55	1.35	1.35	1.14	52	99.56	A	9.166	A	A
	Cs-137	2610	120	4.60	0.70	1.37	1.07	170	319.1	A	4.759	A	A

Matrix:	Grass	Laboratory Results			Stat-Params			Evaluation Parameters and Scores					
								Trueness			Precision		
Samplecode	Analyte	Value	Unc.	[%]	Z-Score	U-Score	Lab/IAEA	A1	A2	Score	P	Score	Final Score
Sample 05	Cs-137	<4	-	-	-	-	-	-	-	-	-	-	A
Sample 06	Cs-137	3010	140	4.65	0.03	0.05	1.00	10	475.7	A	6.135	A	A
Sample 07	Cs-137	10100	480	4.75	0.10	0.17	1.01	100	1518	A	5.843	A	A

Matrix:	Spiked Filter	Laboratory Results			Stat-Params			Evaluation Parameters and Scores					
								Trueness			Precision		
Samplecode	Analyte	Value	Unc.	[%]	Z-Score	U-Score	Lab/IAEA	A1	A2	Score	P	Score	Final Score
	Co-57	-	-	-	-	-	-	-	-	-	-	-	-
	Cs-134	0.24	0.04	16.67	0.91	0.45	1.09	0.02	0.12	A	18.98	A	A
Sample 08	Cs-137	0.45	0.05	11.11	-0.43	-0.31	0.96	0.02	0.17	A	14.00	A	A
	Eu-152	-	-	-	-	-	-	-	-	-	-	-	-
	Am-241	-	-	-	-	-	-	-	-	-	-	-	-
	Co-57	-	-	-	-	-	-	-	-	-	-	-	-
	Cs-134	8.33	0.43	5.16	0.04	0.06	1.00	0.03	1.22	A	5.70	A	A
Sample 09	Cs-137	46.6	2.2	4.72	0.26	0.46	1.03	1.20	6.73	A	5.64	A	A
	Eu-152	-	-	-	-	-	-	-	-	-	-	-	-
	Am-241	-	-	-	-	-	-	-	-	-	-	-	-
	Co-57	-	-	-	-	-	-	-	-	-	-	-	-
	Cs-134	8.13	0.42	5.17	-0.20	-0.37	0.98	0.17	1.20	A	5.70	A	A
Sample 10	Cs-137	45.3	2.2	4.86	-0.02	-0.04	1.00	0.10	6.73	A	5.75	A	A
	Eu-152	-	-	-	-	-	-	-	-	-	-	-	-
	Am-241	-	-	-	-	-	-	-	-	-	-	-	-

Laboratory Code: 12

Matrix:	Spiked Water	Laboratory Results			Stat-Params			Evaluation Parameters and Scores					
								Trueness			Precision		
Samplecode	Analyte	Value	Unc.	[%]	Z-Score	U-Score	Lab/IAEA	A1	A2	Score	P	Score	Final Score
	Co-60	15.17	1.62	10.68	-0.1	-0.1	0.99	0.13	4.21	A	10.76	A	A
	Ba-133	4.04	0.432	10.69	-1.9	-2.2	0.81	0.96	1.14	A	10.88	A	A
	Cs-134	7.79	0.79	10.14	0.1	0.1	1.01	0.09	2.05	A	10.22	A	A
	Cs-137	6.23	0.67	10.75	0.0	0.0	1.00	0.03	1.75	A	10.87	A	A
	Eu-152	14.48	1.55	10.70	-0.6	-0.6	0.94	0.92	4.03	A	10.78	A	A
	Am-241	4.23	0.45	10.64	-1.0	-1.0	0.90	0.47	1.19	A	10.85	A	A
	Co-60	7.17	0.77	10.74	-0.6	-0.6	0.94	0.43	2.00	A	10.82	A	A
	Ba-133	2.96	0.32	10.81	1.8	1.4	1.18	0.46	0.86	A	11.53	A	A
	Cs-134	3.76	0.38	10.11	-0.1	-0.1	0.99	0.04	1.01	A	10.44	A	A
	Cs-137	3.04	0.33	10.86	-0.2	-0.2	0.98	0.06	0.89	A	11.32	A	A
	Eu-152	7.19	0.77	10.71	-0.7	-0.7	0.93	0.51	2.00	A	10.79	A	A
	Am-241	<1.88	0.2	-	-	-	-	-	-	-	-	-	W
	Co-60	10.33	1.1	10.65	-0.3	-0.3	0.97	0.37	2.88	A	10.81	A	A
	Ba-133	3.03	0.32	10.56	-1.3	-1.4	0.87	0.47	0.86	A	10.94	A	A
	Cs-134	5.46	0.55	10.07	0.1	0.1	1.01	0.06	1.44	A	10.24	A	A
	Cs-137	4.52	0.48	10.62	0.3	0.2	1.03	0.12	1.26	A	10.86	A	A
	Eu-152	10.78	1.15	10.67	0.0	0.0	1.00	0.02	3.01	A	10.83	A	A
	Am-241	<2.50	0.27	-	-	-	-	-	-	-	-	-	W

Matrix:	Soil	Laboratory Results			Stat-Params			Evaluation Parameters and Scores					
								Trueness			Precision		
Samplecode	Analyte	Value	Unc.	[%]	Z-Score	U-Score	Lab/IAEA	A1	A2	Score	P	Score	Final Score
Sample 04	K-40	381.32	40.76	10.69	-0.10	-0.08	0.99	3.68	117.1	A	11.88	A	A
	Cs-137	2399.94	256.55	10.69	-0.16	-0.16	0.98	40.06	666.4	A	10.76	N	W

Matrix:	Grass	Laboratory Results			Stat-Params			Evaluation Parameters and Scores					
								Trueness			Precision		
Samplecode	Analyte	Value	Unc.	[%]	Z-Score	U-Score	Lab/IAEA	A1	A2	Score	P	Score	Final Score
Sample 05	Cs-137	<1.44	0.15	-	-	-	-	-	-	-	-	-	W
Sample 06	Cs-137	3017.05	322.52	10.69	0.06	0.05	1.01	17.05	887.8	A	11.41	N	W
Sample 07	Cs-137	9951.94	1063.86	10.69	-0.05	-0.04	1.00	48.06	2882	A	11.22	N	W

Matrix:	Spiked Filter	Laboratory Results			Stat-Params			Evaluation Parameters and Scores					
								Trueness			Precision		
Samplecode	Analyte	Value	Unc.	[%]	Z-Score	U-Score	Lab/IAEA	A1	A2	Score	P	Score	Final Score
	Co-57	0.185	0.0198	10.70	0.28	0.18	1.03	0.01	0.07	A	15.43	A	A
	Cs-134	0.231	0.0234	10.13	0.50	0.36	1.05	0.01	0.08	A	13.61	A	A
Sample 08	Cs-137	0.484	0.0518	10.70	0.30	0.21	1.03	0.01	0.17	A	13.67	A	A
	Eu-152	0.829	0.0886	10.69	-1.09	-0.94	0.89	0.10	0.28	A	12.48	A	A
	Am-241	1.921	0.205	10.67	2.24	1.62	1.22	0.35	0.56	A	11.57	A	A
	Co-57	1.868	0.2	10.71	-0.66	-0.59	0.93	0.13	0.58	A	11.82	A	A
	Cs-134	8.083	0.819	10.13	-0.26	-0.26	0.97	0.22	2.18	A	10.41	A	A
Sample 09	Cs-137	43.274	4.626	10.69	-0.47	-0.44	0.95	2.13	12.47	A	11.13	A	A
	Eu-152	33.291	3.559	10.69	-0.67	-0.65	0.93	2.41	9.61	A	11.13	A	A
	Am-241	61.736	6.6	10.69	1.94	1.48	1.19	10.04	17.52	A	11.13	A	A
	Co-57	1.88	0.201	10.69	-0.60	-0.53	0.94	0.12	0.58	A	11.80	A	A
	Cs-134	8.007	0.811	10.13	-0.35	-0.35	0.96	0.29	2.16	A	10.41	A	A
Sample 10	Cs-137	42.778	4.573	10.69	-0.58	-0.55	0.94	2.62	12.34	A	11.13	A	A
	Eu-152	32.82	3.508	10.69	-0.81	-0.78	0.92	2.88	9.49	A	11.12	A	A
	Am-241	60.806	6.5	10.69	1.76	1.36	1.18	9.11	17.27	A	11.13	A	A

Laboratory Code: 13

Matrix:	Spiked Water	Laboratory Results			Stat-Params			Evaluation Parameters and Scores					
								Trueness			Precision		
Samplecode	Analyte	Value	Unc.	[%]	Z-Score	U-Score	Lab/IAEA	A1	A2	Score	P	Score	Final Score
	Co-60	15	0.97	6.47	-0.2	-0.3	0.98	0.30	2.56	A	6.60	A	A
	Ba-133	-	-	-	-	-	-	-	-	-	-	-	-
	Cs-134	7.8	1.3	16.67	0.1	0.1	1.01	0.10	3.36	A	16.72	A	A
	Cs-137	6.9	1.1	15.94	1.1	0.6	1.11	0.70	2.85	A	16.02	A	A
	Eu-152	-	-	-	-	-	-	-	-	-	-	-	-
	Am-241	-	-	-	-	-	-	-	-	-	-	-	-
	Co-60	8	0.54	6.75	0.5	0.7	1.05	0.40	1.42	A	6.88	A	A
	Ba-133	-	-	-	-	-	-	-	-	-	-	-	-
	Cs-134	4.2	0.67	15.95	1.1	0.6	1.11	0.40	1.75	A	16.17	A	A
	Cs-137	3.4	0.54	15.88	1.0	0.5	1.10	0.30	1.42	A	16.21	A	A
	Eu-152	-	-	-	-	-	-	-	-	-	-	-	-
	Am-241	-	-	-	-	-	-	-	-	-	-	-	-
	Co-60	11	0.35	3.18	0.3	0.7	1.03	0.30	1.04	A	3.69	A	A
	Ba-133	-	-	-	-	-	-	-	-	-	-	-	-
	Cs-134	4.8	0.71	14.79	-1.1	-0.8	0.89	0.60	1.85	A	14.91	A	A
	Cs-137	4.9	0.96	19.59	1.1	0.5	1.11	0.50	2.49	A	19.72	A	A
	Eu-152	-	-	-	-	-	-	-	-	-	-	-	-
	Am-241	-	-	-	-	-	-	-	-	-	-	-	-

Matrix:	Soil	Laboratory Results			Stat-Params			Evaluation Parameters and Scores					
								Trueness			Precision		
Samplecode	Analyte	Value	Unc.	[%]	Z-Score	U-Score	Lab/IAEA	A1	A2	Score	P	Score	Final Score
Sample 04	K-40	460	30	6.52	1.95	2.08	1.19	75	93.02	A	8.338	A	A
	Cs-137	2400	66	2.75	-0.16	-0.55	0.98	40	187	A	3.012	A	A

Matrix:	Grass	Laboratory Results			Stat-Params			Evaluation Parameters and Scores					
								Trueness			Precision		
Samplecode	Analyte	Value	Unc.	[%]	Z-Score	U-Score	Lab/IAEA	A1	A2	Score	P	Score	Final Score
Sample 05	Cs-137	- -	-		-	-	-	-	-	-	-	-	-
Sample 06	Cs-137	2900	120	4.14	-0.33	-0.59	0.97	100	437.8	A	5.755	A	A
Sample 07	Cs-137	9600	270	2.81	-0.40	-0.92	0.96	400	1120	A	4.413	A	A

Matrix:	Spiked Filter	Laboratory Results			Stat-Params			Evaluation Parameters and Scores					
								Trueness			Precision		
Samplecode	Analyte	Value	Unc.	[%]	Z-Score	U-Score	Lab/IAEA	A1	A2	Score	P	Score	Final Score
	Co-57	-	-	-	-	-	-	-	-	-	-	-	-
	Cs-134	0.21	0.049	23.33	-0.45	-0.19	0.95	0.01	0.14	A	25.04	N	W
Sample 08	Cs-137	0.61	0.057	9.34	2.98	2.01	1.30	0.14	0.18	A	12.64	A	A
	Eu-152	1.2	0.16	13.33	2.90	1.58	1.29	0.27	0.44	A	14.81	A	A
	Am-241	-	-	-	-	-	-	-	-	-	-	-	-
	Co-57	-	-	-	-	-	-	-	-	-	-	-	-
	Cs-134	8.9	0.67	7.53	0.72	0.86	1.07	0.60	1.80	A	7.90	A	A
Sample 09	Cs-137	56	2	3.57	2.33	4.34	1.23	10.60	6.30	N	4.72	A	N
	Eu-152	43	1.5	3.49	2.04	3.92	1.20	7.30	4.80	N	4.65	A	N
	Am-241	-	-	-	-	-	-	-	-	-	-	-	-
	Co-57	-	-	-	-	-	-	-	-	-	-	-	-
	Cs-134	9.1	0.55	6.04	0.96	1.37	1.10	0.80	1.51	A	6.51	A	A
Sample 10	Cs-137	55	1.7	3.09	2.11	4.36	1.21	9.60	5.68	N	4.37	A	N
	Eu-152	44	2.2	5.00	2.32	3.37	1.23	8.30	6.35	N	5.87	A	N
	Am-241	-	-	-	-	-	-	-	-	-	-	-	-

Laboratory Code: 14

Matrix:	Spiked Water	Laboratory Results			Stat-Params			Evaluation Parameters and Scores					
								Trueness			Precision		
Samplecode	Analyte	Value	Unc.	[%]	Z-Score	U-Score	Lab/IAEA	A1	A2	Score	P	Score	Final Score
	Co-60	16	1.3	8.13	0.5	0.5	1.05	0.70	3.39	A	8.23	A	A
	Ba-133	4.42	1.01	22.85	-1.2	-0.6	0.88	0.58	2.62	A	22.94	N	W
	Cs-134	6.05	0.859	14.20	-2.1	-1.9	0.79	1.65	2.23	A	14.26	A	A
	Cs-137	7.61	0.884	11.62	2.3	1.6	1.23	1.41	2.30	A	11.73	A	A
	Eu-152	12.2	1.67	13.69	-2.1	-1.9	0.79	3.20	4.34	A	13.75	A	A
	Am-241	<9.9	-	-	-	-	-	-	-	-	-	-	A
	Co-60	7.67	0.995	12.97	0.1	0.1	1.01	0.07	2.58	A	13.04	A	A
	Ba-133	<2.7	-	-	-	-	-	-	-	-	-	-	A
	Cs-134	3.99	0.736	18.45	0.5	0.3	1.05	0.19	1.92	A	18.63	A	A
	Cs-137	4.95	0.775	15.66	6.0	2.4	1.60	1.85	2.02	A	15.99	A	A
	Eu-152	8.27	1.53	18.50	0.7	0.4	1.07	0.57	3.96	A	18.55	N	W
	Am-241	<10	-	-	-	-	-	-	-	-	-	-	A
	Co-60	10.2	1.07	10.49	-0.5	-0.5	0.95	0.50	2.81	A	10.66	A	A
	Ba-133	4.23	0.8	18.91	2.1	0.9	1.21	0.73	2.08	A	19.13	A	A
	Cs-134	4.54	0.743	16.37	-1.6	-1.1	0.84	0.86	1.93	A	16.47	A	A
	Cs-137	3.22	0.768	23.85	-2.7	-1.5	0.73	1.18	2.00	A	23.96	N	N
	Eu-152	8.07	0.98	12.14	-2.5	-2.7	0.75	2.73	2.58	N	12.28	A	N
	Am-241	3.87	0.692	17.88	1.7	0.8	1.17	0.57	1.80	A	18.14	A	A

Matrix:	Soil	Laboratory Results			Stat-Params			Evaluation Parameters and Scores					
								Trueness			Precision		
Samplecode	Analyte	Value	Unc.	[%]	Z-Score	U-Score	Lab/IAEA	A1	A2	Score	P	Score	Final Score
Sample 04	K-40	457	17.1	3.74	1.87	2.74	1.19	72	67.89	N	6.402	A	W
	Cs-137	2620	10.6	0.40	0.74	5.66	1.07	180	82.09	N	1.294	A	W

Matrix:	Grass	Laboratory Results			Stat-Params			Evaluation Parameters and Scores					
								Trueness			Precision		
Samplecode	Analyte	Value	Unc.	[%]	Z-Score	U-Score	Lab/IAEA	A1	A2	Score	P	Score	Final Score
Sample 05	Cs-137	<5.2	-	-	-	-	-	-	-	-	-	-	A
Sample 06	Cs-137	2960	19.5	0.66	-0.13	-0.33	0.99	40	313.7	A	4.054	A	A
Sample 07	Cs-137	9670	39.4	0.41	-0.33	-0.96	0.97	330	883.1	A	3.424	A	A

Matrix:	Spiked Filter	Laboratory Results			Stat-Params			Evaluation Parameters and Scores					
								Trueness			Precision		
Samplecode	Analyte	Value	Unc.	[%]	Z-Score	U-Score	Lab/IAEA	A1	A2	Score	P	Score	Final Score
	Co-57	-	-	-	-	-	-	-	-	-	-	-	-
	Cs-134	-	-	-	-	-	-	-	-	-	-	-	-
Sample 08	Cs-137	-	-	-	-	-	-	-	-	-	-	-	-
	Eu-152	-	-	-	-	-	-	-	-	-	-	-	-
	Am-241	-	-	-	-	-	-	-	-	-	-	-	-
	Co-57	-	-	-	-	-	-	-	-	-	-	-	-
	Cs-134	-	-	-	-	-	-	-	-	-	-	-	-
Sample 09	Cs-137	-	-	-	-	-	-	-	-	-	-	-	-
	Eu-152	-	-	-	-	-	-	-	-	-	-	-	-
	Am-241	-	-	-	-	-	-	-	-	-	-	-	-
	Co-57	-	-	-	-	-	-	-	-	-	-	-	-
	Cs-134	-	-	-	-	-	-	-	-	-	-	-	-
Sample 10	Cs-137	-	-	-	-	-	-	-	-	-	-	-	-
	Eu-152	-	-	-	-	-	-	-	-	-	-	-	-
	Am-241	-	-	-	-	-	-	-	-	-	-	-	-

Laboratory Code: 15

Matrix:	Spiked Water	Laboratory Results			Stat-Params			Evaluation Parameters and Scores					
								Trueness			Precision		
Samplecode	Analyte	Value	Unc.	[%]	Z-Score	U-Score	Lab/IAEA	A1	A2	Score	P	Score	Final Score
	Co-60	16.74	2.21	13.20	0.9	0.6	1.09	1.44	5.73	A	13.27	A	A
	Ba-133	6.14	1.63	26.55	2.3	0.7	1.23	1.14	4.21	A	26.62	N	N
	Cs-134	9.89	1.66	16.78	2.8	1.3	1.28	2.19	4.29	A	16.83	A	A
	Cs-137	9.06	1.55	17.11	4.6	1.8	1.46	2.86	4.01	A	17.18	A	A
	Eu-152	17.83	3.56	19.97	1.6	0.7	1.16	2.43	9.20	A	20.01	N	N
	Am-241	<7.73	-	-	-	-	-	-	-	-	-	-	A
	Co-60	6.87	1.66	24.16	-1.0	-0.4	0.90	0.73	4.29	A	24.20	N	W
	Ba-133	2.32	1.42	61.21	-0.7	-0.1	0.93	0.18	3.67	A	61.34	N	W
	Cs-134	5.33	1.32	24.77	4.0	1.2	1.40	1.53	3.42	A	24.90	N	N
	Cs-137	6.64	1.37	20.63	11.4	2.6	2.14	3.54	3.54	A	20.88	N	N
	Eu-152	5.7	3.13	54.91	-2.6	-0.6	0.74	2.00	8.08	A	54.93	N	N
	Am-241	<7.18	-	-	-	-	-	-	-	-	-	-	A
	Co-60	11.84	2.03	17.15	1.1	0.6	1.11	1.14	5.26	A	17.25	N	W
	Ba-133	3.81	1.37	35.96	0.9	0.2	1.09	0.31	3.54	A	36.07	N	W
	Cs-134	6.91	1.45	20.98	2.8	1.0	1.28	1.51	3.75	A	21.07	N	N
	Cs-137	5.96	1.37	22.99	3.5	1.1	1.35	1.56	3.54	A	23.10	N	N
	Eu-152	8.79	3.41	38.79	-1.9	-0.6	0.81	2.01	8.81	A	38.84	N	N
	Am-241	<7.46	-	-	-	-	-	-	-	-	-	-	A

Matrix:	Soil	Laboratory Results			Stat-Params			Evaluation Parameters and Scores					
								Trueness			Precision		
Samplecode	Analyte	Value	Unc.	[%]	Z-Score	U-Score	Lab/IAEA	A1	A2	Score	P	Score	Final Score
Sample 04	K-40	495	28	5.66	2.86	3.20	1.29	110	88.78	N	7.68	A	N
	Cs-137	2561	121	4.72	0.50	0.97	1.05	121	321.6	A	4.882	A	A

Matrix:	Grass	Laboratory Results			Stat-Params			Evaluation Parameters and Scores					
								Trueness			Precision		
Samplecode	Analyte	Value	Unc.	[%]	Z-Score	U-Score	Lab/IAEA	A1	A2	Score	P	Score	Final Score
Sample 05	Cs-137	5.2	2.34	45.00	16.00	1.35	2.60	3.2	6.125	A	49.24	N	N
Sample 06	Cs-137	2710	130	4.80	-0.97	-1.64	0.90	290	456.4	A	6.246	A	A
Sample 07	Cs-137	8866	420	4.74	-1.13	-2.10	0.89	1134	1394	A	5.831	A	A

Matrix:	Spiked Filter	Laboratory Results			Stat-Params			Evaluation Parameters and Scores					
								Trueness			Precision		
Samplecode	Analyte	Value	Unc.	[%]	Z-Score	U-Score	Lab/IAEA	A1	A2	Score	P	Score	Final Score
	Co-57	-	-	-	-	-	-	-	-	-	-	-	-
	Cs-134	-	-	-	-	-	-	-	-	-	-	-	-
Sample 08	Cs-137	-	-	-	-	-	-	-	-	-	-	-	-
	Eu-152	-	-	-	-	-	-	-	-	-	-	-	-
	Am-241	-	-	-	-	-	-	-	-	-	-	-	-
	Co-57	-	-	-	-	-	-	-	-	-	-	-	-
	Cs-134	-	-	-	-	-	-	-	-	-	-	-	-
Sample 09	Cs-137	-	-	-	-	-	-	-	-	-	-	-	-
	Eu-152	-	-	-	-	-	-	-	-	-	-	-	-
	Am-241	-	-	-	-	-	-	-	-	-	-	-	-
	Co-57	-	-	-	-	-	-	-	-	-	-	-	-
	Cs-134	-	-	-	-	-	-	-	-	-	-	-	-
Sample 10	Cs-137	-	-	-	-	-	-	-	-	-	-	-	-
	Eu-152	-	-	-	-	-	-	-	-	-	-	-	-
	Am-241	-	-	-	-	-	-	-	-	-	-	-	-

Laboratory Code: 16

Matrix:	Spiked Water	Laboratory Results			Stat-Params			Evaluation Parameters and Scores					
								Trueness			Precision		
Samplecode	Analyte	Value	Unc.	[%]	Z-Score	U-Score	Lab/IAEA	A1	A2	Score	P	Score	Final Score
	Co-60	15.96	0.78	4.89	0.4	0.8	1.04	0.66	2.08	A	5.06	A	A
	Ba-133	-	-	-	-	-	-	-	-	-	-	-	-
	Cs-134	7.3	0.44	6.03	-0.5	-0.9	0.95	0.40	1.16	A	6.17	A	A
	Cs-137	6.74	0.41	6.08	0.9	1.3	1.09	0.54	1.09	A	6.29	A	A
	Eu-152	-	-	-	-	-	-	-	-	-	-	-	-
	Am-241	4.81	0.4	8.32	0.2	0.3	1.02	0.11	1.06	A	8.58	A	A
	Co-60	8.76	0.62	7.08	1.5	1.8	1.15	1.16	1.62	A	7.20	A	A
	Ba-133	-	-	-	-	-	-	-	-	-	-	-	-
	Cs-134	3.88	0.35	9.02	0.2	0.2	1.02	0.08	0.94	A	9.40	A	A
	Cs-137	2.73	0.34	12.45	-1.2	-1.0	0.88	0.37	0.91	A	12.87	A	A
	Eu-152	-	-	-	-	-	-	-	-	-	-	-	-
	Am-241	2.11	0.37	17.54	-1.2	-0.8	0.88	0.29	0.99	A	18.02	A	A
	Co-60	11.34	0.72	6.35	0.6	0.9	1.06	0.64	1.93	A	6.62	A	A
	Ba-133	-	-	-	-	-	-	-	-	-	-	-	-
	Cs-134	5.23	0.4	7.65	-0.3	-0.4	0.97	0.17	1.06	A	7.87	A	A
	Cs-137	4.55	0.4	8.79	0.3	0.4	1.03	0.15	1.06	A	9.08	A	A
	Eu-152	-	-	-	-	-	-	-	-	-	-	-	-
	Am-241	3.44	0.44	12.79	0.4	0.3	1.04	0.14	1.16	A	13.14	A	A

Matrix:	Soil	Laboratory Results			Stat-Params			Evaluation Parameters and Scores					
								Trueness			Precision		
Samplecode	Analyte	Value	Unc.	[%]	Z-Score	U-Score	Lab/IAEA	A1	A2	Score	P	Score	Final Score
Sample 04	K-40	464.8	19.1	4.11	2.07	2.89	1.21	79.8	71.35	N	6.624	A	N
	Cs-137	2561.8	80.5	3.14	0.50	1.42	1.05	121.8	221.6	A	3.374	A	A

Matrix:	Grass	Laboratory Results			Stat-Params			Evaluation Parameters and Scores					
								Trueness			Precision		
Samplecode	Analyte	Value	Unc.	[%]	Z-Score	U-Score	Lab/IAEA	A1	A2	Score	P	Score	Final Score
Sample 05	Cs-137	<2.3	-	-	-	-	-	-	-	-	-	-	A
Sample 06	Cs-137	3069.7	95	3.09	0.23	0.46	1.02	69.7	394.9	A	5.057	A	A
Sample 07	Cs-137	9925.8	305.2	3.07	-0.07	-0.16	0.99	74.2	1179	A	4.584	A	A

Matrix:	Spiked Filter	Laboratory Results			Stat-Params			Evaluation Parameters and Scores					
								Trueness			Precision		
Samplecode	Analyte	Value	Unc.	[%]	Z-Score	U-Score	Lab/IAEA	A1	A2	Score	P	Score	Final Score
	Co-57	-	-	-	-	-	-	-	-	-	-	-	-
	Cs-134	-	-	-	-	-	-	-	-	-	-	-	-
Sample 08	Cs-137	-	-	-	-	-	-	-	-	-	-	-	-
	Eu-152	-	-	-	-	-	-	-	-	-	-	-	-
	Am-241	-	-	-	-	-	-	-	-	-	-	-	-
	Co-57	-	-	-	-	-	-	-	-	-	-	-	-
	Cs-134	-	-	-	-	-	-	-	-	-	-	-	-
Sample 09	Cs-137	-	-	-	-	-	-	-	-	-	-	-	-
	Eu-152	-	-	-	-	-	-	-	-	-	-	-	-
	Am-241	-	-	-	-	-	-	-	-	-	-	-	-
	Co-57	-	-	-	-	-	-	-	-	-	-	-	-
	Cs-134	-	-	-	-	-	-	-	-	-	-	-	-
Sample 10	Cs-137	-	-	-	-	-	-	-	-	-	-	-	-
	Eu-152	-	-	-	-	-	-	-	-	-	-	-	-
	Am-241	-	-	-	-	-	-	-	-	-	-	-	-

Laboratory Code: 17

Matrix:	Spiked Water	Laboratory Results			Stat-Params			Evaluation Parameters and Scores					
								Trueness			Precision		
Samplecode	Analyte	Value	Unc.	[%]	Z-Score	U-Score	Lab/IAEA	A1	A2	Score	P	Score	Final Score
	Co-60	11.087	0.6585	5.94	-2.8	-6.1	0.72	4.21	1.78	N	6.08	A	N
	Ba-133	-	-	-	-	-	-	-	-	-	-	-	-
	Cs-134	4.9311	0.40044	8.12	-3.6	-6.7	0.64	2.77	1.06	N	8.22	A	N
	Cs-137	4.2336	0.37526	8.86	-3.2	-5.1	0.68	1.97	1.00	N	9.01	A	N
	Eu-152	-	-	-	-	-	-	-	-	-	-	-	-
	Am-241	3.4077	0.61716	18.11	-2.7	-2.1	0.73	1.29	1.61	A	18.24	A	A
	Co-60	7.974	0.55706	6.99	0.5	0.7	1.05	0.37	1.46	A	7.11	A	A
	Ba-133	-	-	-	-	-	-	-	-	-	-	-	-
	Cs-134	3.5075	0.34117	9.73	-0.8	-0.8	0.92	0.29	0.92	A	10.08	A	A
	Cs-137	4.1446	0.39826	9.61	3.4	2.5	1.34	1.04	1.06	A	10.14	A	A
	Eu-152	-	-	-	-	-	-	-	-	-	-	-	-
	Am-241	2.8682	0.53605	18.69	2.0	0.9	1.20	0.47	1.41	A	19.15	A	A
	Co-60	17.562	0.817	4.65	6.4	8.2	1.64	6.86	2.17	N	5.01	A	N
	Ba-133	-	-	-	-	-	-	-	-	-	-	-	-
	Cs-134	7.9336	0.48475	6.11	4.7	5.1	1.47	2.53	1.28	N	6.38	A	N
	Cs-137	6.3343	0.44344	7.00	4.4	4.3	1.44	1.93	1.17	N	7.36	A	N
	Eu-152	-	-	-	-	-	-	-	-	-	-	-	-
	Am-241	3.9671	0.81442	20.53	2.0	0.8	1.20	0.67	2.12	A	20.75	N	N

Matrix:	Soil	Laboratory Results			Stat-Params			Evaluation Parameters and Scores					
								Trueness			Precision		
Samplecode	Analyte	Value	Unc.	[%]	Z-Score	U-Score	Lab/IAEA	A1	A2	Score	P	Score	Final Score
Sample 04	K-40	425.03	10.248	2.41	1.04	1.78	1.10	40.03	57.98	A	5.727	A	A
	Cs-137	2489.4	5.4263	0.22	0.20	1.62	1.02	49.4	78.66	A	1.249	A	A

Matrix:	Grass	Laboratory Results			Stat-Params			Evaluation Parameters and Scores					
								Trueness			Precision		
Samplecode	Analyte	Value	Unc.	[%]	Z-Score	U-Score	Lab/IAEA	A1	A2	Score	P	Score	Final Score
Sample 05	Cs-137	<2.4749	-	-	-	-	-	-	-	-	-	-	A
Sample 06	Cs-137	3019.5	10.292	0.34	0.07	0.16	1.01	19.5	310.7	A	4.014	A	A
Sample 07	Cs-137	9891.2	18.348	0.19	-0.11	-0.32	0.99	108.8	878.5	A	3.405	A	A

Matrix:	Spiked Filter	Laboratory Results			Stat-Params			Evaluation Parameters and Scores					
								Trueness			Precision		
Samplecode	Analyte	Value	Unc.	[%]	Z-Score	U-Score	Lab/IAEA	A1	A2	Score	P	Score	Final Score
	Co-57	-	-	-	-	-	-	-	-	-	-	-	-
	Cs-134	2.3477	0.13566	5.78	96.71	15.52	10.67	2.13	0.35	N	10.77	A	N
Sample 08	Cs-137	5.8481	0.19595	3.35	114.43	26.89	12.44	5.38	0.52	N	9.15	A	N
	Eu-152	-	-	-	-	-	-	-	-	-	-	-	-
	Am-241	30.999	0.62931	2.03	187.45	46.48	19.74	29.43	1.63	N	4.90	A	N
	Co-57	-	-	-	-	-	-	-	-	-	-	-	-
	Cs-134	76.966	0.6608	0.86	82.73	99.46	9.27	68.67	1.78	N	2.56	A	N
Sample 09	Cs-137	558.26	1.7328	0.31	112.96	230.22	12.30	512.86	5.75	N	3.10	A	N
	Eu-152	-	-	-	-	-	-	-	-	-	-	-	-
	Am-241	1024.6	3.3625	0.33	188.18	261.27	19.82	972.90	9.61	N	3.11	A	N
	Co-57	-	-	-	-	-	-	-	-	-	-	-	-
	Cs-134	76.577	0.66397	0.87	82.26	98.46	9.23	68.28	1.79	N	2.56	A	N
Sample 10	Cs-137	549.32	1.7191	0.31	111.00	227.29	12.10	503.92	5.72	N	3.10	A	N
	Eu-152	-	-	-	-	-	-	-	-	-	-	-	-
	Am-241	1002.3	3.3247	0.33	183.87	257.64	19.39	950.60	9.52	N	3.11	A	N

Laboratory Code: 19

Matrix:	Spiked Water	Laboratory Results			Stat-Params			Evaluation Parameters and Scores					
								Trueness			Precision		
Samplecode	Analyte	Value	Unc.	[%]	Z-Score	U-Score	Lab/IAEA	A1	A2	Score	P	Score	Final Score
	Co-60	17	0.7	4.12	1.1	2.3	1.11	1.70	1.88	A	4.32	A	A
	Ba-133	-	-	-	-	-	-	-	-	-	-	-	-
	Cs-134	7.4	0.5	6.76	-0.4	-0.6	0.96	0.30	1.32	A	6.88	A	A
	Cs-137	7.1	0.7	9.86	1.5	1.3	1.15	0.90	1.82	A	9.99	A	A
	Eu-152	-	-	-	-	-	-	-	-	-	-	-	-
	Am-241	-	-	-	-	-	-	-	-	-	-	-	-
	Co-60	8.5	0.6	7.06	1.2	1.5	1.12	0.90	1.57	A	7.18	A	A
	Ba-133	-	-	-	-	-	-	-	-	-	-	-	-
	Cs-134	3.7	0.6	16.22	-0.3	-0.2	0.97	0.10	1.57	A	16.43	A	A
	Cs-137	3.9	0.7	17.95	2.6	1.1	1.26	0.80	1.82	A	18.24	A	A
	Eu-152	-	-	-	-	-	-	-	-	-	-	-	-
	Am-241	-	-	-	-	-	-	-	-	-	-	-	-
	Co-60	-	-	-	-	-	-	-	-	-	-	-	-
	Ba-133	-	-	-	-	-	-	-	-	-	-	-	-
	Cs-134	-	-	-	-	-	-	-	-	-	-	-	-
	Cs-137	-	-	-	-	-	-	-	-	-	-	-	-
	Eu-152	-	-	-	-	-	-	-	-	-	-	-	-
	Am-241	-	-	-	-	-	-	-	-	-	-	-	-

Matrix:	Soil	Laboratory Results			Stat-Params			Evaluation Parameters and Scores					
								Trueness			Precision		
Samplecode	Analyte	Value	Unc.	[%]	Z-Score	U-Score	Lab/IAEA	A1	A2	Score	P	Score	Final Score
Sample 04	K-40	-	-	-	-	-	-	-	-	-	-	-	-
	Cs-137	2500	8.2	0.33	0.25	1.93	1.02	60	80.24	A	1.273	A	A

Matrix:	Grass	Laboratory Results			Stat-Params			Evaluation Parameters and Scores					
								Trueness			Precision		
Samplecode	Analyte	Value	Unc.	[%]	Z-Score	U-Score	Lab/IAEA	A1	A2	Score	P	Score	Final Score
Sample 05	Cs-137	not detected	2.6	-	-	-	-	-	-	-	-	-	A
Sample 06	Cs-137	3100	11	0.35	0.33	0.83	1.03	100	310.9	A	4.016	A	A
Sample 07	Cs-137	9900	28	0.28	-0.10	-0.29	0.99	100	880.2	A	3.412	A	A

Matrix:	Spiked Filter	Laboratory Results			Stat-Params			Evaluation Parameters and Scores					
								Trueness			Precision		
Samplecode	Analyte	Value	Unc.	[%]	Z-Score	U-Score	Lab/IAEA	A1	A2	Score	P	Score	Final Score
	Co-57	-	-	-	-	-	-	-	-	-	-	-	-
	Cs-134	-	-	-	-	-	-	-	-	-	-	-	-
Sample 08	Cs-137	-	-	-	-	-	-	-	-	-	-	-	-
	Eu-152	-	-	-	-	-	-	-	-	-	-	-	-
	Am-241	-	-	-	-	-	-	-	-	-	-	-	-
	Co-57	-	-	-	-	-	-	-	-	-	-	-	-
	Cs-134	-	-	-	-	-	-	-	-	-	-	-	-
Sample 09	Cs-137	-	-	-	-	-	-	-	-	-	-	-	-
	Eu-152	-	-	-	-	-	-	-	-	-	-	-	-
	Am-241	-	-	-	-	-	-	-	-	-	-	-	-
	Co-57	-	-	-	-	-	-	-	-	-	-	-	-
	Cs-134	-	-	-	-	-	-	-	-	-	-	-	-
Sample 10	Cs-137	-	-	-	-	-	-	-	-	-	-	-	-
	Eu-152	-	-	-	-	-	-	-	-	-	-	-	-
	Am-241	-	-	-	-	-	-	-	-	-	-	-	-

Laboratory Code: 20

Matrix:	Spiked Water	Laboratory Results			Stat-Params			Evaluation Parameters and Scores					
								Trueness			Precision		
Samplecode	Analyte	Value	Unc.	[%]	Z-Score	U-Score	Lab/IAEA	A1	A2	Score	P	Score	Final Score
	Co-60	14.6	0.34	2.33	-0.5	-1.8	0.95	0.70	1.02	A	2.67	A	A
	Ba-133	4.8	0.26	5.42	-0.4	-0.7	0.96	0.20	0.72	A	5.77	A	A
	Cs-134	7.65	0.39	5.10	-0.1	-0.1	0.99	0.05	1.04	A	5.26	A	A
	Cs-137	6.26	0.23	3.67	0.1	0.2	1.01	0.06	0.65	A	4.01	A	A
	Eu-152	14.8	1.1	7.43	-0.4	-0.5	0.96	0.60	2.88	A	7.55	A	A
	Am-241	3.43	1.1	32.07	-2.7	-1.1	0.73	1.27	2.85	A	32.14	N	N
	Co-60	7.84	0.25	3.19	0.3	0.9	1.03	0.24	0.69	A	3.45	A	A
	Ba-133	2.73	0.23	8.42	0.9	0.9	1.09	0.23	0.65	A	9.33	A	A
	Cs-134	4	0.26	6.50	0.5	0.7	1.05	0.20	0.72	A	7.01	A	A
	Cs-137	3.54	0.18	5.08	1.4	2.1	1.14	0.44	0.53	A	6.02	A	A
	Eu-152	8	0.91	11.38	0.4	0.3	1.04	0.30	2.36	A	11.45	A	A
	Am-241	2.92	0.95	32.53	2.2	0.5	1.22	0.52	2.46	A	32.80	N	N
	Co-60	10.5	0.28	2.67	-0.2	-0.6	0.98	0.20	0.89	A	3.26	A	A
	Ba-133	3.49	0.23	6.59	0.0	0.0	1.00	0.01	0.65	A	7.18	A	A
	Cs-134	5.37	0.31	5.77	-0.1	-0.1	0.99	0.03	0.84	A	6.06	A	A
	Cs-137	4.68	0.2	4.27	0.6	1.3	1.06	0.28	0.58	A	4.84	A	A
	Eu-152	8.05	0.98	12.17	-2.5	-2.7	0.75	2.75	2.58	N	12.31	A	N
	Am-241	3.47	0.97	27.95	0.5	0.2	1.05	0.17	2.52	A	28.12	N	W

Matrix:	Soil	Laboratory Results			Stat-Params			Evaluation Parameters and Scores					
								Trueness			Precision		
Samplecode	Analyte	Value	Unc.	[%]	Z-Score	U-Score	Lab/IAEA	A1	A2	Score	P	Score	Final Score
Sample 04	K-40	1127	21	1.86	19.27	25.59	2.93	742	74.82	N	5.519	A	N
	Cs-137	8425	17	0.20	24.53	173.57	3.45	5985	88.96	N	1.246	A	N

Matrix:	Grass	Laboratory Results			Stat-Params			Evaluation Parameters and Scores					
								Trueness			Precision		
Samplecode	Analyte	Value	Unc.	[%]	Z-Score	U-Score	Lab/IAEA	A1	A2	Score	P	Score	Final Score
Sample 05	Cs-137	0.175	0.84	480.00	-9.13	-1.96	0.09	1.825	2.4	A	480.4	N	N
Sample 06	Cs-137	2815	13	0.46	-0.62	-1.53	0.94	185	311.4	A	4.027	A	A
Sample 07	Cs-137	9228	24	0.26	-0.77	-2.26	0.92	772	879.4	A	3.41	A	A

Matrix:	Spiked Filter	Laboratory Results			Stat-Params			Evaluation Parameters and Scores					
								Trueness			Precision		
Samplecode	Analyte	Value	Unc.	[%]	Z-Score	U-Score	Lab/IAEA	A1	A2	Score	P	Score	Final Score
	Co-57	0.255	0.05	19.61	4.17	1.39	1.42	0.08	0.14	A	22.54	A	A
	Cs-134	0.313	0.029	9.27	4.23	2.64	1.42	0.09	0.09	N	12.98	A	N
Sample 08	Cs-137	0.607	0.028	4.61	2.91	2.81	1.29	0.14	0.13	N	9.68	A	N
	Eu-152	0.903	0.11	12.18	-0.29	-0.22	0.97	0.03	0.32	A	13.78	A	A
	Am-241	0.632	0.041	6.49	-5.97	-11.56	0.40	0.94	0.21	N	7.87	A	N
	Co-57	1.97	0.23	11.68	-0.15	-0.12	0.99	0.03	0.65	A	12.70	A	A
	Cs-134	10.3	0.19	1.84	2.41	7.25	1.24	2.00	0.71	N	3.03	A	W
Sample 09	Cs-137	56.7	0.23	0.41	2.49	7.96	1.25	11.30	3.66	N	3.11	A	N
	Eu-152	36.4	0.54	1.48	0.20	0.57	1.02	0.70	3.16	A	3.42	A	A
	Am-241	18.4	0.17	0.92	-6.44	-20.70	0.36	33.30	4.15	N	3.23	A	N
	Co-57	1.82	0.24	13.19	-0.90	-0.69	0.91	0.18	0.67	A	14.10	A	A
	Cs-134	10.6	0.19	1.79	2.77	8.34	1.28	2.30	0.71	N	3.00	A	N
Sample 10	Cs-137	60.4	0.24	0.40	3.30	10.56	1.33	15.00	3.66	N	3.11	A	N
	Eu-152	38.5	0.56	1.45	0.78	2.27	1.08	2.80	3.18	A	3.41	A	A
	Am-241	19.1	0.17	0.89	-6.31	-20.26	0.37	32.60	4.15	N	3.22	A	N

APPENDIX II
EVALUATION PER ANALYTE

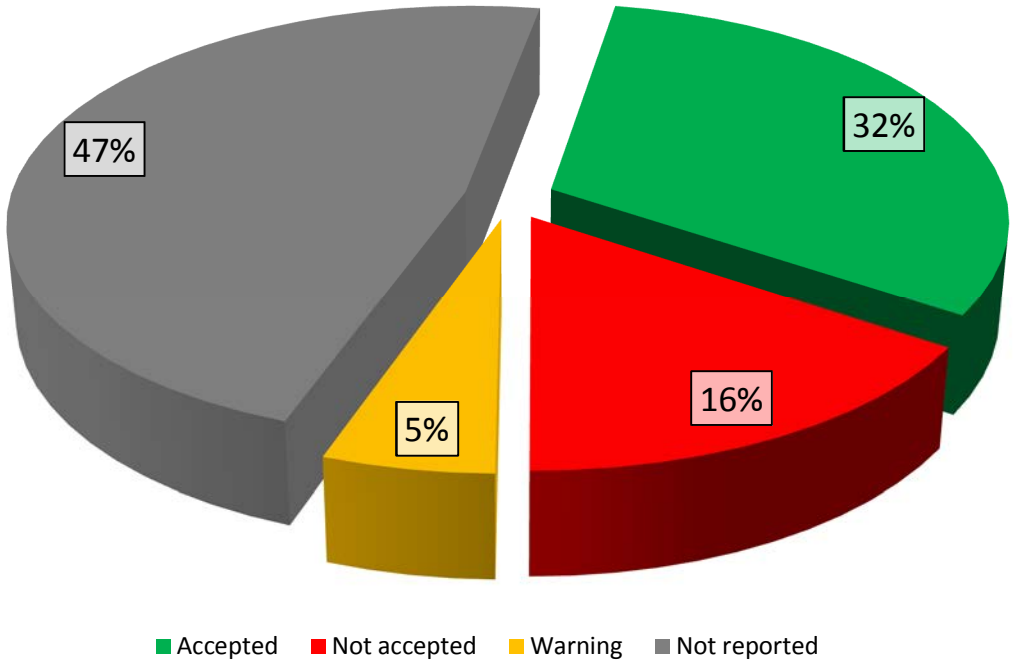

FIG. 7. The distribution of the u-scores for Am-241 in water (sample 01).

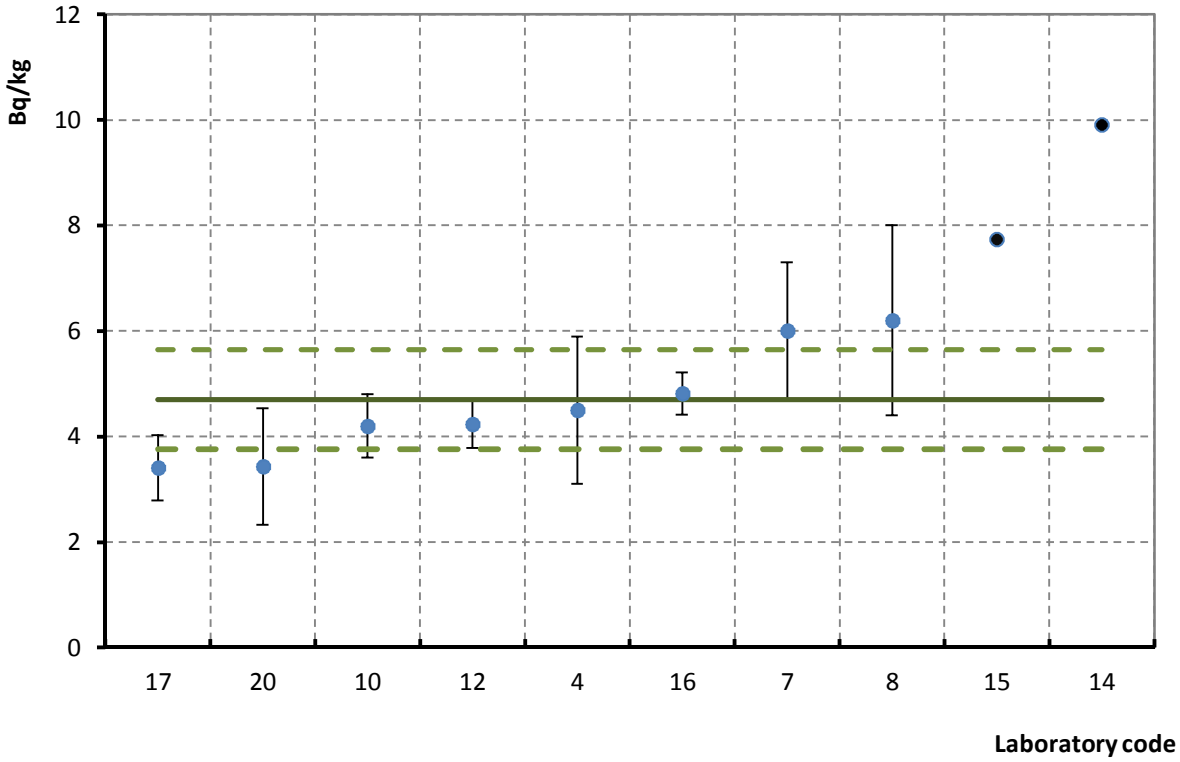

FIG. 8. *The reported results of Am-241 in water (sample 01).*

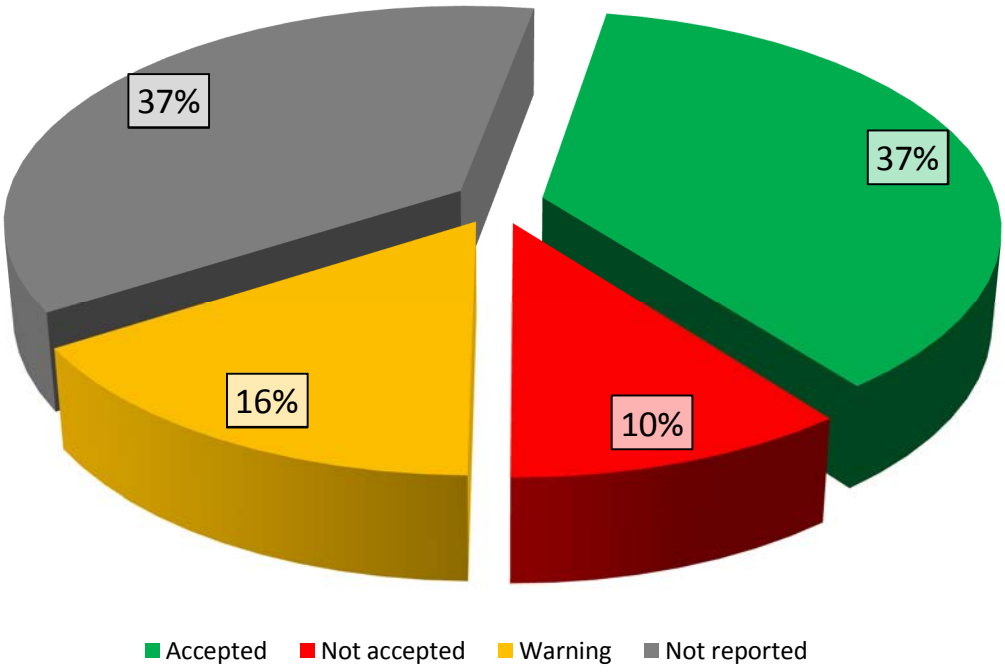

FIG. 9. The distribution of the u-scores for Ba-133 in water (sample 01).

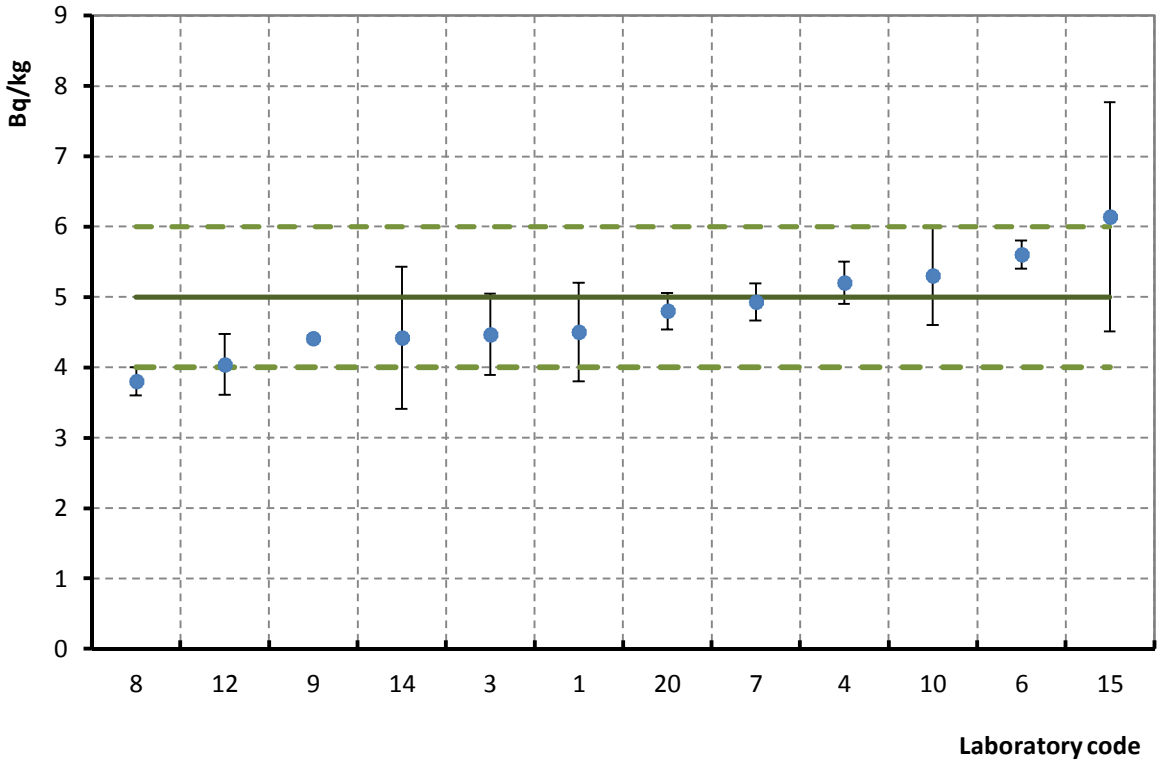

FIG. 10. The reported results of Ba-133 in water (sample 01).

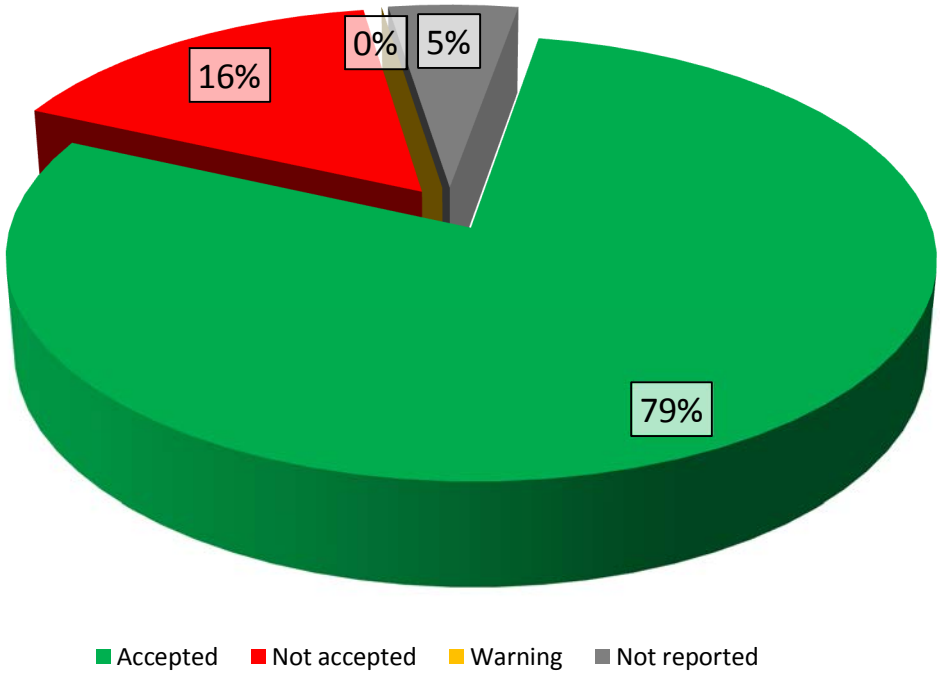

FIG. 11. The distribution of the u-scores for Co-60 in water (sample 01).

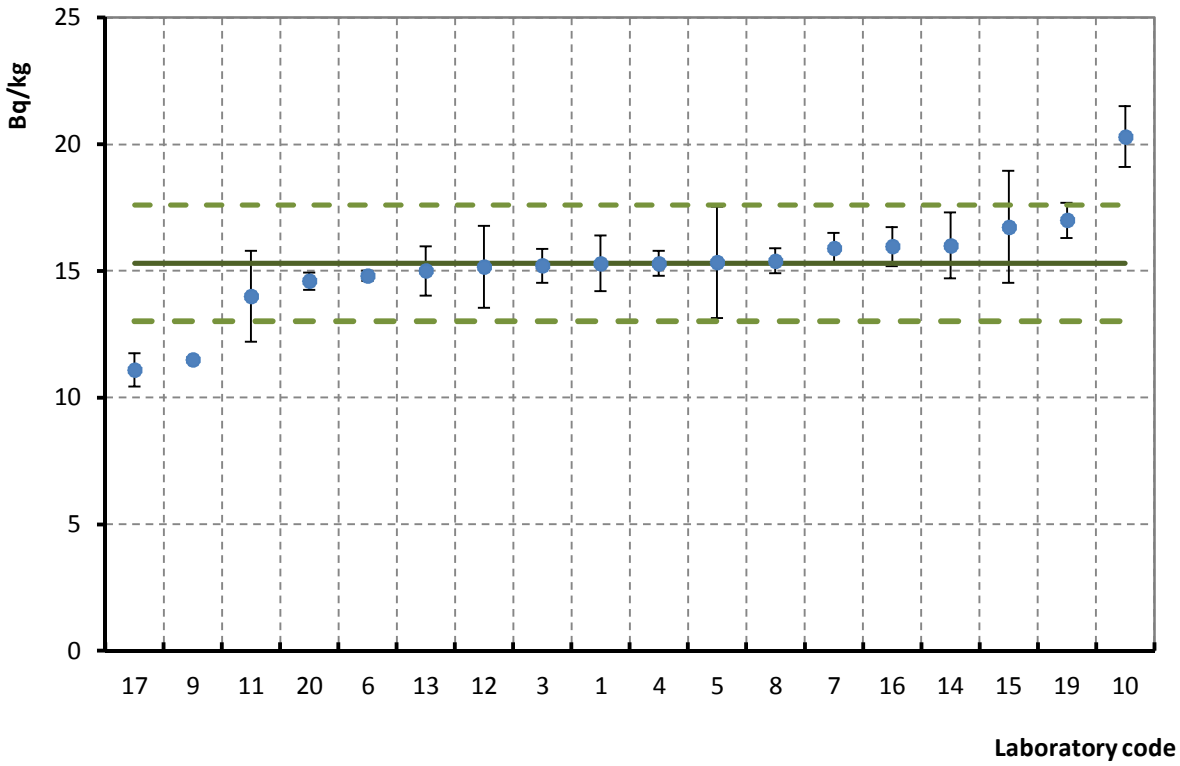

FIG. 12. The reported results of Co-60 in water (sample 01).

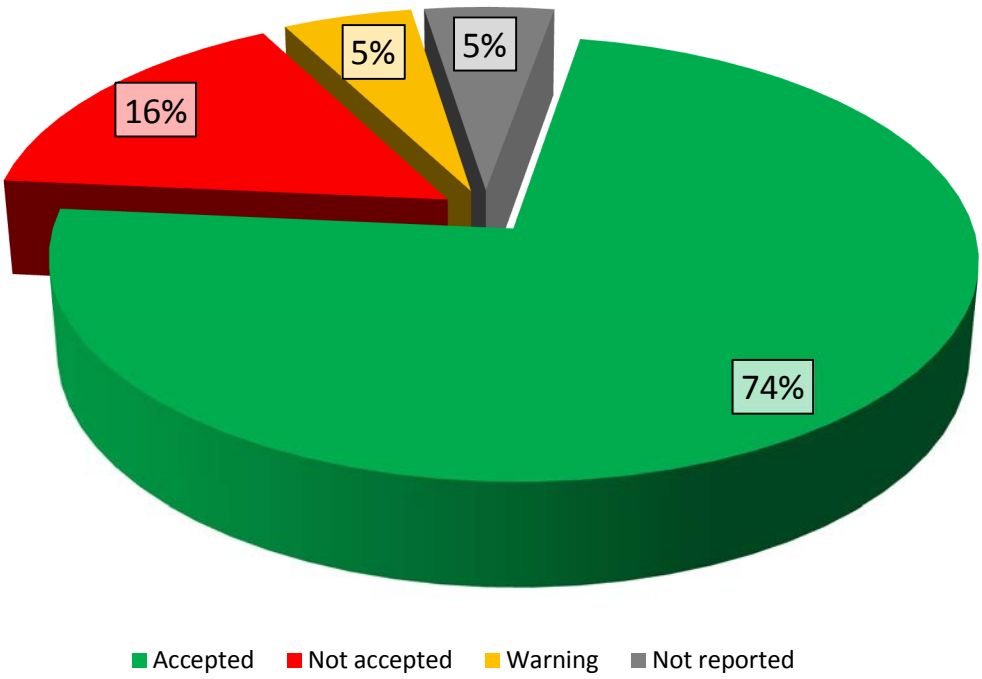

FIG. 13. *The distribution of the u-scores for Cs-134 in water (sample 01).*

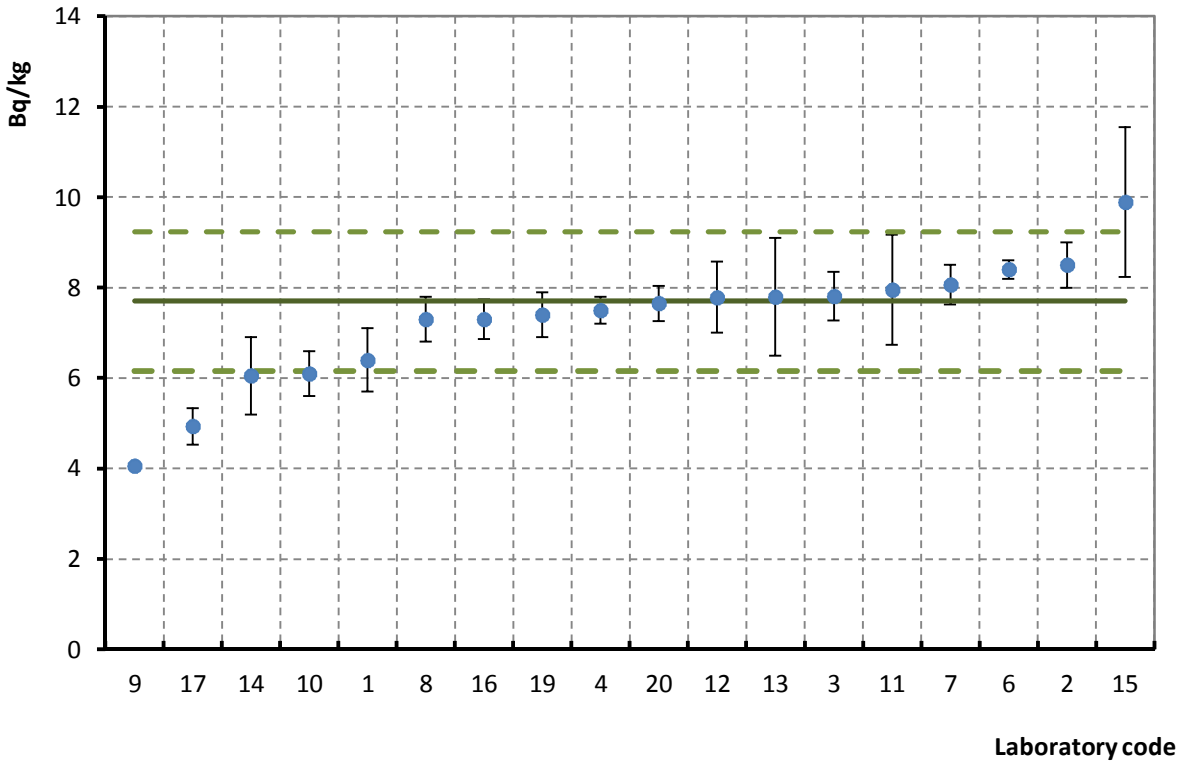

FIG. 14. The reported results of Cs-134 in water (sample 01).

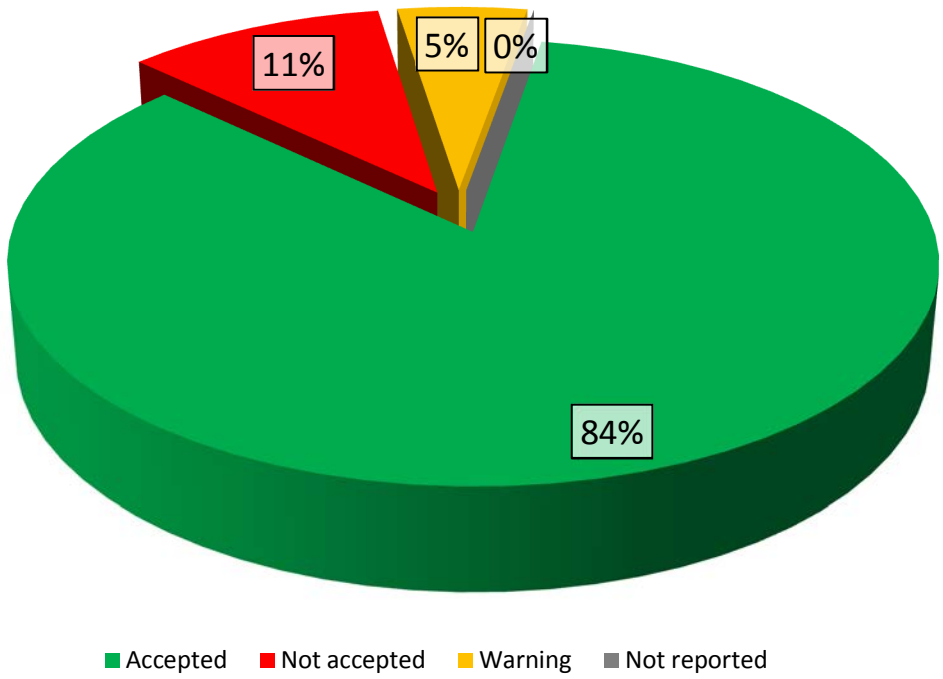

FIG. 15. The distribution of the u-scores for Cs-137 in water (sample 01).

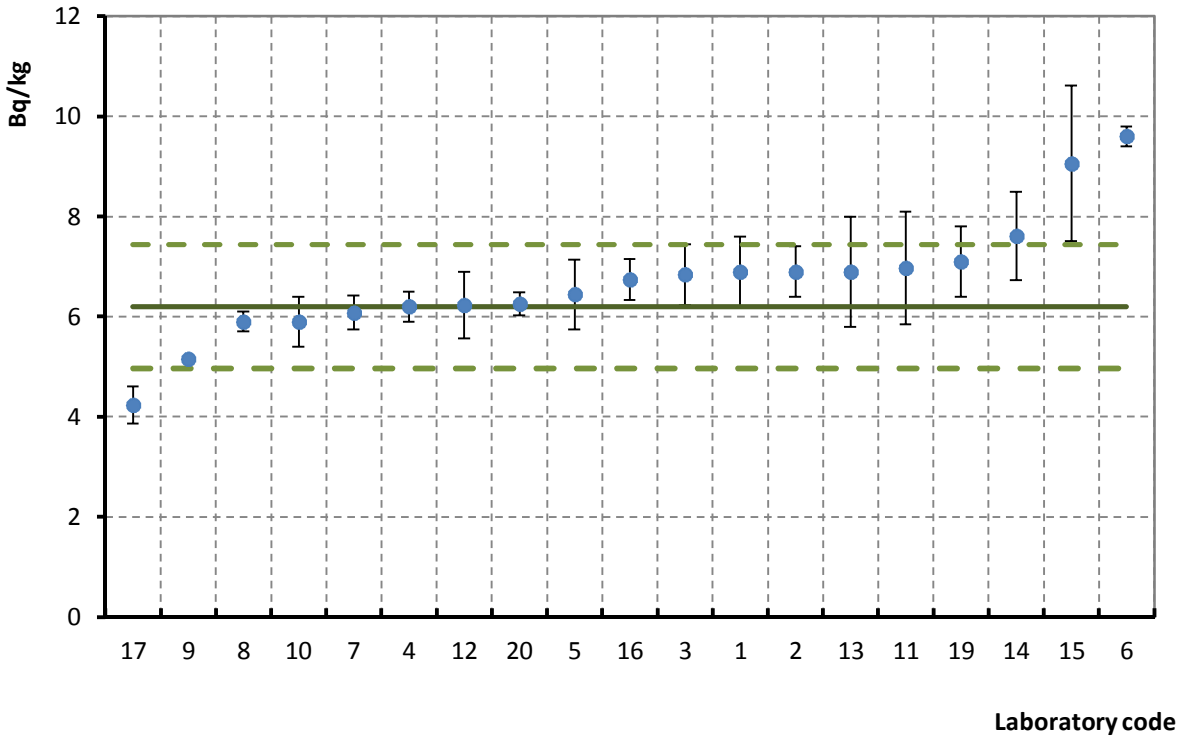

FIG. 16. The reported results of Cs-137 in water (sample 01).

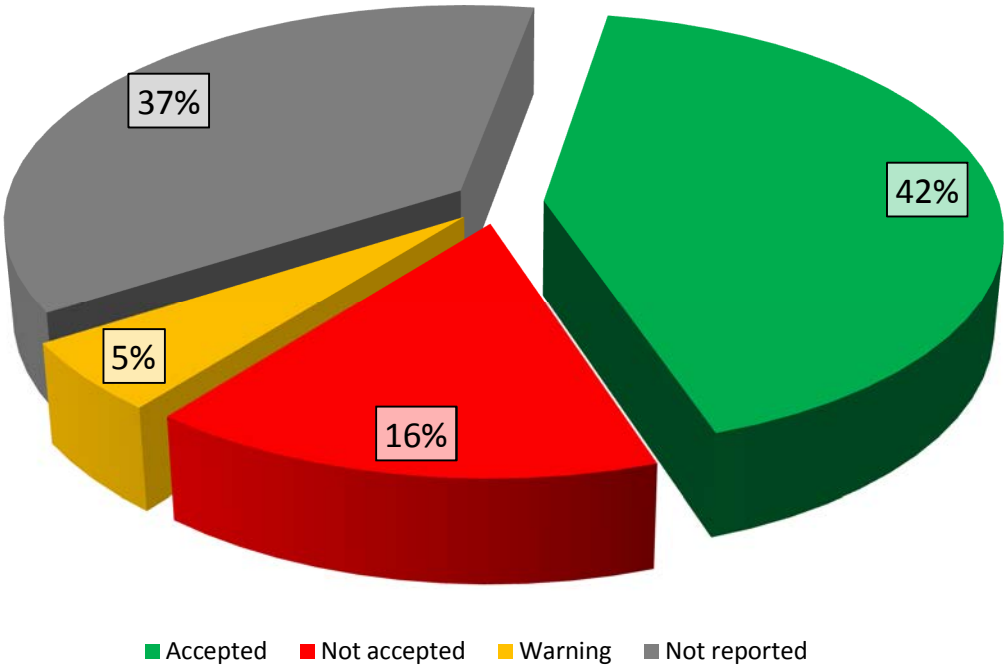

FIG. 17. The distribution of the u-scores for Eu-152 in water (sample 01).

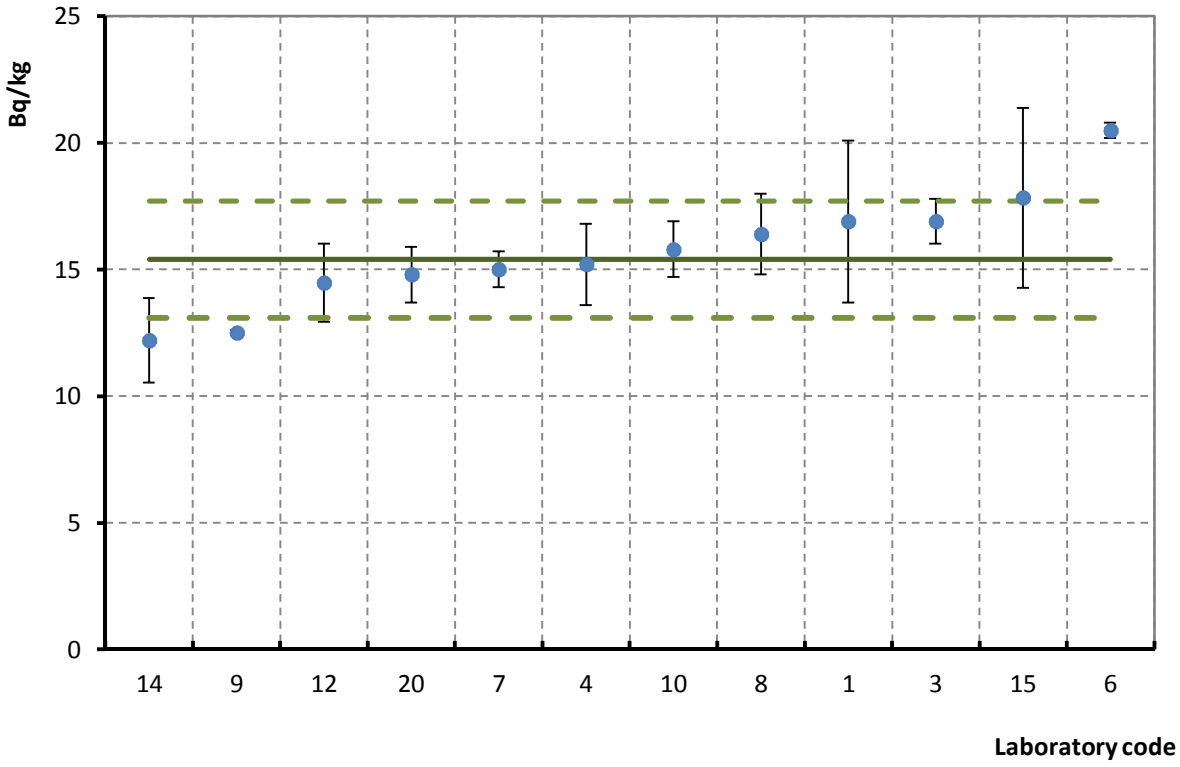

FIG. 18. The reported results of Eu-152 in water (sample 01).

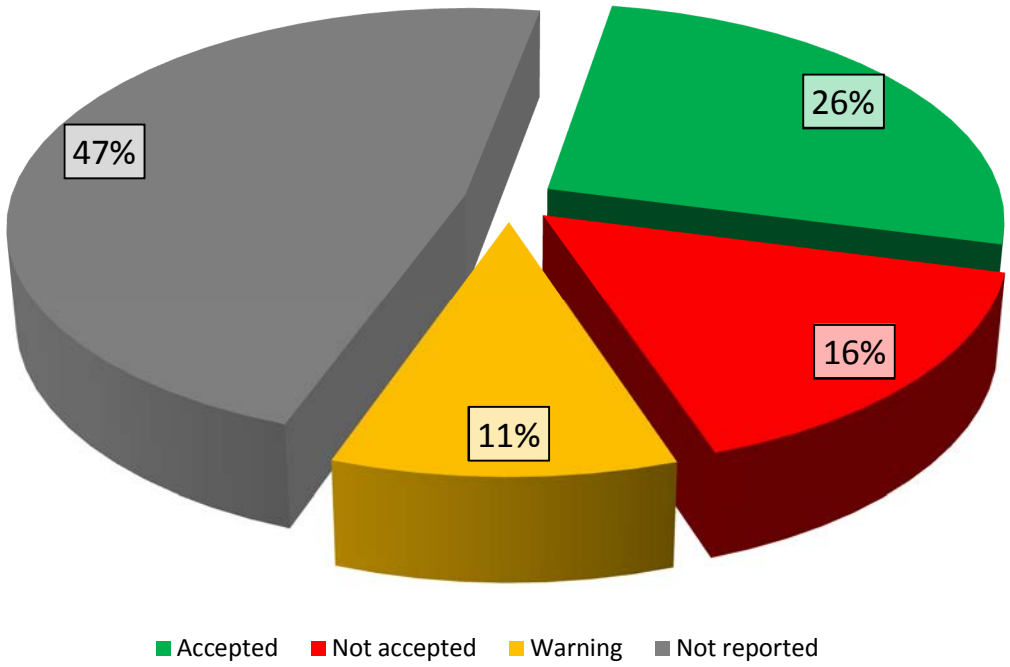

FIG. 19. The distribution of the u-scores for Am-241 in water (sample 02).

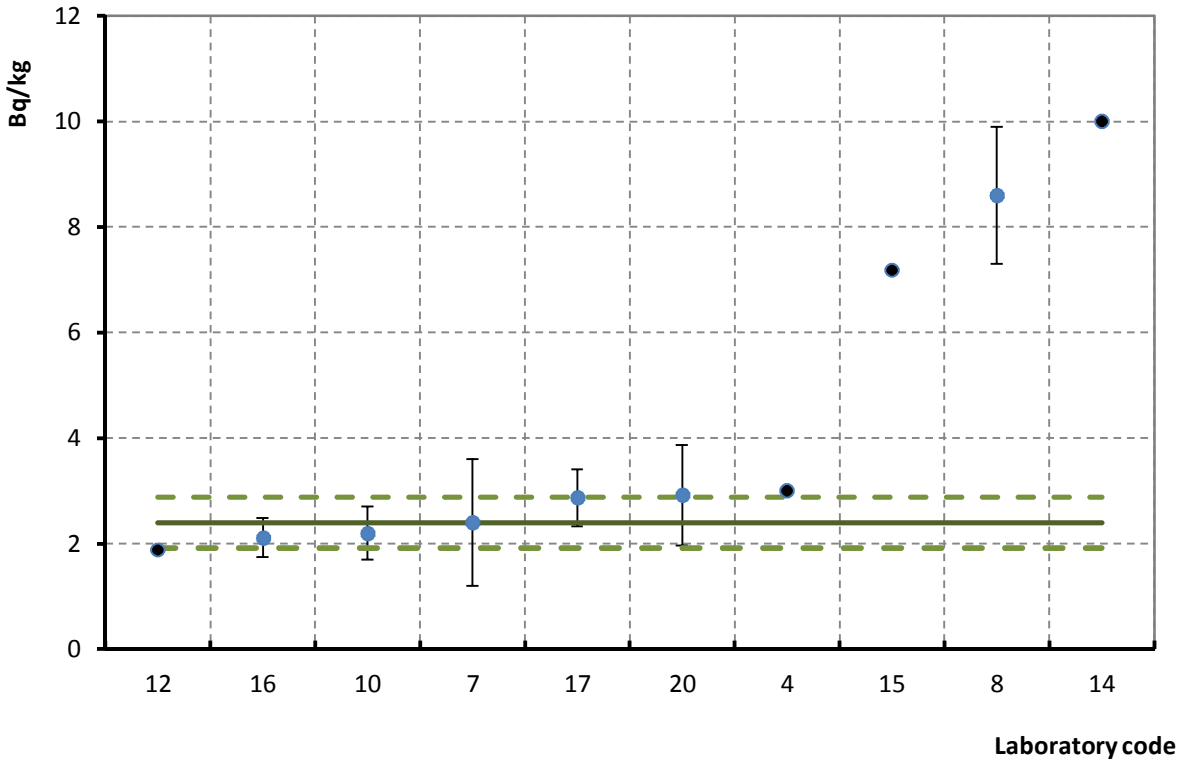

FIG. 20. The reported results of Am-241 in water (sample 02).

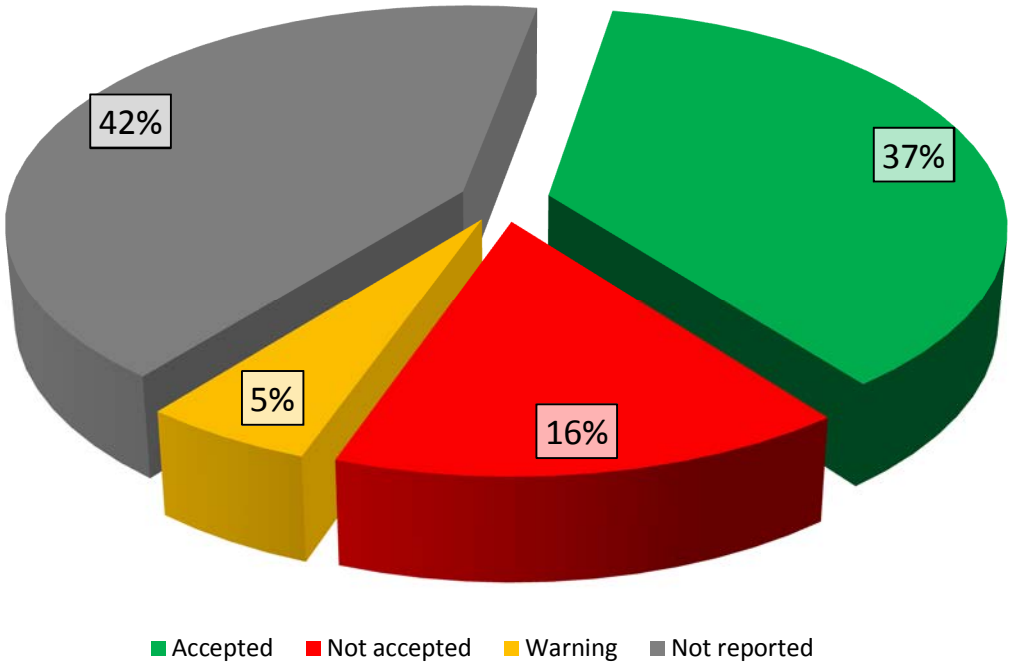

FIG. 21. The distribution of the u-scores for Ba-133 in water (sample 02).

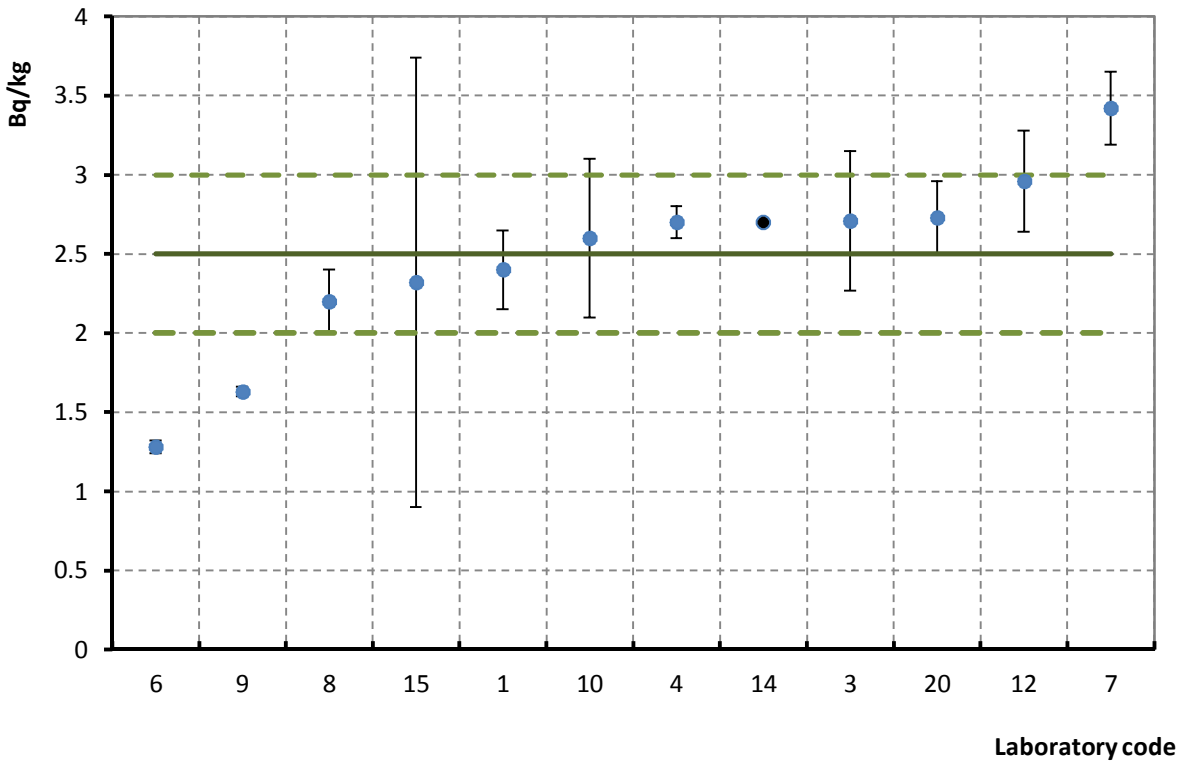

FIG. 22. The reported results of Ba-133 in water (sample 02).

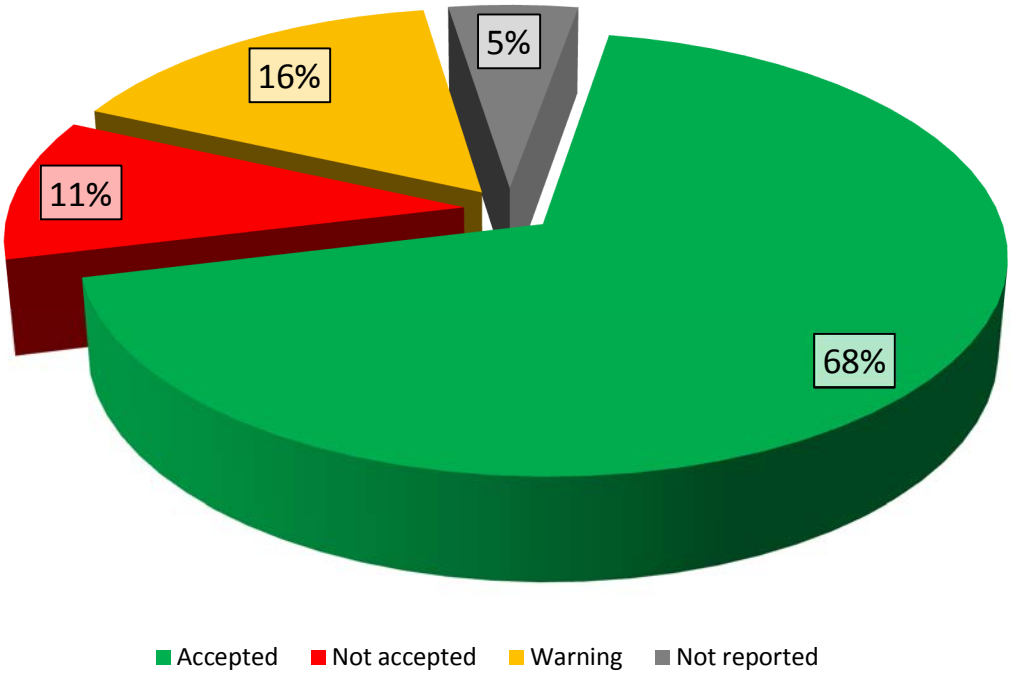

FIG. 23. The distribution of the u-scores for Co-60 in water (sample 02).

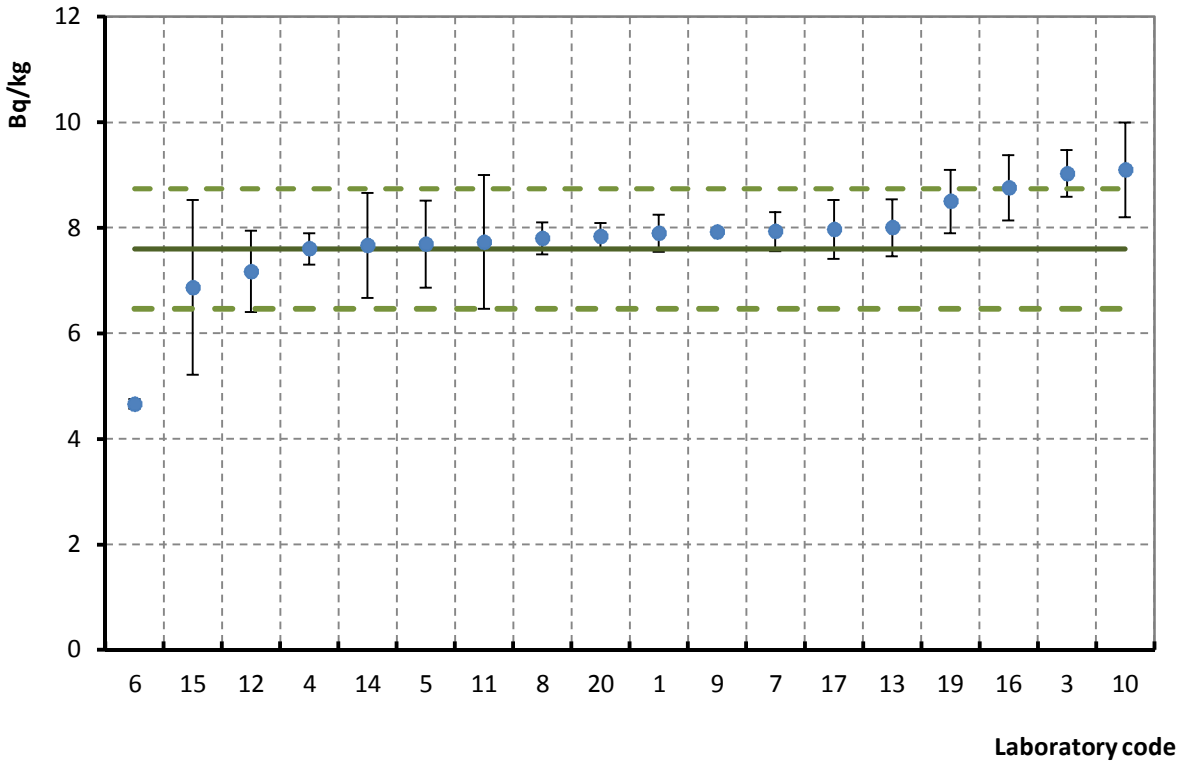

FIG. 24. The reported results of Co-60 in water (sample 02).

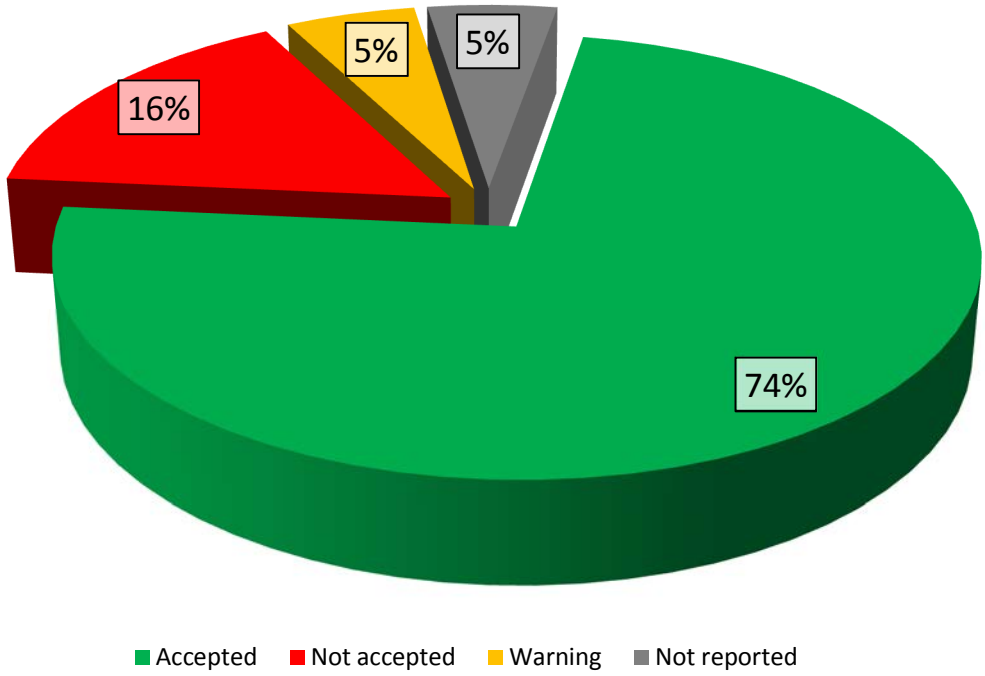

FIG. 25. The distribution of the u-scores for Cs-134 in water (sample 02).

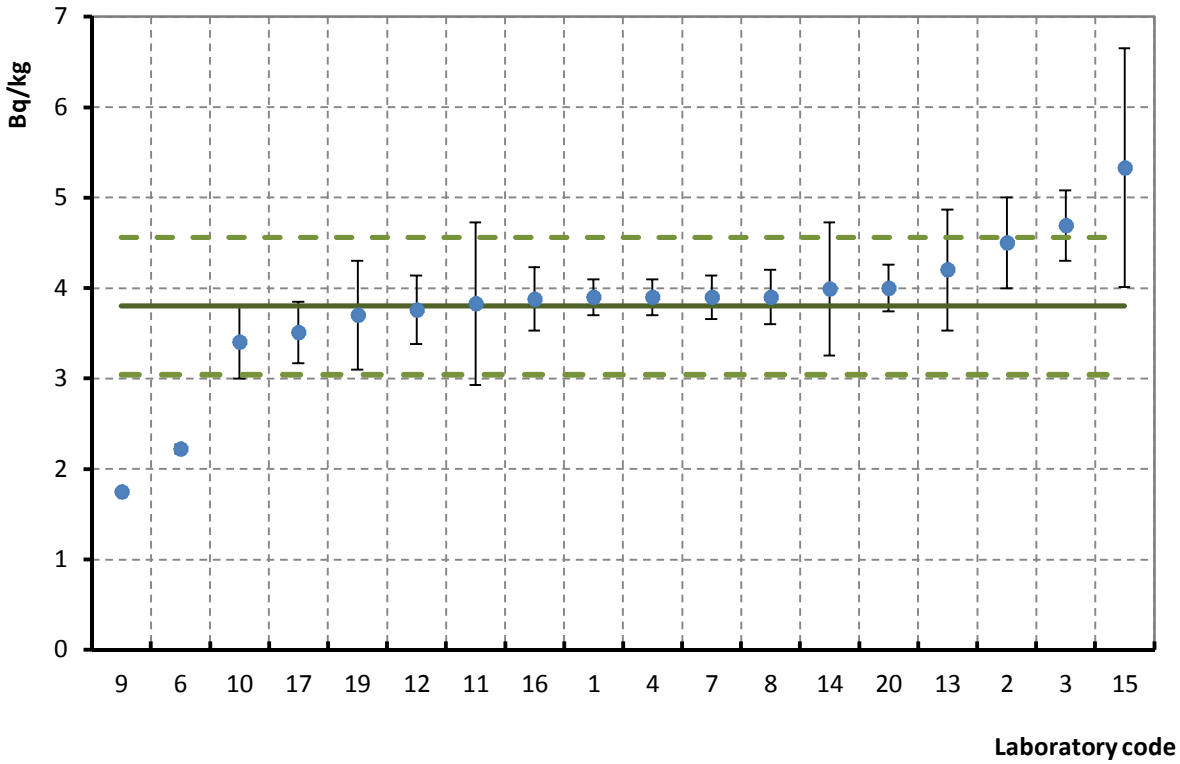

FIG. 26. The reported results of Cs-134 in water (sample 02).

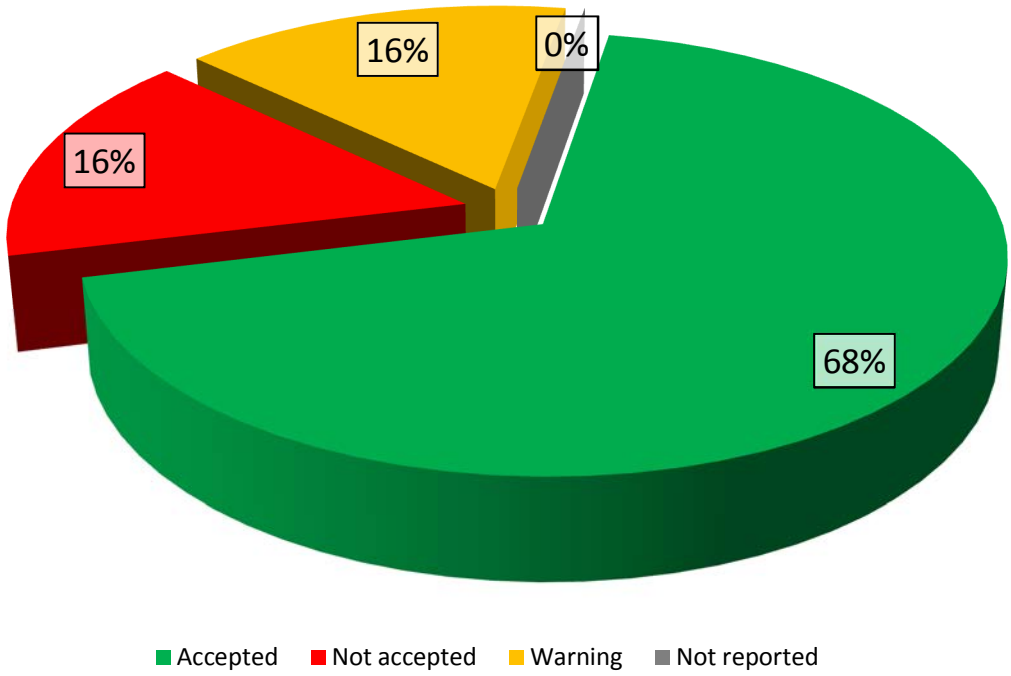

FIG. 27. The distribution of the u-scores for Cs-137 in water (sample 02).

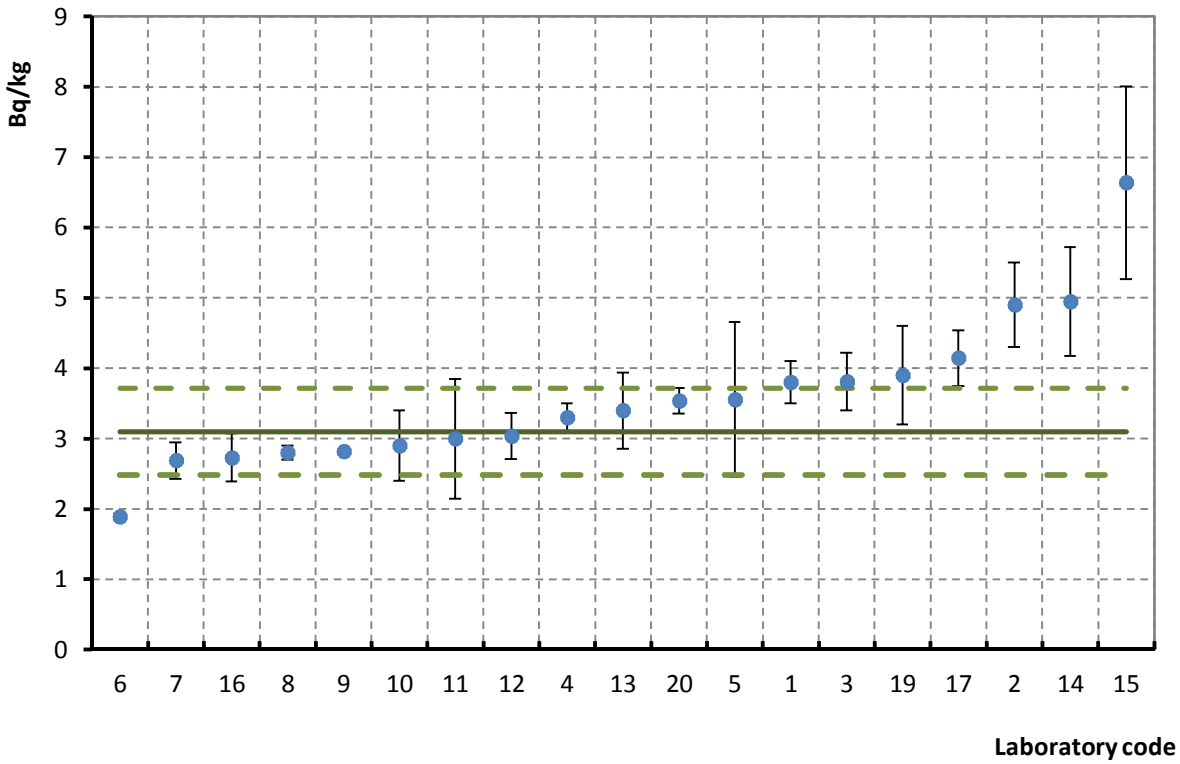

FIG. 28. The reported results of Cs-137 in water (sample 02).

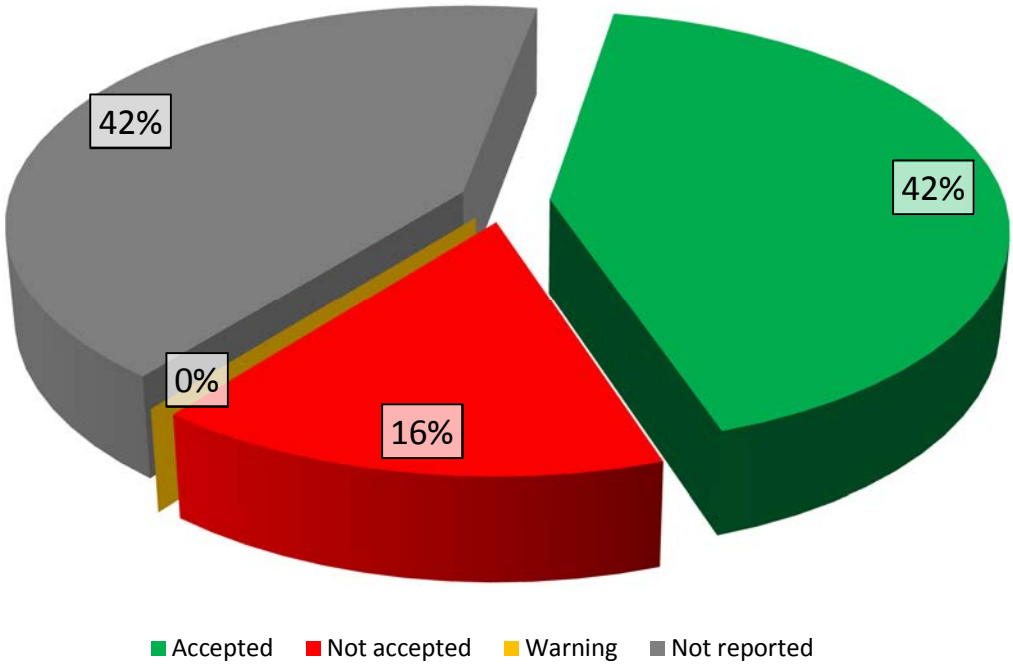

FIG. 29. The distribution of the u-scores for Eu-152 in water (sample 02).

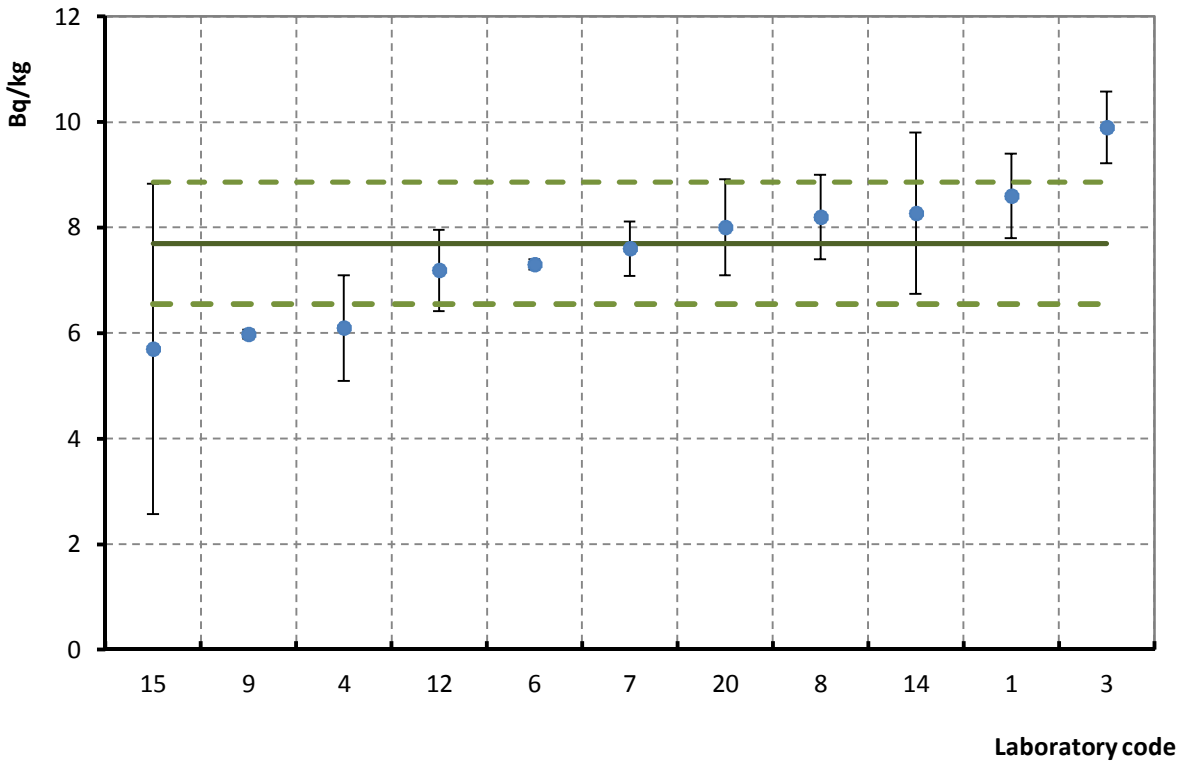

FIG. 30. The reported results of Eu-152 in water (sample 02).

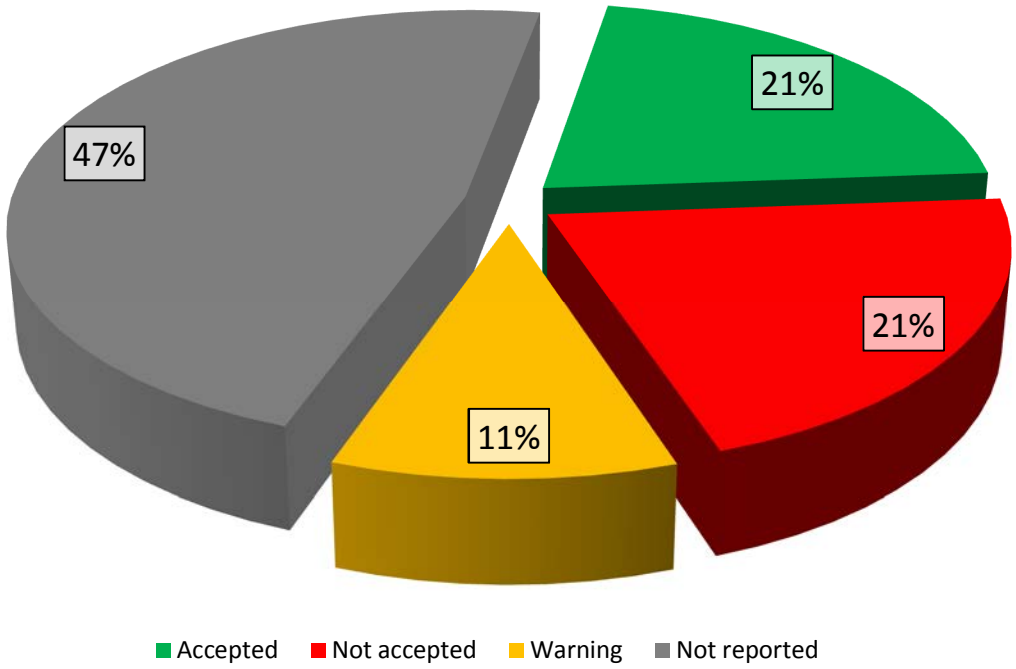

FIG. 31. The distribution of the u-scores for Am-241 in water (sample 03).

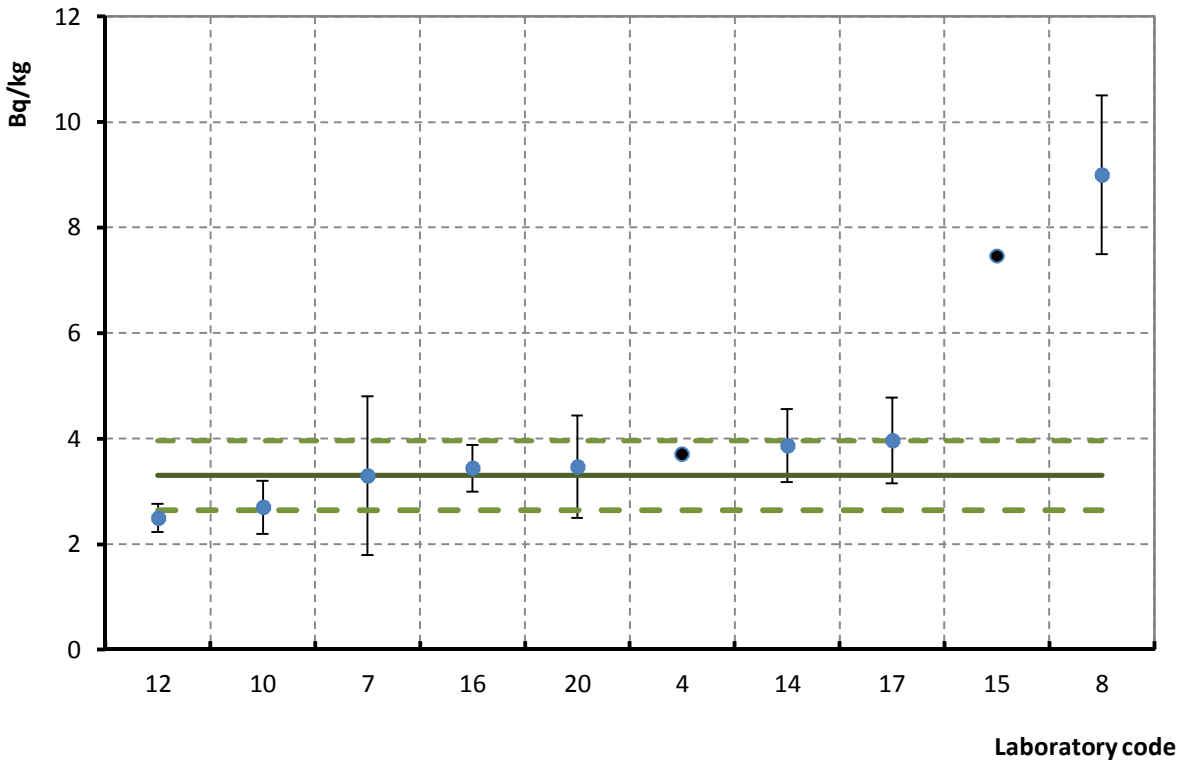

FIG. 32. The reported results of Am-241 in water (sample 03).

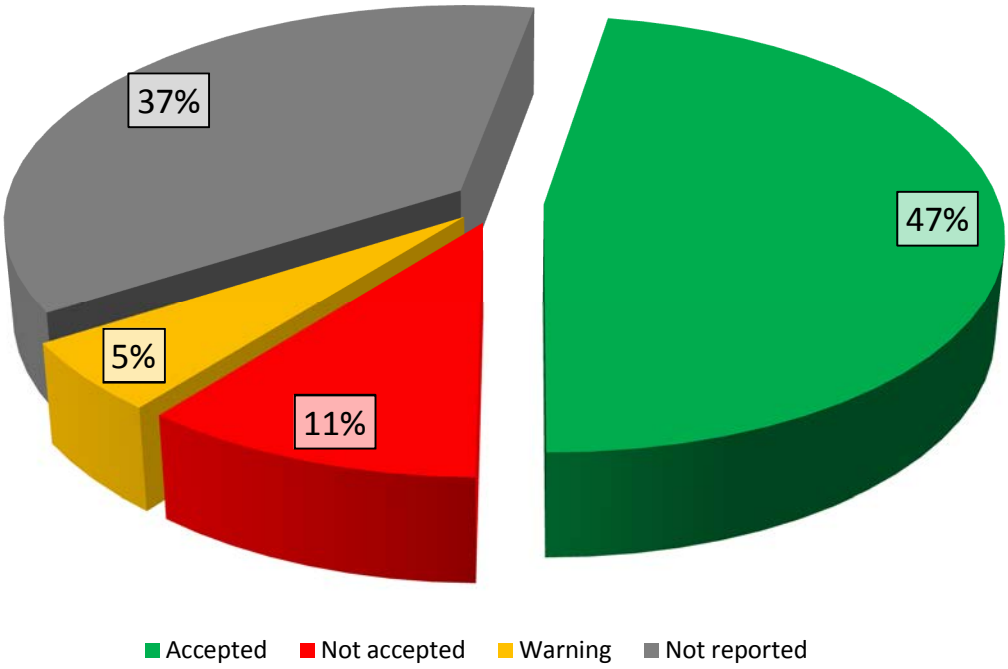

FIG. 33. The distribution of the u-scores for Ba-133 in water (sample 03).

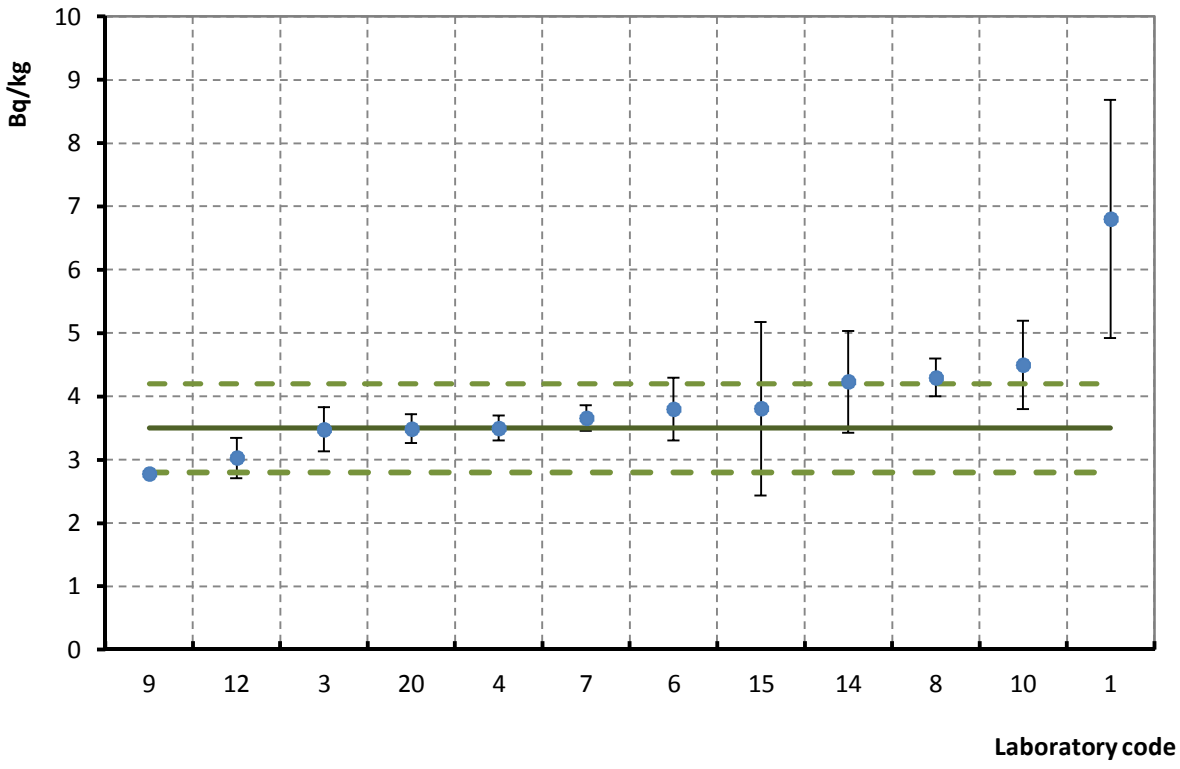

FIG. 34. The reported results of Ba-133 in water (sample 03).

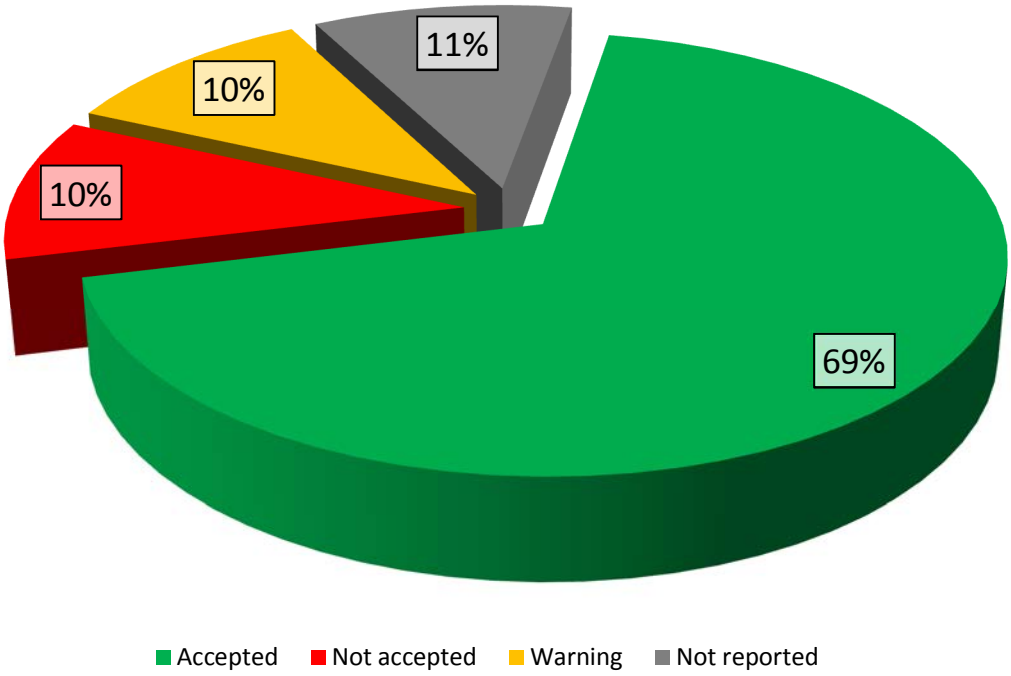

FIG. 35. The distribution of the u-scores for Co-60 in water (sample 03).

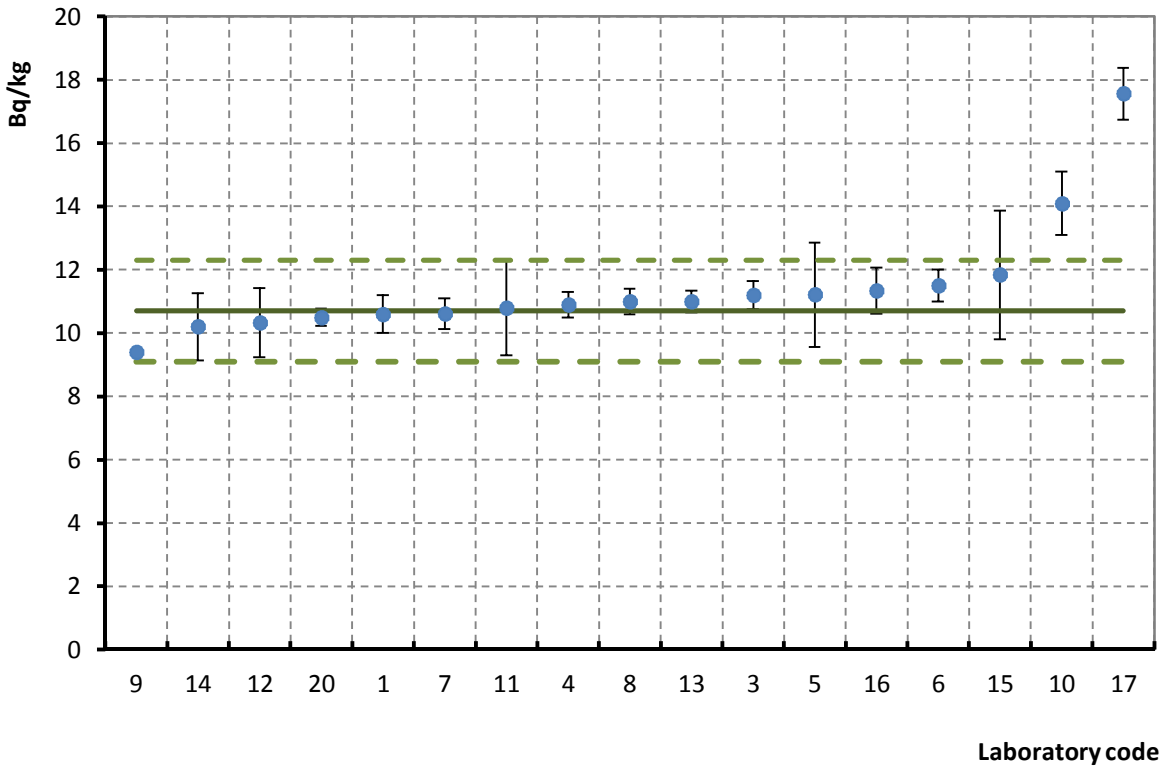

FIG. 36. The reported results of Co-60 in water (sample 03).

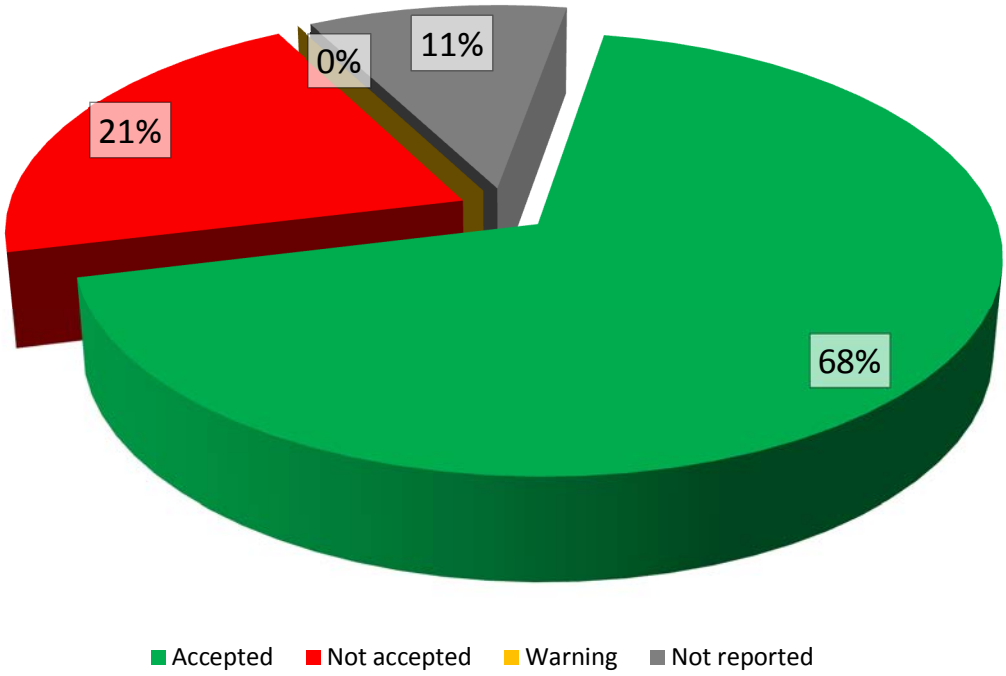

FIG. 37. The distribution of the u-scores for Cs-134 in water (sample 03).

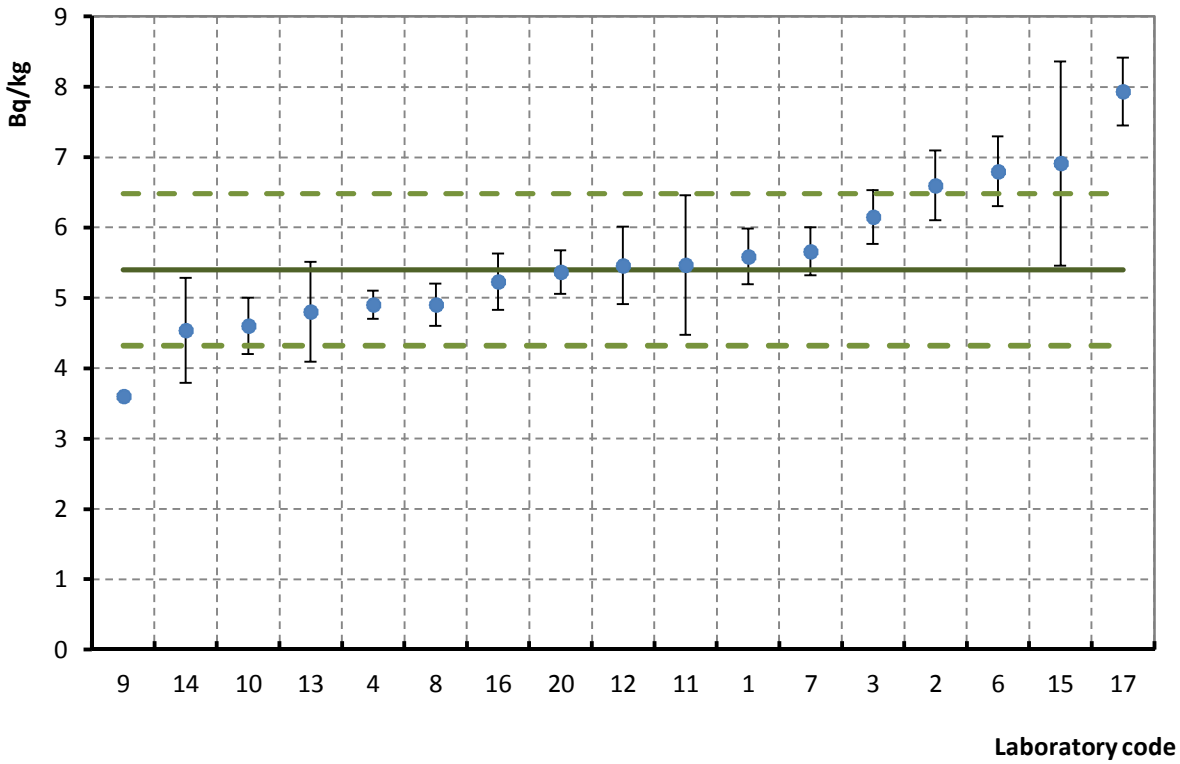

FIG. 38. The reported results of Cs-134 in water (sample 03).

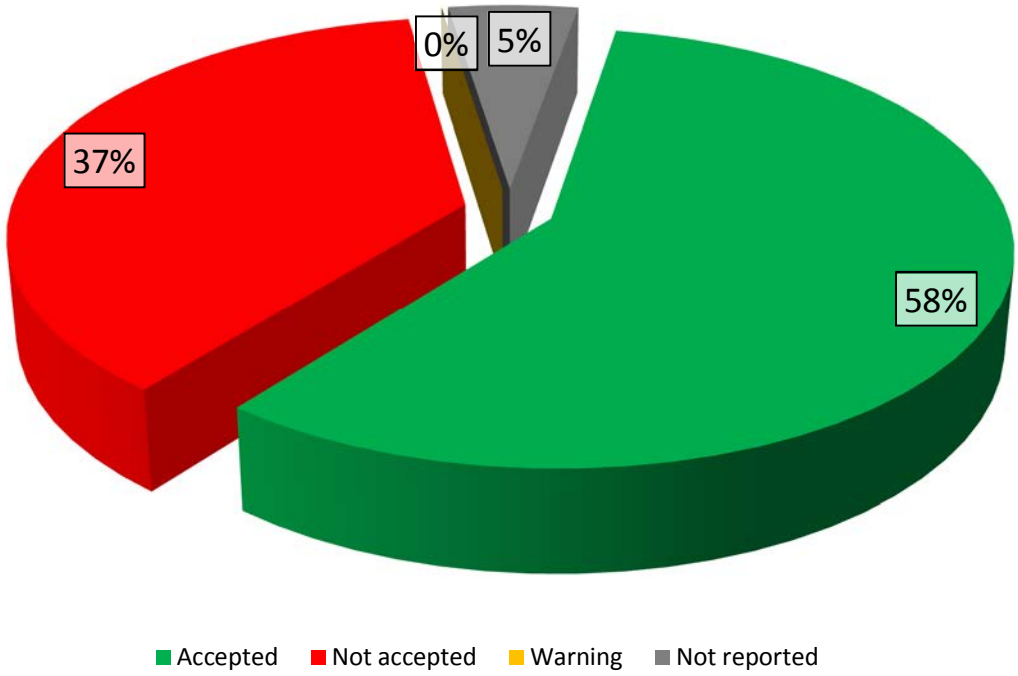

FIG. 39. The distribution of the u-scores for Cs-137 in water (sample 03).

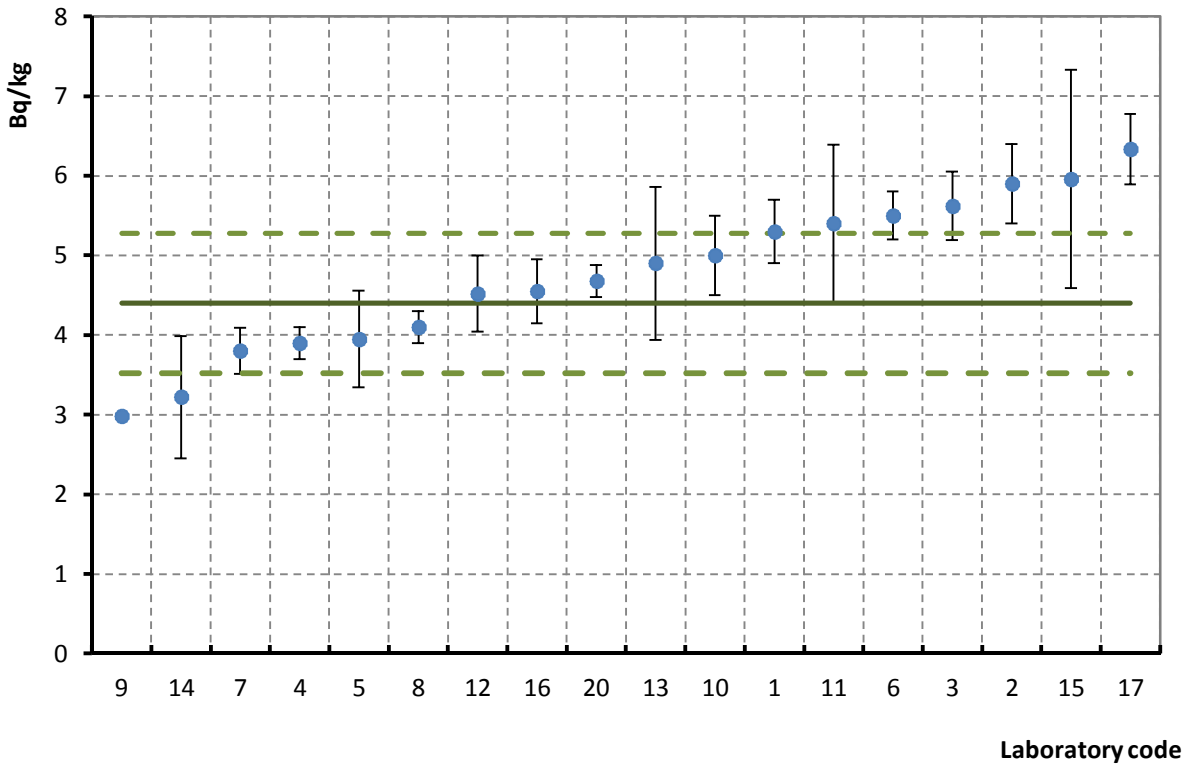

FIG. 40. The reported results of Cs-137 in water (sample 03).

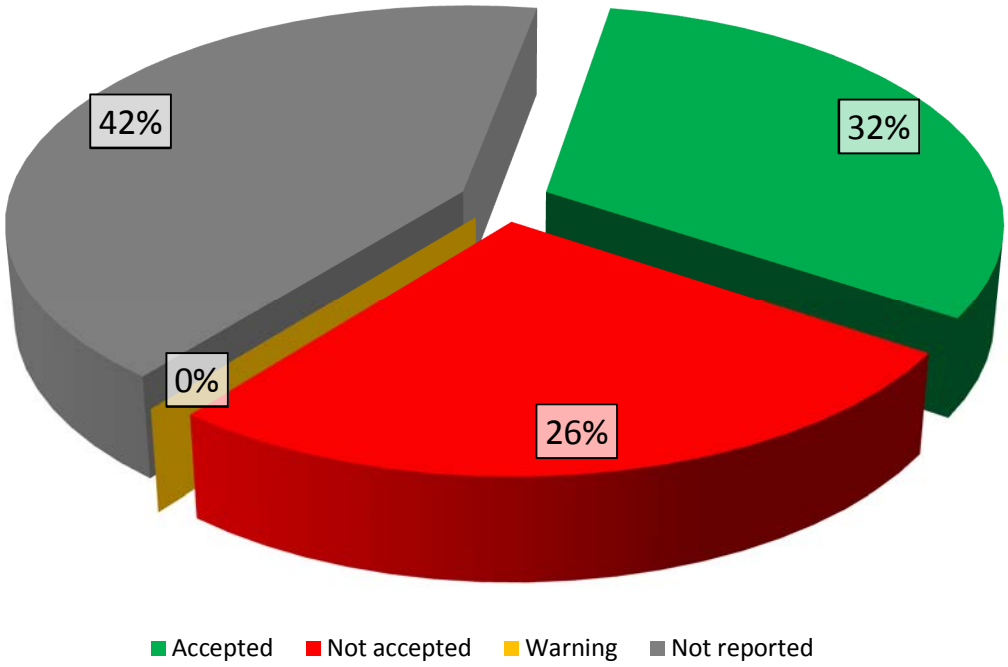

FIG. 41. The distribution of the u-scores for Eu-152 in water (sample 03).

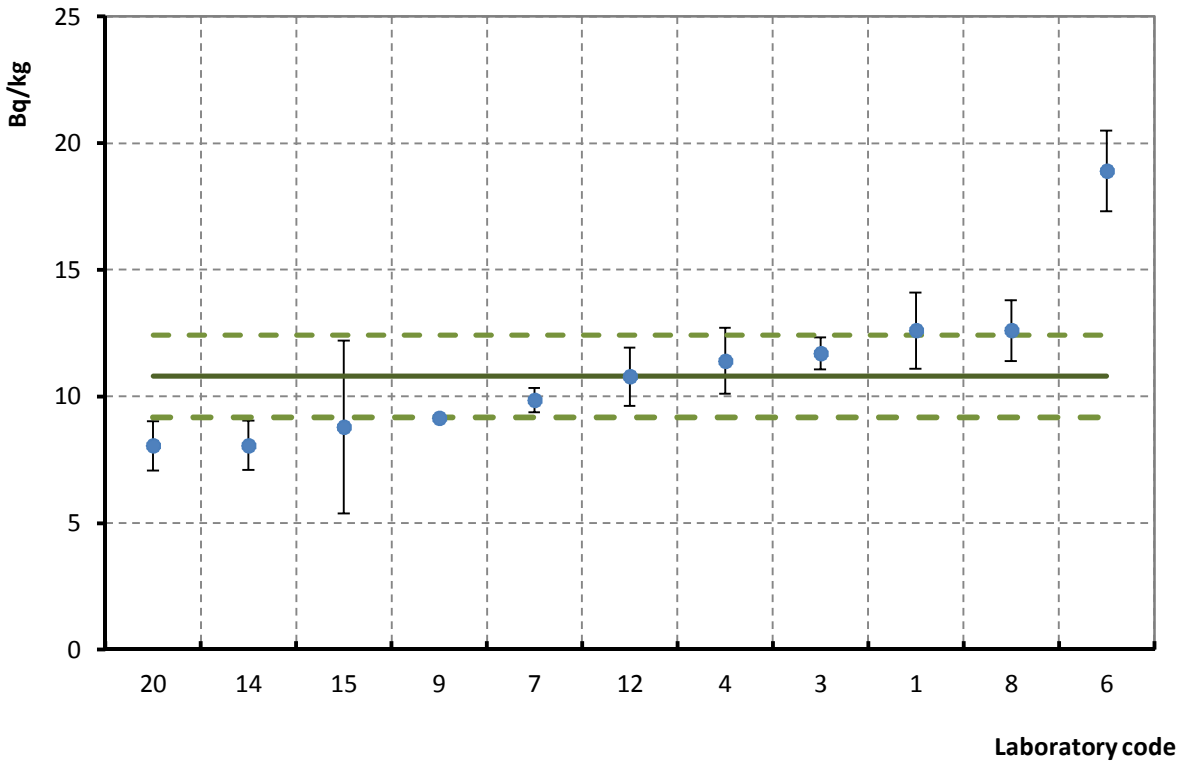

FIG. 42. The reported results of Eu-152 in water (sample 03)

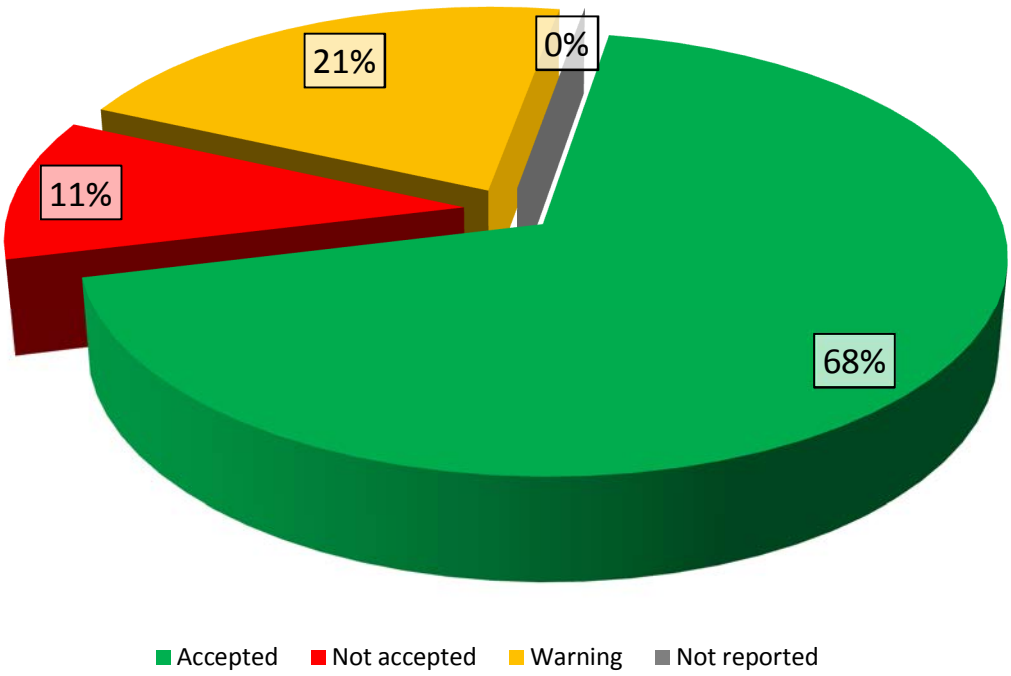

FIG. 43. The distribution of the u-scores for Cs-137 in soil (sample 04).

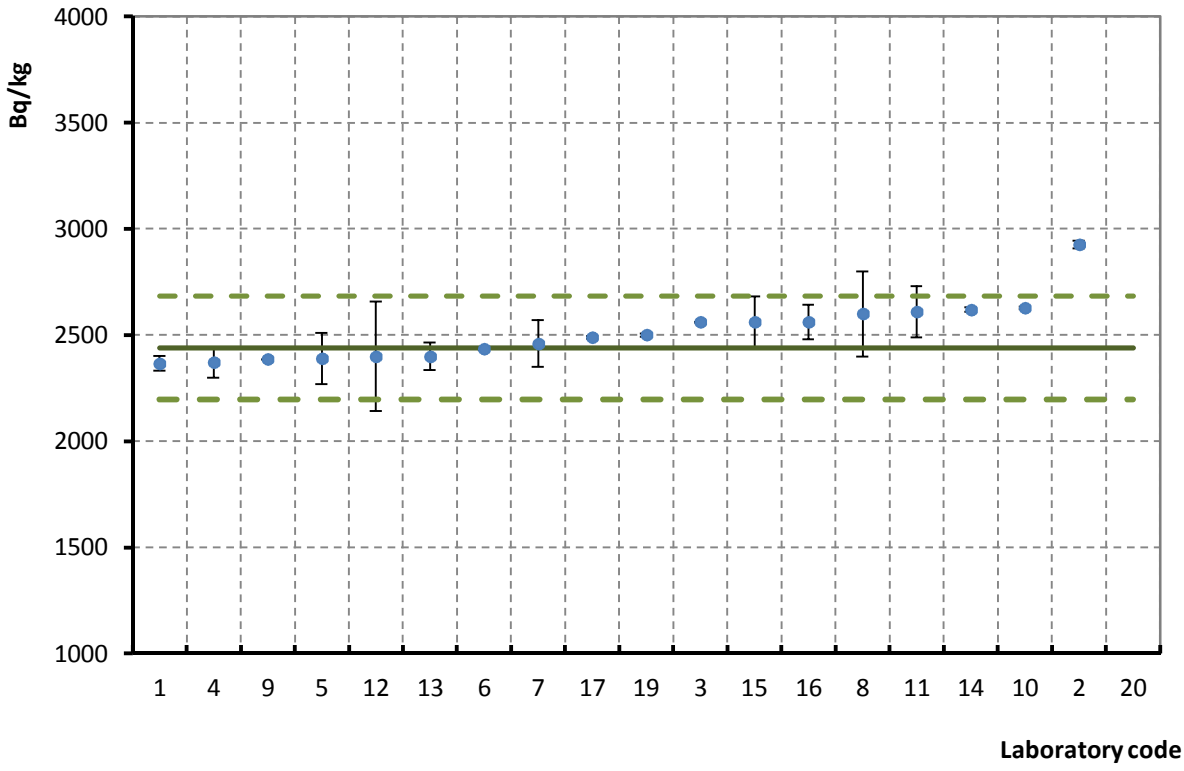

FIG. 44. The reported results of Cs-137 in soil (sample 04).

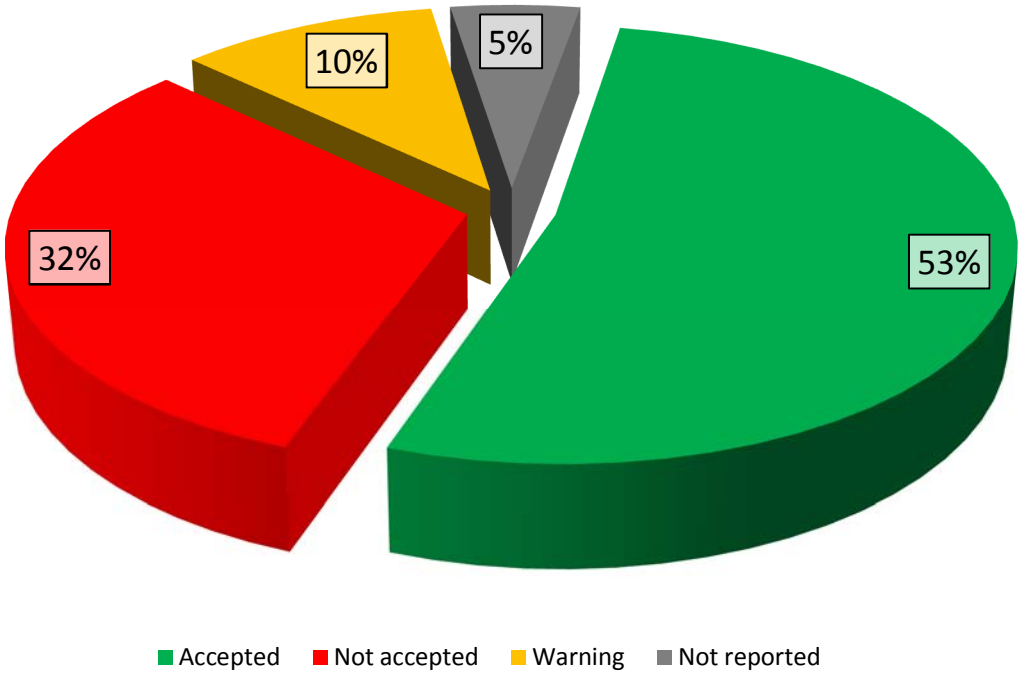

FIG. 45. The distribution of the u-scores for K-40 in soil (sample 04).

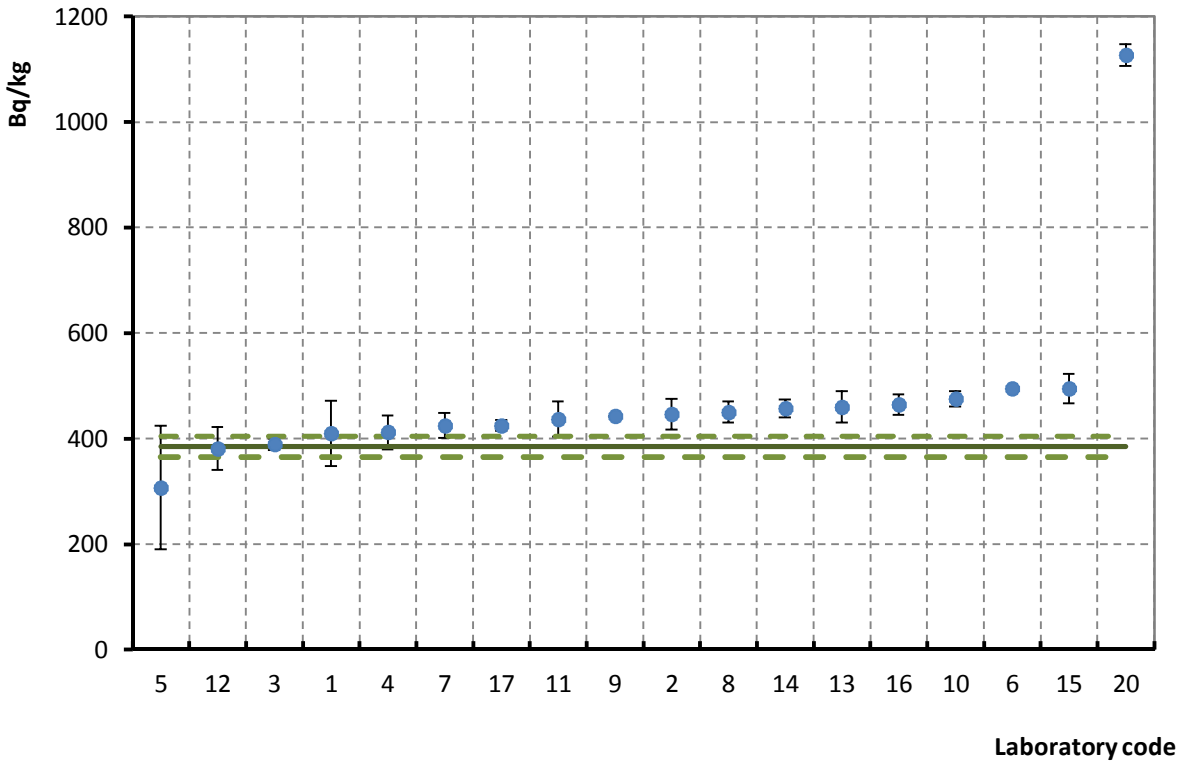

FIG. 46. The reported results of K-40 in soil (sample 04).

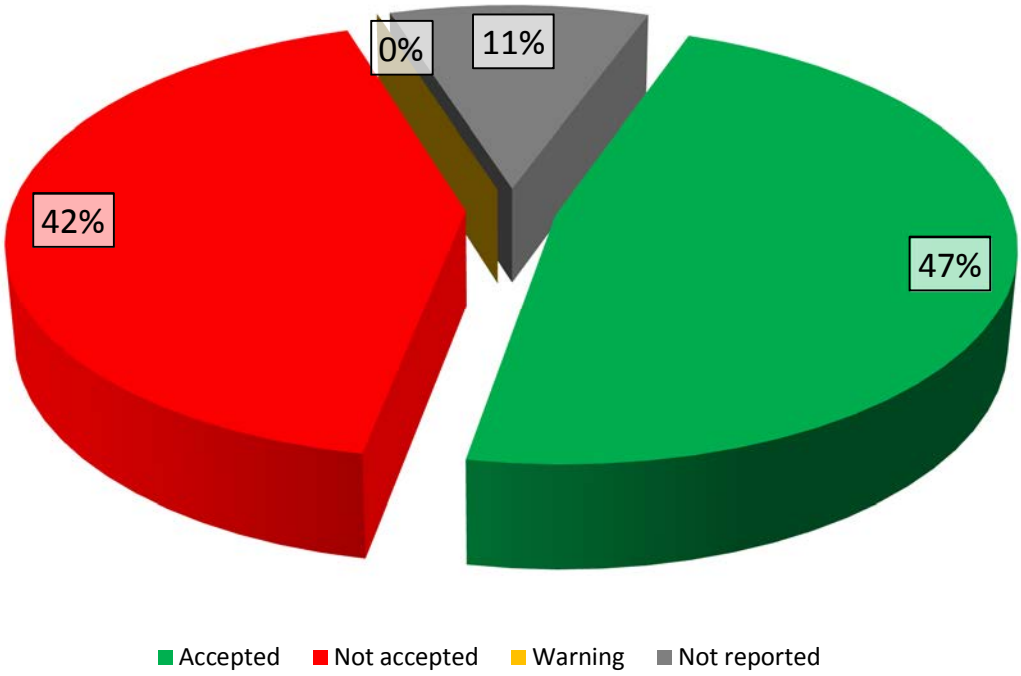

FIG. 47. The distribution of the u-scores for Cs-137 in grass (sample 05).

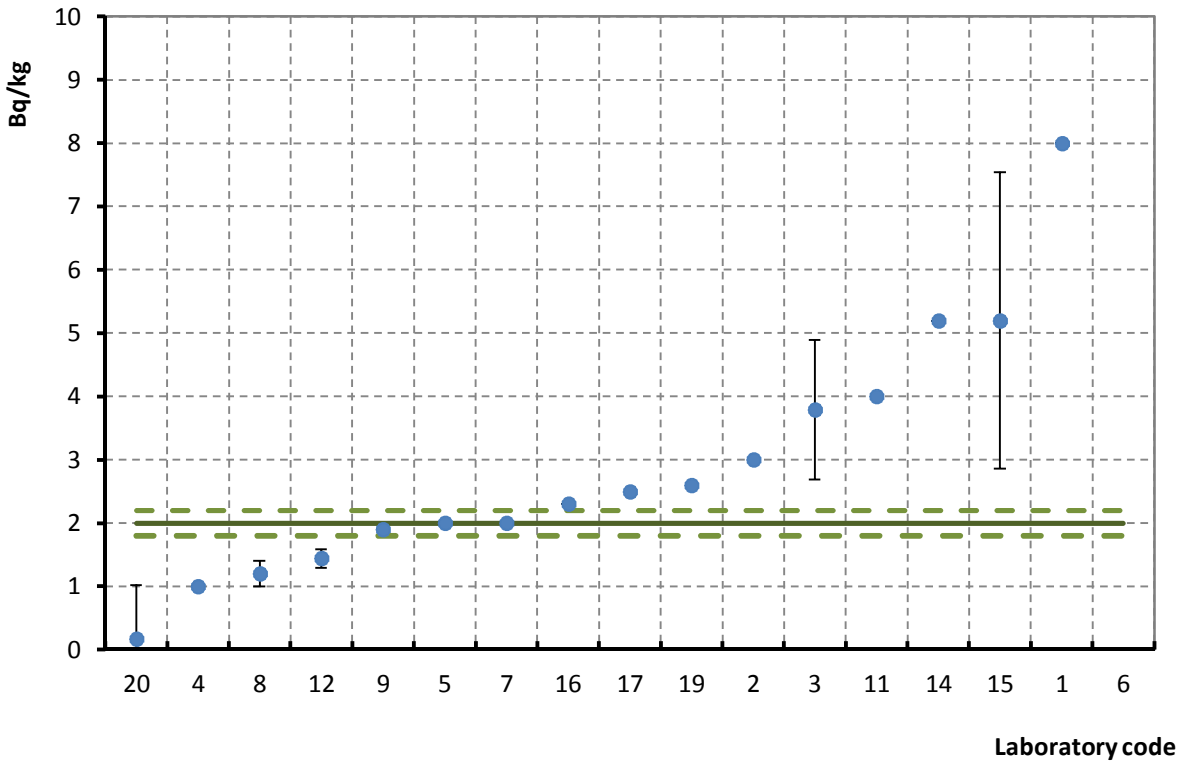

FIG. 48. The reported results of Cs-137 in grass (sample 05).

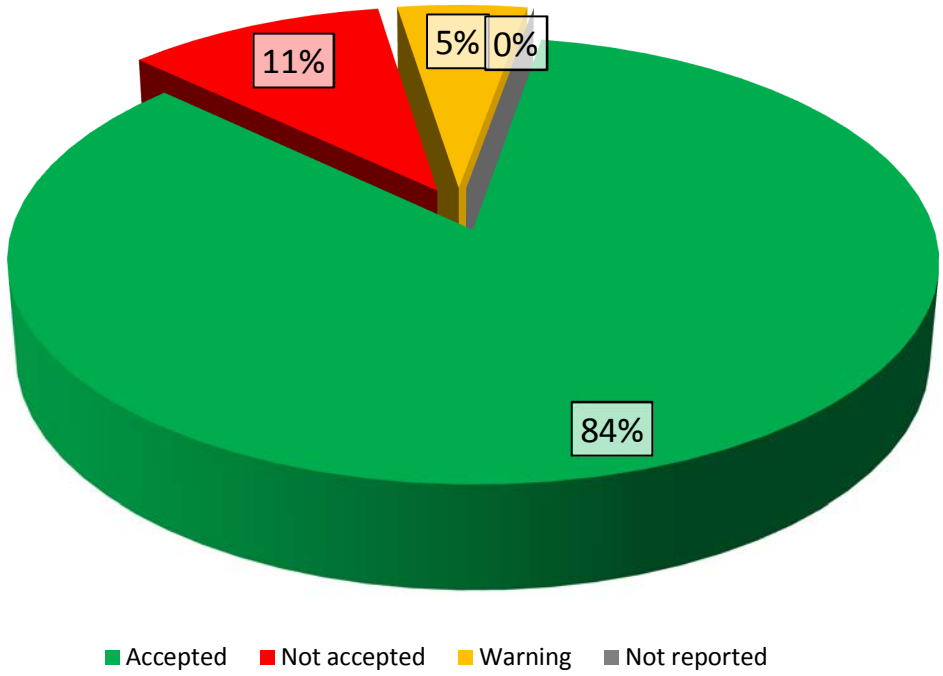

FIG. 49. The distribution of the u-scores for Cs-137 in grass (sample 06).

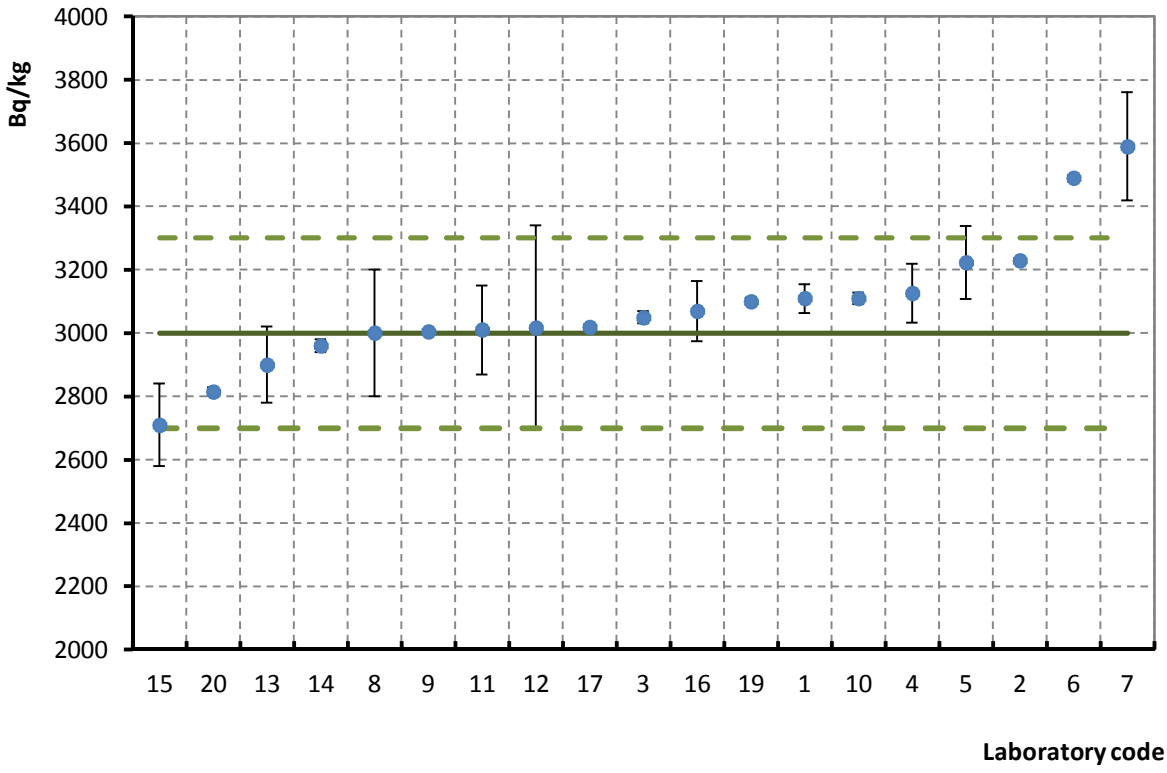

FIG. 50. The reported results of Cs-137 in grass (sample 06).

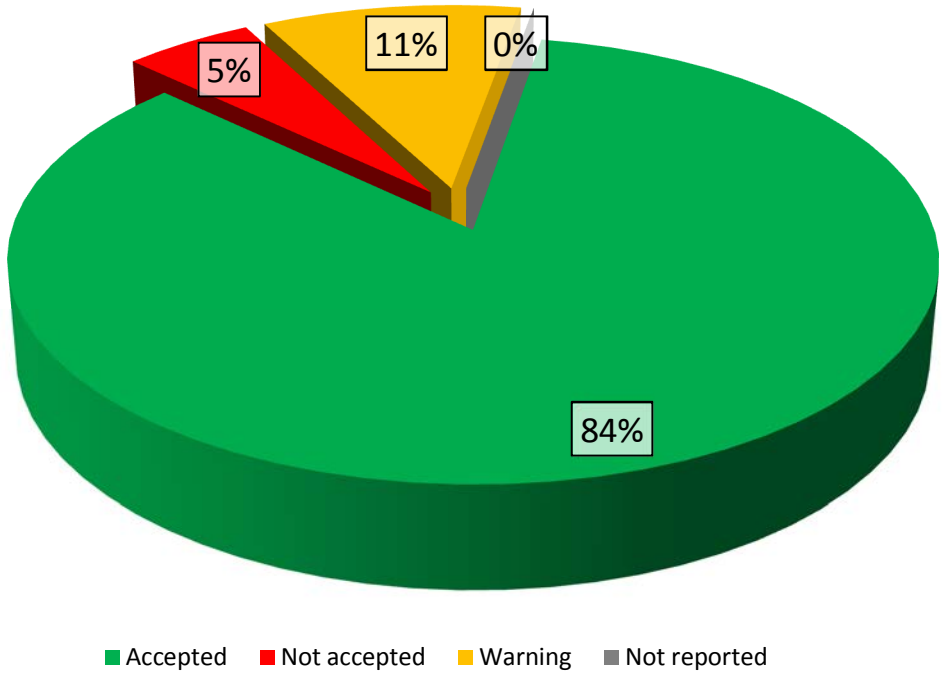

FIG. 51. The distribution of the u-scores for Cs-137 in grass (sample 07).

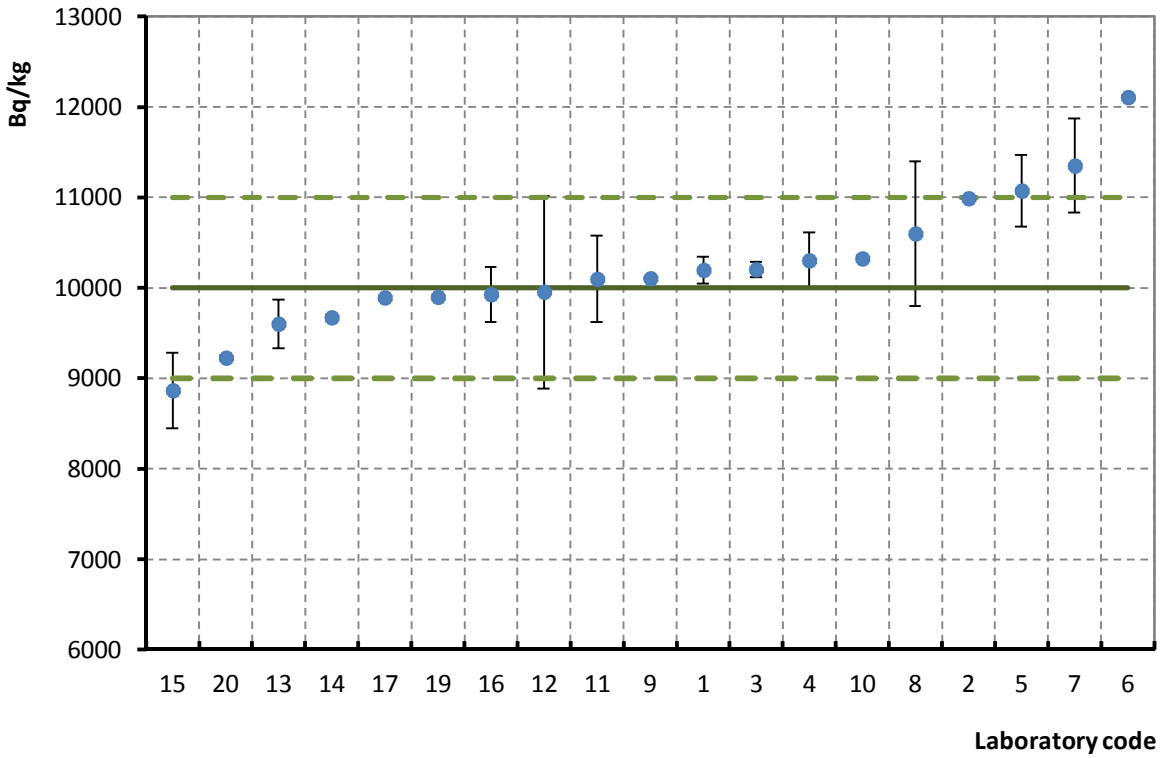

FIG. 52. The reported results of Cs-137 in grass (sample 07).

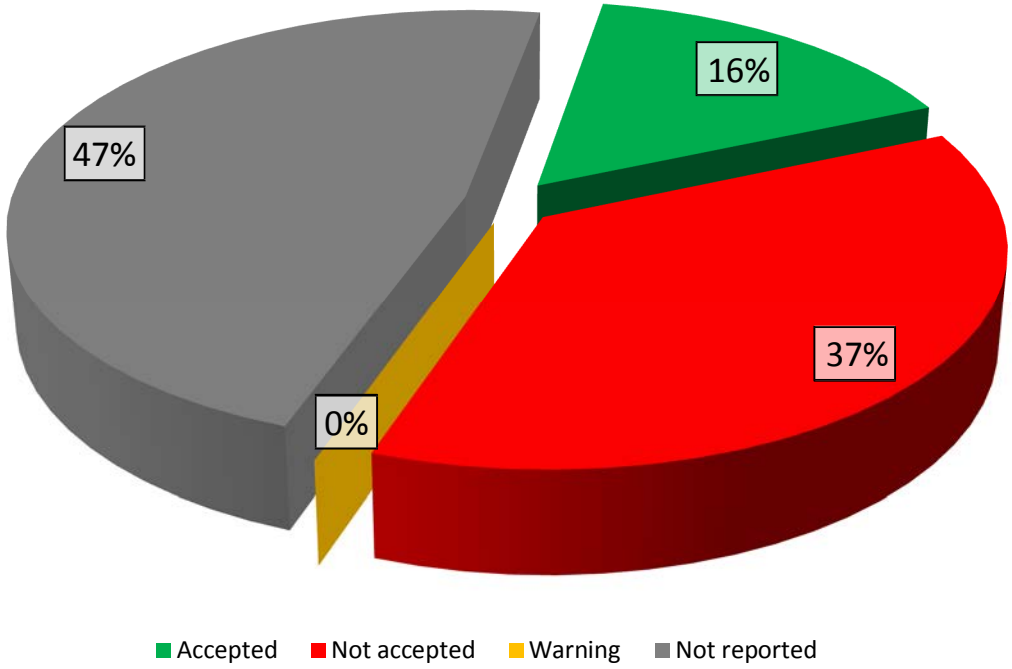

FIG. 53. The distribution of the u-scores for Am-241 in filter (sample 08).

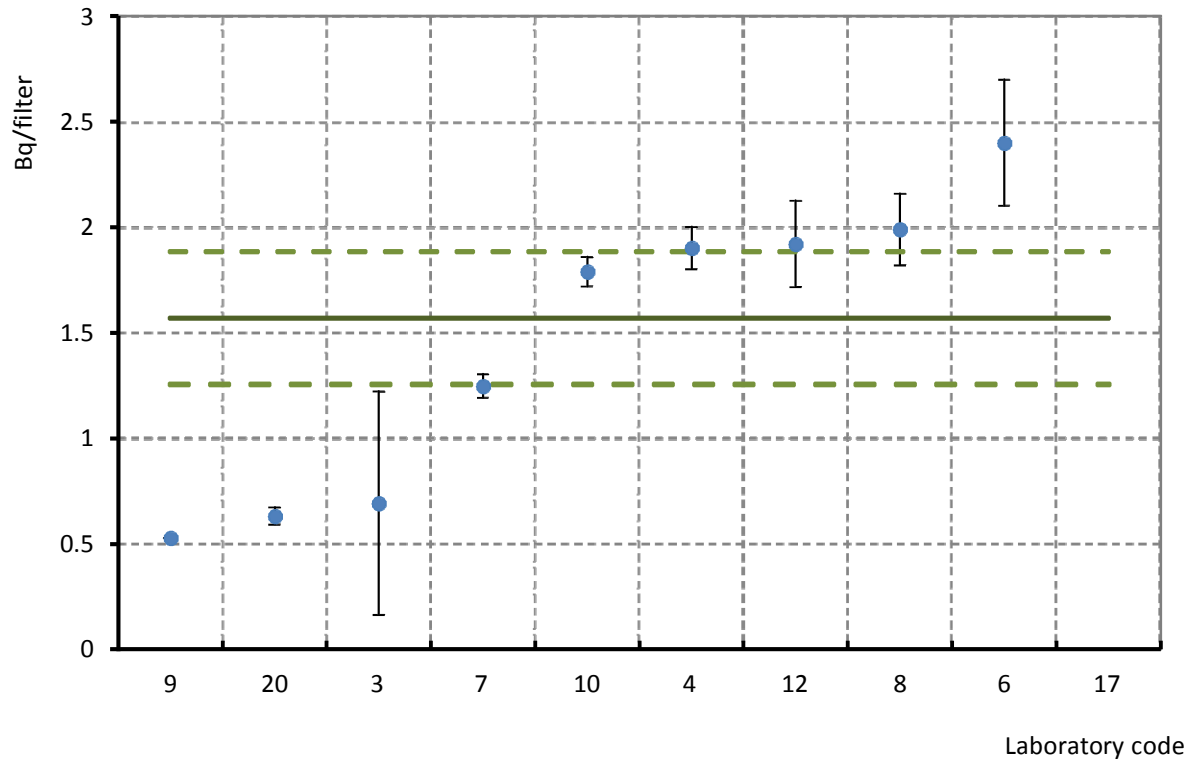

FIG. 54. The reported results of Am-241 in filter (sample 08).

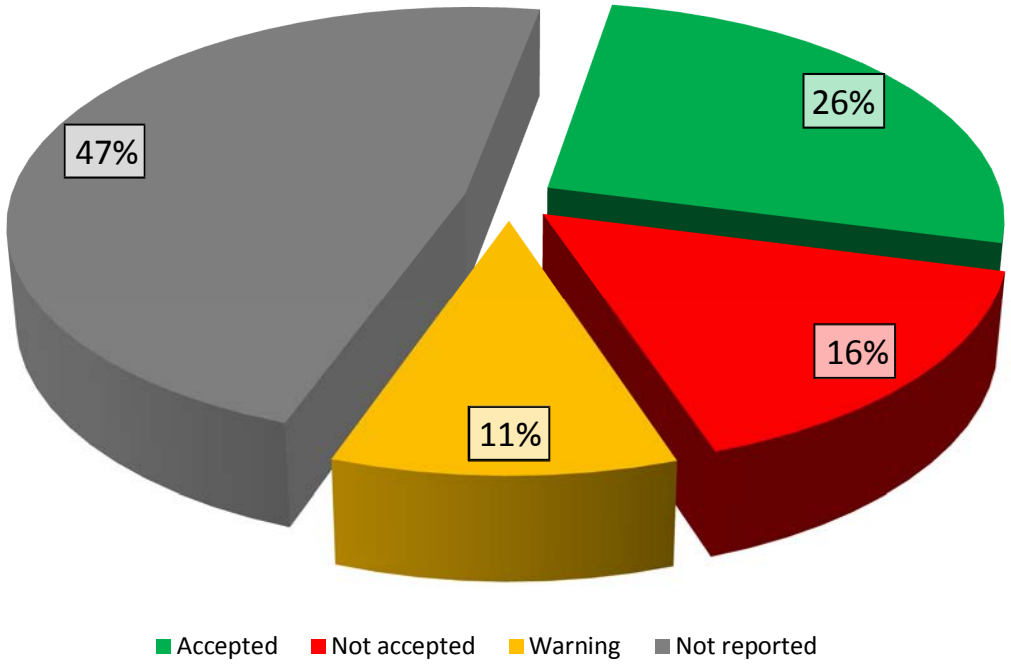

FIG. 55. The distribution of the u-scores for Co-57 in filter (sample 08).

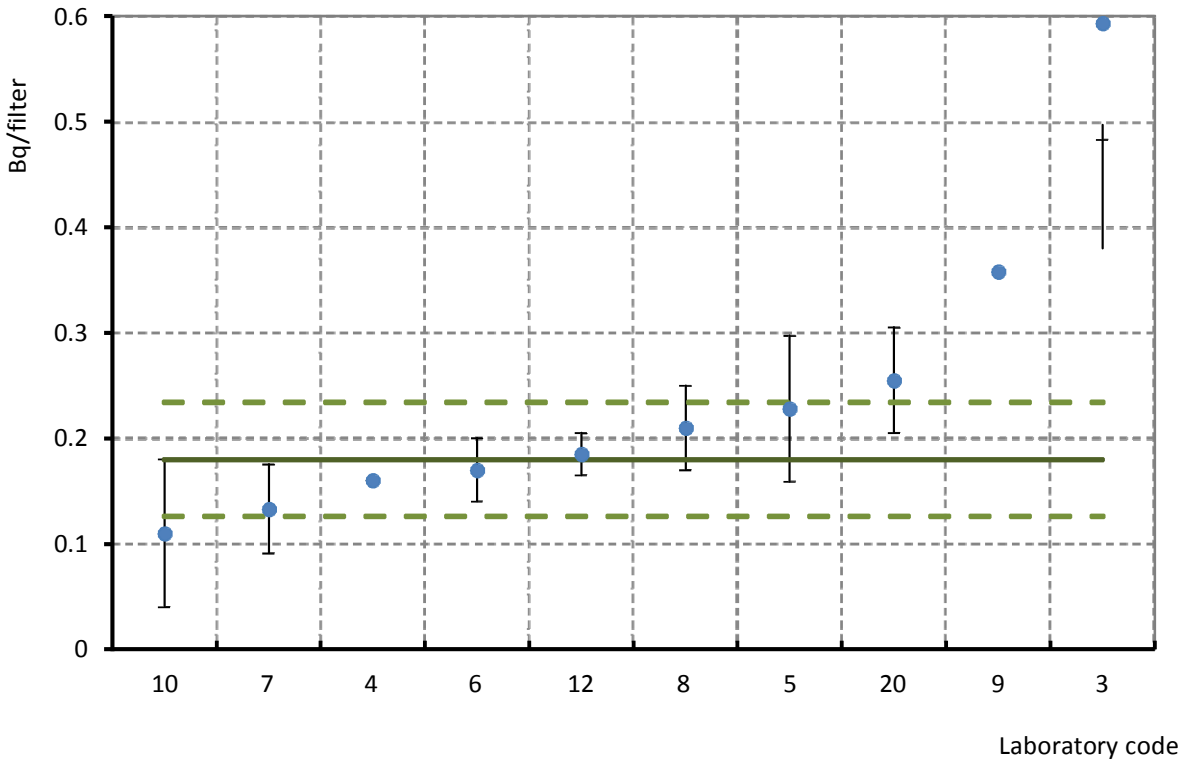

FIG. 56. The reported results of Co-57 in filter (sample 08).

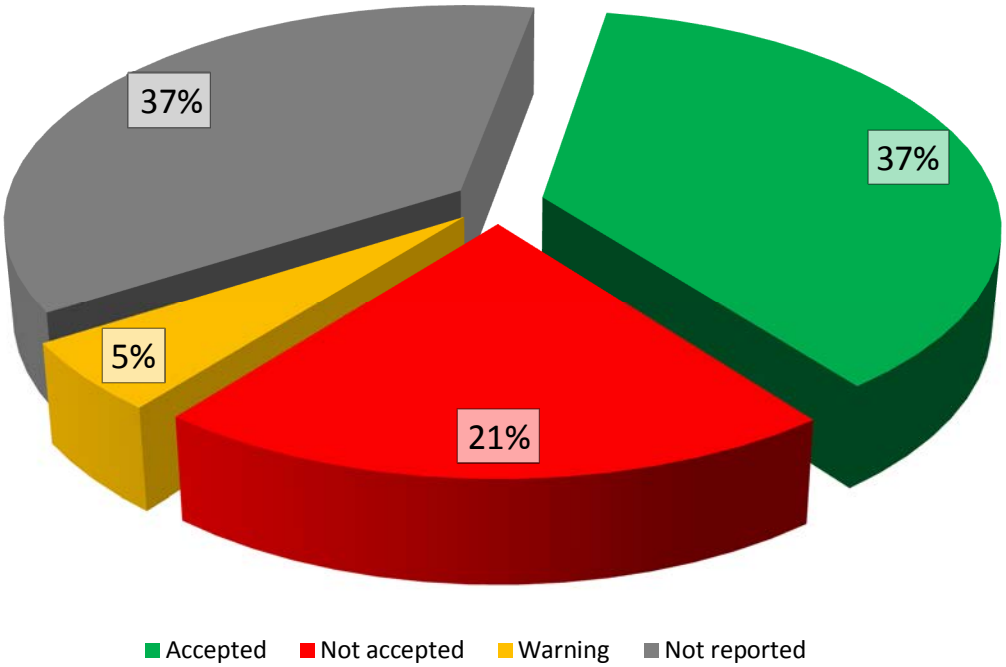

FIG. 57. The distribution of the u-scores for Cs-134 in filter (sample 08).

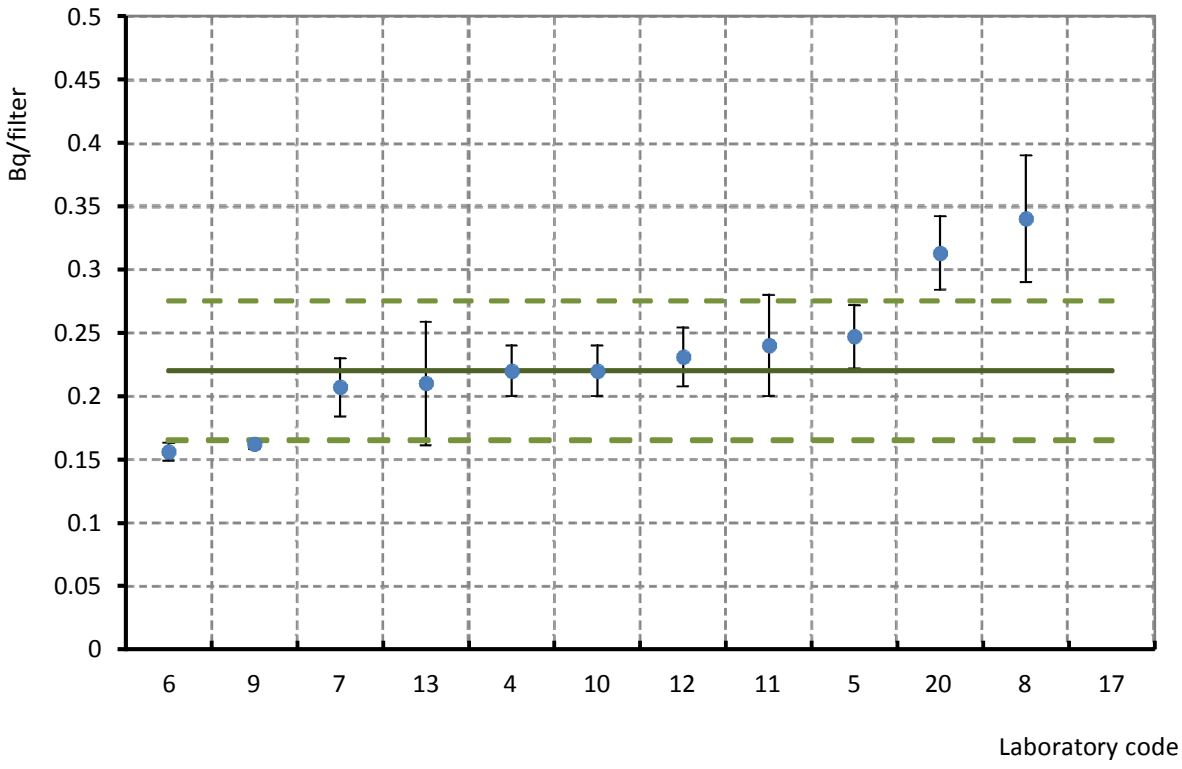

FIG. 58. The reported results of Cs-134 in filter (sample 08).

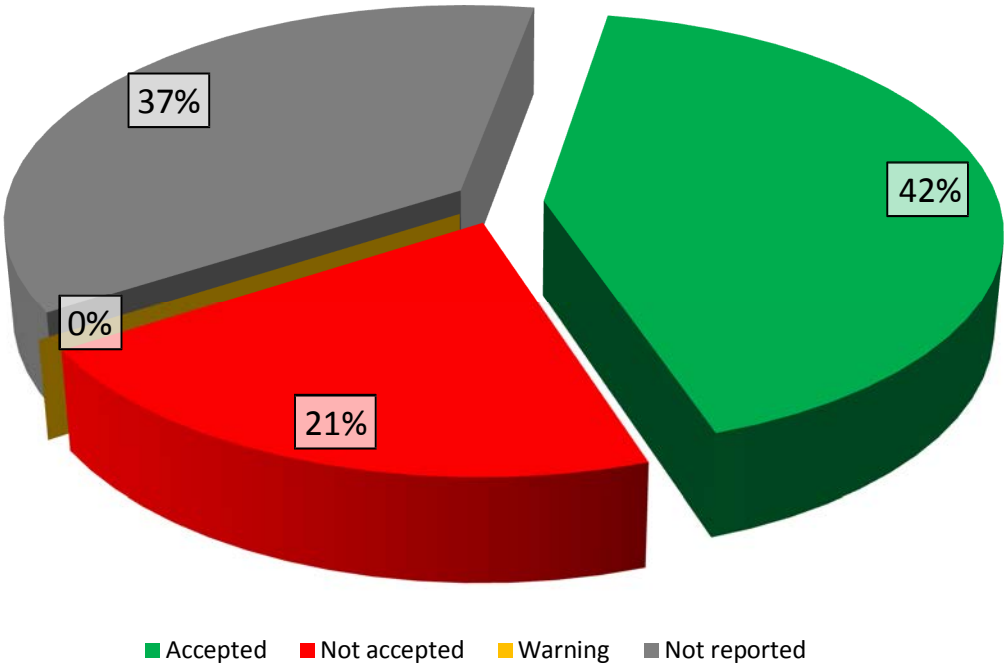

FIG. 59. The distribution of the u-scores for Cs-137 in filter (sample 08).

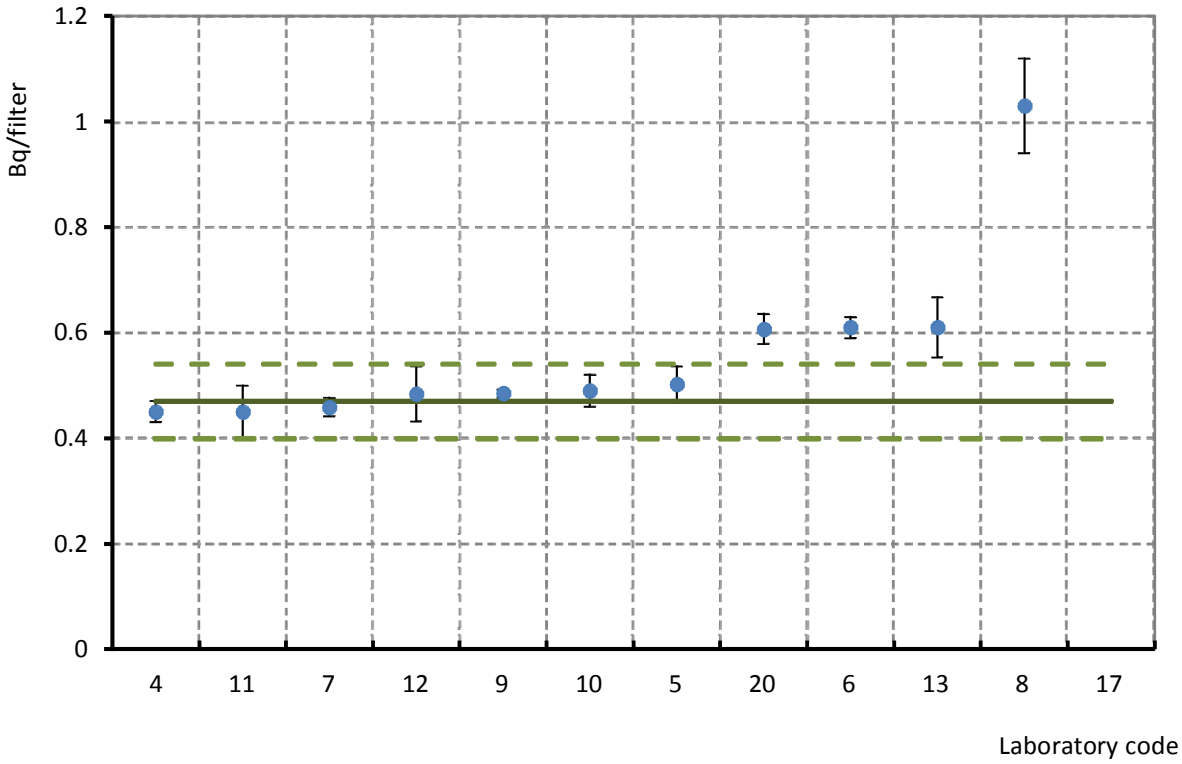

FIG. 60. The reported results of Cs-137 in filter (sample 08).

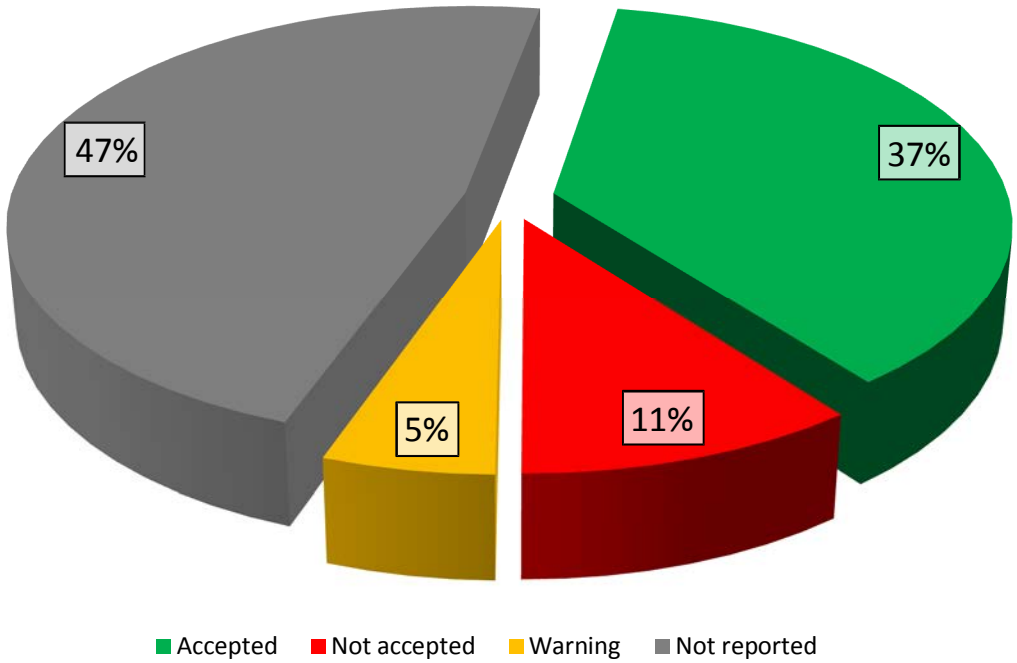

FIG. 61. The distribution of the u-scores for Eu-152 in filter (sample 08).

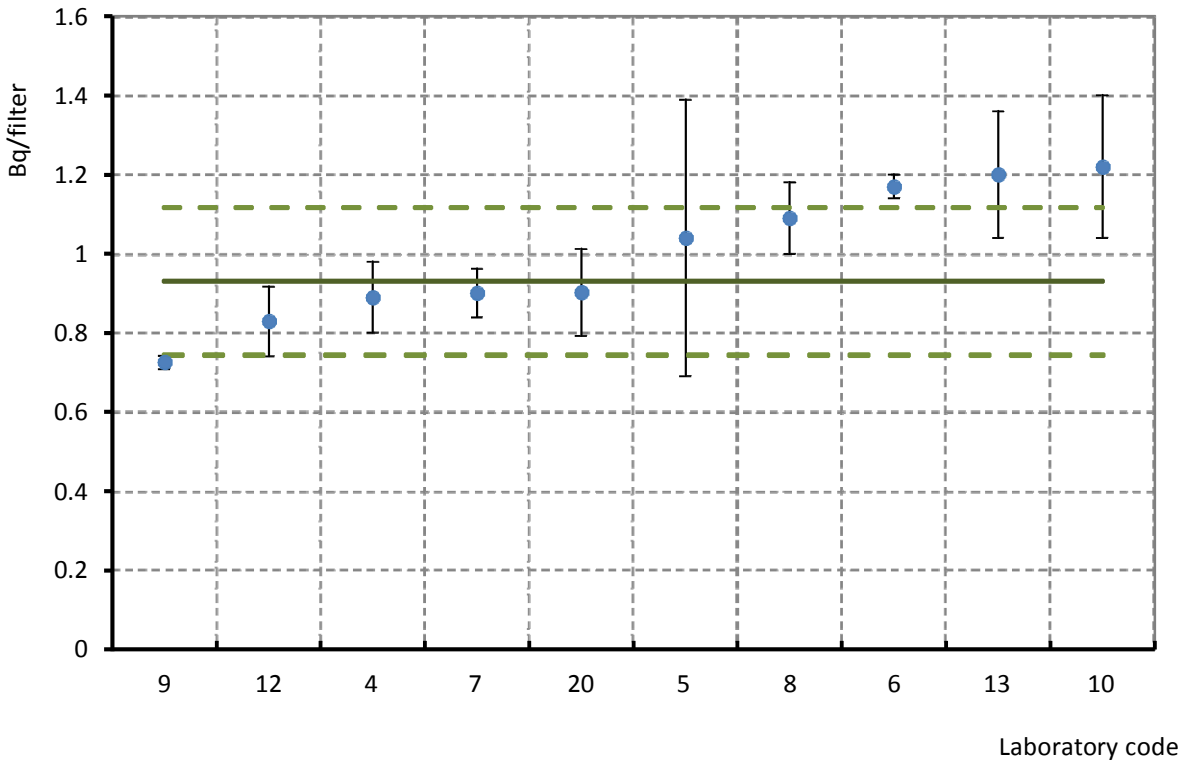

FIG. 62. The reported results of Eu-152 in filter (sample 08).

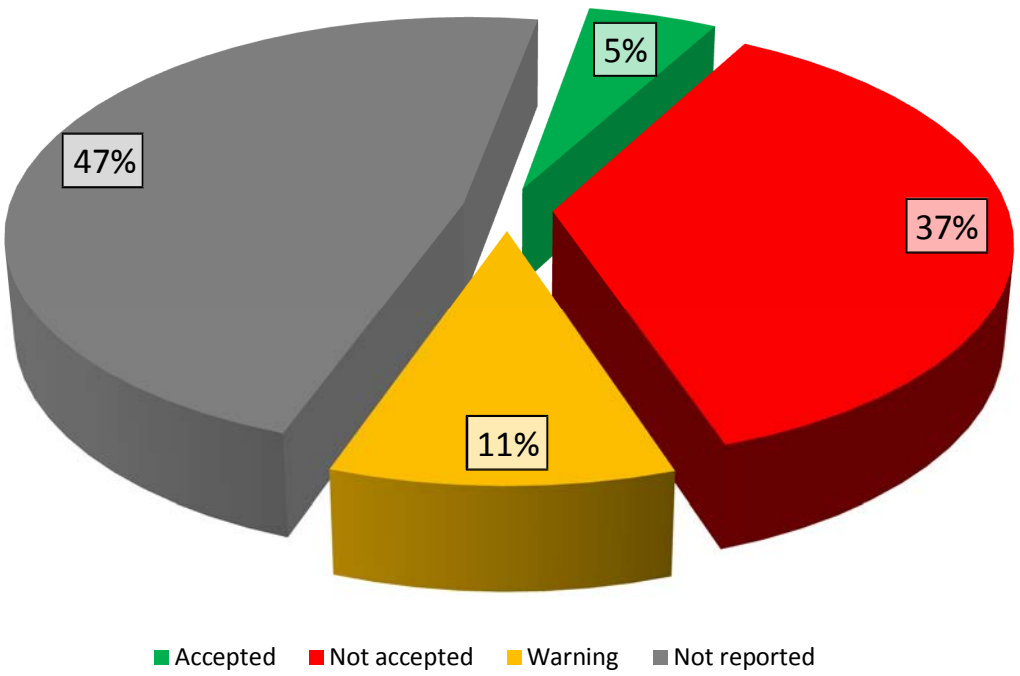

FIG. 63. The distribution of the u-scores for Am-241 in filter (sample 09).

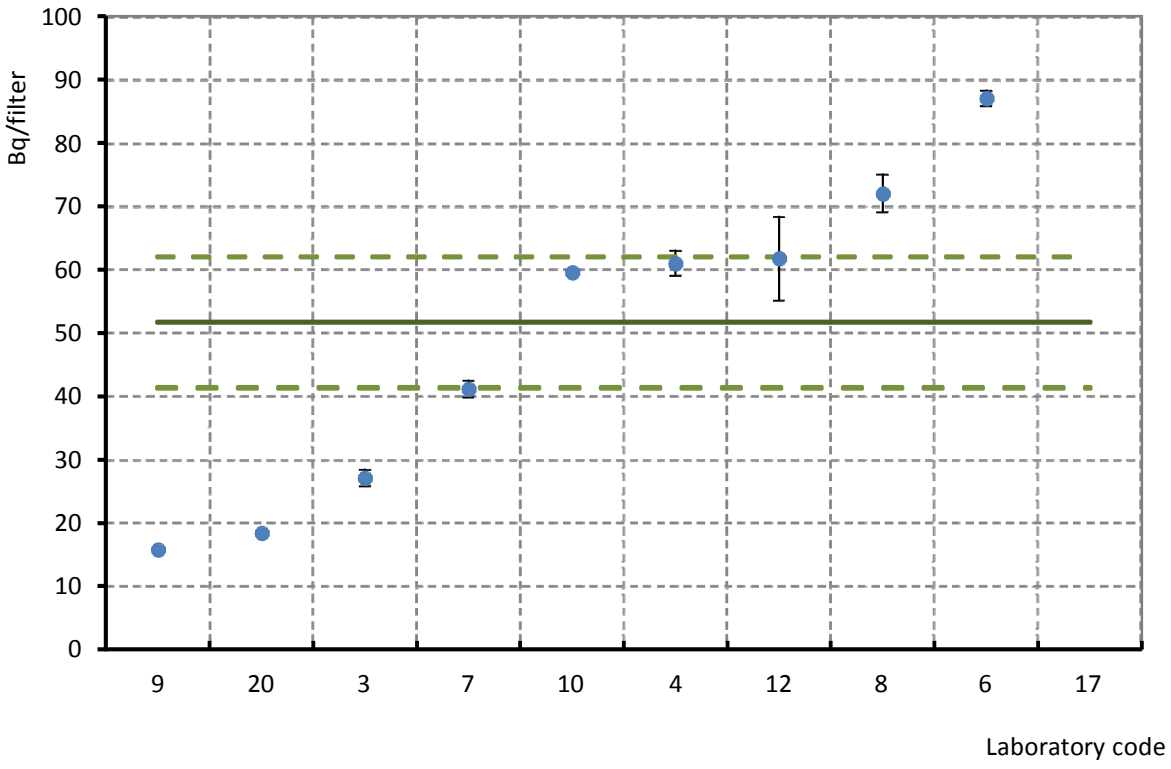

FIG. 64. The reported results of Am-241 in filter (sample 09).

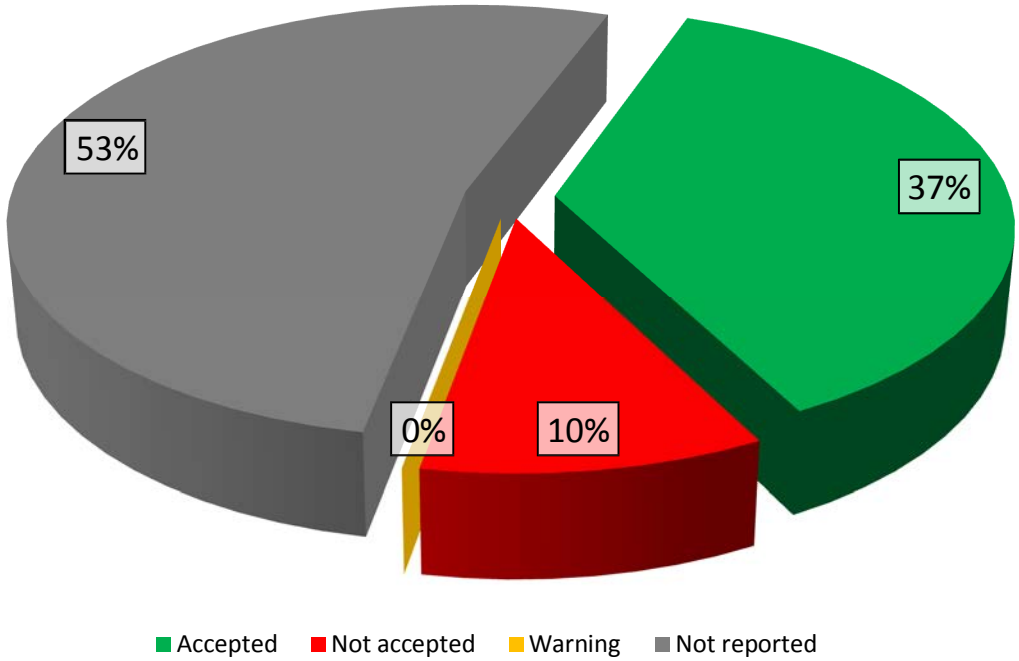

FIG. 65. The distribution of the u-scores for Co-57 in filter (sample 09).

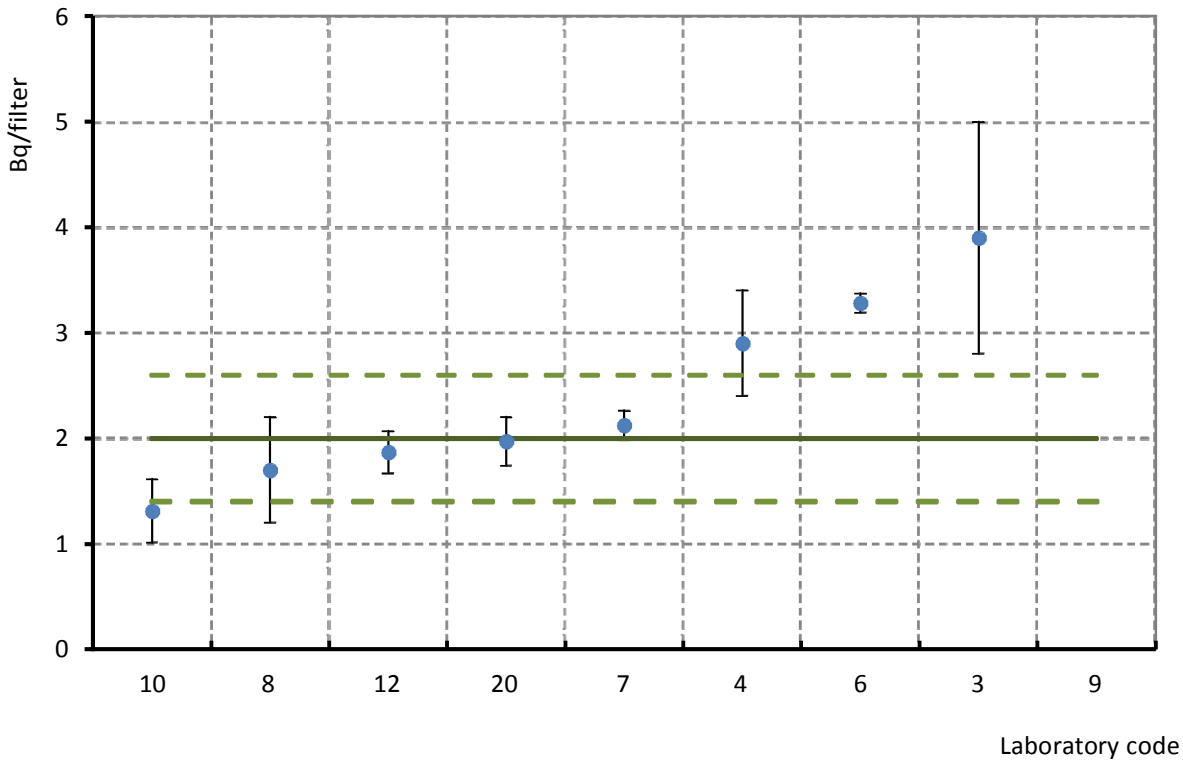

FIG. 66. The reported results of Co-57 in filter (sample 09).

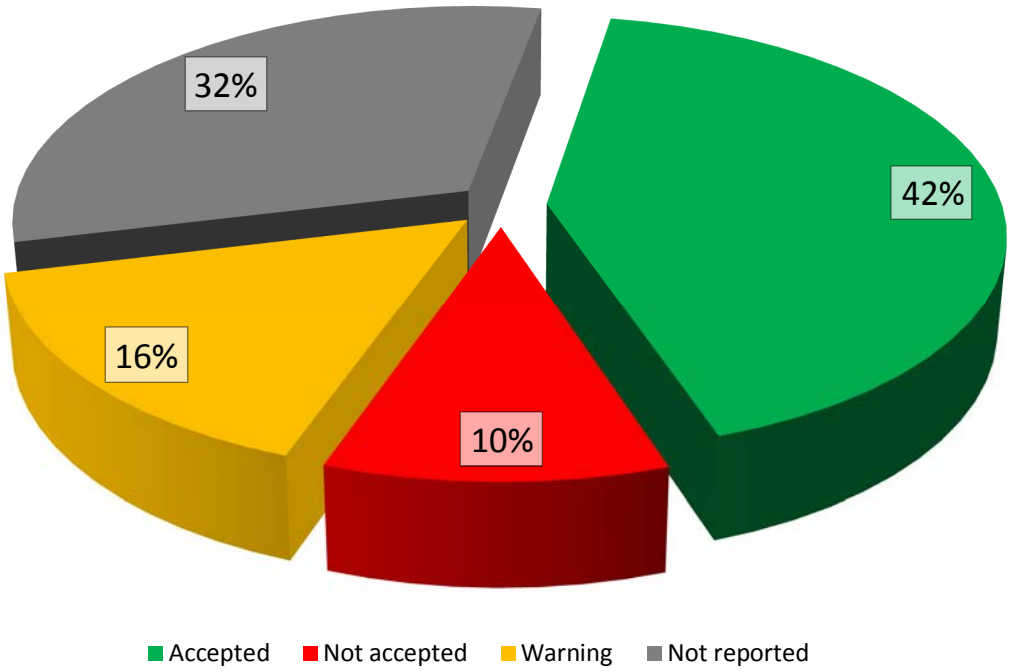

FIG. 67. The distribution of the u-scores for Cs-134 in filter (sample 09).

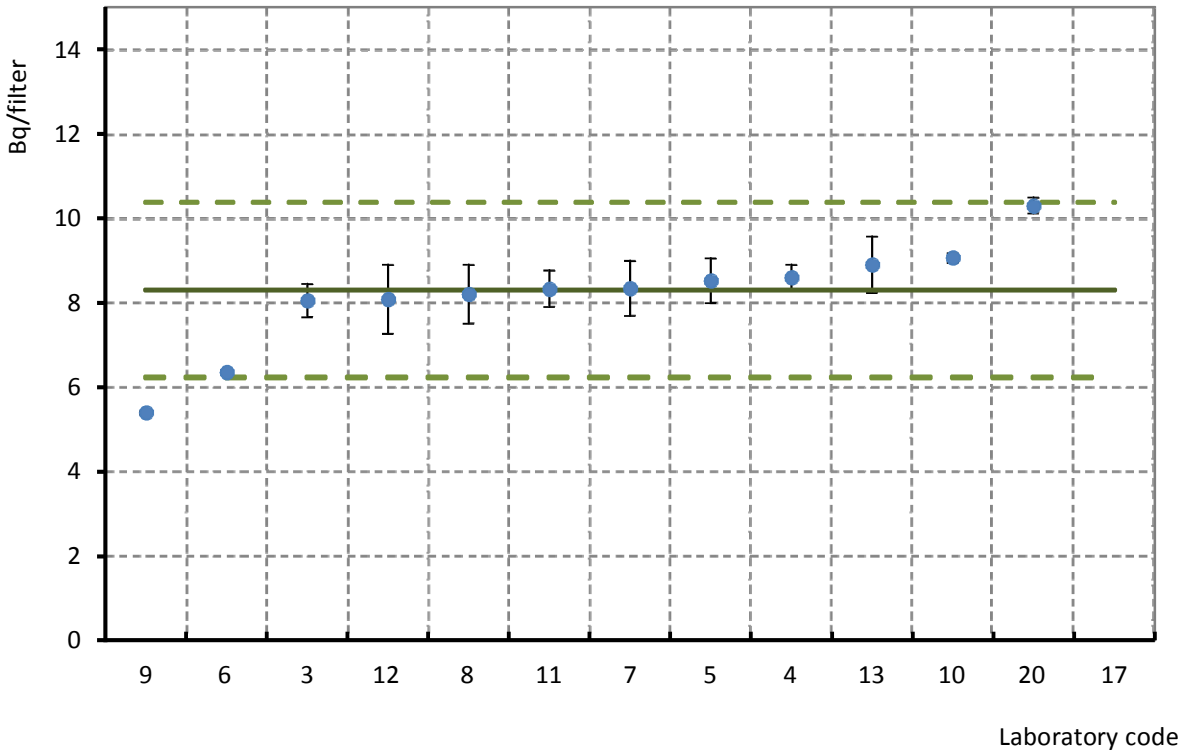

FIG. 68. The reported results of Cs-134 in filter (sample 09).

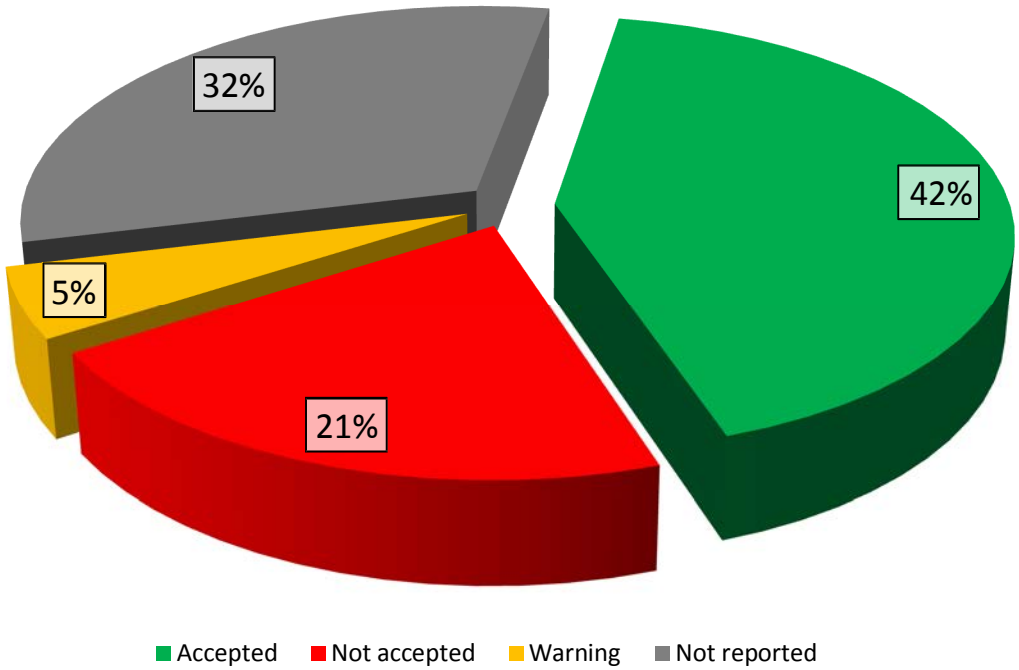

FIG. 69. The distribution of the u-scores for Cs-137 in filter (sample 09).

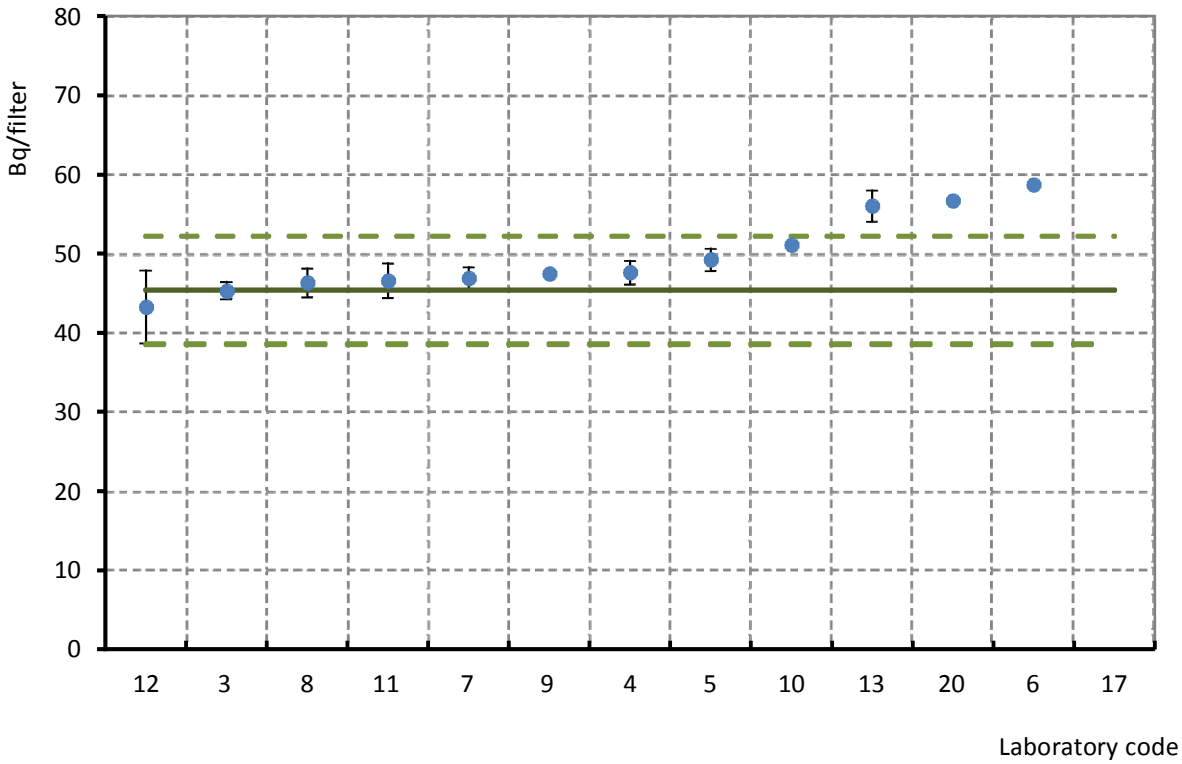

FIG. 70. The reported results of Cs-137 in filter (sample 09).

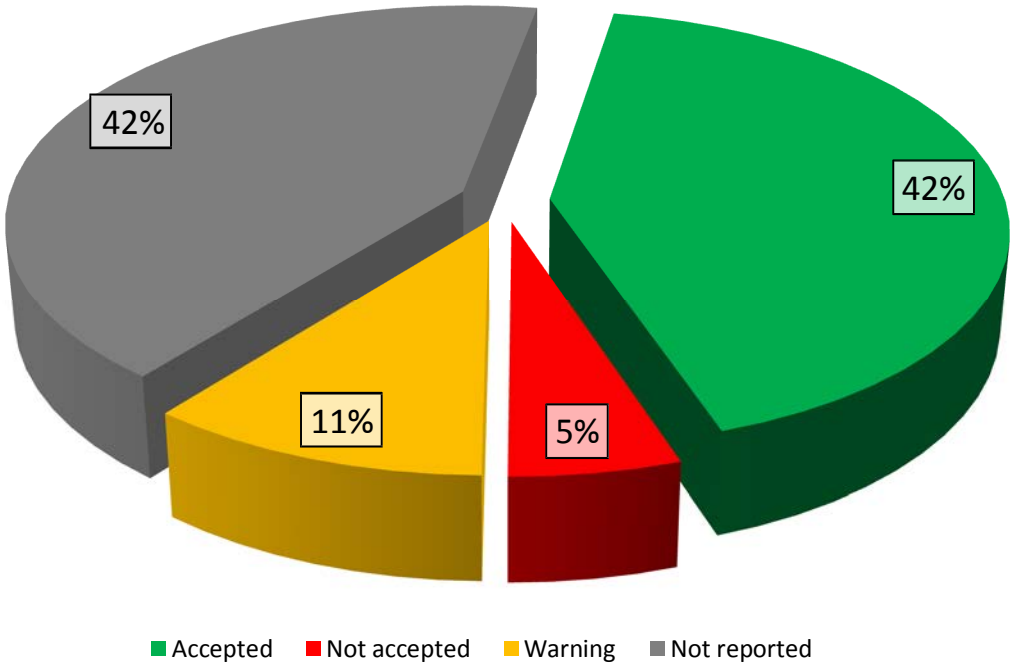

FIG. 71. The distribution of the u-scores for Eu-152 in filter (sample 09).

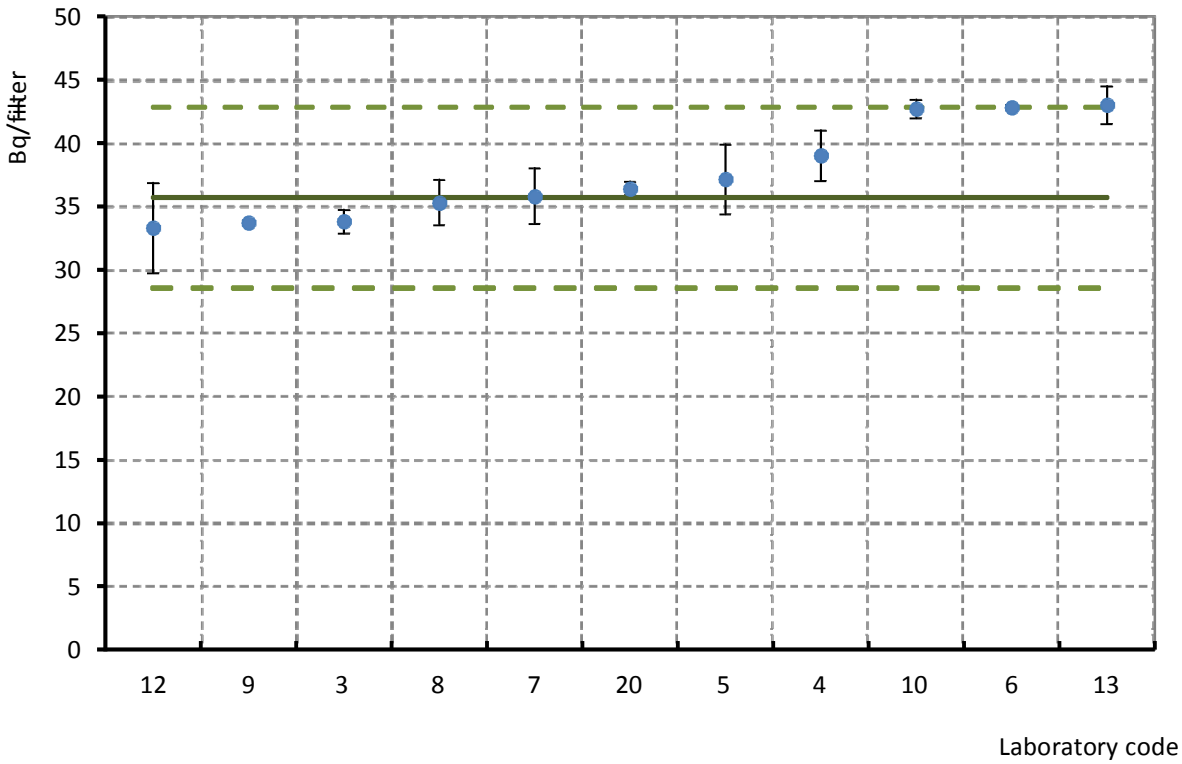

FIG. 72. The reported results of Eu-152 in filter (sample 09).

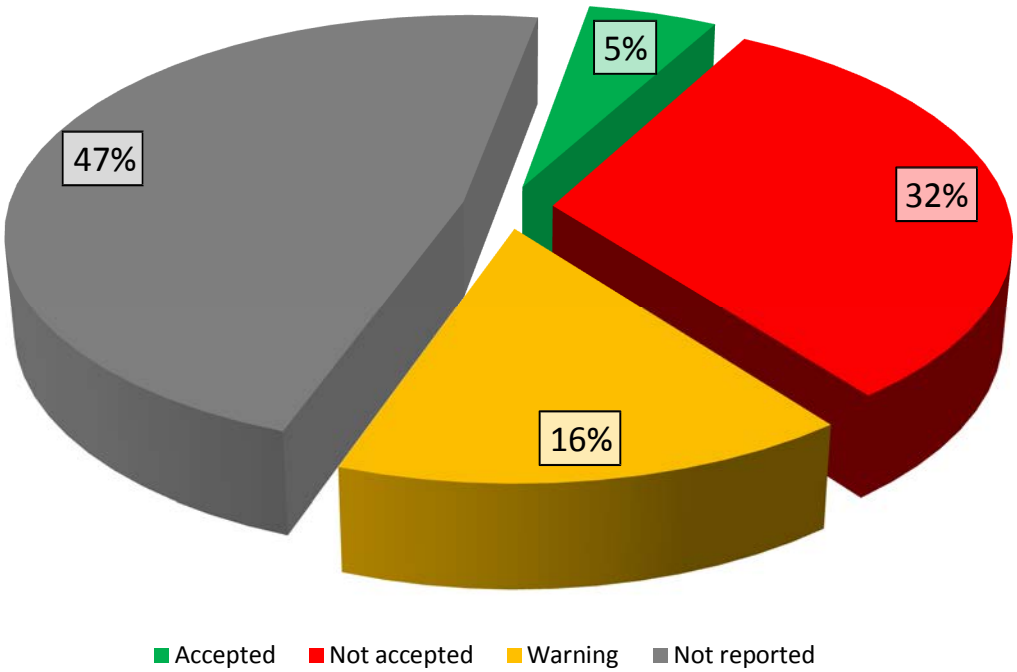

FIG. 73. The distribution of the u-scores for Am-241 in filter (sample 10).

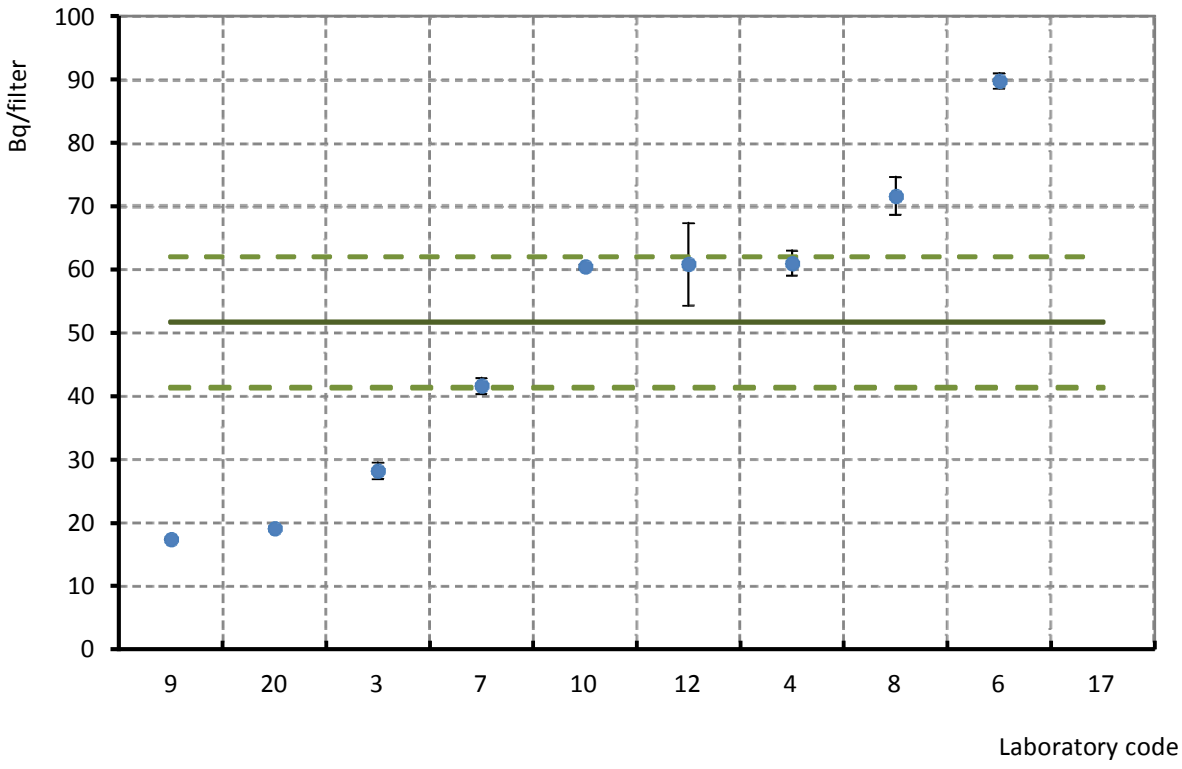

FIG. 74. The reported results of Am-241 in filter (sample 10).

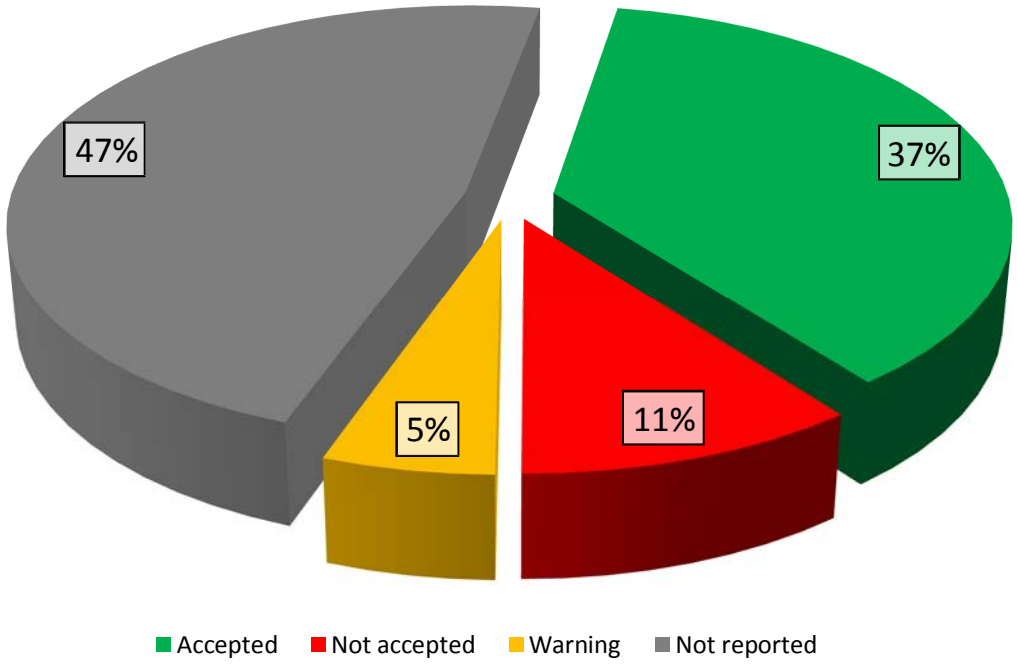

FIG. 75. The distribution of the u-scores for Co-57 in filter (sample 10).

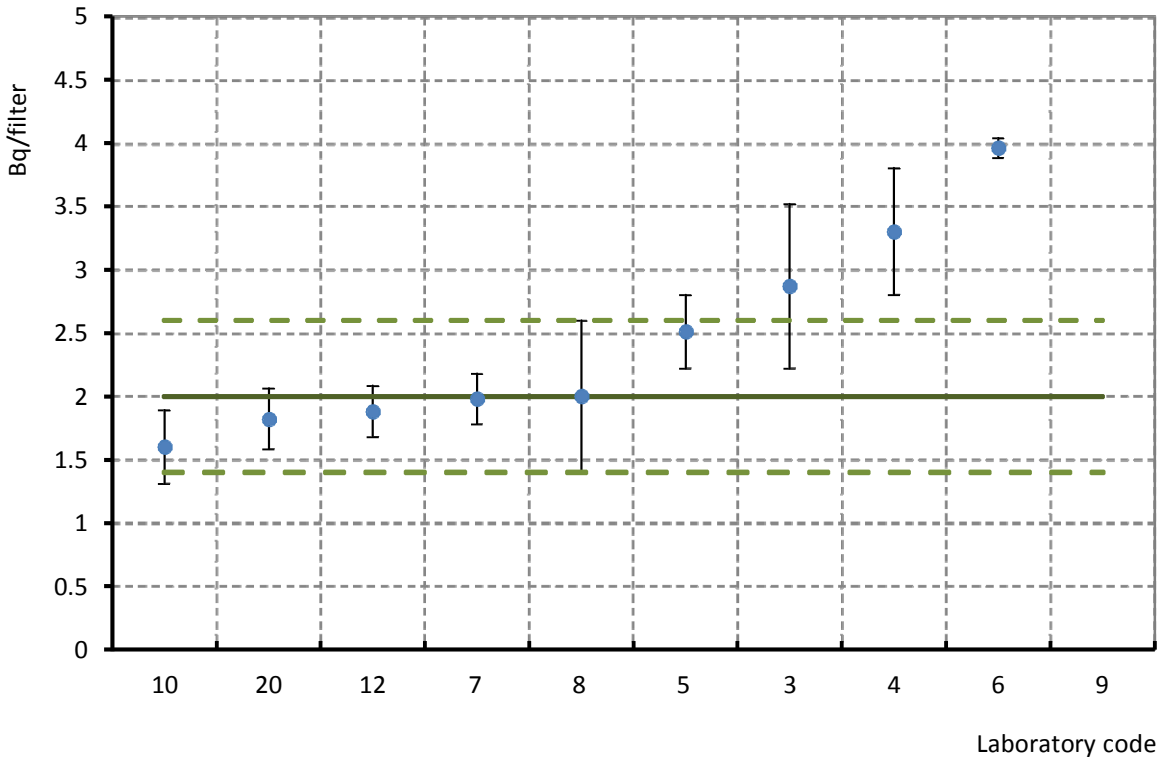

FIG. 76. The reported results of Co-57 in filter (sample 10).

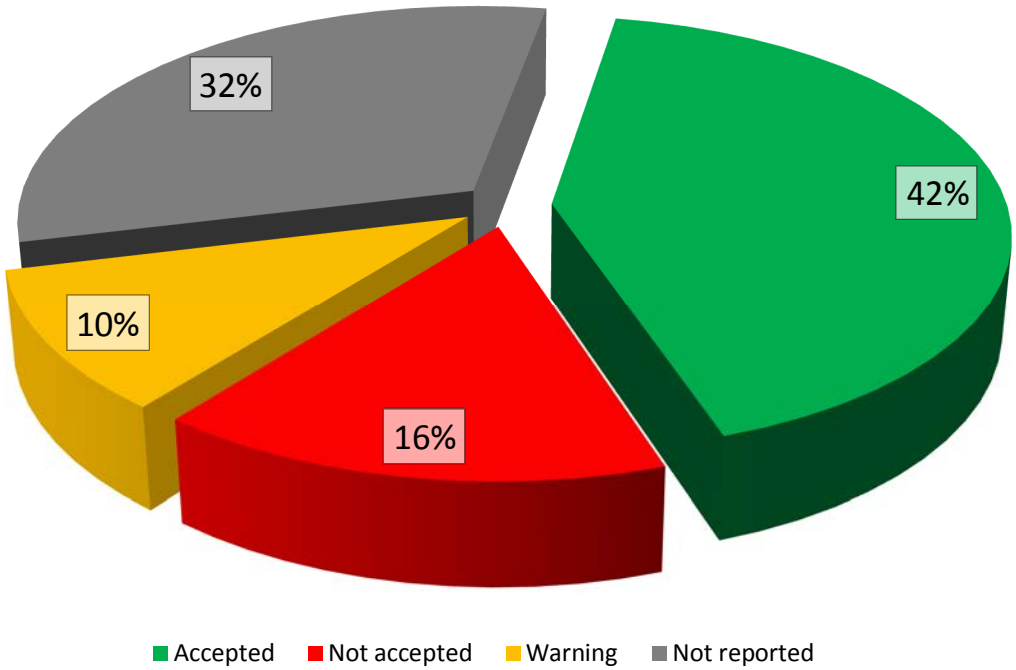

FIG. 77. The distribution of the u-scores for Cs-134 in filter (sample 10).

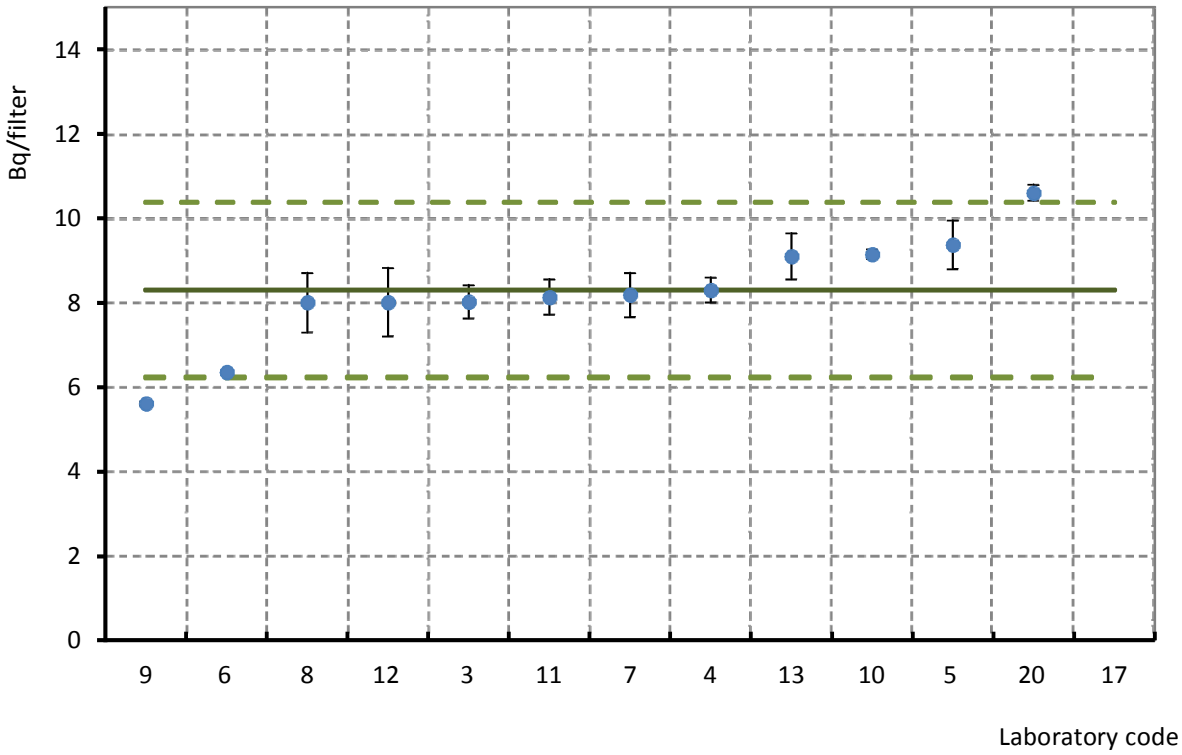

FIG. 78. The reported results of Cs-134 in filter (sample 10).

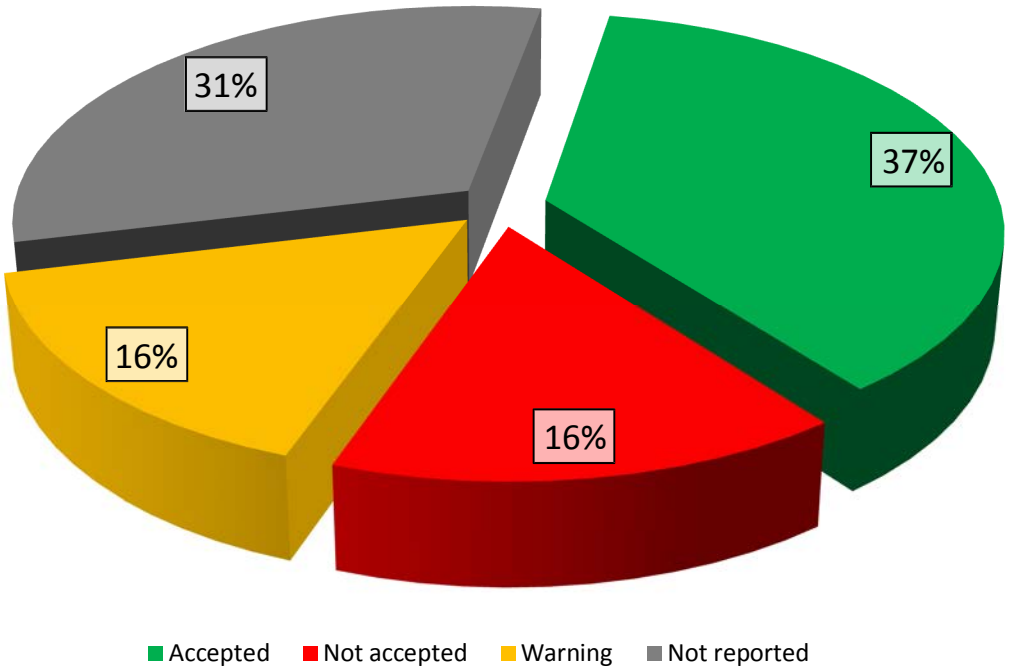

FIG. 79. The distribution of the u-scores for Cs-137 in filter (sample 10).

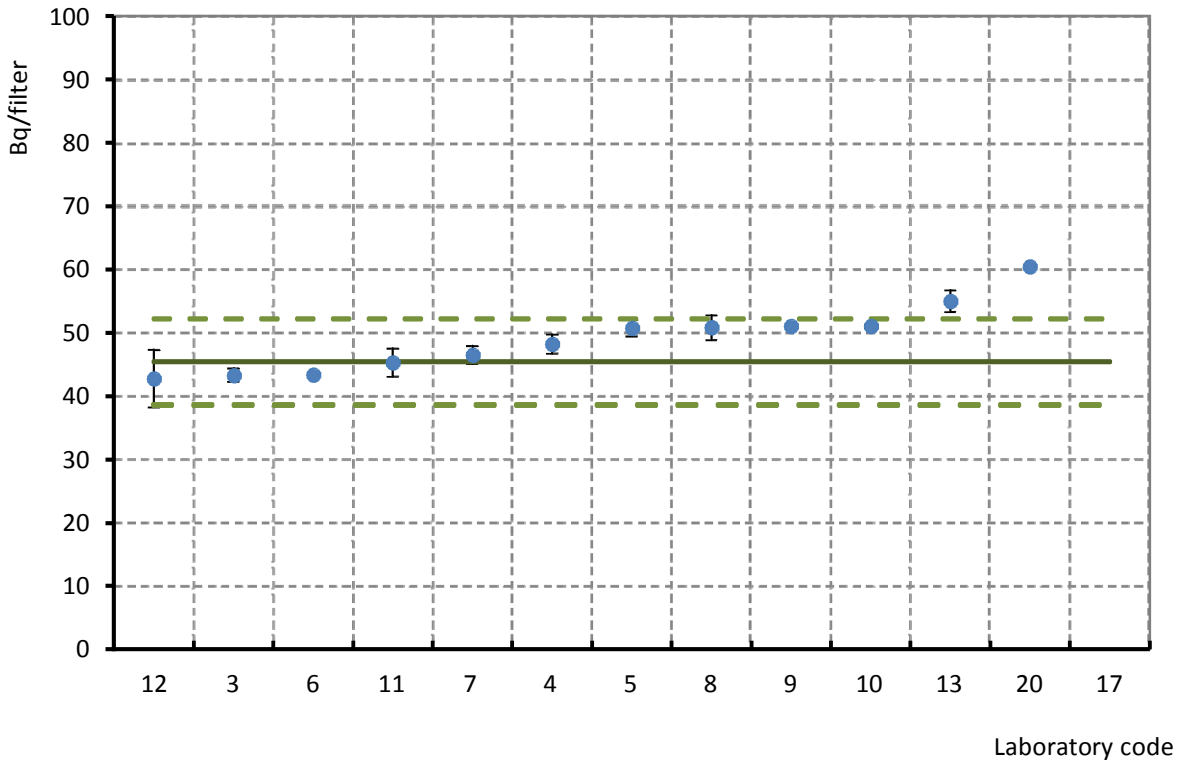

FIG. 80. The reported results of Cs-137 in filter (sample 10).

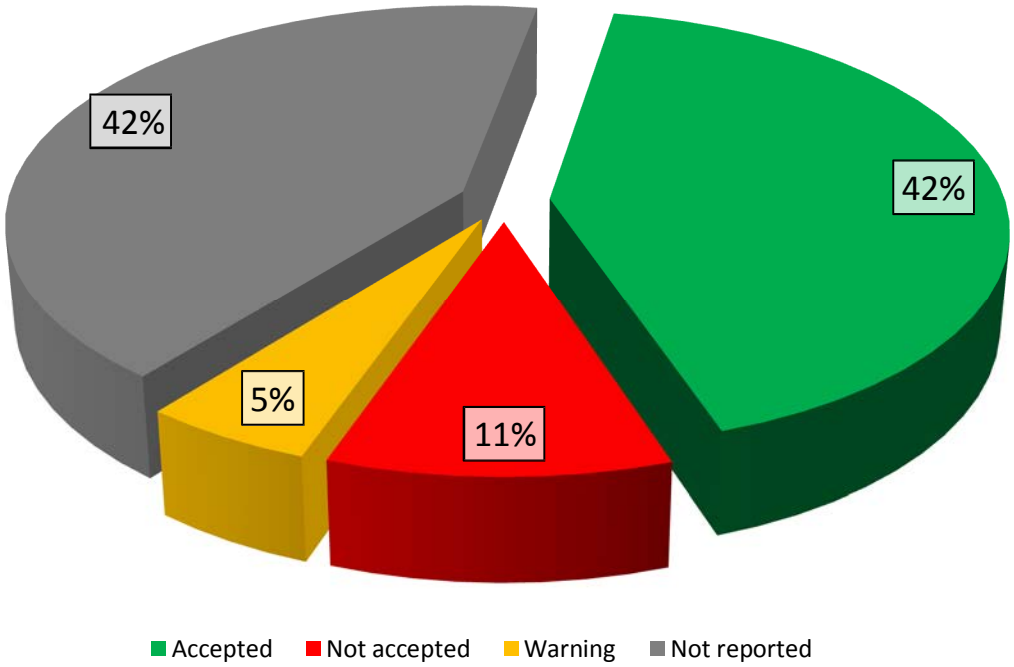

FIG. 81. The distribution of the u-scores for Eu-152 in filter (sample 10).

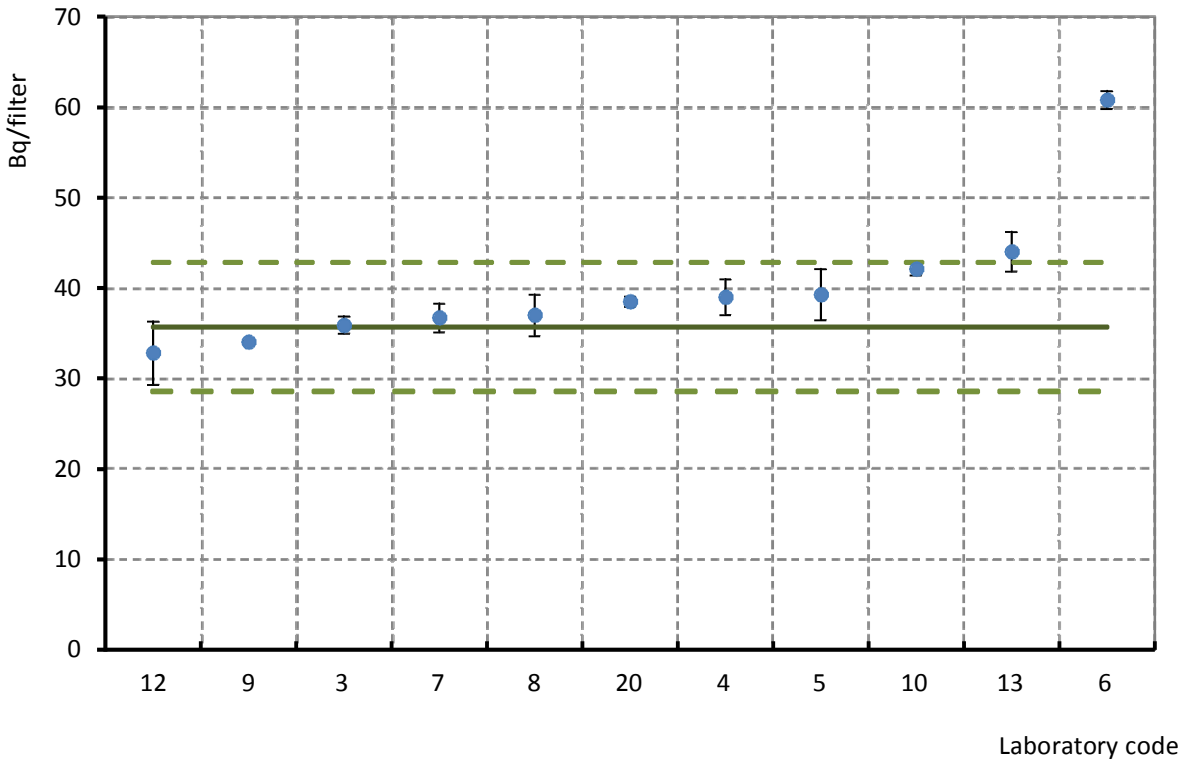

FIG. 82. The reported results of Eu-152 in filter (sample 10).

APPENDIX III

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