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ALMERA Proficiency Test on the Determination of Radionuclides in Spinach, Soil and Water

IAEA-CU-2007-04

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INTERNATIONAL ATOMIC ENERGY AGENCY
VIENNA, 2009

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FOREWORD

The Analytical Laboratories for the Measurement of Environmental Radioactivity (ALMERA) network established by the IAEA in 1995 makes available to Member States a world-wide network of analytical laboratories capable of providing reliable and timely analysis of environmental samples in the event of an accidental or intentional release of radioactivity. The network is a technical collaboration of existing institutions. It provides an operational framework to link expertise and resources, in particular when a boundary-transgressing contamination is expected or when an event is of international significance.

A primary requirement of the ALMERA members is participation in the IAEA interlaboratory comparisons which are specifically organized for ALMERA on a regular basis. These exercises are designed to monitor and demonstrate the performance and analytical capabilities of the network members, and to identify gaps and problem areas where further development is needed. Continued membership has benefits in training and educational opportunities, enhanced mutual trust in results and methodology and objective evidence for accreditation purposes.

The performance evaluation results of the proficiency tests performed in the frame of the ALMERA network are not anonymous for those laboratories nominating to participate as ALMERA members.

The Chemistry Unit of the Physics, Chemistry and Instrumentation Laboratory in the IAEA Laboratory, Seibersdorf in Austria, has the programmatic responsibility to support activities in Member States laboratories, including coordination of ALMERA network.

This report describes the methodology employed and the results obtained in the IAEA-CU-2009-04 proficiency test on determination of radionuclides in spinach, soil and water.

The IAEA officer responsible for this publication is A. Shakhashiro of the Agency's Laboratories, Seibersdorf and Headquarters, Austria.

EDITORIAL NOTE

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CONTENTS

1. INTRODUCTION

The use of reference materials and interlaboratory comparison exercises are among the most important tools for the production of reliable measurement results and for the achievement of a required quality level. Through the evaluation reports provided to the participating laboratories in the interlaboratory comparison exercises, the IAEA provides direct consultation and guidance on appropriate measurement techniques to be applied, and identifies gaps and problem areas where further development is needed. This helps participating laboratories to improve both their measurement techniques and performance. With the advent of "mutual recognition" on both a European and world wide basis, it is now essential that laboratories participate in proficiency testing schemes that will provide an interpretation and assessment of results which is transparent to the participating laboratory and its "customer".

The Chemistry Unit of the Physics, Chemistry and Instrumentation Laboratory in the Agency's Laboratory, Seibersdorf in Austria, has the programmatic responsibility to provide assistance to Member State laboratories in maintaining and improving the reliability of analytical measurement results, both in trace element and radionuclide determinations. This is accomplished through the provision of reference materials of terrestrial origin, validated analytical procedures, training in the implementation of internal quality control, and through the evaluation of measurement performance by organization of worldwide and regional interlaboratory comparison exercises.

The activities of the Chemistry Unit are also addressed to support global radionuclide measurement systems, in issues of international concern related to an accidental or intentional release of radioactivity in the environment. To fulfil this obligation and ensure a reliable worldwide, rapid and consistent response, the Chemistry Unit coordinates an international network of Analytical Laboratories for the Measurement of Environmental Radioactivity (ALMERA). The network, established by the IAEA in 1995 [1, 2, 3] makes available to Member States a world-wide network of analytical laboratories capable of providing reliable and timely analysis of environmental samples in the event of an accidental or intentional release of radioactivity. The network is a technical collaboration of existing institutions. It provides an operational framework to link expertise and resources, in particular when a boundary-transgressing contamination is expected or when an event is of international significance.

A primary requirement of the ALMERA members is participation in the IAEA interlaboratory comparison exercises which are specifically organized for ALMERA on a regular basis. These exercises are designed to monitor and demonstrate the performance and analytical capabilities of the network members, and to identify gaps and problem areas where further development is needed. Continued membership has benefits in training and educational opportunities, enhanced mutual trust in results and methodology and objective evidence for accreditation purposes.

The performance evaluation results of the proficiency test performed in the frame of the ALMERA network are not anonymous for those laboratories nominating to participate as ALMERA members.

In the proficiency test described in this report, 250 test samples (reference materials) were prepared and distributed to the participating laboratories in June 2006. Laboratories were sent samples containing known activities of gamma emitting radionuclides in three matrices (soil, spinach and water), and were requested to return the results within three days of receipt of the samples (short-term reporting). The participating laboratories were also requested to analyse the samples employing the methods used in their routine work, and were given three months to report long term results so that their performance on the test samples could be directly related to the real performance of the rapid reporting.
Thirty six laboratories reported their results in the rapid mode of reporting and fifty eight laboratories from 46 different Member States reported their results in the normal long term reporting mode.

The efforts of participants and laboratories who responded to this proficiency test and contributed to the present work are highly appreciated and acknowledged.

The IAEA is appreciative of the contribution of the following institutes in the characterisation of the spinach sample IAEA-330:

- STUK-Radiation and Nuclear Safety Authority, Radionuclide Analytics, Helsinki, Finland.
- Institute of Isotopes, Hungarian Academy of Sciences, Budapest, Hungary.
- The Hungarian Agricultural Authority, Central Radioanalytical Laboratory, Budapest, Hungary. (IAEA collaborating center for preparation of reference materials)
- Korea Institute of Nuclear Safety, Daejeon, the Republic of Korea.
- Nuclear and Technological Institute, Department of Radiological Protection and Nuclear Safety, Sacavém, Portugal.

The institutes' contributions were at no cost to the IAEA.

2. MATERIALS AND METHODS

2.1. Proficiency test objectives

The measurement of spinach, soil and water samples containing a mixture of radionuclides with an unknown (to the participants) composition was aiming at:

- assessment of the analytical performance of the ALMERA Members,
- testing the results comparability of radiological measurements amongst ALMERA laboratories and
- assisting ALMERA laboratories in improving their analytical performance.

2.2. Participants

A total of 58 laboratories from 46 Member States (from Europe 36, Asia 14, Latin America 4, Australia 2, Africa 1, North America 1) reported their results to the IAEA. A full listing of participants is given in Appendix III.

2.3. Composition and preparation of proficiency test materials

The following proficiency test design was applied:

- one natural spinach sample (100g)
- one spiked soil sample (200 g)
- one spiked water sample (500 ml)

2.3.1. Preparation of the spiked soil IAEA-444

A soil from China was used to prepare a spiked mineral matrix with 8 gamma emitting radionuclides. Before using the soil for spiking, it was milled and sieved to collect the appropriate fraction at mesh size less than 0.25 mm, and then homogenised.

The matrix of Chinese soil was characterised and a number of samples were pre-screened for radionuclides prior to spiking. The results have shown that the material is free from radionuclides, except for Cs-137, which was present at 2.6 ± 0.2 Bq/kg based on dry mass. (Ref. date: 2006-01-01). In addition, Pb-210 was found at 48 ± 1.5 Bq/kg dry mass. The moisture content was found to be 2.3 ± 0.5 %.

The preparation of the spiked soil sample was performed according to a validated procedure, full details can be found in [4].

The target values were established based on the certified activity values assigned to each radionuclide, taking into account the successive dilution steps, the mass of spiking solutions and the amount of matrix being spiked. The target values together with the respective uncertainties are presented in Table 1.

To test the homogeneity of the spiked soil samples, 4 bottles were randomly selected and three sample portions at 50 g from each bottle were measured by three gamma-ray spectrometers.

TABLE 1. THE TARGET VALUES AND THE RESPECTIVE STANDARD COMBINED UNCERTAINTIES USED IN THE EVALUATION IN THIS PT.

Radionuclide	IAEA-444 Spiked soil sample		IAEA-445 Spiked water sample		IAEA-330 Spinach sample	
	Target value	Combined standard uncertainty	Target value	Combined standard uncertainty	Target value	Combined standard uncertainty
	Bq/kg (dry mass)		Bq/kg		Bq/kg (dry mass)	
K-40	-	-	-	-	1188	30
Mn-54	61.0	1.24	4.74	0.02	-	-
Co-60	82.6	2.0	7.52	0.06	-	-
Zn-65	29.9	0.99	13.06	0.15	-	-
Sr-90	-	-	-	-	20.1	2.1
Cd-109	248.7	5.18	34.96	0.20	-	-
Cs-134	59.4	1.73	7.65	0.10	-	-
Cs-137	68.5	1.38	8.12	0.06	1235	35
Pb-210	48.0	1.5	29.34	0.5	-	-
U-234	-	-	-	-	1.02	0.07
U-238	-	-	-	-	0.95	0.05
Pu-238	-	-	-	-	0.023	0.013
Pu-239+240	-	-	-	-	0.049	0.028
Am-241	55.6	1.60	7.11	0.05	0.062	0.034

For all samples the reference date is 15 October 2007, the combined standard uncertainty is expressed at 1σ level.

The first is a n-type coaxial Ge detector (OX) model GR3019 (Canberra); of 35% efficiency relative to 3”x3” of NaI(Tl) scintillation detector and resolution of 1.85 keV at 1.332 keV.

The second is a broad energy type Ge detector (BE) model BE2825 (Canberra); energy resolutions are 0.670 and 1.78 keV at 122 keV and 1332 keV gamma-rays, respectively.

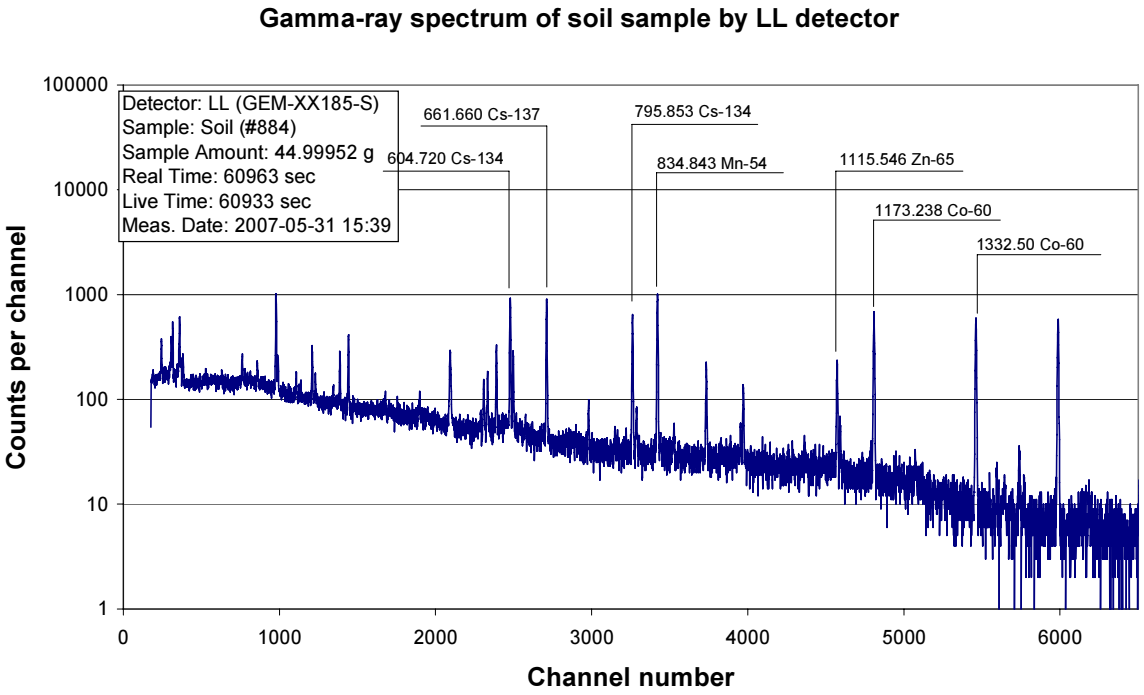
The third is a p-type coaxial Ge detector (LL) model GEM-XX185-S (Ortec); of 60% efficiency relative to 3”x3” of NaI(Tl) scintillation detector and resolution of 1.81 keV at 1.332 keV.

The detectors were mounted in a 10 cm thick lead shield. Canberra digital electronics and GENIE-2000 software were used. The measurements were performed at the Chemistry Unit of Seibersdorf laboratories. The OX system was used for measurement of whole energy region of gamma-rays, and BE and LL systems were used for low and high energy regions of gamma-rays, respectively. Figures 1, 2, 3 and 4 present examples of the obtained spectra.

Table 2. lists the measurement live time, repeatability relative standard deviation of the method (Method RSD) and “between-within bottles” relative standard deviation (BB RSD) of the homogeneity test.

The measurement results of the homogeneity test showed that there is no significant difference between the BB RSD and the Method RSD for the 12 measured sample portions, which indicates satisfactory homogeneity of the material. Figures 5-14 show a graphical presentation of the homogeneity test of soil sample.

To control the quality of the spiked soil, all PT samples were measured for 900 seconds and the spectra were checked for any inconsistency or outlier results, Figures 15 and 16 show examples of quality control results.



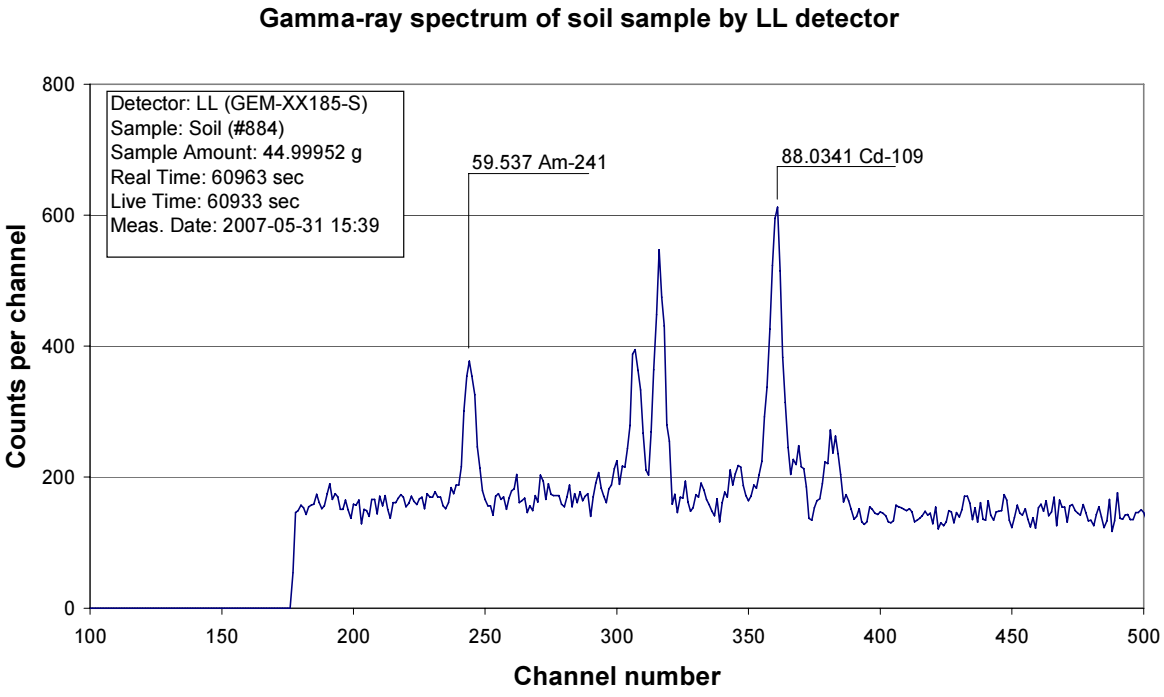
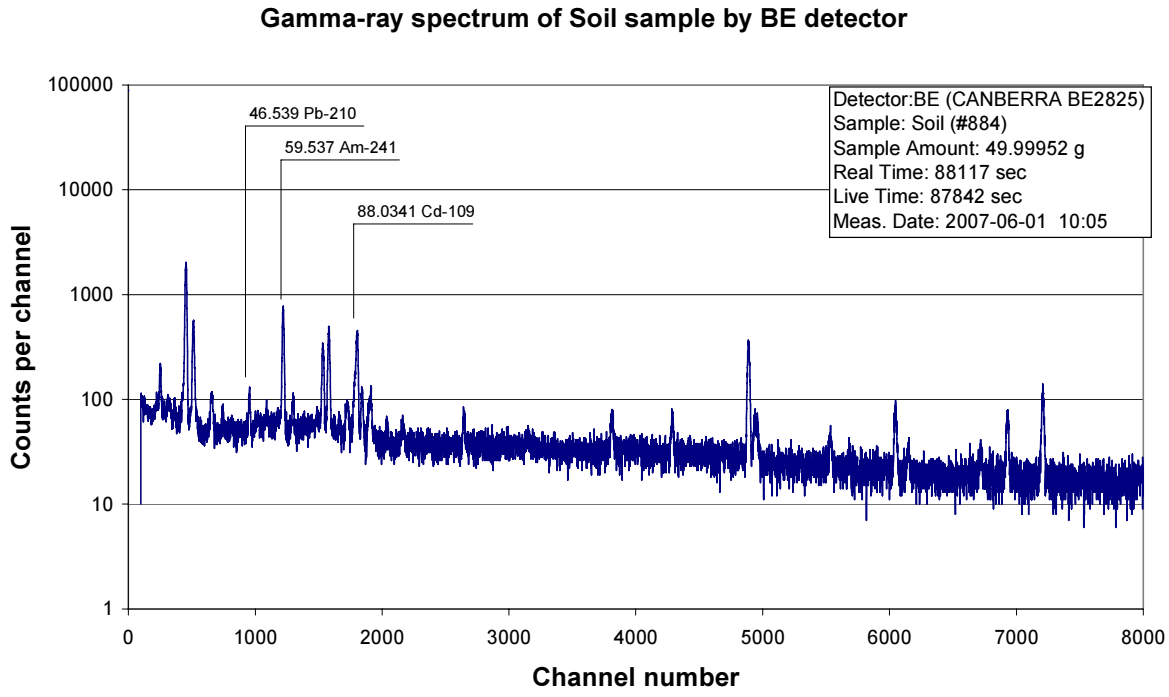
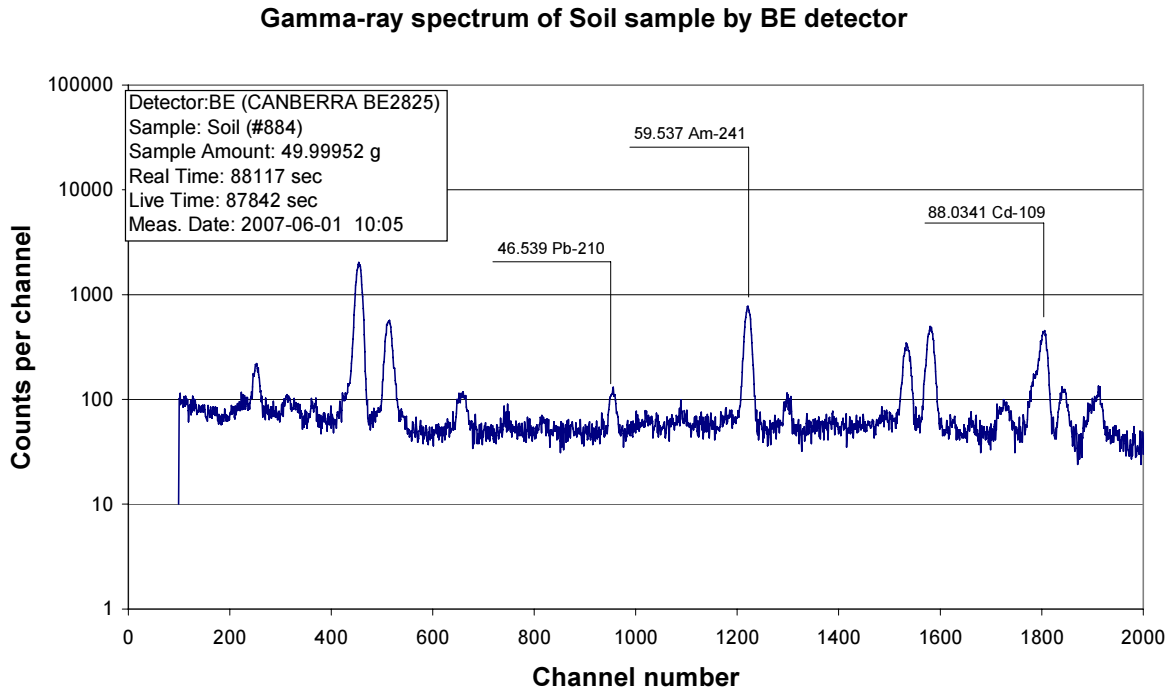
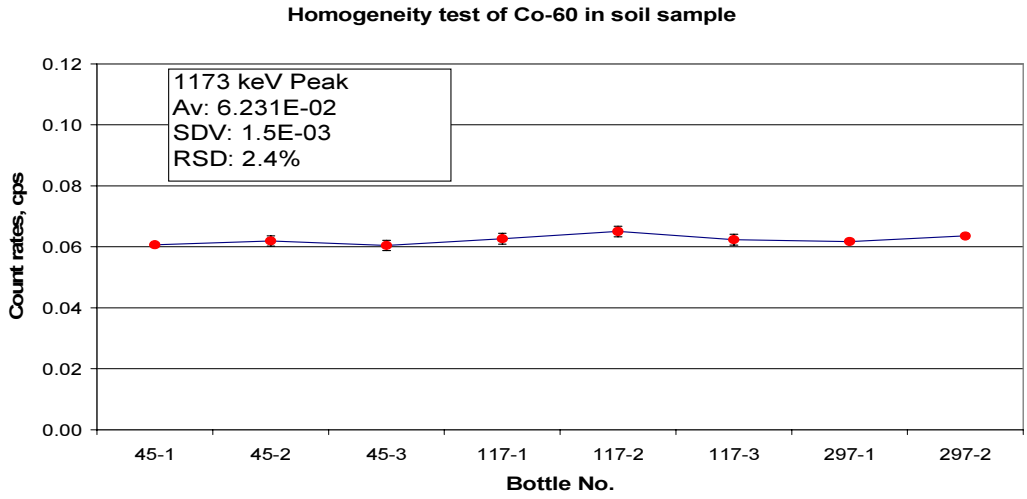


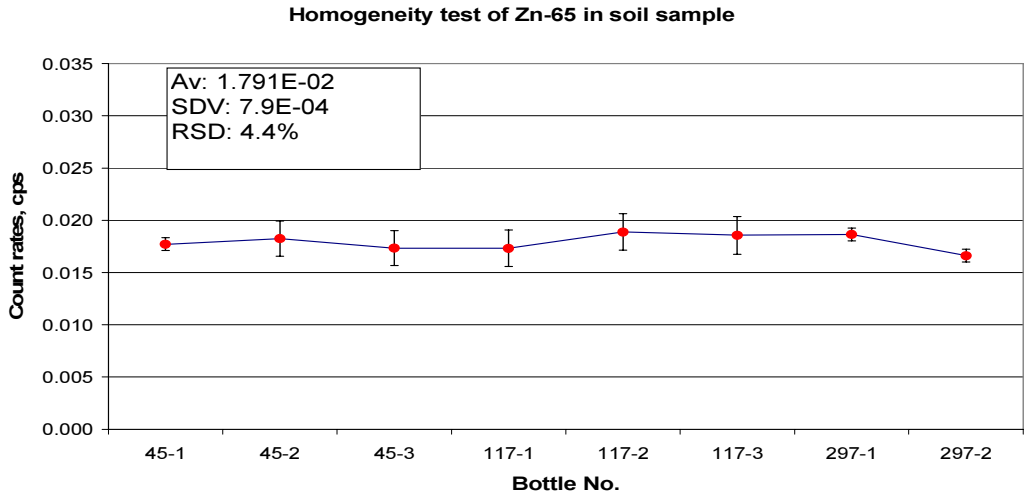
Fig. 1. and 2. Gamma-ray spectrum of the low and high energy region of the soil sample.

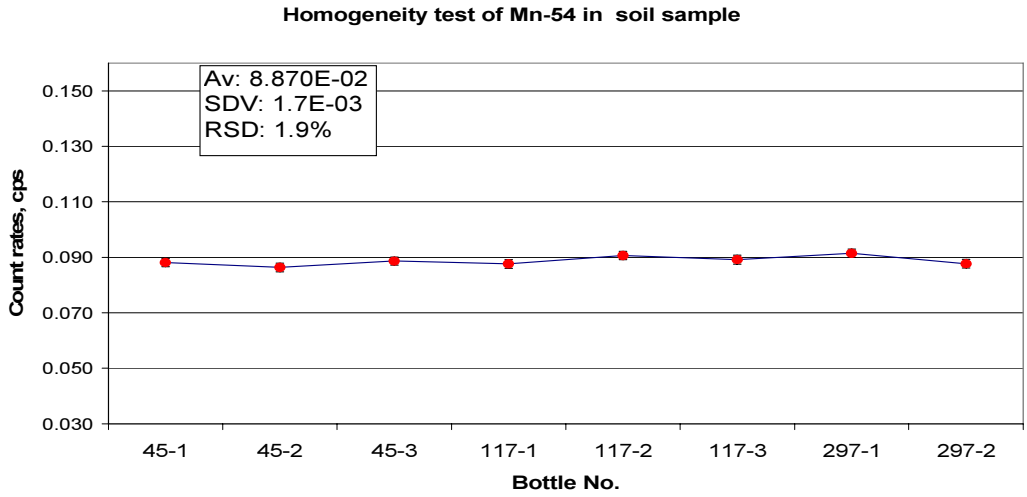




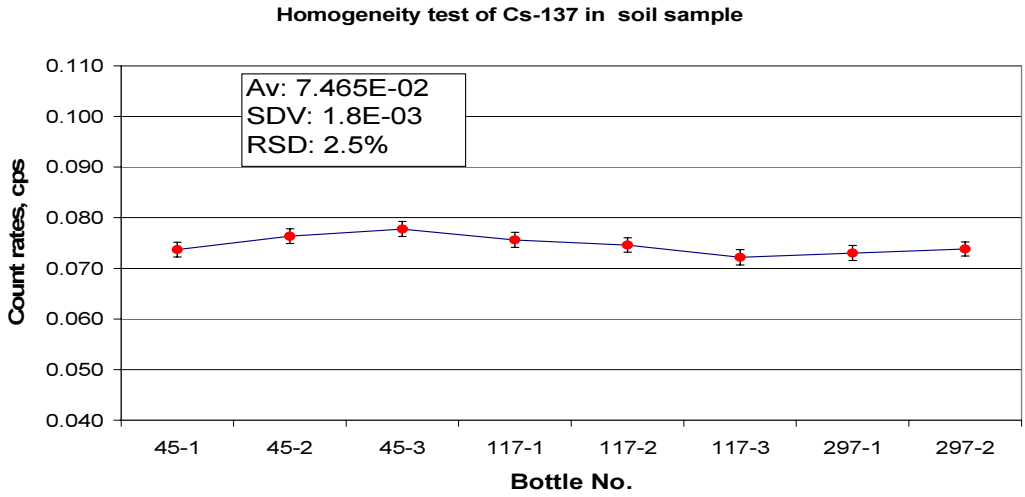
Figs. 3 and 4: Low energy region of gamma spectrum of the soil sample using broad energy range detector.

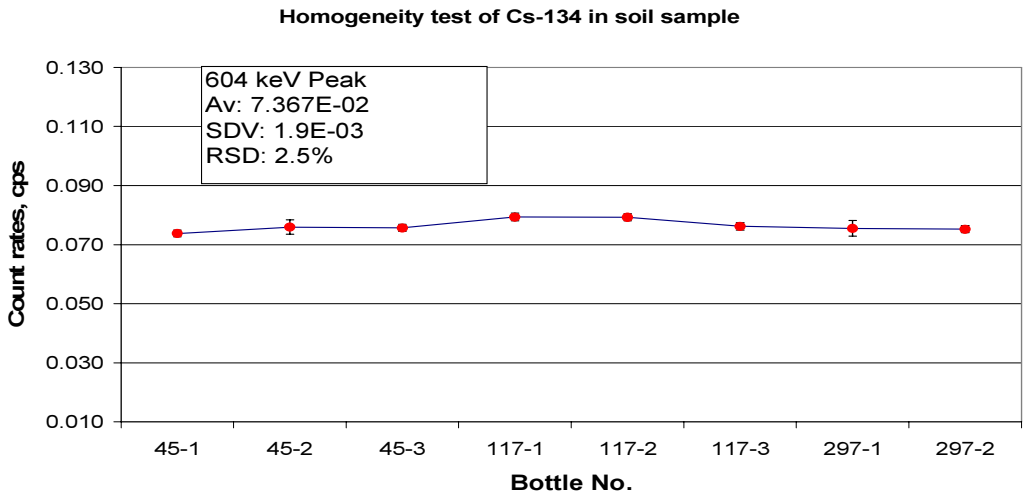


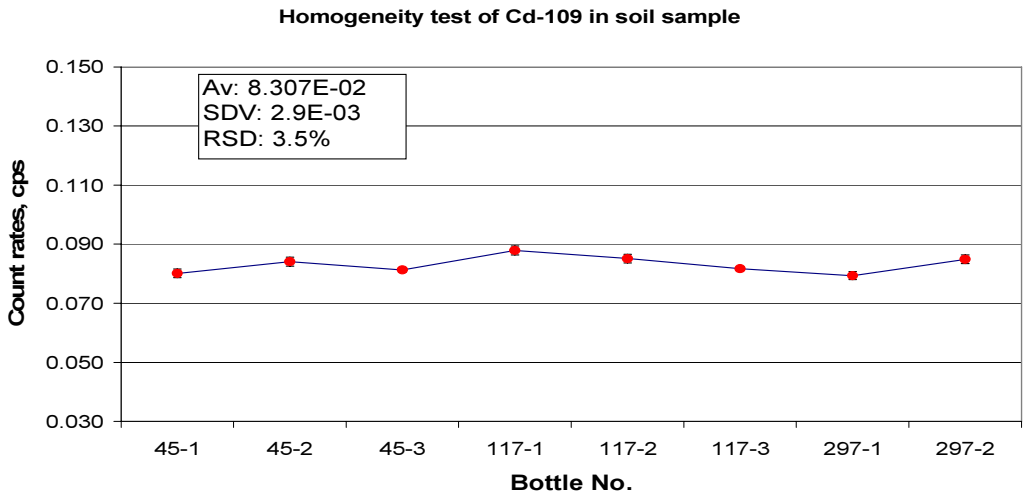




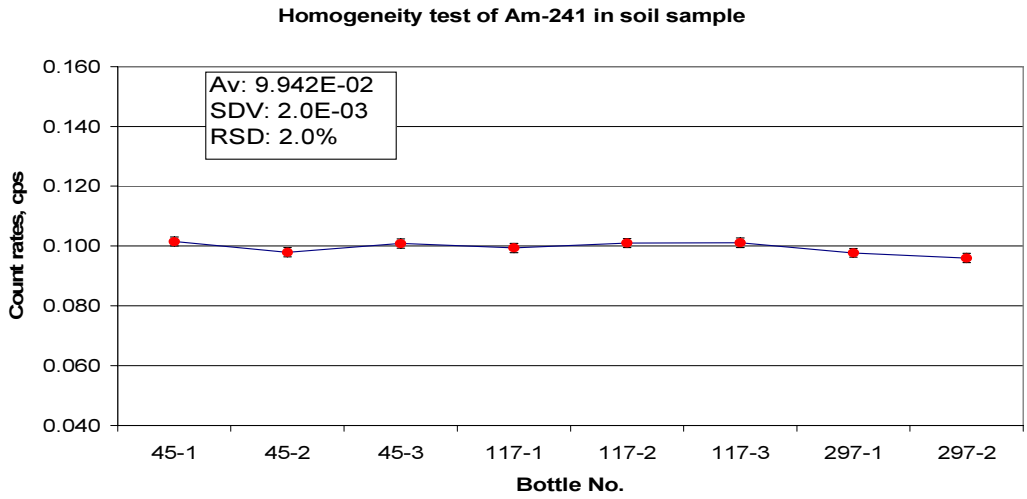
Figs. 5, 6 and 7: Graphical representation of homogeneity test results.

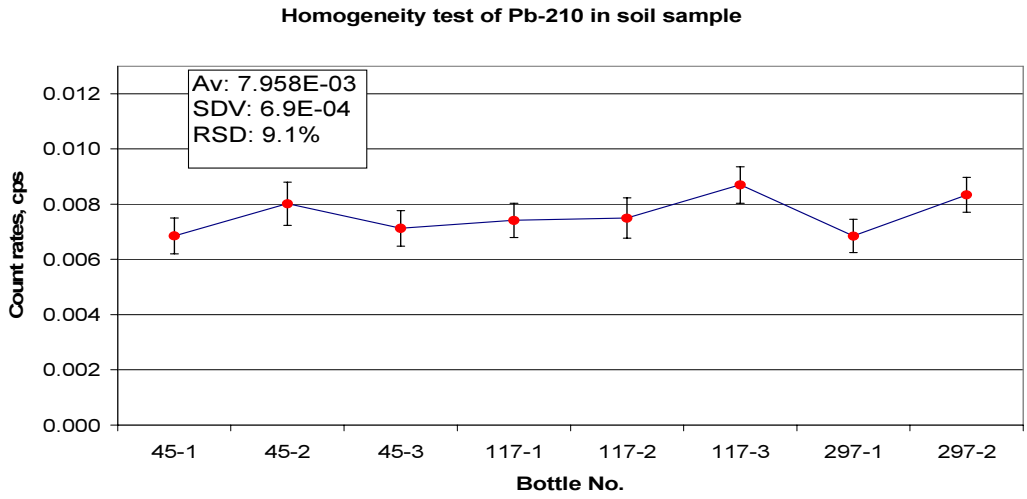


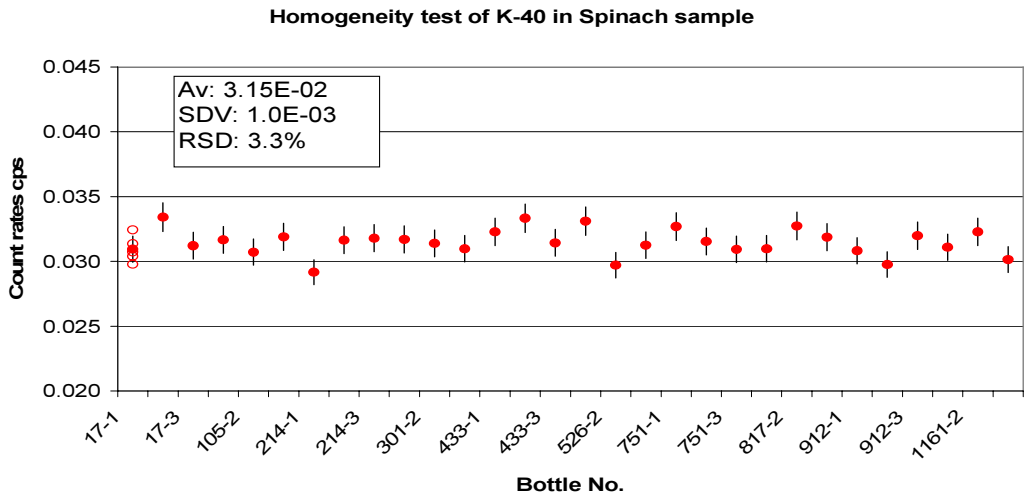




Figs. 8, 9 and 10: Graphical representation of homogeneity test results.







Figs. 11, 12 and 13: Graphical representations of homogeneity test results.

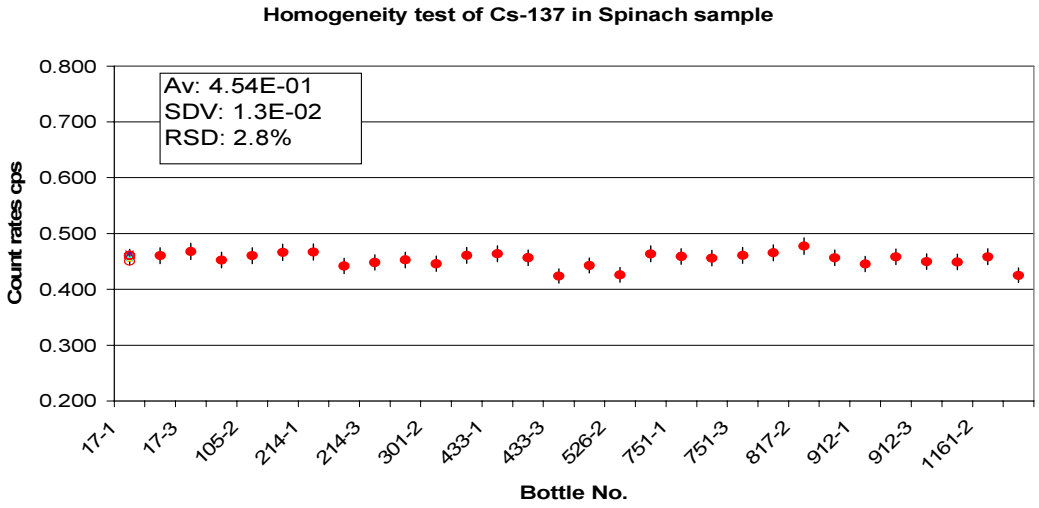
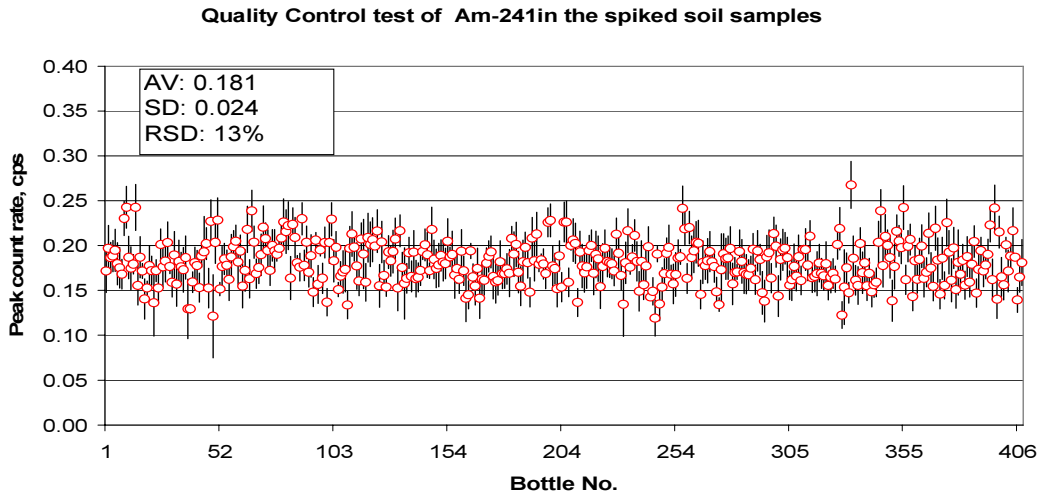
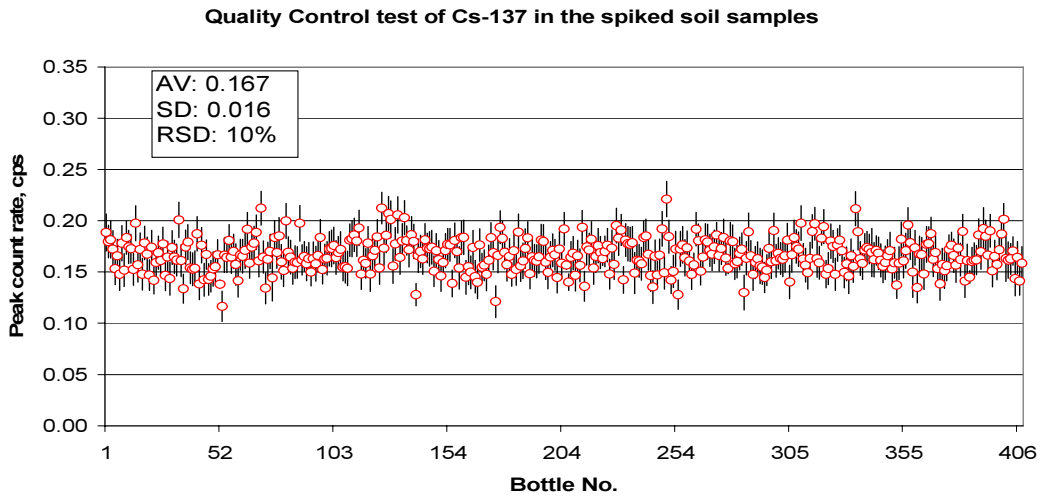


Fig. 14: Graphical representation of homogeneity test results.





Figs. 15 and 16:. Quality control test of the spiked soil samples, measuring time 900 seconds.

TABLE 2. HOMOGENEITY TEST PARAMETERS

Nuclide	Meas. Live Time, sec	Method RSD (%)	Between Bottles RSD (%)
Mn-54	43200	2.3	1.9
Co-60	43200	2.1	2.4
Zn-65	43200	4.0	4.4
Cd-109	80000	4.6	3.5
Cs-134	43200	4.2	2.5
Cs-137	43200	3.3	2.5
Pb-210	80000	10.4	9.1
Am-241	80000	1.4	2.0

2.3.2. Preparation of the spiked water IAEA-445

The water sample was gravimetrically prepared in one batch. A portion of 220 kg of acidified demineralised water was spiked with a mixture of certified single radionuclide solutions traceable to a national standard of radioactivity. Then a pump with multiple outlets was used to homogenise the bulk water sample in a tank of 600 L. Three water sample portions at 100 g were analysed by gamma spectrometry. The relative standard deviation of each analyte was calculated. It was found that the relative standard deviations of all analytes were below the method repeatability relative standard deviation, which demonstrates satisfactory homogeneity of the water sample.

The final target activity concentration for each radionuclide was calculated from the certified activity values assigned to each radionuclide, taking into account the successive dilution steps, the mass of spiking mixture and the amount of water being spiked as determined from weighing. The combined standard uncertainty includes two major components: uncertainty of the certified solution and weighing uncertainty.

Table 1 lists the target values and the associated combined uncertainty in water sample; the identification of certified solutions used in this PT is listed in Table 3.

2.3.3. Preparation of the natural spinach sample IAEA-330

The IAEA-330 spinach sample was collected in Chernobyl area. The spinach was dried, milled and sieved to collect the appropriate fraction at mesh size less than 0.35 mm, and then homogenised. The homogeneity of K-40 and Cs-137 was tested by analysing 10 samples at 3 replicates each at 10 g sample portion using the gamma spectrometry instrumentation set-up described above.

The homogeneity test results provided experimental evidence that satisfactory level of within and between bottles homogeneity have been attained.

The target values of K-40 and Cs-137 in the spinach material were derived from the results of 12 bottles analysed at the Chemistry Unit of Seibersdorf laboratories using gamma spectrometry.

The target values of α and β emitting nuclides were derived based on the measurement results of 30 bottles at the Chemistry Unit of Seibersdorf Laboratories according to the following method.

TABLE 3. THE IDENTIFICATION OF THE CERTIFIED SOLUTIONS OF EACH RADIONUCLIDE USED IN SPIKING THE SOIL AND WATER SAMPLES IN THIS PROFICIENCY TEST.

Nuclide	Source manufacturer and batch number
Mn-54	AMERSHAM: MFZ64; NO S3/28/12
Co-60	CERCA-LEA FRAMATOME: CO60-ELSB50; NO 72452
Zn-65	CERCA-LEA FRAMATOME: ZN65-ELSB50; NO 7020
Cd-109	AMERSHAM: CUZ64;NO S3/36/23
Cs-134	CERCA-LEA FRAMATOME: CS134-ELSB50; NO 70823
Cs-137	AMERSHAM: CDZ64; NO S4/14/70
Pb-210	SRM 4337, NIST, Reference date 15-06-2007.
Am-241	CERCA-LEA FRAMATOME: AM241-ELSB30; NO 5104

- *Treatment of the spinach sample IAEA-330*

The sample (95 g dry mass) was ashed at 600 ^{o}C. The sample decomposition was carried out using the conventional wet digestion procedures [5]. After addition of Sr carrier, U-232, Pu-242 and Am-243 tracers as described in the combined procedure of Sr-90, Am-241 and Pu isotopes [6].

- *Radiochemical Separations*

The radiochemical separation of Pu and Am was carried out using anion exchange column (BioRad AG 1-X8 and 1-X4, 100-200 mesh). Strontium was separated using Sr resin (Eichrom Tec., USA) according to a sequential combined procedure [5].

For the separation of uranium, the supernatant obtained from Ca-oxalate precipitation was evaporated to dryness, the oxalate was decomposed by digestion and repeated evaporation with 65% HNO_3. The residues were dissolved in 15-30 ml 3 M HNO_3, and then loaded on UTEVA resin column (Bed volume; 1.4 ml, column length: 26 mm) pre-conditioned with 20 ml 3 M HNO_3. The column was washed with 30 ml 3 M HNO_3, followed by 20 ml 6 M HCl. Uranium fraction was eluted with 6ml of H_2O, and then evaporated with 2 ml 65% HNO_3.

After electro-deposition on a stainless steel discs, uranium was determined by alpha-spectrometry.

- *Instrumentation*

Pu-239+240, Am-241 and Uranium isotopes were measured by alpha-spectrometer system (EG & G ORTEC OCTETE, with EG & G Ultra BU-020-450 and Canberra AMX 884 multiplexer, RPI 554, ADC 8701, and AIM556 modules). The alpha spectra were evaluated using Canberra Genie 2000 software.

Sr-90 was measured by liquid scintillation counter (WALLAC QUANTULUS 1220, PerkinElmer, USA). The scintillation spectra of Sr-90 were evaluated using Wallac WINQ v. 1.1 and EASY view v.1.0.3.4.

Typical alpha-spectra of Pu, Am and U sources, separated from the spinach candidate reference material IAEA-330 are shown in Figures 2.17, 2.18 and 2.19. Measurement times: 699000s for Am, 790000 s for Pu and 230000 s for U. Typical chemical recoveries were between 60-90 %.

To derive the target values of the spinach sample, a robust approach proposed by David L. Duewer [7] was applied on the analytical results reported by the Seibersdorf laboratories and the Mixture Model Median (MM-median) was calculated. The MM-median is a direct analogue of the median. It is the location which divides the Mixture Model Probability Density Function (MM-PDF) into two sections of equal area.

To estimate the standard uncertainty associated with the target values of the spinach sample the MM-median based Standard Deviation S(MM-median) was calculated from the span of the central 50% of the MM-PDF density.

To confirm the target values, 5 expert laboratories from Finland, Hungary, Republic of Korea and Portugal analysed the spinach sample. Each laboratory received 3 bottles, and was asked to analyse the analytes of interest in each bottle. The obtained results from the expert laboratories were used to confirm the IAEA target values. In total 30 and 15 bottles were analysed in Seibersdorf laboratories and expert laboratories respectively during the characterisation campaign of the spinach material.

The IAEA derived target values were in good agreement with the expert laboratories results.

The target values of the spinach material with the respective uncertainties are presented in Table 1.

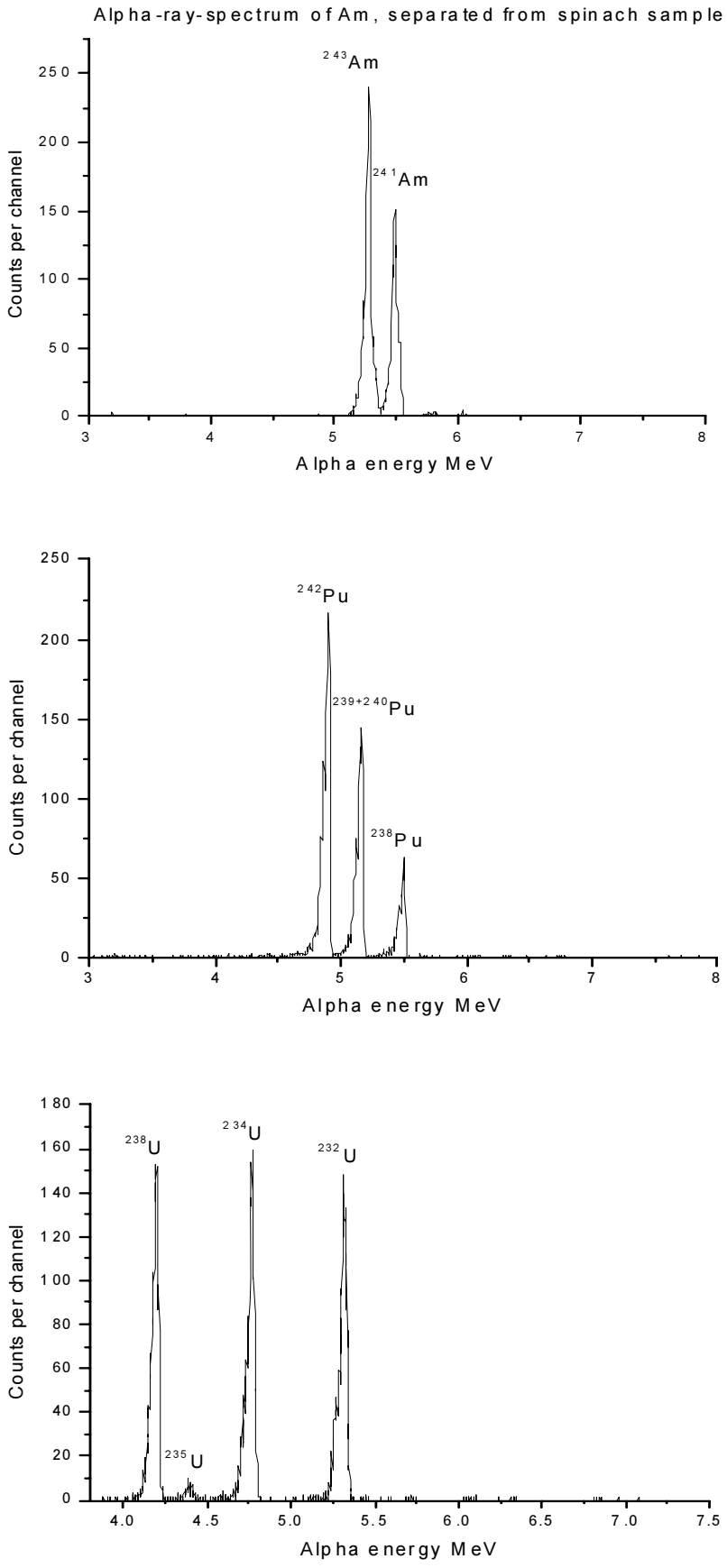


Fig. 17., 18. and 19. Alpha –ray spectra of Am, Pu and U separated from spinach IAEA-330.

Figures 2.20 and 2.21 show the PT materials sets.

Fig. 20. A set of the PT material.

Fig. 21. Distribution of the PT sets.

2.4. Reference time

The reference time for all activity concentrations is 15 October 2007.

3. PERFORMANCE CRITERIA

Currently most laboratories produce test results accompanied, at best, with an indication of their repeatability only and provide no indication of their analytical uncertainty. However, new requirements coming into force (ISO/IEC 17025:2005) [8] require that laboratories have to express their measurement uncertainty.

Several rating systems have been developed for determining a laboratory's performance and the meaning of the results of the different scoring systems are 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 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 Chemistry Unit in the Agency's laboratories takes into consideration the trueness and the precision of the reported data and it includes in the evaluation both the total combined uncertainty associated with the target value of proficiency testing samples and the total uncertainty reported by the participating laboratories. According to the newly adopted approach, the reported results are evaluated against the acceptance criteria for accuracy and precision and assigned the status "acceptable" or "not acceptable" accordingly. A result must pass both criteria to be assigned the final status of "acceptable". 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 a result $\text{Value}_{\text{reported}}$ (a single measurement of analyte concentration in a test material) is obtaining 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:

$$Bias_{relative} = \frac{Value_{reported} - Value_{target}}{Value_{target}} \times 100\% \quad (1)$$

3.2. 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:

$$z_{Score} = \frac{Value_{reported} - Value_{target}}{\sigma} \qquad (2)$$

On the basis of the "fitness for purpose" principle, the target standard deviation (σ) is:

$$0.10 \text{ x } Value_{target}$$

The laboratory performance is evaluated as satisfactory if $| z_{Score} | \leq 2$; questionable for $2 < | z_{Score} | < 3$, and unsatisfactory for $| z_{Score} | \geq 3$.

3.3. The u-score value

The value of the u_{test} was calculated according to the following equation [9]

$$u_{test} = \frac{\left|Value_{target} - Value_{reported}\right|}{\sqrt{u_{target}^2 + u_{reported}^2}} \qquad (3)$$

This value is 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 normalised error. This is especially useful when evaluating results, which uncertainty may overlap with the reference interval.

It should be noted that the choice of the significance level is subjective. For this proficiency test we have set the limiting value for the u-test parameter to 2.58 for a level of probability at 99% to determine if a result passes the test ($u < 2.58$).

3.4. Evaluation criteria

The proficiency test results were evaluated against the acceptance criteria for trueness and precision and assigned the status "Acceptable", "Warning" or "Not Acceptable" accordingly [10].

3.4.1. Trueness

The participant result is assigned "Acceptable" status for trueness if:

$$A1 \leq A2$$

where:

$$A1 = \left|Value_{target} - Value_{reported}\right|$$

$$A2 = 2.58 \times \sqrt{u_{target}^2 + u_{reported}^2}$$

3.4.2. Precision

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

$$P = \sqrt{\left(\frac{Unc_{target}}{Value_{target}}\right)^2 + \left(\frac{Unc_{reportedt}}{Value_{reported}}\right)^2} \times 100\%$$

P directly depends on the measurement uncertainty claimed by the participant. The Limit of Acceptable Precision (LAP) for each analyte respectively is defined for the respective 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 "acceptable" for precision when P ≤ LAP. The LAP value used in the evaluation of all radionuclides is listed in Table 4.
In the final evaluation, both scores for trueness and precision are combined. A result must obtain an "acceptable" score in both criteria to be assigned the final score "acceptable". Obviously, if a score of "not acceptable" was obtained for both trueness and precision, the final score will also be "not acceptable". In cases where either precision or trueness is "not acceptable", a further check is applied. The reported result relative bias (R. Bias) is compared with the maximum acceptable bias (MAB). If R. Bias ≤ MAB, the final score will be "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 result close to the assigned property value are reported, but the associated uncertainty is large. If R. Bias > MAB, the result will be "Not Acceptable". The MAB value used in the evaluation of all radionuclides is listed in Table 4.

3.5. *Evaluation criteria for* Pu-238, Pu-239+240 and Am-241

As it can be noticed from Table 1, the uncertainty associated with the target values of Pu-238, Pu-239+240 and Am-241 are relatively high due to the low activity of these analytes and relatively high uncertainty associated with the between bottles heterogeneity. Therefore, for the purpose of evaluation in this PT the Upper Limit of Evaluation (ULE) was introduced for these three nuclides. The ULE was calculated as the following:

$$ULE = Value_{target} + 2S(MM\text{-}median)$$

The participant result was assigned acceptable score if:

$$Value_{reported.} - Uncertainty_{reported.} < ULE$$

If the evaluation approach and/or acceptance criteria applied in this PT are not appropriate for the types of analyses and application performed in one of the participating laboratories, it is suggested to apply a self- scoring evaluation system which could fits specific requirements.

TABLE 4. VALUES OF LAP, MAB AND ULE USED FOR THE EVALUATION IN THIS PROFICIENCY TEST.

	LAP (%)			MAB (%)			ULE [Bq/kg]
	Soil IAEA-444	Water IAEA-445	Spinach IAEA-330	Soil IAEA-444	Water IAEA-445	Spinach IAEA-330	
K-40	-	-	15	-	-	15	-
Mn-54	15	10	-	15	10	-	-
Co-60	15	10	-	15	10	-	-
Zn-65	15	10	-	15	10	-	-
Sr-90	-	-	15	-	-	15	-
Cd-109	20	15	-	20	15	-	-
Cs-134	15	10	-	15	10	-	-
Cs-137	15	10	15	15	10	15	-
Pb-210	20	25	-	20	25	-	-
U-234	-	-	20	-	-	20	-
U-238	-	-	20	-	-	20	-
Pu-238	-	-	-	-	-	-	0.05
Pu-239+240	-	-	-	-	-	-	0.11
Am-241	20	15	-	20	15	-	0.13

4. RESULTS AND DISCUSSION

4.1. General

1546 measurement results in rapid and long term modes were reported to the IAEA in this 2007 PT from 58 laboratories in 46 Member States. The participants' data along with the statistical performance evaluation were compiled and presented in two tables which constitute an integral part of this report. Appendix I shows a summary evaluation for each laboratory and an extraction of the reported information in the PT questionnaire regarding the applied analytical technique. Performance evaluation tables sorted by analyte are reported in Appendix II, list of participating laboratories is presented in Appendix III.

Table 5 reports summary evaluation of each radionuclides in rapid and long term reporting modes. It can be seen that the number of reported results in the rapid reporting exercise (Table 6) is smaller than the repotted results in the long term reporting exercise (Table 7).

The overall evaluation showed that 78% of all reported results fulfilled the PT criteria. The results' evaluation shows that there are no specific measurement problems for K-40, Mn-54, Co-60, Zn-65, Sr-90, Cd-109, Cs-134, Cs-137, Pb-210 and Am-241. Analytical methods for the determination of U-234, U-238, Pu-238, Pu-239+240 should be improved.

TABLE 5. THE DISTRIBUTION OF RESULTS SCORED AS ACCEPTABLE/WARNING/NOT ACCEPTABLE FOR ALL EVALUATED NUCLIDES.

Nuclides	Total number of reported results		Acceptable (%)		Warning (%)		Not acceptable (%)	
	Rapid reporting	Long term	Rapid reporting	Long term	Rapid reporting	Long term	Rapid reporting	Long term
Am-241	69	92	78.3	76.0	7.2	5.0	14.5	19.0
Cd-109	65	76	67.7	71.0	9.2	3.7	23.1	25.2
Co-60	73	98	89.0	85.2	5.5	6.15	5.5	8.7
Cs-134	73	82	74.0	70.7	19.2	14.7	6.8	14.7
Cs-137	110	154	89.1	89.0	3.6	3.5	7.3	7.5
K-40	37	55	76	78	14	11	11	11
Mn-54	73	94	82.2	81.7	11.0	7.8	6.8	10.4
Pb-210	45	53	68.9	65.4	11.1	8.6	20.0	25.9
Pu-238	8	15	88	73	0	0	12	27
Pu-239+240	9	18	89	67	0	0	11	33
Sr-90	9	26	67	69	0	12	33	19
U-234	7	18	71	50	0	11	29	39
U-238	7	18	57	50	14	17	29	33
Zn-65	73	89	86.3	78.8	5.5	8.8	8.2	12.4

TABLE 6. SUMMARY EVALUATION OF THE RAPID REPORTING RESULTS OF THE IAEA-CU-2007-04 ALMERA PROFICIENCY TEST

	Soil								Spinach								Water								Summary evaluation			
Lab Code	Mn-54	Co-60	Zn-65	Cd-109	Cs-134	Cs-137	Pb-210	Am-241	K -40	Sr- 90	Cs -137	U -234	U -238	Pu- 238	Pu -239+240	Am- 241	Mn-54	Co-60	Zn-65	Cd-109	Cs-134	Cs-137	Pb-210	Am-241	Total rep. results	A	W	N
8	A	A	A	N	A	A	N	A	A	NR	A	NR	NR	NR	NR	NR	A	A	A	A	W	A	A	A	18	15	1	2
9	A	A	A	A	A	A	A	A	N	A	A	NR	NR	A	A	A	W	W	W	A	W	W	W	A	22	15	6	1
10	A	A	A	A	A	A	A	A	A	NR	A	NR	NR	NR	NR	NR	A	A	W	A	A	A	NR	A	17	16	1	0
12	A	A	A	A	A	A	A	A	A	NR	A	A	W	NR	NR	NR	A	A	A	A	A	A	A	A	20	19	1	0
18	A	A	W	A	A	A	A	A	A	N	A	A	A	A	A	N	A	A	A	W	A	A	A	A	24	21	2	1
24	A	A	A	A	A	A	A	A	A	N	A	NR	NR	NR	NR	NR	A	A	A	A	A	A	A	A	19	18	0	1
35	A	A	A	A	A	A	A	A	A	NR	A	NR	NR	NR	NR	NR	A	A	A	A	A	A	A	A	18	18	0	0
37	N	N	N	NR	N	N	NR	N	NR	NR	N	NR	NR	NR	NR	NR	N	N	N	N	A	N	NR	N	14	1	0	13
44	A	A	N	NR	A	A	NR	NR	A	A	A	NR	NR	NR	NR	NR	A	A	A	NR	A	A	NR	NR	13	12	0	1
50	W	A	A	N	A	A	A	A	W	A	A	N	N	N	N	NR	A	A	A	A	A	N	N	N	23	13	2	8
52	A	A	A	NR	W	A	A	A	A	NR	A	NR	NR	NR	NR	NR	A	A	A	NR	A	A	NR	A	15	14	1	0
110	A	A	A	A	W	A	NR	A	A	NR	A	NR	NR	NR	NR	NR	A	A	A	A	W	A	NR	A	16	14	2	0
112	A	A	A	A	A	A	N	A	A	N	A	NR	NR	NR	A	A	A	A	A	W	A	A	A	W	21	17	2	2
124	A	W	A	N	A	A	N	A	W	A	A	A	A	NR	A	NR	A	A	A	A	A	A	N	A	22	17	2	3
134	A	A	A	NR	A	A	NR	NR	A	NR	A	NR	NR	NR	NR	NR	A	A	A	NR	A	A	NR	NR	12	12	0	0
144	NR	NR	NR	NR	NR	NR	NR	NR	A	NR	A	NR	NR	NR	NR	NR	A	A	A	A	A	A	A	A	10	10	0	0
147	A	A	A	N	W	W	N	W	A	NR	A	NR	NR	A	NR	NR	A	W	A	W	W	A	A	A	18	10	6	2
148	W	N	N	N	N	N	NR	NR	A	NR	W	NR	NR	NR	NR	NR	A	A	A	A	W	A	NR	NR	14	6	3	5
150	A	A	A	A	A	A	A	A	A	NR	A	NR	NR	NR	NR	NR	A	A	A	A	A	A	A	A	18	18	0	0

	Soil								Spinach								Water								Summary evaluation			
Lab Code	Mn-54	Co-60	Zn-65	Cd-109	Cs-134	Cs-137	Pb-210	Am-241	K -40	Sr- 90	Cs -137	U -234	U -238	Pu- 238	Pu -239+240	Am- 241	Mn-54	Co-60	Zn-65	Cd-109	Cs-134	Cs-137	Pb-210	Am-241	Total rep. results	A	W	N
151	N	N	N	W	A	N	N	N	A	NR	A	NR	NR	NR	NR	NR	A	A	A	A	W	A	W	A	18	9	3	6
161	A	A	A	A	A	A	A	A	A	A	A	N	N	A	A	A	A	A	A	A	A	A	A	A	23	21	0	2
162	A	A	A	N	W	A	W	A	A	NR	A	NR	NR	NR	NR	NR	N	A	A	N	N	N	N	N	18	9	2	7
179	A	A	A	N	A	A	NR	N	N	NR	A	A	A	A	A	A	A	A	A	N	A	A	NR	A	21	17	0	4
186	A	A	A	W	A	A	A	W	A	NR	A	NR	NR	NR	NR	NR	A	A	A	W	A	A	A	A	18	15	3	0
189	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	W	A	A	A	A	A	W	A	24	22	2	0
209	A	A	A	A	A	A	A	A	A	NR	A	NR	NR	NR	NR	NR	A	A	A	A	A	A	A	A	18	18	0	0
252	A	A	A	A	A	A	NR	NR	A	NR	A	NR	NR	NR	NR	NR	A	A	A	NR	A	A	NR	NR	13	13	0	0
257	A	A	A	A	A	A	N	A	N	NR	N	NR	NR	NR	NR	NR	A	A	A	A	A	A	W	A	18	14	1	3
260	A	A	A	N	A	A	NR	A	A	NR	A	NR	NR	NR	NR	NR	A	A	A	A	A	A	NR	A	16	15	0	1
269	W	A	A	A	A	A	NR	A	A	NR	A	NR	NR	A	A	NR	A	A	A	N	N	A	NR	W	18	14	2	2
279	A	A	A	A	A	A	A	A	A	NR	A	NR	NR	NR	NR	NR	A	A	A	A	A	A	A	A	18	18	0	0
280	W	A	N	A	W	A	NR	N	A	NR	W	NR	NR	NR	NR	NR	W	W	A	A	N	A	NR	A	16	8	5	3
291	A	A	A	A	W	A	A	A	W	NR	A	NR	NR	NR	NR	NR	N	A	W	A	W	A	A	A	18	13	4	1
293	W	A	A	A	A	A	A	W	W	NR	A	NR	NR	NR	NR	NR	A	A	A	A	W	A	A	A	18	14	4	0
296	A	A	A	A	A	A	NR	NR	A	NR	A	NR	NR	NR	NR	NR	A	A	A	A	A	A	NR	NR	14	14	0	0
305	A	A	A	N	A	A	NR	A	A	NR	A	NR	NR	NR	NR	NR	A	A	A	A	A	A	NR	N	16	14	0	2

A: Acceptable, W: Warning, N : Not acceptable, NR: Not reported.

TABLE 7. SUMMARY EVALUATION OF THE LONG TERM REPORTING RESULTS OF THE IAEA-CU-2007-04 ALMERA PROFICIENCY TEST

	Soil								Spinach								Water								Summary evaluation			
Lab Code	Mn-54	Co-60	Zn-65	Cd1-09	Cs-134	Cs-137	Pb-210	Am-241	K -40	Sr- 90	Cs -137	U -234	U -238	Pu- 238	Pu -239+240	Am- 241	Mn-54	Co-60	Zn-65	Cd-109	Cs-134	Cs-137	Pb-210	Am-241	Total rep. results	A	W	N
4	A	A	A	A	A	A	A	A	A	NR	A	NR	NR	NR -	NR	NR	A	A	A	A	A	A	A	A	18	18	0	0
6	A	A	N	A	A	A	NR	N	A	NR	A	NR	NR	NR	NR	NR	A	A	A	N	A	A	NR	A	16	13	0	3
8	A	A	A	N	A	A	N	A	A	NR	A	NR	NR	NR	NR	NR	A	A	A	A	W	A	A	A	18	15	1	2
9	A	A	W	A	A	A	A	A	N	A	A	A	A	A	A	A	W	A	W	N	A	A	N	N	24	17	3	4
10	A	A	A	A	A	A	A	A	A	NR	A	NR	NR	NR	NR	NR	A	A	W	A	A	A	NR	A	17	16	1	0
12	A	A	W	A	A	A	A	A	A	NR	A	A	W	NR	NR	NR	A	A	A	W	A	A	A	A	20	17	3	0
18	A	A	W	A	A	A	A	A	A	N	A	A	A	A	A	N	A	A	A	A	N	A	A	A	24	18	1	5
24	A	A	A	A	A	A	A	A	A	N	A	A	A	NR	NR	NR	A	W	W	A	A	A	A	A	21	18	2	1
29	A	A	A	NR	A	A	NR	A	A	NR	A	NR	NR	NR	NR	NR	A	A	N	NR	A	A	NR	A	14	13	0	1
31	A	A	A	N	A	A	NR	N	NR	NR	A	NR	NR	NR	NR	NR	NR	NR	NR	NR	N	N	NR	N	11	6	0	5
35	A	A	A	A	A	A	W	A	A	NR	A	NR	NR	NR	NR	NR	A	W	A	A	N	A	A	A	18	15	2	1
36	A	A	A	A	A	A	N	A	A	N	A	W	W	NR	NR	NR	A	A	A	A	A	A	N	A	21	16	2	3
37	N	N	N	N	W	N	N	W	A	NR	A	NR	NR	NR	NR	NR	A	A	A	N	A	W	A	W	18	7	4	7
43	A	A	A	N	A	A	A	A	A	A	A	NR	NR	NR	NR	NR	A	A	A	A	A	A	A	A	19	18	0	1
44	A	A	W	NR	A	A	NR	NR	A	A	A	NR	NR	NR	NR	NR	N	N	N	NR	A	A	NR	NR	13	9	1	3
50	W	A	A	N	A	A	A	A	W	A	A	N	N	N	N	NR	A	A	A	A	A	N	N	N	23	13	2	8
52	W	W	A	A	N	A	A	A	W	W	A	NR	NR	NR	NR	NR	A	W	A	A	W	A	NR	A	18	11	6	1
53	A	A	A	W	A	A	A	A	A	NR	A	NR	NR	NR	NR	NR	A	A	W	A	W	A	A	A	18	15	3	0
99	A	A	A	A	A	A	N	A	W	NR	A	NR	NR	NR	NR	NR	A	A	A	A	W	A	N	N	18	13	2	3
102	A	A	A	N	W	A	N	N	A	NR	A	N	N	N	N	NR	N	A	A	A	W	A	A	A	22	12	2	8
104	A	A	A	A	A	A	A	A	A	NR	A	NR	NR	A	A	A	A	A	A	A	A	A	A	A	21	21	0	0
110	A	A	A	A	N	A	NR	A	A	NR	A	NR	NR	NR	NR	NR	A	A	A	A	W	A	NR	A	16	14	1	1
111	NR	NR	NR	NR	NR	NR	NR	A	NR	NR	NR	NR	NR	A	A	A	NR	NR	NR	NR	NR	NR	NR	A	5	5	0	0

	Soil								Spinach								Water								Summary evaluation			
Lab Code	Mn-54	Co-60	Zn-65	Cd1-09	Cs-134	Cs-137	Pb-210	Am-241	K -40	Sr- 90	Cs -137	U -234	U -238	Pu- 238	Pu -239+240	Am- 241	Mn-54	Co-60	Zn-65	Cd-109	Cs-134	Cs-137	Pb-210	Am-241	Total rep. results	A	W	N
112	A	A	A	A	A	A	A	A	A	W	A	NR	NR	A	A	A	A	A	A	N	W	A	A	W	22	18	3	1
124	A	W	A	N	A	A	N	A	N	A	A	W	W	NR	A	NR	A	A	A	A	A	A	N	A	22	15	3	4
134	A	A	A	NR	A	A	NR	NR	A	NR	A	NR	NR	NR	NR	NR	A	N	A	NR	A	A	NR	NR	12	11	0	1
137	A	A	A	A	A	A	A	A	N	A	N	NR	NR	NR	NR	NR	A	A	A	A	A	A	N	A	18	15	0	3
144	A	A	A	A	A	A	W	A	A	A	A	NR	NR	NR	NR	NR	A	A	W	W	A	A	A	A	19	16	3	0
147	A	A	A	A	A	A	N	W	W	N	A	NR	NR	A	N	N	A	N	A	W	W	A	A	A	22	14	4	4
148	N	N	N	N	N	N	NR	NR	W	NR	N	NR	NR	NR	NR	NR	A	A	A	A	N	A	NR	NR	14	5	1	8
150	A	A	A	A	A	A	A	A	A	A	A	N	A	N	N	NR	A	A	A	A	A	A	A	A	23	20	0	3
151	N	N	N	N	A	N	N	N	A	A	A	NR	NR	NR	NR	NR	A	A	A	A	N	A	W	A	19	10	1	8
160	A	A	A	A	W	A	N	W	A	NR	A	NR	NR	NR	NR	NR	A	A	A	A	N	A	NR	A	17	13	2	2
161	A	A	W	A	A	A	W	A	A	A	A	N	N	A	A	A	A	A	A	A	A	A	A	A	24	20	2	2
179	A	A	A	N	A	A	NR	N	A	NR	A	N	N	N	A	N	A	A	A	A	A	A	NR	N	21	14	0	7
182	A	A	NR	N	A	A	N	NR	N	NR	W	N	N	NR	N	NR	N	N	NR	N	N	N	A	NR	16	5	1	10
186	A	A	A	A	A	A	N	A	A	NR	A	NR	NR	NR	NR	NR	A	A	A	A	A	A	N	A	18	16	0	2
189	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	W	A	24	23	1	0
206	A	A	A	N	A	A	NR	A	NR	NR	A	NR	NR	NR	NR	NR	N	N	N	N	A	N	NR	N	15	8	0	7
237	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	N	A	A	A	A	A	24	23	0	1
245	A	A	A	A	A	A	W	A	A	NR	A	NR	NR	NR	NR	NR	A	A	A	A	A	A	A	A	18	17	1	0
252	A	A	A	A	A	A	NR	A	A	NR	A	NR	NR	NR	NR	NR	A	A	A	N	A	A	NR	A	16	15	0	1
255	N	N	N	A	N	N	NR	A	A	NR	A	NR	NR	NR	NR	NR	N	A	A	N	A	A	NR	N	16	8	0	8
257	A	A	A	A	A	A	A	A	N	NR	N	NR	NR	NR	NR	NR	W	A	A	A	A	A	A	A	18	15	1	2
260	A	A	A	N	A	A	NR	A	A	A	A	NR	NR	A	A	N	A	A	A	A	A	A	NR	A	20	18	0	2
262	A	A	A	A	A	A	A	A	A	NR	A	NR	NR	NR	NR	NR	A	A	A	N	A	A	A	N	18	16	0	2
265	A	A	A	A	A	A	A	N	A	A	A	NR	NR	NR	NR	NR	W	A	N	A	A	A	NR	A	18	15	1	2
269	W	A	A	A	W	W	NR	A	A	NR	A	A	A	A	A	NR	A	A	A	A	N	A	NR	W	20	15	4	1
272	A	A	A	A	A	A	W	A	A	NR	A	NR	NR	NR	NR	NR	A	A	A	A	A	A	A	A	18	17	1	0

	Soil								Spinach								Water								Summary evaluation			
Lab Code	Mn-54	Co-60	Zn-65	Cd1-09	Cs-134	Cs-137	Pb-210	Am-241	K -40	Sr- 90	Cs -137	U -234	U -238	Pu- 238	Pu -239+240	Am- 241	Mn-54	Co-60	Zn-65	Cd-109	Cs-134	Cs-137	Pb-210	Am-241	Total rep. results	A	W	N
279	A	A	A	A	A	A	A	A	A	NR	A	NR	NR	NR	NR	NR	A	A	A	A	A	A	A	A	18	18	0	0
280	W	A	N	A	W	A	NR	N	A	A	W	NR	NR	NR	NR	NR	N	N	A	A	N	A	NR	A	17	9	3	5
291	A	A	A	A	W	A	A	A	W	W	A	N	N	NR	NR	NR	N	A	N	A	W	A	A	A	21	13	4	4
293	W	A	A	A	A	A	A	N	A	A	A	A	A	NR	NR	NR	A	A	A	A	N	A	A	A	21	18	1	2
299	A	A	A	A	N	A	A	A	A	N	A	NR	NR	NR	NR	NR	A	A	N	NR	A	A	A	N	18	14	0	4
305	A	A	A	N	A	A	NR	A	A	A	A	A	A	NR	N	NR	A	A	A	N	A	A	NR	N	20	16	0	4
310	A	A	A	N	A	A	A	A	A	A	A	NR	NR	NR	NR	NR	A	A	A	A	N	A	A	A	19	17	0	2
316	A	A	A	N	N	A	N	A	NR	NR	NR	NR	NR	NR	NR	NR	A	A	A	A	A	A	N	A	16	12	0	4
321	W	W	A	N	W	W	A	A	N	NR	N	NR	NR	NR	NR	NR	N	W	N	NR	A	W	NR	A	16	5	6	5

A: Acceptable, W: Warning, N: Not acceptable, NR: Not reported.

4.2. Improvement of the quality of reported results of Cd-109 and Pb-210

The evaluation of the results of the ALMERA PT in 2006 [11] demonstrated that the most problematic nuclides were Cd-109 and Pb-210. In this 2007 PT, the ALMERA laboratories who participated in the 2006 ALMERA PT were able to improve the quality of reported results for these two nuclides in 2007 PT, which suggests an improvement in the analytical performance of the ALMERA members. Table 8 lists such a comparison.

Table 8. Comparison of number of not acceptable results in 2006 PT and 2007 PT

	2006 ALMERA Proficiency test	*2007 ALMERA Proficiency test*
Nuclide	*Percentage of "Not acceptable" results [%]*	*Percentage of "Not acceptable" results [%]*
Cd-109	44	23
Pb-210	35	20

It is suggested that the major sources of bias and incomparability in Pb-210 results could be attributed to the inappropriate detector calibration and/or the overestimation or underestimation of the self attenuation factor. As an example of practical approach for self absorption correction the approach suggested by Cutshall, Larsen and Olsen [12]. In certain laboratories the efficiency calibration was extrapolated, which led to large discrepancies.

4.3. Improvement of the overall analytical performance

Thirty six members of ALMERA participated in both PTs in 2006 and 2007. The overall performance was improved in 2007 ALMERA PT despite the fact that more difficult nuclides such as Pu and U isotopes were introduced in the 2007 ALMERA PT. The number of "not acceptable" results in 2007 ALMERA PT was decreased in comparison to 2006 ALMERA PT.

To demonstrate the improvement in the analytical performance in 2007 PT comparing to 2006 PT a Weighted Summary Score (WSC) was calculated for each laboratory based on its performance as the following:

WSC= (Number of acceptable results*2)+Number of warnings*1

Table 10 shows the laboratory codes in 2006 and 2007 PT and the comparison between the calculated WSC in 2006 and 2007. It can be noticed that most of the laboratories have improved their performance.

Studying the reported analytical results for soil and water samples of the laboratories who participated in both 2006 and 2007 ALMERA proficiency tests, it was possible to track the performance of the ALMERA laboratories for each analyte. The "not acceptable" results reported by this group of participants were tacked to find out if there was any improvement on the quality of reported results in this PT. From the comparison it was found that in average more than 73% of "not acceptable" results reported in 2006 PT were improved to "acceptable" or "warning" status, Table 9. This clearly suggests that most of the participants

were able to identify the analytical problem occurred during the participation in the 2006 PT and were able to improve their performance in the current PT.

In the contrary, certain number of the participants were not able to keep their good performance demonstrated in the 2006 PT and the quality of reported results in 2007 was worse than those reported in 2006 for certain laboratories. Around 8% of the reported results from the 2006 PT participants stepped down from “acceptable” in 2006 to “not acceptable”. This suggests that one shot of participation in a PT is not a sufficient evidence for a good and stable performance, only continuous participation in PTs demonstrates the stability of the analytical system performance.

Table 9 shows the percentage of positive or negative development of the analytical performance per analyte.

Table 9. Comparison of analytical performance between the two ALMERA PTs in 2006 and 2007

	Positive Development From “N” in 2006 PT to “A” in ALMERA 2007 PT	Negative Development From “A” in 2006 PT to “N” in 2007 ALMERA PT
Am-241	90.0	10.2
Cd-109	73.1	12.5
Co-60	66.7	4.5
Cs-134	81.8	8.8
Cs-137	62.5	3.3
K-40	62.5	7.4
Mn-54	100.0	8.2
Pb-210	55.6	9.4
Zn-65	62.5	9.7

4.4. Technical information provided by the participants

Appendix I contains the summary evaluation of each laboratory along with the summary of the reported technical information. For each laboratory, the Appendix I lists the radionuclides which did not pass the test and which should be investigated for corrective actions.

Table 10. Comparison of the analytical performance in 2007 PT with the analytical performance in 2006 PT

Lab code	ALMERA PT 2006 score	count	Weighted summary score	Lab code	ALMERA PT 2007 score	count	Weighted summary score
35	A	14	29	235	A	14	29
	F	3			F	3	
	W	1			W	1	
145	A	12	28	269	A	15	34
	F	2			F	1	
	W	4			W	4	
158	A	17	35	272	A	17	35
	F	0			F	0	
	W	1			W	1	
238	A	11	25	179	A	14	28
	F	3			F	7	
	W	3			W	0	
250	A	15	32	279	A	18	36
	F	1			F	0	
	W	2			W	0	
273	A	12	26	265	A	15	31
	F	4			F	2	
	W	2			W	1	
292	A	16	33	9	A	17	37
	F	1			F	4	
	W	1			W	3	
293	A	13	29	53	A	15	33
	F	2			F	0	
	W	3			W	3	
294	A	10	22	186	A	16	32
	F	6			F	2	
	W	2			W	0	
300	A	18	36	151	A	10	21
	F	0			F	8	
	W	0			W	1	
303	A	17	35	291	A	13	30
	F	0			F	4	
	W	1			W	4	

ALMERA PT 2006				ALMERA PT 2007			
Lab code	score	count	Weighted summary score	Lab code	score	count	Weighted summary score
305	A	12	27	147	A	14	32
	F	3			F	4	
	W	3			W	4	
306	A	17	34	4	A	18	36
	F	1			F	0	
	W	0			W	0	
311	A	17	35	112	A	18	39
	F	0			F	1	
	W	1			W	3	
313	A	12	24	10	A	16	33
	F	3			F	0	
	W	0			W	1	
314	A	17	34	150	A	20	40
	F	1			F	3	
	W	0			W	0	
316	A	13	26	252	A	15	30
	F	2			F	1	
	W	0			W	0	
319	A	12	25	189	A	23	47
	F	5			F	0	
	W	1			W	1	
322	A	11	26	8	A	15	31
	F	3			F	2	
	W	4			W	1	
325	A	15	30	110	A	14	29
	F	1			F	1	
	W	0			W	1	
326	A	12	25	50	A	13	28
	F	5			F	8	
	W	1			W	2	
327	A	16	33	237	A	23	46
	F	1			F	1	
	W	1			W	0	
330	A	2	9	148	A	5	11
	F	10			F	8	
	W	5			W	1	

Lab code	ALMERA PT 2006 score	count	Weighted summary score	Lab code	ALMERA PT 2007 score	count	Weighted summary score
331	A	16	32	144	A	16	35
	F	2			F	0	
	W	0			W	3	
332	A	10	20	44	A	9	19
	F	8			F	3	
	W	0			W	1	
333	A	13	27	137	A	15	30
	F	4			F	3	
	W	1			W	0	
334	A	14	30	12	A	17	37
	F	2			F	0	
	W	2			W	3	
335	A	14	32	257	A	15	31
	F	0			F	2	
	W	4			W	1	
337	A	4	14	321	A	5	16
	F	8			F	5	
	W	6			W	6	
338	A	9	20	260	A	18	36
	F	3			F	2	
	W	2			W	0	
343	A	14	28	262	A	16	32
	F	4			F	2	
	W	0			W	0	
347	A	14	30	161	A	20	42
	F	2			F	2	
	W	2			W	2	
348	A	15	31	18	A	18	37
	F	2			F	5	
	W	1			W	1	
349	A	10	21	255	A	8	16
	F	5			F	8	
	W	1			W	0	
351	A	16	32	24	A	18	38
	F	2			F	1	
	W	0			W	2	

Lab code	ALMERA PT 2006			Lab code	ALMERA PT 2007		
	score	count	Weighted summary score		score	count	Weighted summary score
361	A	9	23	52	A	11	28
	F	2			F	1	
	W	5			W	6	
367	A	16	32	245	A	17	35
	F	2			F	0	
	W	0			W	1	

From Appendix I it can be found that the majority of the participating laboratories calibrated their system using multi gamma standard source.

4.5. Recommendations to the laboratories

Fifteen and eight laboratories reported their results for gamma and alpha beta emitting nuclides respectively without any "not acceptable" score. Table 11 lists the codes of these laboratories. Only three participating laboratories with codes 9, 189 and 237 reported all alpha beta emitting nuclides (6 results) and obtained 100% acceptable results.

It is recommended to this group of laboratory to maintain the statistical control of the analytical process and to monitor it. This group of laboratories reported satisfactory analytical results for the scope and evaluation criteria of this PT.

Table 11. Laboratories reported results without any "not acceptable" score

Laboratory code	
Gamma emitting nuclides	Alpha, beta emitting nuclides
4, 10, 12, 24, 53, 104, 111, 144, 150, 161, 189, 245, 272, 279	9, 112, 124, 179, 189, 237, 269, 293

Laboratories with codes 37, 148, 151, 255 generally performed well in water analysis while in soil sample "not acceptable" performance was observed. This could be attributed to the matrix effect and inappropriate corrections or efficiency calibration. While laboratories with codes 44, 182 and 206 performed well in soil sample but they have to review the procedure used for the gamma emitting nuclides in water.

Laboratories with codes 50,147, 182 reported relatively high results for U, Pu and/or Sr-90 isotopes, while laboratories 18, 24, 161, 291 reported lower activities in spinach around 50% of the IAEA value which could be attributed to an error in the calculations or incomplete recovery correction.

5. CONCLUSIONS

The IAEA-CU-2007-04 proficiency test was successfully completed with a high level of reporting of analytical results to the IAEA. Most participants were able to quantify all of the nuclides in the three matrices. 15% of all reported results did not pass the PT acceptance criteria, which indicates an improvement in the overall performance compared with the 2006 ALMERA PT.

The evaluation results of the 2007 ALMERA PT demonstrated that on average more than 73% of "not acceptable" results reported in the 2006 ALMERA PT were improved to "acceptable" or "warning" status in 2007 ALMERA PT. This clearly suggests that most of the participants were able to identify the analytical problem which occurred during the participation in the 2006 PT and improved their performance in the current PT.

On the other hand, around 8% of the reported results from the 2006 ALMERA PT participants moved stepped down from "acceptable" in 2006 ALMERA PT to "not acceptable" in 2007 ALMERA PT. This suggests that a one-off participation in a PT is not a sufficient evidence for a viable and stable analytical performance, only continuous monitoring of the analytical performance using internal quality control mechanisms and external quality such as participation in PTs will demonstrate the stability and reliability of the analytical system performance. In addition, the results of the 2006 PT, shows that the performance in the determination of the of Cd-109 and Pb-210 were improved and it was found that more than 75% of the participating laboratories were able to pass the PT criteria compared to 50% in the 2006 PT.

It was found that the number of ALMERA laboratories who are ready to report results for alpha and beta emitting nuclides is limited and more attention should be given to develop the capabilities in the determination of these nuclides.

The quality of the reported analytical results in rapid and long term reporting modes is comparable, which suggests that the quality of rapid reporting analytical results (in case of emergency) could be used for decision making in case of emergency for these matrices and analytes.

The PT demonstrates the shortage in technical capacity of ALMERA laboratories in analyzing transuranic elements and Sr-90. The number of laboratories capable of reporting reliable and valid analytical results for transuranic elements and Sr-90 was significantly less than those for gamma emitting radionuclides.

This ALMERA series of PTs provides the tool and mechanism to improve the ALMERA laboratories analytical performance and enhance the comparability and reliability of the determination of radionuclides in environmental matrices.

Generally speaking, this exercise provided the possibility to quantify the level of analytical performance of the ALMERA network members and it is a step forwards in the improvement of the network performance in the determination of alpha, beta and gamma emitting radionuclides in different environmental matrices.

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APPENDIX I
REPORTED TECHNICAL INFORMATION AND SUMMARY EVALUATION SORTED BY LABORATORY CODE

The summary technical information on the analytical procedure is presented as reported by the participants against the percentage of score, for each participating laboratory the nuclides which need some corrective actions were listed. The following codes were used:

- for performance evaluation A: Acceptable, W: Warning, N: Not Acceptable.
- for applied corrections: 1: Moisture Content, 2: Decay Correction, 3: Self Attenuation, 4: Random Summing, 5: Coincidence Summing, 6: Cascade Correction, 7: Background Correction, NR: Not reported.

Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the IAEA or any of its staff members thereof.

In these tables, individual laboratory data is presented in ascending order of the laboratory code.

Lab. code	Number of reported results	% A	% W	% N	Gamma Software	Method of efficiency calibration	Applied corrections	Nuclides need corrective actions		
								Spinach	Soil	Water
4	18	100.00	0.00	0.00	Genie ESP	Multinuclide standard	1, 2, 3, 4, 5, 6, 7			
6	16	81.25	0.00	18.75	Assayer	Multinuclide standard	1, 2, 7		Am-241; Zn-65	Cd-109
8	18	83.33	5.56	11.11	GammaVision Model A66-B32 Version 5.20	Mathematical approach	1, 2, 3, 5, 7		Cd-109; Pb-210	
9	24	70.83	12.50	16.67	Self made for gamma spectrometry	Multinuclide standard	1, 2, 3, 5, 7	K-40		Am-241; Cd-109; Pb-210
10	17	94.12	5.88	0.00	Interwinner	Multinuclide standard	1			
12	20	85.00	15.00	0.00	GENIE 2000	Selective standard nuclides	1, 2, 7			
18	24	75.00	4.17	20.83	GENIE 2000 Version 3.1	Multinuclide standard	1, 2, 3, 4, 5, 7	Am-241; Pu-238; Pu-239+240; Sr-90		Cs-134
19	14	57.14	14.29	28.57	GammaVision	Multinuclide standard	NR	K-40	Co-60; Cs-137	Cs-134
24	21	85.71	9.52	4.76	SpecDec	Selective standard nuclides	1, 2, 7	Sr-90		
29	14	92.86	0.00	7.14	GENIE 2000	Multinuclide standard	1, 2, 7			Zn-65
31	11	54.55	0.00	45.45	GammaVision 32	Multinuclide standard	2, 7		Am-241; Cd-109	Am-241; Cs-134; Cs-137
35	18	83.33	11.11	5.56	GENIE 2000	Multinuclide standard	1, 2, 3, 4, 5, 7			Cs-134
36	21	76.19	9.52	14.29	GammaVision	Multinuclide standard	2, 7	Sr-90	Pb-210	Pb-210

Lab. code	Number of reported results	% A	% W	% N	Gamma Software	Method of efficiency calibration	Applied corrections	Nuclides need corrective actions		
								Spinach	Soil	Water
37	18	38.89	22.22	38.89	Pulse Height Analysis Software	Multinuclide standard	1, 2, 7		Cd-109; Co-60; Cs-137; Mn-54; Pb-210; Zn-65	Cd-109
43	19	94.74	0.00	5.26	WinQ for Sr-90; Apex/Genie for K-40\, Cs-137	Multinuclide standard	1, 2, 7		Cd-109	
44	13	69.23	7.69	23.08	GammaTrac	Multinuclide standard	1, 2, 7			Co-60; Mn-54; Zn-65
50	23	56.52	8.70	34.78	GENIE 2000	Multinuclide standard	1, 2, 3, 7	Pu-238; Pu-239+240; U-234; U-238	Cd-109	Am-241; Cs-137; Pb-210
52	18	61.11	33.33	5.56	Apex	Mathematical approach	2, 3		Cs-134	
53	18	83.33	16.67	0.00	GENIE 2000	Multinuclide standard	1, 2, 7			
55	18	88.89	11.11	0.00	Genie -2000\, -USA	Multinuclide standard	1, 2, 7			
99	18	72.22	11.11	16.67	GENIE 2000	Multinuclide standard	1, 2, 3, 4, 6, 7		Pb-210	Am-241; Pb-210
102	22	54.55	9.09	36.36	GENIE-2000	Multinuclide standard	3	Pu-238; Pu-239+240; U-234; U-238	Am-241; Cd-109; Pb-210	Mn-54
104	21	100.00	0.00	0.00	In House	Multinuclide standard	2, 7			
110	16	87.50	6.25	6.25	GENIE 2000 version V1.3\,1999	Multinuclide standard	1, 2, 3, 4, 5, 6, 7		Cs-134	

Lab. code	Number of reported results	% A	% W	% N	Gamma Software	Method of efficiency calibration	Applied corrections	Nuclides need corrective actions		
								Spinach	Soil	Water
111	5	100.00	0.00	0.00	GENIE 2000	Other	7			
112	22	81.82	13.64	4.55	GENIE-2000 2.1	Multinuclide standard	1, 2, 3, 6, 7			Cd-109
124	22	68.18	13.64	18.18	IW 4.1 for gamma and manual for alpha	Selective standard nuclides	1, 7	K-40	Cd-109; Pb-210	Pb-210
134	12	91.67	0.00	8.33	EMCAPLUS 3.0	Selective standard nuclides	2, 7			Co-60
137	18	83.33	0.00	16.67	Omnigam	Multinuclide standard	2, 7	Cs-137; K-40		Pb-210
144	19	84.21	15.79	0.00	GAMMA VISION - 32 Model A66 - B32	Multinuclide standard	1, 2, 4, 7			
147	22	63.64	18.18	18.18	GammaVision	Multinuclide standard	1, 2, 7	Pu-239+240; Sr-90	Pb-210	Co-60
148	14	35.71	7.14	57.14	APEX - GENIE 2000	Multinuclide standard	1, 2, 7	Cs-137	Cd-109; Co-60; Cs-134; Cs-137; Mn-54; Zn-65	Cs-134
150	23	86.96	0.00	13.04	GammaVision	Multinuclide standard	2, 3, 5, 7	Pu-238; Pu-239+240; U-234;		
151	19	52.63	5.26	42.11	GENIE 2000	Mathematical approach	1, 2, 3, 4, 5, 6, 7		Am-241; Cd-109; Co-60; Cs-137; Mn-54; Pb-210; Zn-65	Cs-134
160	17	76.47	11.76	11.76	Gamma Vision-32 Version 6	Multinuclide standard	1, 2, 7		Pb-210	Cs-134

Lab. code	Number of reported results	% A	% W	% N	Gamma Software	Method of efficiency calibration	Applied corrections	Nuclides need corrective actions		
								Spinach	Soil	Water
161	24	83.33	8.33	8.33	GENIE 2000	Multinuclide standard	1, 2, 3, 7	U-234; U-238		
179	21	66.67	0.00	33.33	GammaVision 6.01	Multinuclide standard	1, 2, 7	Am-241; Pu-238; U-234; U-238	Am-241; Cd-109	Am-241
182	16	31.25	6.25	62.50	NR	Selective standard nuclides	2	Pu-239+240; U-234; U-238;	Cd-109; Pb-210	Cd-109; Co-60; Cs-134; Cs-137; Mn-54
186	18	88.89	0.00	11.11	Genie2K	Multinuclide standard	1, 2, 7		Pb-210	Pb-210
189	24	95.83	4.17	0.00	GENIE 2000	Multinuclide standard	1, 2, 3, 4, 5, 6, 7			
206	15	53.33	0.00	46.67	GENIE 2000	Multinuclide standard	2		Cd-109	Am-241; Cd-109; Co-60; Cs-137; Mn-54; Zn-65
237	24	95.83	0.00	4.17	Interwinner 5.0	Multinuclide standard	1, 2, 4, 5, 6, 7			Zn-65
245	18	94.44	5.56	0.00	NR	Multinuclide standard	1, 2, 3, 4, 7			
252	16	93.75	0.00	6.25	GammaTrac	Multinuclide standard	1, 2, 3, 7			Cd-109
255	16	50.00	0.00	50.00	NR	Multinuclide standard	NR		Co-60; Cs-134; Cs-137; Mn-54; Zn-65	Am-241; Cd-109; Mn-54
257	18	83.33	5.56	11.11	SPUNAL	Multinuclide standard	1, 2	Cs-137; K-40		
260	20	90.00	0.00	10.00	GENIE 2000	Selective standard nuclides	1, 7	Am-241	Cd-109	

Lab. code	Number of reported results	% A	% W	% N	Gamma Software	Method of efficiency calibration	Applied corrections	Nuclides need corrective actions		
								Spinach	Soil	Water
262	18	88.89	0.00	11.11	GENIE 2000	Multinuclide standard	1, 2, 7			Am-241; Cd-109
265	18	83.33	5.56	11.11	GENIE 2000	Multinuclide standard	1, 2, 5, 7		Am-241	Zn-65
269	20	75.00	20.00	5.00	GENIE 2000	Multinuclide standard	1, 7			Cs-134
272	18	94.44	5.56	0.00	Winner 6.0	Multinuclide standard	1, 2, 3, 7			
279	18	100.00	0.00	0.00	GAMMA-99	Selective standard nuclides	2, 3, 5, 7			
280	17	52.94	17.65	29.41	NR	Multinuclide standard	2, 7		Am-241; Zn-65	Co-60; Cs-134; Mn-54
291	21	61.90	19.05	19.05	Gamma vision	Multinuclide standard	1, 2, 4, 7	U-234; U-238		Mn-54; Zn-65
293	21	85.71	4.76	9.52	WINNER 6.0	Multinuclide standard	1, 2, 7		Am-241	Cs-134
299	18	77.78	0.00	22.22	Genie2000	Mathematical approach	2	Sr-90	Cs-134	Am-241; Zn-65
305	20	80.00	0.00	20.00	LSRM-2000	Multinuclide standard	1, 2, 3, 6, 7	Pu-239+240	Cd-109	Am-241; Cd-109
310	19	89.47	0.00	10.53	Genie2000	Mathematical approach	1, 2, 3, 4, 5, 6, 7		Cd-109	Cs-134
321	16	31.25	37.50	31.25	GENIE 2000	Other	1, 2, 7	Cs-137; K-40	Cd-109	Mn-54; Zn-65

Codes for applied corrections:

1: Moisture Content,2: Decay Correction, 3: Self Attenuation, 4: Random Summing, 5: Coincidence Summing, 6: Cascade Correction, 7: Background Correction

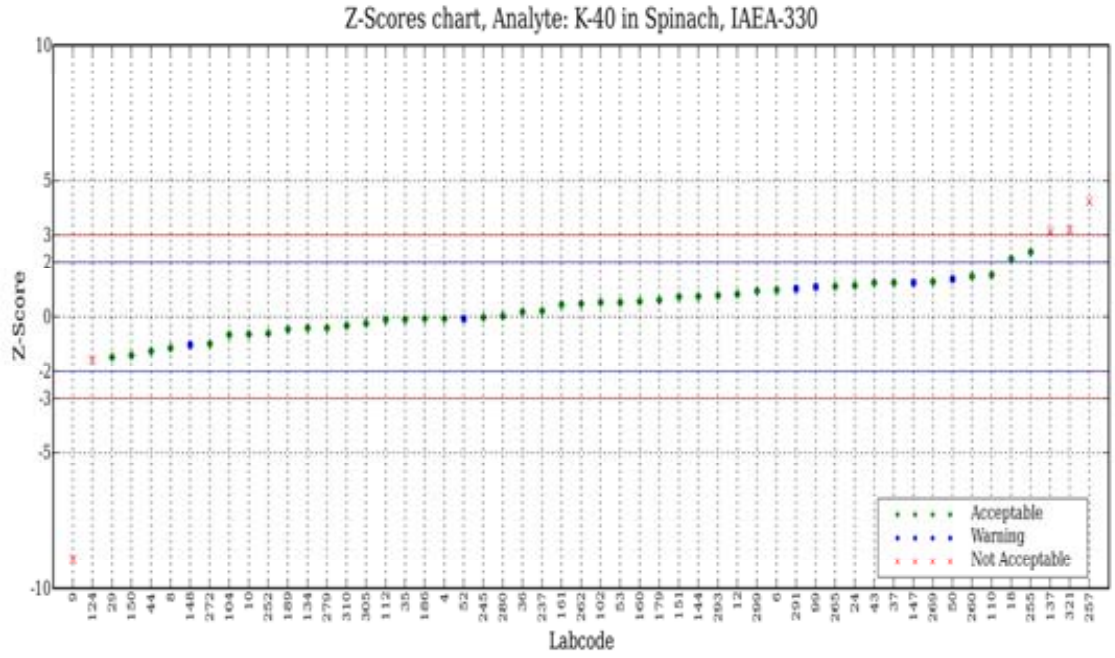
APPENDIX II
PERFORMANCE EVALUATION TABLES SORTED BY RADIONUCLIDE

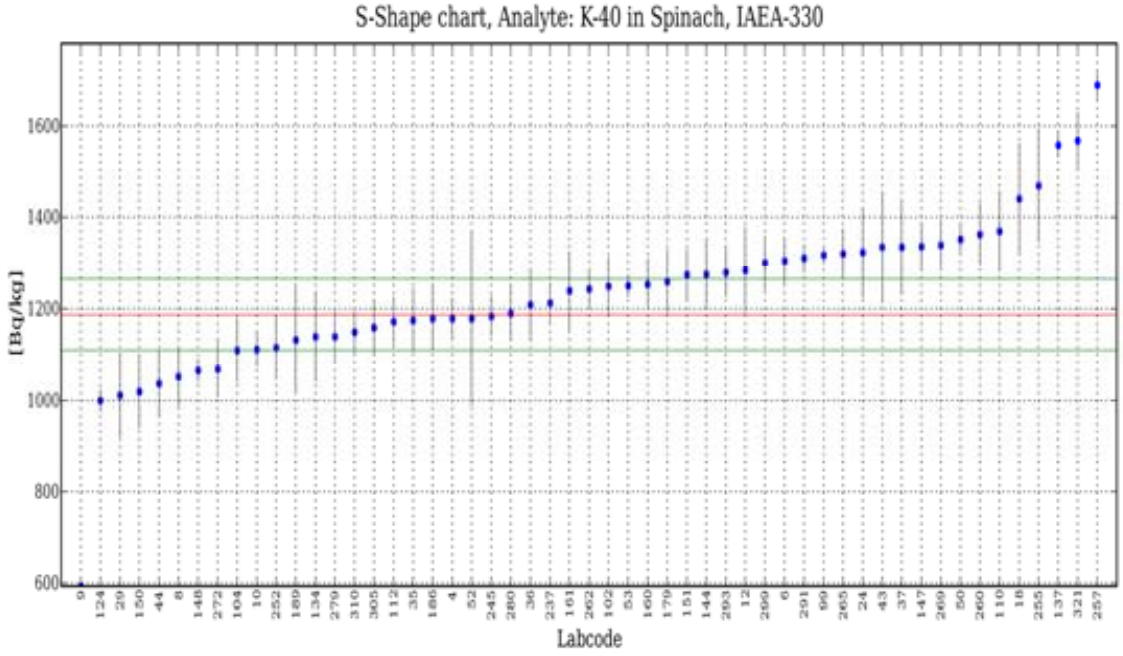
All results listed in this Appendix are expressed in Bq/kg units at a reference date set to 2007-15-October. The abbreviations and calculation formulas used in the individual evaluation tables are explained in paragraph 3 of this report.

The individual laboratory evaluation reports are presented in ascending order of the laboratory code.

Analyte: K-40 in Spinach, IAEA-330

Target Value: 1188.0 ± 30.0 [Bq/kg]





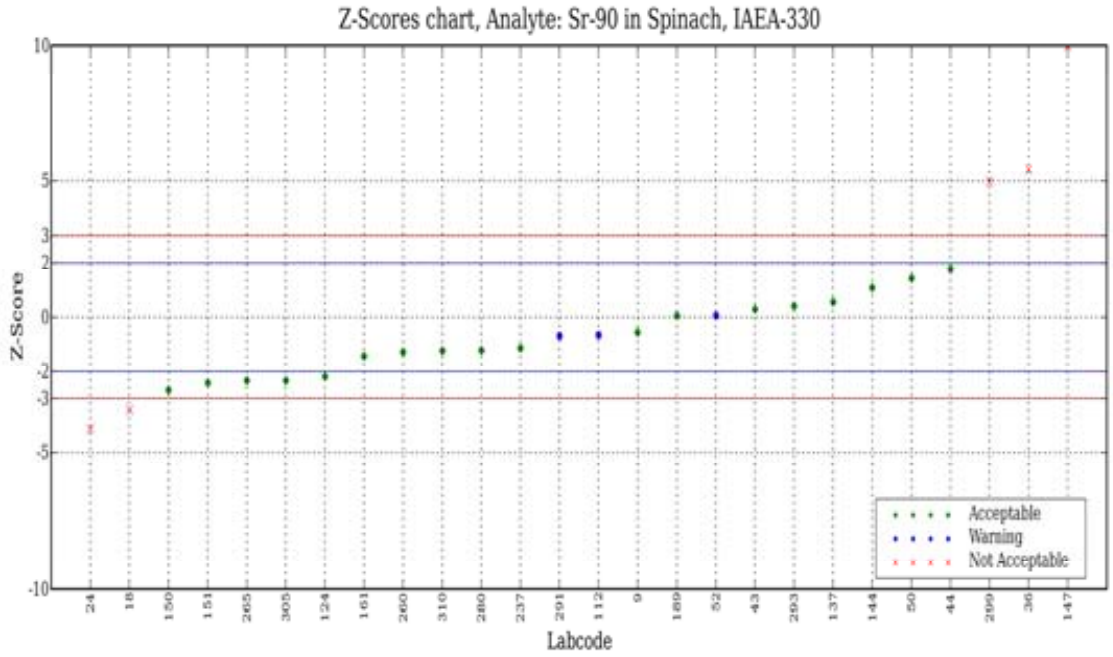
Analyte: K-40 in Spinach, IAEA-330

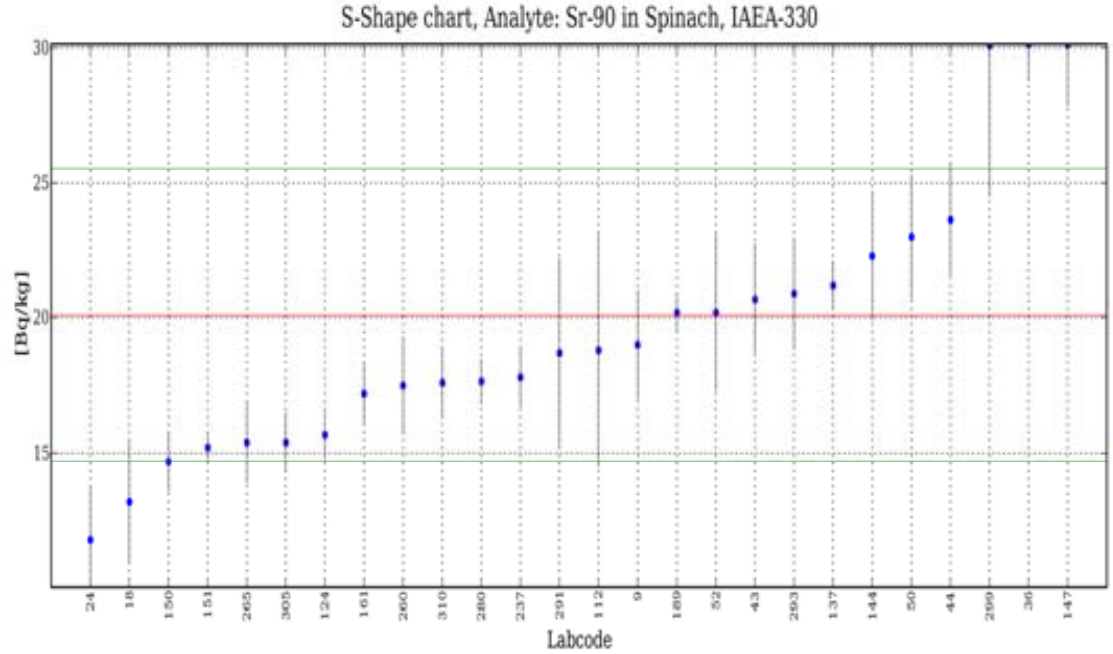
Lab code	Rep. Value	Rep. Unc.	Unc. [%]	Rel. Bias	A1	A2	True.	P	Prec.	Final Score
4	1180.00	43.00	3.64	-0.67	8.00	135.27	A	4.43	A	A
6	1304.00	52.00	3.99	9.76	116.00	154.89	A	4.72	A	A
8	1053.00	66.00	6.27	-11.36	135.00	187.05	A	6.76	A	A
9	125.00	13.00	10.40	-89.48	1063.00	84.35	N	10.70	A	N
10	1112.00	37.00	3.33	-6.40	76.00	122.90	A	4.18	A	A
12	1285.00	94.00	7.32	8.16	97.00	254.57	A	7.74	A	A
18	1441.10	121.50	8.43	21.30	253.10	322.88	A	8.80	A	A
24	1323.00	98.00	7.41	11.36	135.00	264.42	A	7.83	A	A
29	1012.00	92.00	9.09	-14.81	176.00	249.66	A	9.44	A	A
35	1176.00	69.00	5.87	-1.01	12.00	194.12	A	6.39	A	A
36	1208.90	78.48	6.49	1.76	20.90	216.77	A	6.97	A	A
37	1335.36	104.29	7.81	12.40	147.36	279.98	A	8.21	A	A
43	1335.00	121.60	9.11	12.37	147.00	323.13	A	9.45	A	A
44	1038.00	71.00	6.84	-12.63	150.00	198.86	A	7.29	A	A
50	1352.00	35.00	2.59	13.80	164.00	118.93	N	3.62	A	W
52	1180.00	190.00	16.10	-0.67	8.00	496.27	A	16.30	N	W
53	1251.00	25.00	2.00	5.30	63.00	100.75	A	3.22	A	A
99	1317.00	20.00	1.52	10.86	129.00	93.02	N	2.95	A	W
102	1250.00	62.00	4.96	5.22	62.00	177.70	A	5.57	A	A
104	1110.00	70.00	6.31	-6.57	78.00	196.49	A	6.79	A	A
110	1370.00	88.00	6.42	15.32	182.00	239.87	A	6.90	A	A
112	1173.00	54.00	4.60	-1.26	15.00	159.38	A	5.25	A	A
124	1000.30	24.80	2.48	-15.80	187.70	100.42	N	3.54	A	N
134	1139.90	98.00	8.60	-4.05	48.10	264.42	A	8.96	A	A
137	1559.00	27.00	1.73	31.23	371.00	104.13	N	3.06	A	N
144	1276.00	75.00	5.88	7.41	88.00	208.41	A	6.40	A	A
147	1336.00	47.00	3.52	12.46	148.00	143.86	N	4.33	A	W
148	1067.00	25.76	2.41	-10.19	121.00	102.02	N	3.49	A	W
150	1020.00	80.00	7.84	-14.14	168.00	220.44	A	8.24	A	A
151	1275.00	55.00	4.31	7.32	87.00	161.64	A	5.00	A	A
160	1254.10	55.20	4.40	5.56	66.10	162.09	A	5.07	A	A
161	1240.00	85.00	6.85	4.38	52.00	232.56	A	7.31	A	A
179	1260.00	70.00	5.56	6.06	72.00	196.49	A	6.10	A	A
182	<236									
186	1180.00	70.00	5.93	-0.67	8.00	196.49	A	6.45	A	A
189	1133.40	113.20	9.99	-4.60	54.60	302.14	A	10.30	A	A
237	1213.00	44.00	3.63	2.10	25.00	137.40	A	4.42	A	A
245	1185.00	44.00	3.71	-0.25	3.00	137.40	A	4.49	A	A

Lab code	Rep. Value	Rep. Unc.	Unc. [%]	Rel. Bias	A1	A2	True.	P	Prec.	Final Score
252	1116.00	67.00	6.00	-6.06	72.00	189.40	A	6.51	A	A
255	1470.00	124.00	8.44	23.74	282.00	329.15	A	8.81	A	A
257	1690.00	32.00	1.89	42.26	502.00	113.17	N	3.16	A	N
260	1363.00	68.00	4.99	14.73	175.00	191.75	A	5.59	A	A
262	1244.00	40.00	3.22	4.71	56.00	129.00	A	4.09	A	A
265	1320.00	55.00	4.17	11.11	132.00	161.64	A	4.87	A	A
269	1339.00	54.10	4.04	12.71	151.00	159.60	A	4.76	A	A
272	1070.00	62.00	5.79	-9.93	118.00	177.70	A	6.32	A	A
279	1140.00	58.00	5.09	-4.04	48.00	168.47	A	5.68	A	A
280	1190.04	58.70	4.93	0.17	2.04	170.08	A	5.54	A	A
291	1310.00	30.00	2.29	10.27	122.00	109.46	N	3.41	A	W
293	1280.00	53.00	4.14	7.74	92.00	157.13	A	4.85	A	A
299	1300.00	60.00	4.62	9.43	112.00	173.07	A	5.26	A	A
305	1160.00	60.00	5.17	-2.36	28.00	173.07	A	5.76	A	A
310	1150.00	46.00	4.00	-3.20	38.00	141.69	A	4.73	A	A
321	1568.65	61.96	3.95	32.04	380.65	177.61	N	4.69	A	N

Analyte: Sr-90 in Spinach, IAEA-330

Target Value: 20.1 ± 2.1 [Bq/kg]



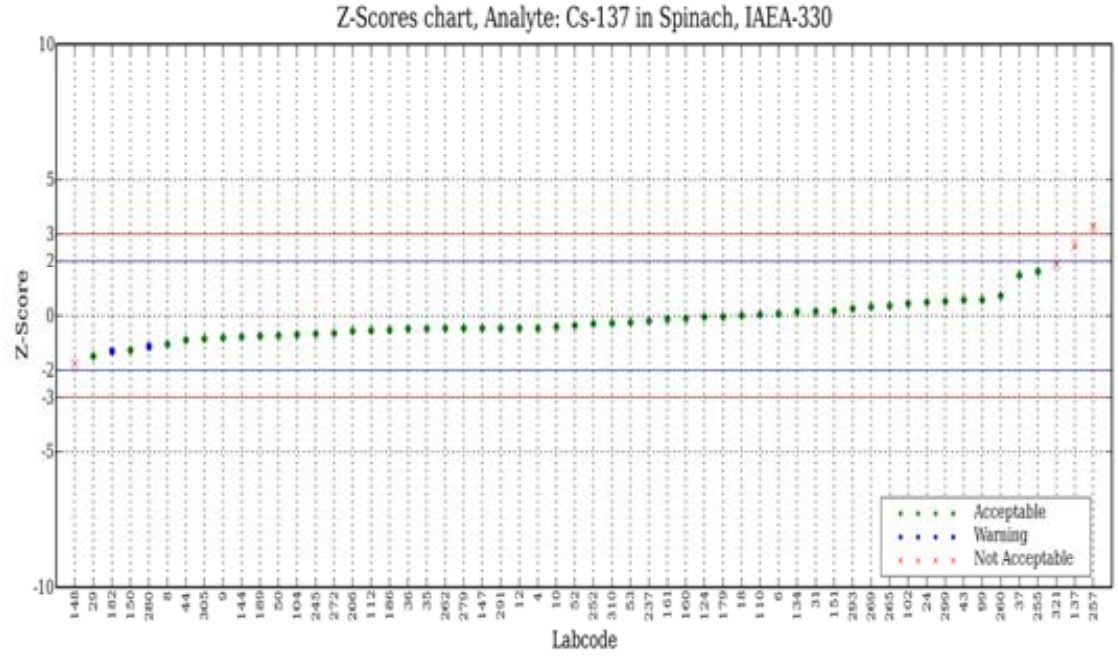


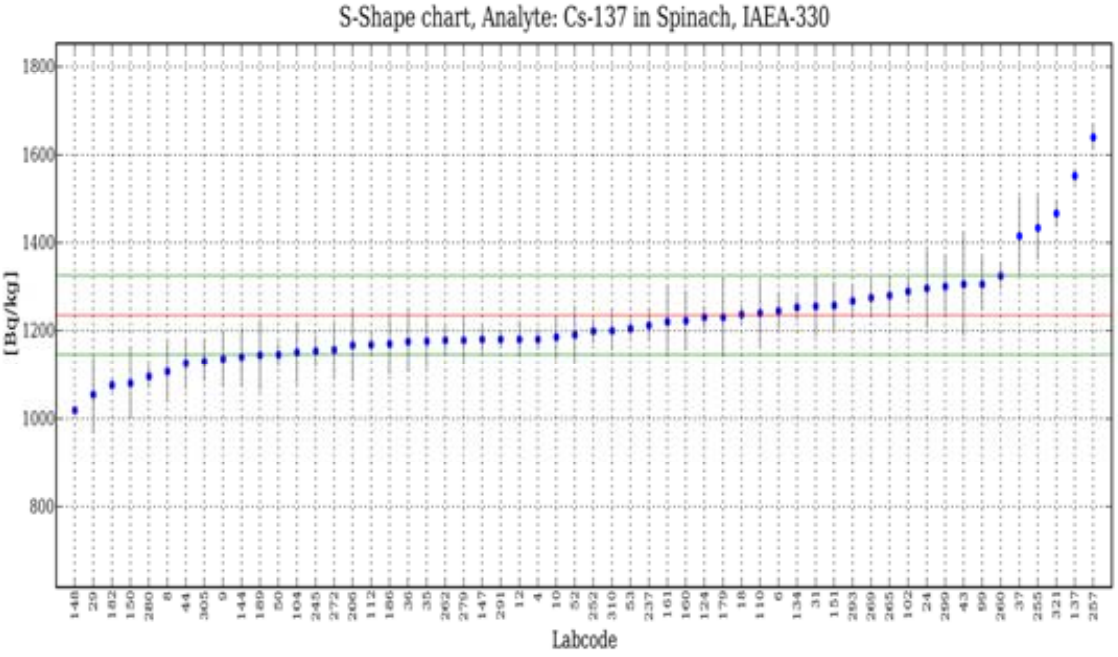
Analyte: Sr-90 in Spinach, IAEA-330

Lab code	Rep. Value	Rep. Unc.	Unc. [%]	Rel. Bias	A1	A2	True.	P	Prec.	Final Score
9	19.00	2.00	10.53	-5.47	1.10	7.48	A	14.83	A	A
18	13.20	2.30	17.42	-34.33	6.90	8.04	A	20.32	N	N
24	11.80	2.00	16.95	-41.29	8.30	7.48	N	19.91	N	N
36	31.00	1.37	4.42	54.23	10.90	6.47	N	11.34	A	N
43	20.68	2.07	10.01	2.89	0.58	7.61	A	14.47	A	A
44	23.65	2.10	8.88	17.66	3.55	7.66	A	13.71	A	A
50	23.00	2.30	10.00	14.43	2.90	8.04	A	14.46	A	A
52	20.20	2.90	14.36	0.50	0.10	9.24	A	17.76	N	W
112	18.80	4.30	22.87	-6.47	1.30	12.35	A	25.15	N	W
124	15.69	0.95	6.05	-21.94	4.41	5.95	A	12.08	A	A
137	21.20	0.90	4.25	5.47	1.10	5.89	A	11.28	A	A
144	22.30	2.40	10.76	10.95	2.20	8.23	A	15.00	A	A
147	70.00	2.30	3.29	248.26	49.90	8.04	N	10.95	A	N
150	14.70	1.10	7.48	-26.87	5.40	6.12	A	12.85	A	A
151	15.22	0.56	3.68	-24.28	4.88	5.61	A	11.08	A	A
161	17.20	1.10	6.40	-14.43	2.90	6.12	A	12.25	A	A
189	20.20	0.70	3.47	0.50	0.10	5.71	A	11.01	A	A
237	17.80	1.10	6.18	-11.44	2.30	6.12	A	12.14	A	A
260	17.50	1.80	10.29	-12.94	2.60	7.14	A	14.66	A	A
265	15.40	1.50	9.74	-23.38	4.70	6.66	A	14.28	A	A
280	17.64	0.83	4.71	-12.24	2.46	5.83	A	11.46	A	A
291	18.70	3.50	18.72	-6.97	1.40	10.53	A	21.44	N	W
293	20.90	2.05	9.81	3.98	0.80	7.57	A	14.33	A	A
299	30.10	5.60	18.60	49.75	10.00	15.43	A	21.34	N	N
305	15.40	1.10	7.14	-23.38	4.70	6.12	A	12.66	A	A
310	17.60	1.30	7.39	-12.44	2.50	6.37	A	12.80	A	A

Analyte: Cs-137 in Spinach, IAEA-330

Target Value: 1235.0 ± 35.0 [Bq/kg]





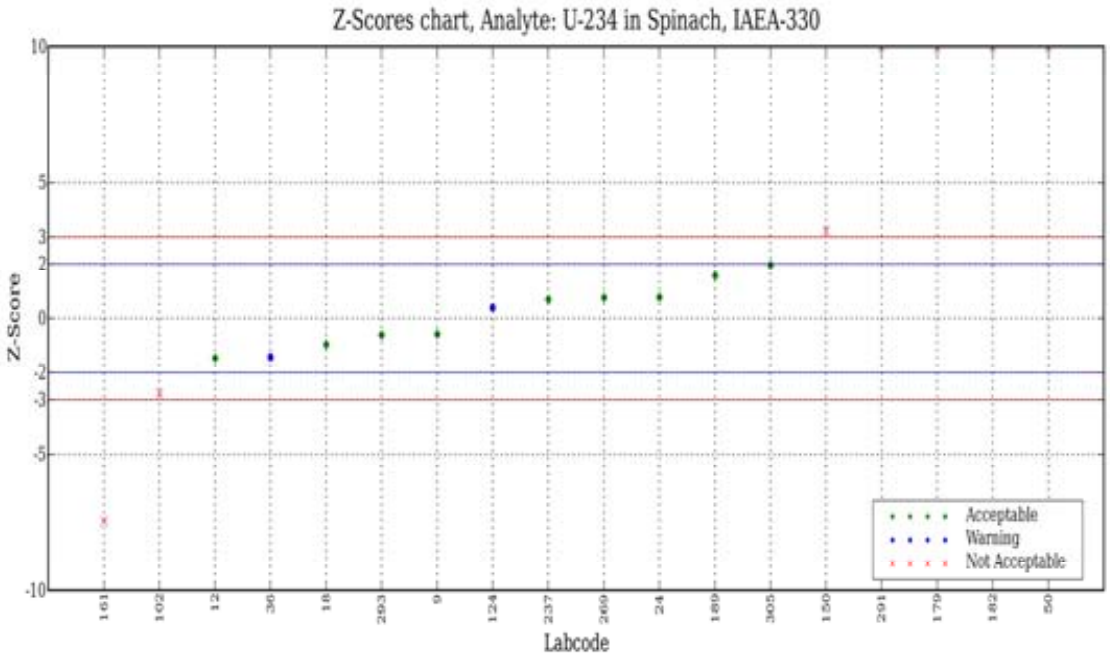
Analyte: Cs-137 in Spinach, IAEA-330

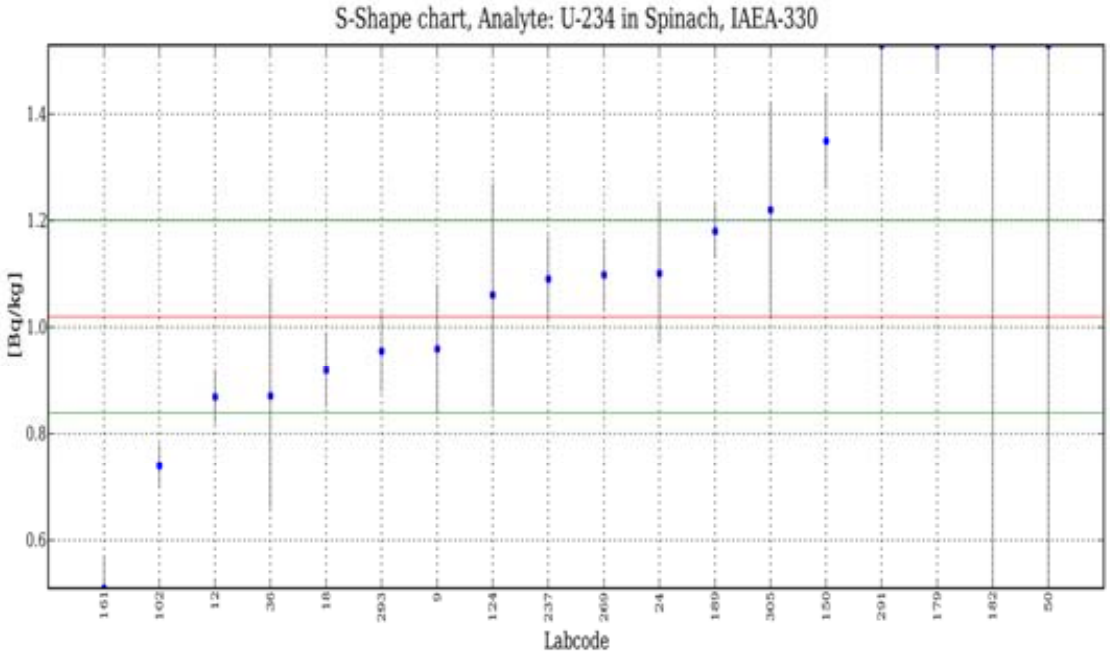
Lab code	Rep. Value	Rep. Unc.	Unc. [%]	Rel. Bias	A1	A2	True.	P	Prec.	Final Score
4	1180.00	24.00	2.03	-4.45	55.00	109.49	A	3.49	A	A
6	1245.00	42.00	3.37	0.81	10.00	141.05	A	4.41	A	A
8	1107.00	67.00	6.05	-10.36	128.00	195.02	A	6.68	A	A
9	1135.00	60.00	5.29	-8.10	100.00	179.21	A	6.00	A	A
10	1185.00	50.00	4.22	-4.05	50.00	157.46	A	5.08	A	A
12	1180.00	41.00	3.47	-4.45	55.00	139.08	A	4.48	A	A
18	1236.40	23.22	1.88	0.11	1.40	108.37	A	3.40	A	A
24	1296.00	88.00	6.79	4.94	61.00	244.34	A	7.36	A	A
29	1054.00	85.00	8.06	-14.66	181.00	237.16	A	8.55	A	A
31	1254.82	68.54	5.46	1.60	19.82	198.55	A	6.15	A	A
35	1176.00	61.00	5.19	-4.78	59.00	181.45	A	5.91	A	A
36	1175.23	69.59	5.92	-4.84	59.77	200.97	A	6.56	A	A
37	1415.96	89.48	6.32	14.65	180.96	247.89	A	6.93	A	A
43	1305.00	118.10	9.05	5.67	70.00	317.80	A	9.48	A	A
44	1125.00	58.00	5.16	-8.91	110.00	174.77	A	5.88	A	A
50	1145.00	27.00	2.36	-7.29	90.00	114.05	A	3.69	A	A
52	1190.00	66.00	5.55	-3.64	45.00	192.74	A	6.23	A	A
53	1205.00	20.00	1.66	-2.43	30.00	104.00	A	3.28	A	A
99	1306.00	60.00	4.59	5.75	71.00	179.21	A	5.40	A	A
102	1289.00	29.00	2.25	4.37	54.00	117.27	A	3.62	A	A
104	1150.00	70.00	6.09	-6.88	85.00	201.92	A	6.71	A	A
110	1240.00	76.00	6.13	0.40	5.00	215.87	A	6.75	A	A
112	1168.00	26.00	2.23	-5.43	67.00	112.49	A	3.60	A	A
124	1230.00	24.90	2.02	-0.40	5.00	110.82	A	3.48	A	A
134	1252.60	30.40	2.43	1.43	17.60	119.61	A	3.73	A	A
137	1552.00	17.00	1.10	25.67	317.00	100.39	N	3.04	A	N
144	1140.00	65.00	5.70	-7.69	95.00	190.47	A	6.37	A	A
147	1180.00	30.00	2.54	-4.45	55.00	118.93	A	3.81	A	A
148	1019.00	8.84	0.87	-17.49	216.00	93.14	N	2.96	A	N
150	1080.00	80.00	7.41	-12.55	155.00	225.29	A	7.93	A	A
151	1257.00	53.00	4.22	1.78	22.00	163.87	A	5.08	A	A
160	1221.90	67.70	5.54	-1.06	13.10	196.63	A	6.22	A	A
161	1220.00	80.00	6.56	-1.21	15.00	225.29	A	7.14	A	A
179	1230.00	90.00	7.32	-0.40	5.00	249.14	A	7.85	A	A
182	1075.50	12.90	1.20	-12.91	159.50	96.24	N	3.08	A	W
186	1170.00	70.00	5.98	-5.26	65.00	201.92	A	6.62	A	A
189	1143.90	80.10	7.00	-7.38	91.10	225.53	A	7.55	A	A
206	1167.00	82.00	7.03	-5.51	68.00	230.03	A	7.58	A	A
237	1212.00	33.00	2.72	-1.86	23.00	124.11	A	3.93	A	A

Lab code	Rep. Value	Rep. Unc.	Unc. [%]	Rel. Bias	A1	A2	True.	P	Prec.	Final Score
245	1153.00	36.00	3.12	-6.64	82.00	129.54	A	4.22	A	A
252	1198.00	28.00	2.34	-3.00	37.00	115.64	A	3.67	A	A
255	1434.00	72.00	5.02	16.11	199.00	206.55	A	5.77	A	A
257	1640.00	28.00	1.71	32.79	405.00	115.64	N	3.31	A	N
260	1324.00	30.00	2.27	7.21	89.00	118.93	A	3.63	A	A
262	1178.00	31.00	2.63	-4.62	57.00	120.63	A	3.87	A	A
265	1280.00	43.00	3.36	3.64	45.00	143.04	A	4.40	A	A
269	1275.00	39.40	3.09	3.24	40.00	135.97	A	4.19	A	A
272	1156.00	66.00	5.71	-6.40	79.00	192.74	A	6.37	A	A
279	1178.00	56.00	4.75	-4.62	57.00	170.38	A	5.53	A	A
280	1095.14	25.73	2.35	-11.32	139.86	112.08	N	3.68	A	W
291	1180.00	20.00	1.69	-4.45	55.00	104.00	A	3.30	A	A
293	1267.00	37.00	2.92	2.59	32.00	131.40	A	4.07	A	A
299	1300.00	70.00	5.38	5.26	65.00	201.92	A	6.08	A	A
305	1130.00	46.00	4.07	-8.50	105.00	149.13	A	4.96	A	A
310	1200.00	46.00	3.83	-2.83	35.00	149.13	A	4.77	A	A
321	1467.25	29.75	2.03	18.81	232.25	118.51	N	3.48	A	N

Analyte: U-234 in Spinach, IAEA-330

Target Value: 1.02 ± 0.07 [Bq/kg]



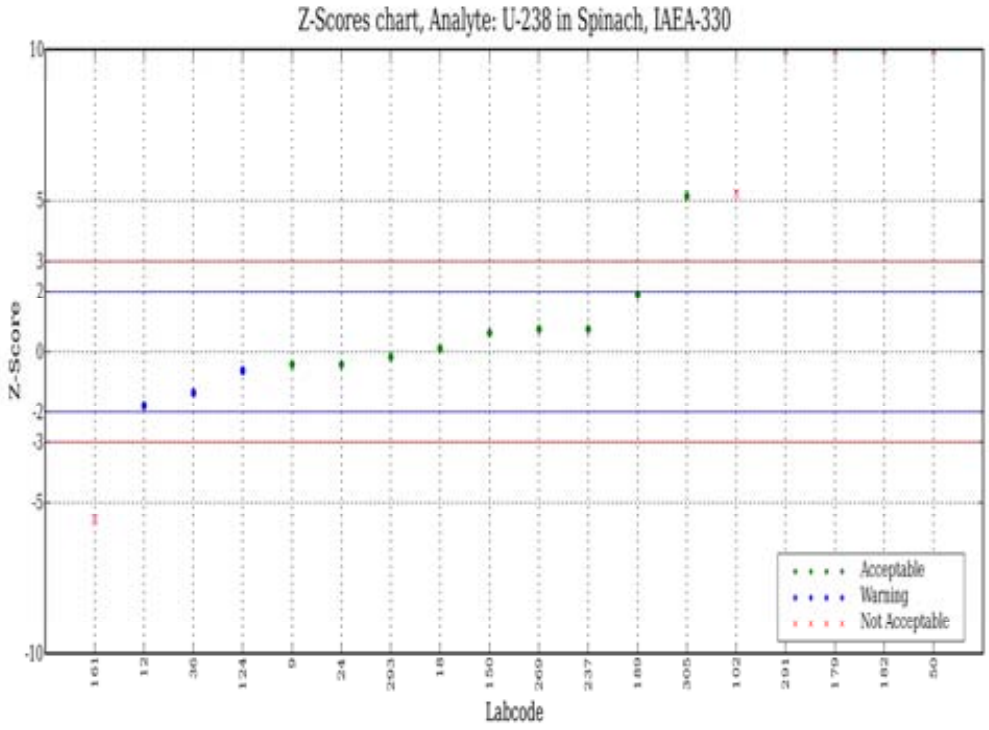


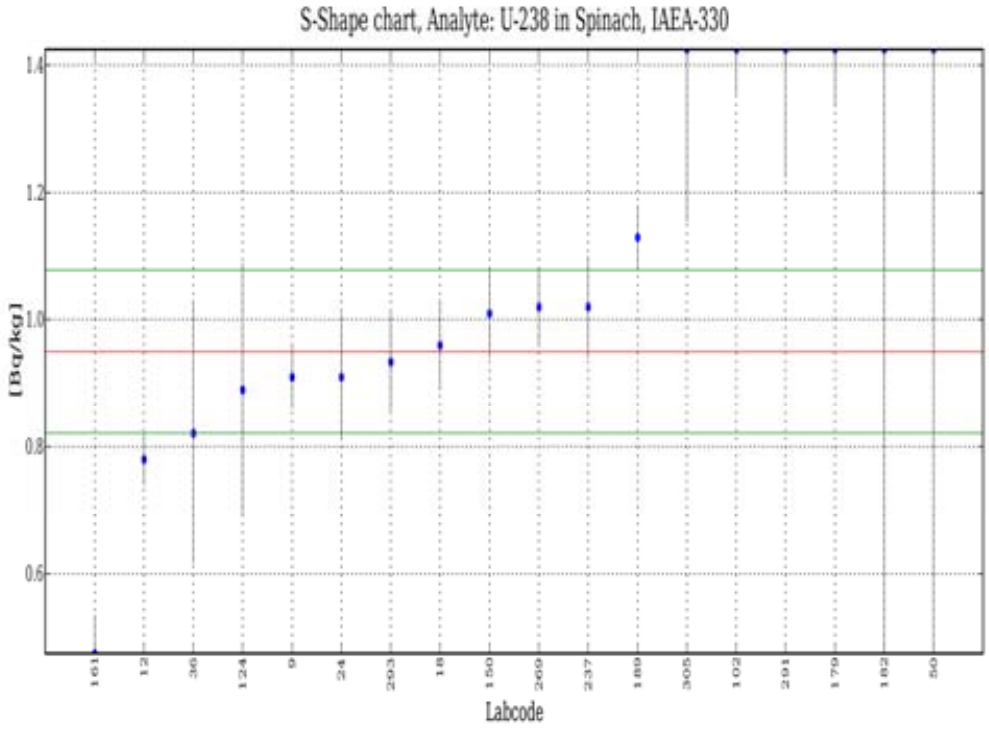
Analyte: U-234 in Spinach, IAEA-330

Lab code	Rep. Value	Rep. Unc.	Unc. [%]	Rel. Bias	A1	A2	True	P	Prec.	Final Score
9	0.96	0.12	12.50	-5.88	0.06	0.36	A	14.26	A	A
12	0.87	0.05	5.75	-14.71	0.15	0.22	A	8.95	A	A
18	0.92	0.07	7.61	-9.80	0.10	0.26	A	10.25	A	A
24	1.10	0.13	11.82	7.84	0.08	0.38	A	13.67	A	A
36	0.87	0.21	24.31	-14.51	0.15	0.58	A	25.26	N	W
50	99.30	6.90	6.95	9635.20	98.28	17.80	N	9.77	A	N
102	0.74	0.04	5.41	-27.45	0.28	0.21	N	8.74	A	N
124	1.06	0.21	19.81	3.92	0.04	0.57	A	20.97	N	W
150	1.35	0.09	6.67	32.35	0.33	0.29	N	9.57	A	N
161	0.26	0.06	23.08	-74.51	0.76	0.24	N	24.08	N	N
179	7.76	0.05	0.68	660.91	6.74	0.23	N	6.90	A	N
182	10.98	1.36	12.39	976.47	9.96	3.51	N	14.16	A	N
189	1.18	0.05	4.24	15.69	0.16	0.22	A	8.07	A	A
237	1.09	0.08	7.34	6.86	0.07	0.27	A	10.05	A	A
269	1.10	0.07	6.10	7.65	0.08	0.25	A	9.18	A	A
291	2.20	0.20	9.09	115.69	1.18	0.55	N	11.39	A	N
293	0.96	0.08	8.13	-6.27	0.06	0.27	A	10.64	A	A
305	1.22	0.20	16.39	19.61	0.20	0.55	A	17.77	A	A

Analyte: U-238 in Spinach, IAEA-330

Target Value: 0.95 ± 0.05 [Bq/kg]





Analyte: U-238 in Spinach, IAEA-330

Lab code	Rep. Value	Rep. Unc.	Unc. [%]	Rel. Bias	A1	A2	True	P	Prec.	Final Score
9	0.91	0.05	5.49	-4.21	0.04	0.18	A	7.61	A	A
12	0.78	0.04	5.13	-17.89	0.17	0.17	N	7.35	A	W
18	0.96	0.07	7.29	1.05	0.01	0.22	A	8.99	A	A
24	0.91	0.10	10.99	-4.21	0.04	0.29	A	12.18	A	A
36	0.82	0.20	24.97	-13.58	0.13	0.54	A	25.52	N	W
50	57.50	4.00	6.96	5952.6	56.55	10.32	N	8.72	A	N
102	1.45	0.07	4.83	52.63	0.50	0.22	N	7.14	A	N
124	0.89	0.20	22.47	-6.32	0.06	0.53	A	23.08	N	W
150	1.01	0.07	6.93	6.32	0.06	0.22	A	8.70	A	A
161	0.42	0.06	14.29	-55.79	0.53	0.20	N	15.22	A	N
179	6.88	0.09	1.32	624.14	5.93	0.27	N	5.43	A	N
182	12.52	1.88	15.02	1217.8	11.57	4.85	N	15.91	A	N
189	1.13	0.05	4.42	18.95	0.18	0.18	A	6.88	A	A
237	1.02	0.08	7.84	7.37	0.07	0.24	A	9.45	A	A
269	1.02	0.06	6.08	7.37	0.07	0.21	A	8.04	A	A
291	2.20	0.20	9.09	131.58	1.25	0.53	N	10.50	A	N
293	0.93	0.08	8.22	-1.68	0.02	0.24	A	9.76	A	A
305	1.44	0.27	18.75	51.58	0.49	0.71	A	19.47	A	A

Analyte: Pu-238 in Spinach, IAEA-330

ULE=0.05 [Bq/kg]

Lab code	Rep. Value	Reported Unc.	Unc. [%]	Final Score
9	0.06	0.07	116.67	A
18	0.06	0.01	15.00	A
50	4.90	0.30	6.12	N
102	28.80	3.00	10.42	N
104	0.03	0.00	6.64	A
111	0.01	0.00	19.66	A
112	0.01	0.00	17.12	A
147	<0.94			A
150	0.10			
161	0.01	0.01	58.33	A
179	0.21	0.00	1.87	N
182	0.00	0.00		-
189	0.01	0.00	7.14	A
237	<0.08			A
260	0.04	0.00	12.85	A
269	0.03	0.01	19.23	A

Analyte: Pu-239+240 in Spinach, IAEA-330

ULE=0.11 [Bq/kg]

Lab code	Rep. Value	Reported Unc.	Unc. [%]	Final Score
9	0.15	0.17	113.33	A
18	0.13	0.02	15.38	A
50	8.60	0.50	5.81	N
102	2.01	0.21	10.23	N
104	0.04	0.01	21.14	A
111	0.03	0.00	15.26	A
112	0.03	0.00	10.94	A
124	0.12	0.04	33.33	A
147	1.20	0.20	16.67	N
150	0.14			
161	0.04	0.03	80.00	A
179	0.09	0.00	0.87	A
182	0.83	0.07	8.43	N
189	0.04	0.00	4.76	A
237	<0.08			
260	0.03	0.00	13.38	A
269	0.05	0.01	17.02	A
305	0.28	0.04	14.29	N

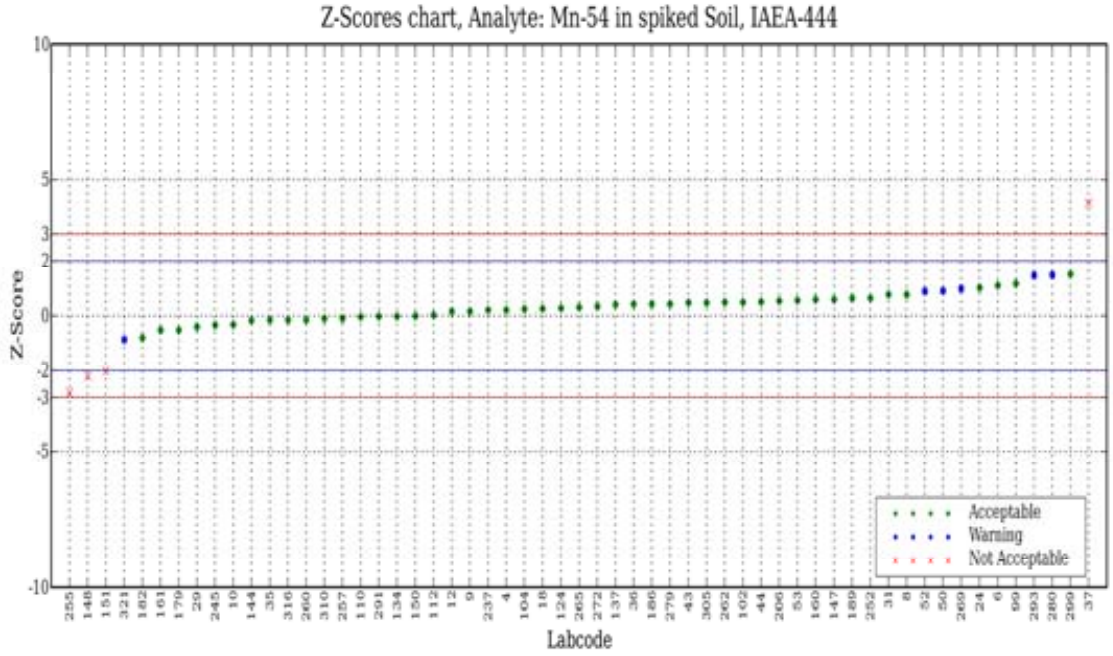
Analyte: Am-241 in Spinach, IAEA-330

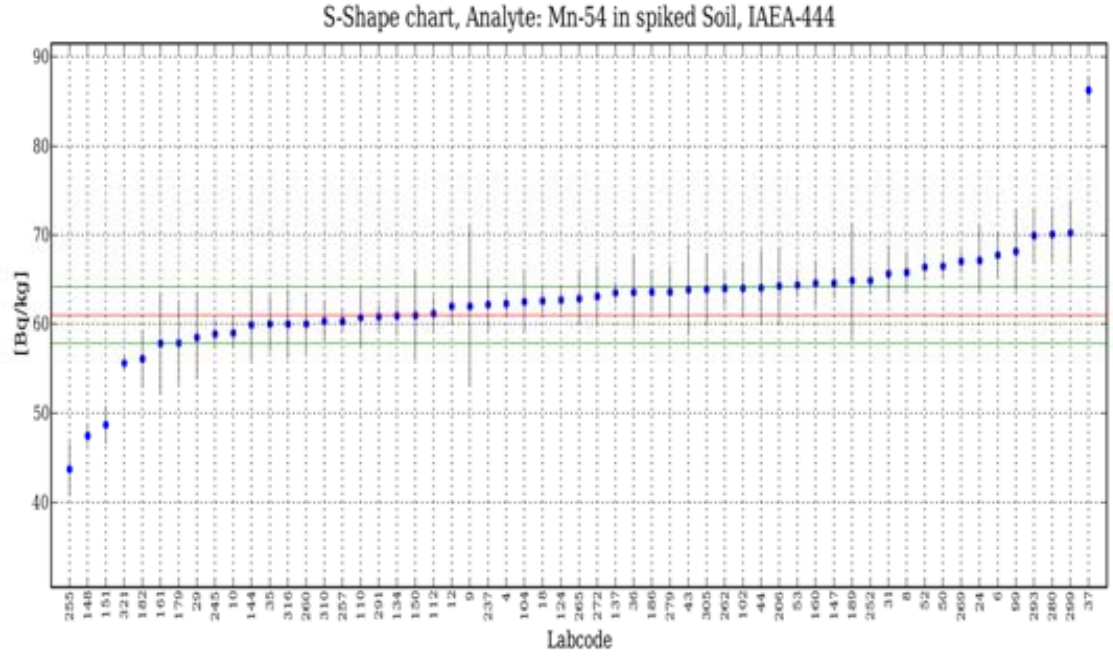
ULE=0.13 [Bq/kg]

Lab code	Rep. Value	Reported Unc.	Unc. [%]	Final Score
9	0.10	0.07	70.00	A
18	0.23	0.03	13.04	N
104	0.11	0.00	3.60	A
111	0.05	0.00	9.56	A
112	0.04	0.00	11.69	A
147	<1.6			
161	0.03	0.01	21.21	A
179	0.34	0.00	1.14	N
189	0.04	0.00	11.43	A
237	0.16	0.05	31.25	A
260	0.30	0.03	9.60	N

Analyte: Mn-54 in spiked Soil, IAEA-444

Target Value: 61.0 ± 1.24 [Bq/kg]





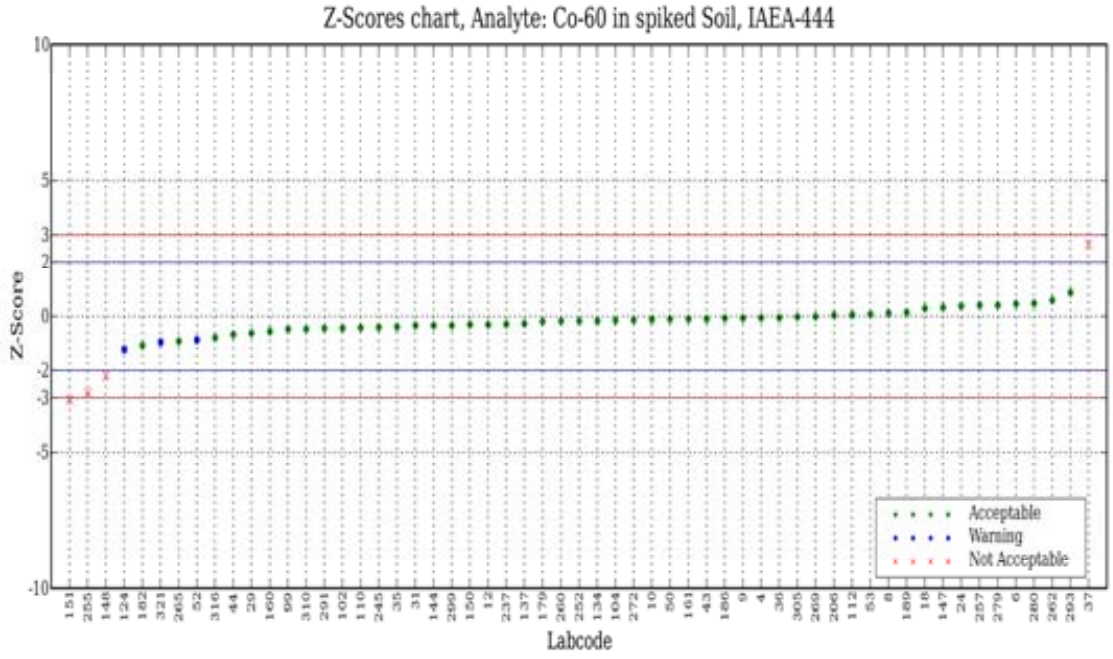
Analyte: Mn-54 in spiked Soil, IAEA-444

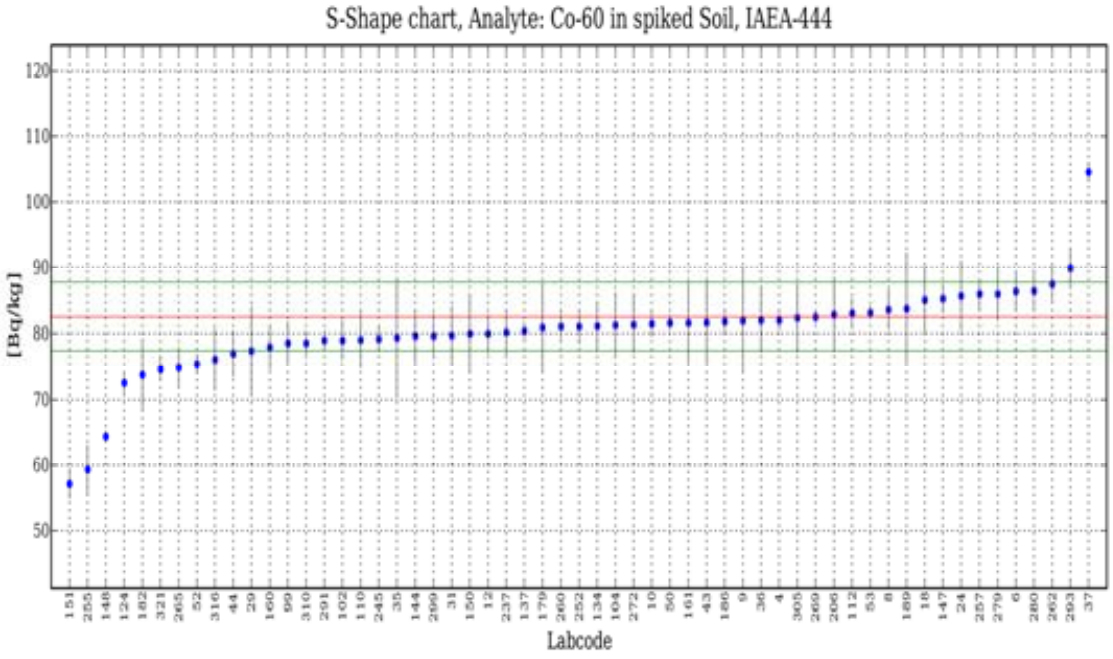
Lab code	Rep. Value	Rep. Unc.	Unc. [%]	Rel. Bias	A1	A2	True	P	Prec.	Final Score
4	62.30	1.20	1.93	2.13	1.30	4.45	A	2.80	A	A
6	67.80	2.50	3.69	11.15	6.80	7.20	A	4.21	A	A
8	65.78	2.35	3.57	7.84	4.78	6.86	A	4.11	A	A
9	62.00	9.00	14.52	1.64	1.00	23.44	A	14.66	A	A
10	58.98	1.70	2.88	-3.31	2.02	5.43	A	3.53	A	A
12	62.00	2.00	3.23	1.64	1.00	6.07	A	3.81	A	A
18	62.60	1.42	2.27	2.62	1.60	4.86	A	3.05	A	A
24	67.20	3.90	5.80	10.16	6.20	10.56	A	6.15	A	A
29	58.50	4.70	8.03	-4.10	2.50	12.54	A	8.29	A	A
31	65.67	3.20	4.87	7.66	4.67	8.85	A	5.28	A	A
35	60.00	3.10	5.17	-1.64	1.00	8.61	A	5.55	A	A
36	63.59	4.03	6.34	4.25	2.59	10.88	A	6.66	A	A
37	86.25	1.50	1.74	41.39	25.25	5.03	N	2.68	A	N
43	63.87	5.13	8.03	4.70	2.87	13.62	A	8.29	A	A
44	64.10	4.20	6.55	5.08	3.10	11.30	A	6.86	A	A
50	66.50	1.40	2.11	9.02	5.50	4.83	N	2.93	A	W
52	66.40	1.50	2.26	8.85	5.40	5.02	N	3.04	A	W
53	64.40	1.40	2.17	5.57	3.40	4.83	A	2.98	A	A
99	68.20	4.50	6.60	11.80	7.20	12.04	A	6.90	A	A
102	64.00	3.00	4.69	4.92	3.00	8.38	A	5.11	A	A
104	62.50	3.50	5.60	2.46	1.50	9.58	A	5.96	A	A
110	60.73	3.19	5.25	-0.44	0.27	8.83	A	5.63	A	A
112	61.20	1.90	3.10	0.33	0.20	5.85	A	3.71	A	A
124	62.72	1.44	2.30	2.82	1.72	4.90	A	3.07	A	A
134	60.90	2.20	3.61	-0.16	0.10	6.52	A	4.15	A	A
137	63.50	1.20	1.89	4.10	2.50	4.45	A	2.78	A	A
144	59.90	4.00	6.68	-1.80	1.10	10.80	A	6.98	A	A
147	64.60	1.70	2.63	5.90	3.60	5.43	A	3.33	A	A
148	47.51	1.08	2.27	-22.11	13.49	4.24	N	3.05	A	N
150	61.00	5.00	8.20	0.00	0.00	13.29	A	8.45	A	A
151	48.70	2.10	4.31	-20.16	12.30	6.29	N	4.77	A	N
160	64.59	2.58	3.99	5.89	3.59	7.39	A	4.48	A	A
161	57.80	5.60	9.69	-5.25	3.20	14.80	A	9.90	A	A
179	57.85	4.55	7.87	-5.16	3.15	12.17	A	8.12	A	A
182	56.10	3.25	5.79	-8.03	4.90	8.97	A	6.14	A	A
186	63.60	2.30	3.62	4.26	2.60	6.74	A	4.15	A	A
189	64.90	6.50	10.02	6.39	3.90	17.07	A	10.22	A	A
206	64.30	4.30	6.69	5.41	3.30	11.55	A	6.99	A	A
237	62.20	2.90	4.66	1.97	1.20	8.14	A	5.09	A	A

Lab code	Rep. Value	Rep. Unc.	Unc. [%]	Rel. Bias	A1	A2	True	P	Prec.	Final Score
245	58.90	1.61	2.73	-3.44	2.10	5.24	A	3.41	A	A
252	64.90	1.40	2.16	6.39	3.90	4.83	A	2.96	A	A
255	43.73	2.97	6.79	-28.31	17.27	8.30	N	7.09	A	N
257	60.30	1.30	2.16	-1.15	0.70	4.64	A	2.96	A	A
260	60.00	3.30	5.50	-1.64	1.00	9.10	A	5.86	A	A
262	64.00	2.00	3.13	4.92	3.00	6.07	A	3.73	A	A
265	62.87	3.02	4.80	3.07	1.87	8.42	A	5.22	A	A
269	67.05	1.28	1.91	9.92	6.05	4.60	N	2.79	A	W
272	63.10	3.40	5.39	3.44	2.10	9.34	A	5.76	A	A
279	63.60	2.90	4.56	4.26	2.60	8.14	A	4.99	A	A
280	70.11	3.00	4.28	14.93	9.11	8.38	N	4.74	A	W
291	60.80	1.40	2.30	-0.33	0.20	4.83	A	3.07	A	A
293	69.99	3.10	4.43	14.74	8.99	8.61	N	4.87	A	W
299	70.30	3.40	4.84	15.25	9.30	9.34	A	5.25	A	A
305	63.90	4.10	6.42	4.75	2.90	11.05	A	6.73	A	A
310	60.30	2.20	3.65	-1.15	0.70	6.52	A	4.18	A	A
316	60.00	3.80	6.33	-1.64	1.00	10.31	A	6.65	A	A
321	55.61	0.96	1.73	-8.84	5.39	4.05	N	2.67	A	W

Analyte: Co-60 in spiked Soil, IAEA-444

Target Value: 82.6 ± 2.01 [Bq/kg]





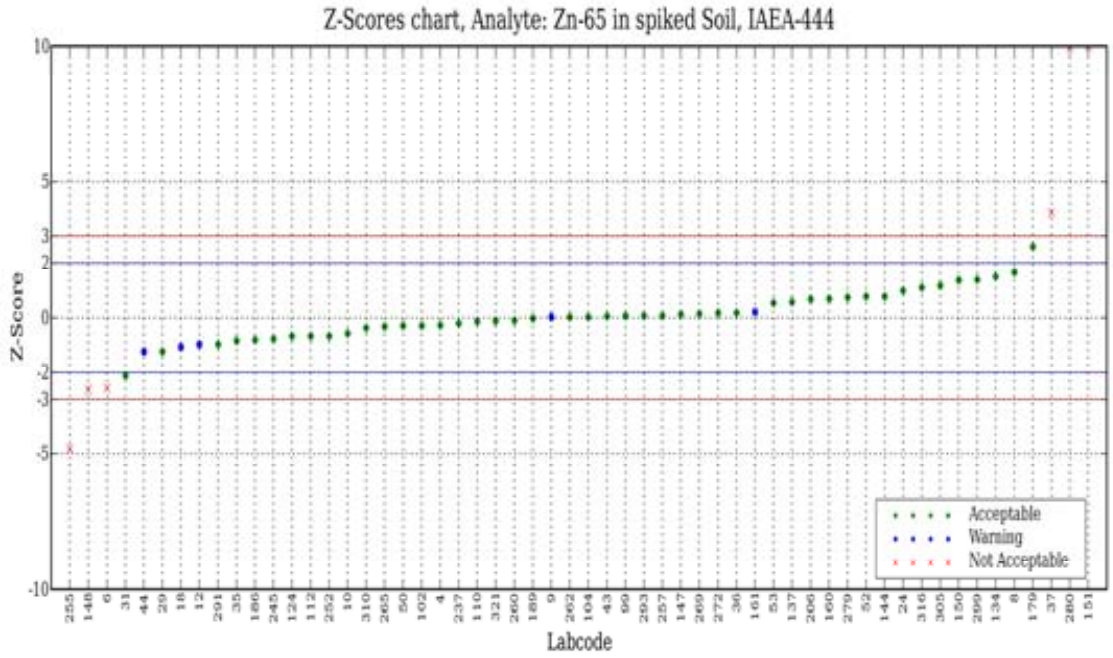
Analyte: Co-60 in spiked Soil, IAEA-444

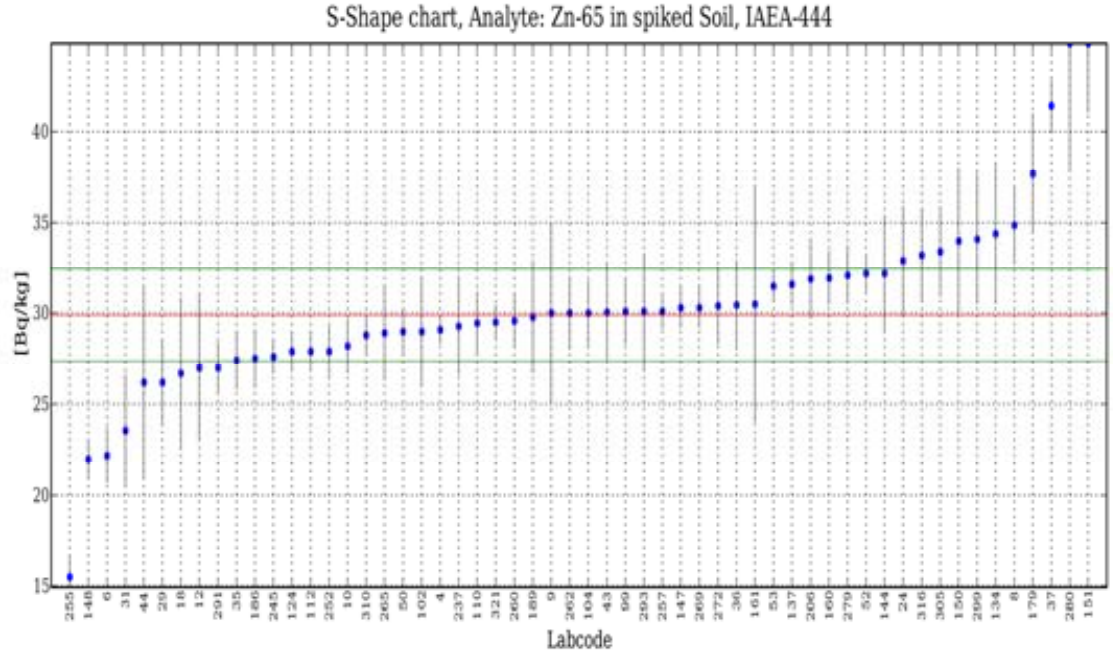
Lab code	Rep. Value	Rep. Unc.	Unc. [%]	Rel. Bias	A1	A2	True	P	Prec.	Final Score
4	82.10	1.60	1.95	-0.61	0.50	6.63	A	3.12	A	A
6	86.40	3.00	3.47	4.60	3.80	9.32	A	4.24	A	A
8	83.64	3.03	3.62	1.26	1.04	9.38	A	4.36	A	A
9	82.00	8.00	9.76	-0.73	0.60	21.28	A	10.05	A	A
10	81.50	1.95	2.39	-1.33	1.10	7.23	A	3.41	A	A
12	80.00	3.00	3.75	-3.15	2.60	9.32	A	4.47	A	A
18	85.10	5.06	5.95	3.03	2.50	14.05	A	6.42	A	A
24	85.70	5.30	6.18	3.75	3.10	14.62	A	6.65	A	A
29	77.40	6.60	8.53	-6.30	5.20	17.80	A	8.87	A	A
31	79.73	4.44	5.57	-3.47	2.87	12.57	A	6.08	A	A
35	79.40	9.00	11.34	-3.87	3.20	23.79	A	11.59	A	A
36	82.07	4.85	5.91	-0.64	0.53	13.55	A	6.39	A	A
37	104.60	1.52	1.45	26.63	22.00	6.50	N	2.83	A	N
43	81.76	6.47	7.91	-1.02	0.84	17.48	A	8.28	A	A
44	77.00	3.50	4.55	-6.78	5.60	10.41	A	5.16	A	A
50	81.70	1.20	1.47	-1.09	0.90	6.04	A	2.84	A	A
52	75.40	1.50	1.99	-8.72	7.20	6.47	N	3.14	A	W
53	83.20	1.00	1.20	0.73	0.60	5.79	A	2.71	A	A
99	78.60	3.20	4.07	-4.84	4.00	9.75	A	4.74	A	A
102	79.00	3.00	3.80	-4.36	3.60	9.32	A	4.51	A	A
104	81.30	4.90	6.03	-1.57	1.30	13.66	A	6.50	A	A
110	79.06	4.21	5.33	-4.29	3.54	12.04	A	5.85	A	A
112	83.10	2.30	2.77	0.61	0.50	7.88	A	3.69	A	A
124	72.56	1.68	2.32	-12.15	10.04	6.76	N	3.36	A	W
134	81.20	3.50	4.31	-1.69	1.40	10.41	A	4.95	A	A
137	80.40	1.40	1.74	-2.66	2.20	6.32	A	2.99	A	A
144	79.70	4.00	5.02	-3.51	2.90	11.55	A	5.58	A	A
147	85.30	2.20	2.58	3.27	2.70	7.69	A	3.55	A	A
148	64.36	0.94	1.46	-22.08	18.24	5.72	N	2.84	A	N
150	80.00	6.00	7.50	-3.15	2.60	16.33	A	7.88	A	A
151	57.20	2.30	4.02	-30.75	25.40	7.88	N	4.70	A	N
160	77.95	3.37	4.32	-5.63	4.65	10.12	A	4.96	A	A
161	81.70	6.10	7.47	-1.09	0.90	16.57	A	7.85	A	A
179	81.01	6.63	8.18	-1.92	1.59	17.87	A	8.54	A	A
182	73.80	5.31	7.20	-10.65	8.80	14.65	A	7.60	A	A
186	81.90	1.80	2.20	-0.85	0.70	6.96	A	3.28	A	A
189	83.80	8.50	10.14	1.45	1.20	22.53	A	10.43	A	A
206	82.90	5.60	6.76	0.36	0.30	15.35	A	7.18	A	A

Lab code	Rep. Value	Rep. Unc.	Unc. [%]	Rel. Bias	A1	A2	True	P	Prec.	Final Score
237	80.20	3.50	4.36	-2.91	2.40	10.41	A	5.00	A	A
245	79.20	1.92	2.42	-4.12	3.40	7.17	A	3.43	A	A
252	81.10	2.60	3.21	-1.82	1.50	8.48	A	4.02	A	A
255	59.34	3.75	6.32	-28.16	23.26	10.98	N	6.77	A	N
257	86.00	2.30	2.67	4.12	3.40	7.88	A	3.62	A	A
260	81.10	2.40	2.96	-1.82	1.50	8.08	A	3.83	A	A
262	87.50	2.70	3.09	5.93	4.90	8.68	A	3.93	A	A
265	74.91	3.01	4.02	-9.31	7.69	9.34	A	4.70	A	A
269	82.59	0.93	1.13	-0.01	0.01	5.71	A	2.68	A	A
272	81.40	4.30	5.28	-1.45	1.20	12.25	A	5.82	A	A
279	86.00	4.00	4.65	4.12	3.40	11.55	A	5.25	A	A
280	86.46	3.10	3.59	4.67	3.86	9.53	A	4.33	A	A
291	79.00	1.50	1.90	-4.36	3.60	6.47	A	3.09	A	A
293	89.91	3.00	3.34	8.85	7.31	9.32	A	4.13	A	A
299	79.70	3.40	4.27	-3.51	2.90	10.19	A	4.91	A	A
305	82.40	5.20	6.31	-0.24	0.20	14.38	A	6.76	A	A
310	78.60	1.80	2.29	-4.84	4.00	6.96	A	3.34	A	A
316	76.10	4.70	6.18	-7.87	6.50	13.19	A	6.64	A	A
321	74.66	1.67	2.24	-9.61	7.94	6.74	N	3.31	A	W

Analyte: Zn-65 in spiked Soil, IAEA-444

Target Value: 29.9 ± 0.99 [Bq/kg]





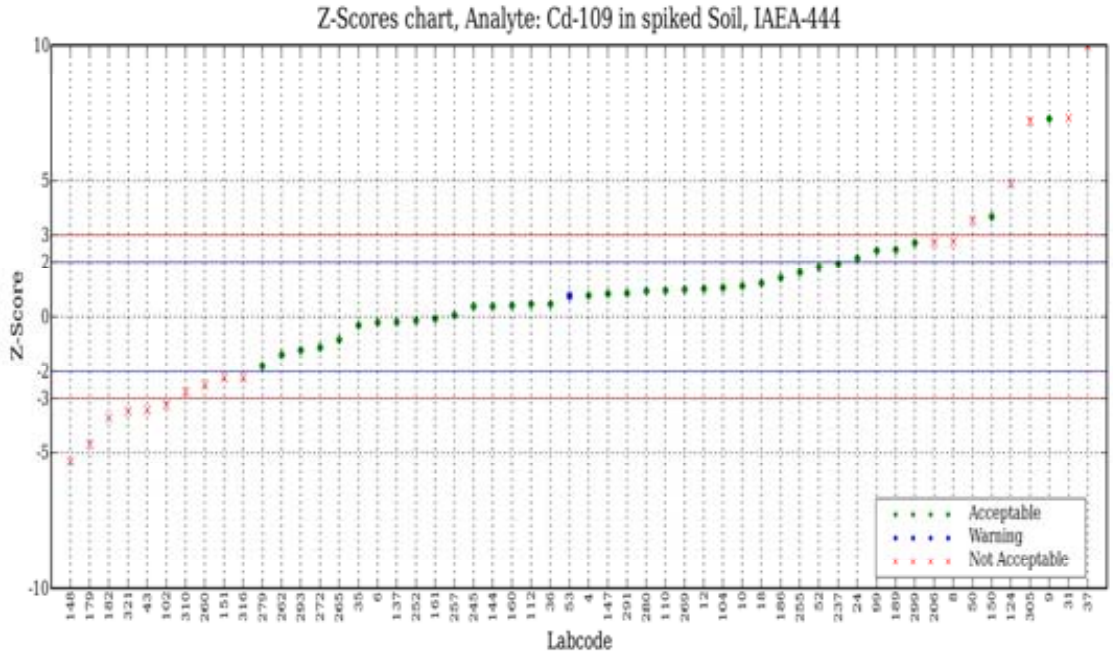
Analyte: Zn-65 in spiked Soil, IAEA-444

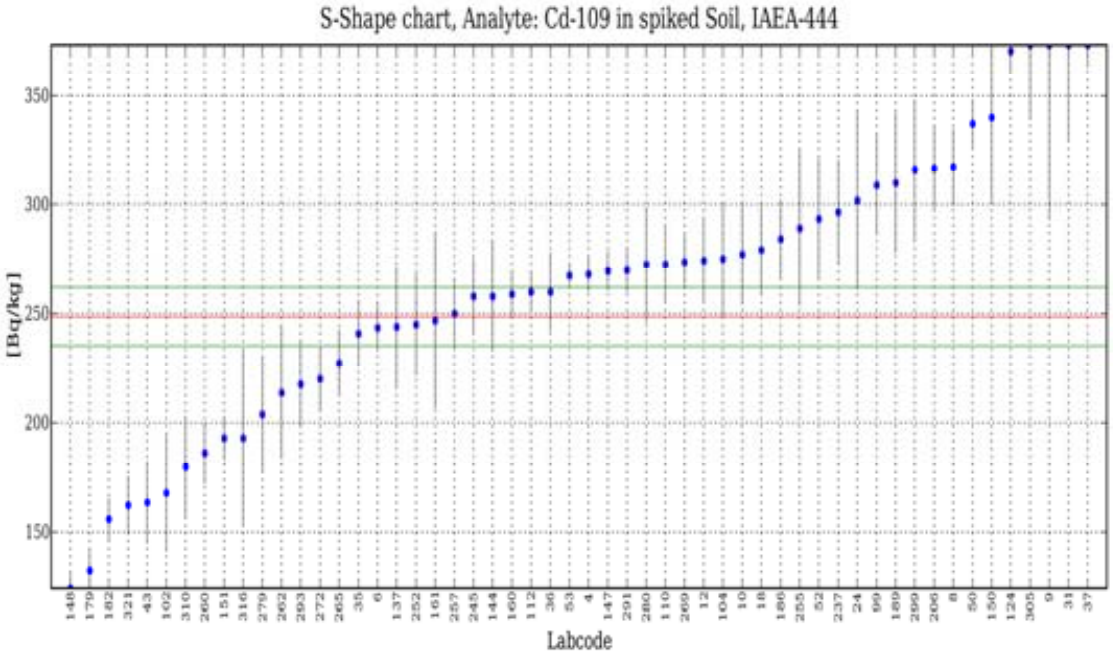
Lab code	Rep. Value	Rep. Unc.	Unc. [%]	Rel. Bias	A1	A2	True	P	Prec.	Final Score
4	29.10	0.80	2.75	-2.68	0.80	3.28	A	4.30	A	A
6	22.20	1.50	6.76	-25.75	7.70	4.64	N	7.52	A	N
8	34.86	2.13	6.11	16.59	4.96	6.06	A	6.95	A	A
9	30.00	5.00	16.67	0.33	0.10	13.15	A	16.99	N	W
10	28.20	1.50	5.32	-5.69	1.70	4.64	A	6.27	A	A
12	27.00	4.00	14.81	-9.70	2.90	10.63	A	15.18	N	W
18	26.70	4.18	15.66	-10.70	3.20	11.08	A	16.00	N	W
24	32.90	3.00	9.12	10.03	3.00	8.15	A	9.70	A	A
29	26.20	2.40	9.16	-12.37	3.70	6.70	A	9.74	A	A
31	23.55	3.11	13.21	-21.24	6.35	8.42	A	13.61	A	A
35	27.40	1.60	5.84	-8.36	2.50	4.85	A	6.71	A	A
36	30.45	2.47	8.11	1.84	0.55	6.87	A	8.76	A	A
37	41.41	1.41	3.41	38.51	11.51	4.45	N	4.75	A	N
43	30.07	2.62	8.71	0.57	0.17	7.23	A	9.32	A	A
44	26.20	5.20	19.85	-12.37	3.70	13.66	A	20.12	N	W
50	29.00	1.30	4.48	-3.01	0.90	4.22	A	5.57	A	A
52	32.20	1.06	3.29	7.69	2.30	3.74	A	4.67	A	A
53	31.50	0.80	2.54	5.35	1.60	3.28	A	4.17	A	A
99	30.10	1.80	5.98	0.67	0.20	5.30	A	6.84	A	A
102	29.00	3.00	10.34	-3.01	0.90	8.15	A	10.86	A	A
104	30.00	1.80	6.00	0.33	0.10	5.30	A	6.85	A	A
110	29.47	1.71	5.80	-1.44	0.43	5.10	A	6.68	A	A
112	27.90	1.00	3.58	-6.69	2.00	3.63	A	4.88	A	A
124	27.90	1.00	3.58	-6.69	2.00	3.63	A	4.88	A	A
134	34.40	3.90	11.34	15.05	4.50	10.38	A	11.81	A	A
137	31.60	1.20	3.80	5.69	1.70	4.01	A	5.04	A	A
144	32.20	3.20	9.94	7.69	2.30	8.64	A	10.47	A	A
147	30.30	1.10	3.63	1.34	0.40	3.82	A	4.91	A	A
148	22.00	1.05	4.77	-26.42	7.90	3.72	N	5.81	A	N
150	34.00	4.00	11.76	13.71	4.10	10.63	A	12.22	A	A
151	78.50	3.80	4.84	162.54	48.60	10.13	N	5.86	A	N
160	31.95	1.50	4.69	6.86	2.05	4.64	A	5.74	A	A
161	30.50	6.50	21.31	2.01	0.60	16.96	A	21.57	N	W
179	37.70	3.31	8.78	26.09	7.80	8.91	A	9.38	A	A
186	27.50	1.60	5.82	-8.03	2.40	4.85	A	6.69	A	A
189	29.80	3.10	10.40	-0.33	0.10	8.40	A	10.92	A	A
206	31.90	2.20	6.90	6.69	2.00	6.22	A	7.65	A	A
237	29.30	2.70	9.22	-2.01	0.60	7.42	A	9.79	A	A
245	27.60	0.93	3.37	-7.69	2.30	3.50	A	4.72	A	A

Lab code	Rep. Value	Rep. Unc.	Unc. [%]	Rel. Bias	A1	A2	True	P	Prec.	Final Score
252	27.90	1.50	5.38	-6.69	2.00	4.64	A	6.31	A	A
255	15.51	1.10	7.09	-48.13	14.39	3.82	N	7.83	A	N
257	30.10	0.96	3.19	0.67	0.20	3.56	A	4.60	A	A
260	29.60	1.50	5.07	-1.00	0.30	4.64	A	6.05	A	A
262	30.00	2.00	6.67	0.33	0.10	5.76	A	7.44	A	A
265	28.91	2.59	8.96	-3.31	0.99	7.15	A	9.55	A	A
269	30.32	1.11	3.66	1.40	0.42	3.84	A	4.94	A	A
272	30.40	2.10	6.91	1.67	0.50	5.99	A	7.66	A	A
279	32.10	1.60	4.98	7.36	2.20	4.85	A	5.98	A	A
280	62.45	6.97	11.16	108.86	32.55	18.16	N	11.64	A	N
291	27.00	1.40	5.19	-9.70	2.90	4.42	A	6.15	A	A
293	30.10	3.20	10.63	0.67	0.20	8.64	A	11.13	A	A
299	34.10	3.60	10.56	14.05	4.20	9.63	A	11.06	A	A
305	33.40	2.50	7.49	11.71	3.50	6.94	A	8.18	A	A
310	28.80	1.10	3.82	-3.68	1.10	3.82	A	5.05	A	A
316	33.20	2.60	7.83	11.04	3.30	7.18	A	8.50	A	A
321	29.52	0.93	3.15	-1.27	0.38	3.50	A	4.57	A	A

Analyte: Cd-109 in spiked Soil, IAEA-444

Target Value: 248.7 ± 5.18 [Bq/kg]





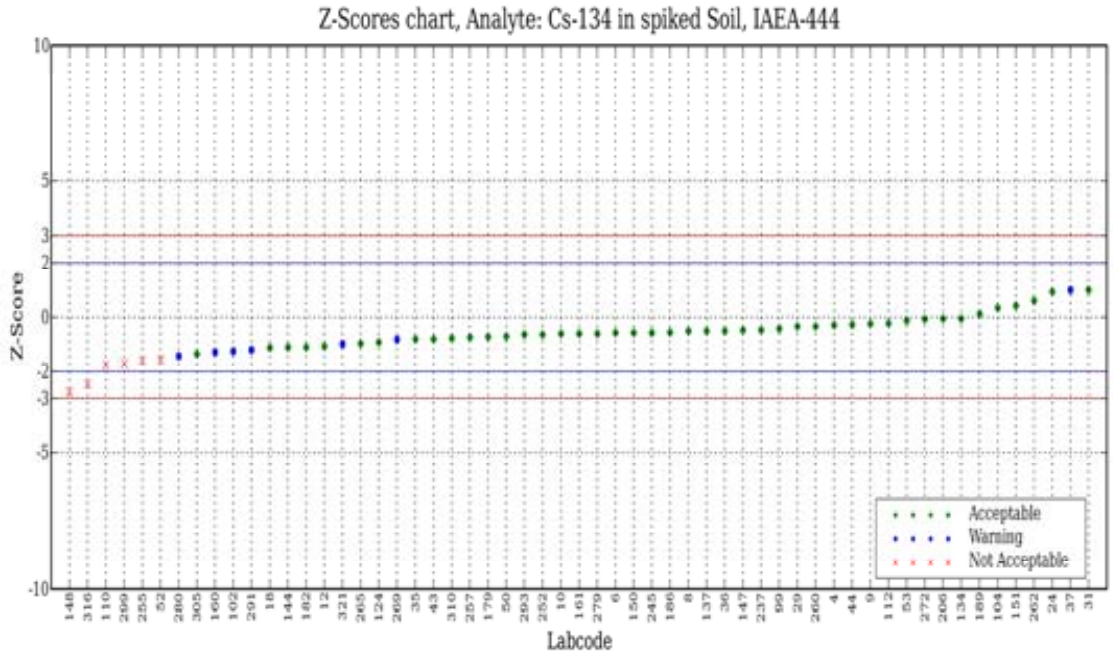
Analyte: Cd-109 in spiked Soil, IAEA-444

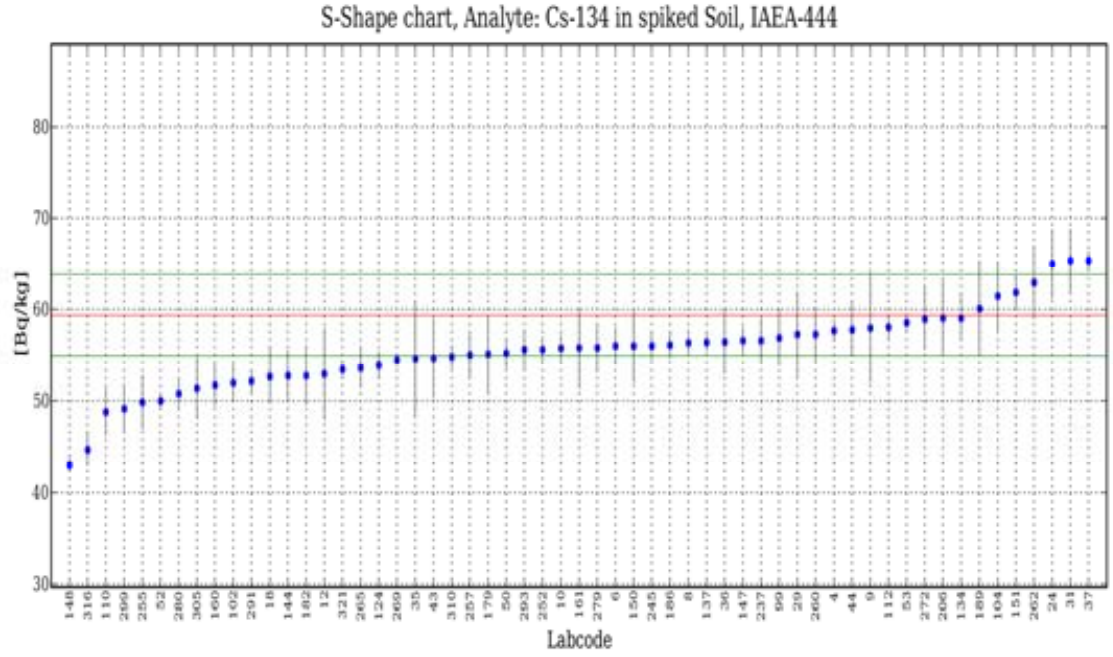
Lab code	Rep. Value	Rep. Unc.	Unc. [%]	Rel. Bias	A1	A2	True	P	Prec.	Final Score
4	268.00	8.00	2.99	7.76	19.30	24.59	A	3.64	A	A
6	243.70	10.60	4.35	-2.01	5.00	30.44	A	4.82	A	A
8	317.10	17.60	5.55	27.50	68.40	47.33	N	5.93	A	N
9	430.00	80.00	18.60	72.90	181.30	206.83	A	18.72	A	A
10	276.90	22.80	8.23	11.34	28.20	60.32	A	8.49	A	A
12	274.00	19.00	6.93	10.17	25.30	50.81	A	7.24	A	A
18	279.00	20.30	7.28	12.18	30.30	54.05	A	7.57	A	A
24	301.80	40.80	13.52	21.35	53.10	106.11	A	13.68	A	A
31	430.84	43.85	10.18	73.24	182.14	113.92	N	10.39	A	N
35	241.00	15.00	6.22	-3.10	7.70	40.94	A	6.56	A	A
36	260.02	17.80	6.85	4.55	11.32	47.83	A	7.16	A	A
37	539.56	10.01	1.86	116.95	290.86	29.09	N	2.79	A	N
43	163.60	18.76	11.47	-34.22	85.10	50.21	N	11.65	A	N
50	337.00	11.30	3.35	35.50	88.30	32.07	N	3.95	A	N
52	293.40	27.50	9.37	17.97	44.70	72.20	A	9.60	A	A
53	267.50	5.10	1.91	7.56	18.80	18.75	N	2.82	A	W
99	309.00	23.00	7.44	24.25	60.30	60.83	A	7.73	A	A
102	168.00	27.00	16.07	-32.45	80.70	70.93	N	16.21	A	N
104	275.00	26.00	9.45	10.57	26.30	68.40	A	9.68	A	A
110	272.50	17.60	6.46	9.57	23.80	47.33	A	6.79	A	A
112	260.00	9.00	3.46	4.54	11.30	26.79	A	4.04	A	A
124	370.20	10.10	2.73	48.85	121.50	29.29	N	3.43	A	N
137	244.00	27.00	11.07	-1.89	4.70	70.93	A	11.26	A	A
144	258.00	25.00	9.69	3.74	9.30	65.87	A	9.91	A	A
147	269.50	9.00	3.34	8.36	20.80	26.79	A	3.94	A	A
148	116.10	7.38	6.36	-53.32	132.60	23.26	N	6.69	A	N
150	340.00	40.00	11.76	36.71	91.30	104.06	A	11.95	A	A
151	193.00	10.00	5.18	-22.40	55.70	29.06	N	5.58	A	N
160	258.95	10.67	4.12	4.12	10.25	30.60	A	4.62	A	A
161	247.00	40.10	16.23	-0.68	1.70	104.32	A	16.37	A	A
179	132.36	9.41	7.11	-46.78	116.34	27.71	N	7.41	A	N
182	156.00	9.52	6.10	-37.27	92.70	27.96	N	6.45	A	N
186	284.00	18.00	6.34	14.19	35.30	48.32	A	6.67	A	A
189	309.90	32.10	10.36	24.61	61.20	83.89	A	10.57	A	A
206	316.60	19.70	6.22	27.30	67.90	52.55	N	6.56	A	N
237	296.40	24.00	8.10	19.18	47.70	63.35	A	8.36	A	A
245	258.00	17.00	6.59	3.74	9.30	45.85	A	6.91	A	A
252	245.00	23.00	9.39	-1.49	3.70	60.83	A	9.62	A	A
255	289.07	35.55	12.30	16.23	40.37	92.69	A	12.47	A	A

Lab code	Rep. Value	Rep. Unc.	Unc. [%]	Rel. Bias	A1	A2	True	P	Prec.	Final Score
257	250.00	16.00	6.40	0.52	1.30	43.39	A	6.73	A	A
260	186.20	14.00	7.52	-25.13	62.50	38.51	N	7.80	A	N
262	214.00	30.00	14.02	-13.95	34.70	78.55	A	14.17	A	A
265	227.50	15.03	6.61	-8.52	21.20	41.02	A	6.93	A	A
269	273.43	12.18	4.45	9.94	24.73	34.15	A	4.92	A	A
272	220.50	14.30	6.49	-11.34	28.20	39.24	A	6.81	A	A
279	204.00	26.00	12.75	-17.97	44.70	68.40	A	12.91	A	A
280	272.33	26.38	9.69	9.50	23.63	69.36	A	9.91	A	A
291	270.00	10.00	3.70	8.56	21.30	29.06	A	4.25	A	A
293	218.00	20.00	9.17	-12.34	30.70	53.30	A	9.41	A	A
299	316.00	32.00	10.13	27.06	67.30	83.63	A	10.34	A	A
305	428.00	34.00	7.94	72.09	179.30	88.73	N	8.21	A	N
310	180.00	23.00	12.78	-27.62	68.70	60.83	N	12.95	A	N
316	193.00	40.00	20.73	-22.40	55.70	104.06	A	20.83	N	N
321	162.32	13.35	8.22	-34.73	86.38	36.94	N	8.48	A	N

Analyte: Cs-134 in spiked Soil, IAEA-444

Target Value: 59.4 ± 1.73 [Bq/kg]





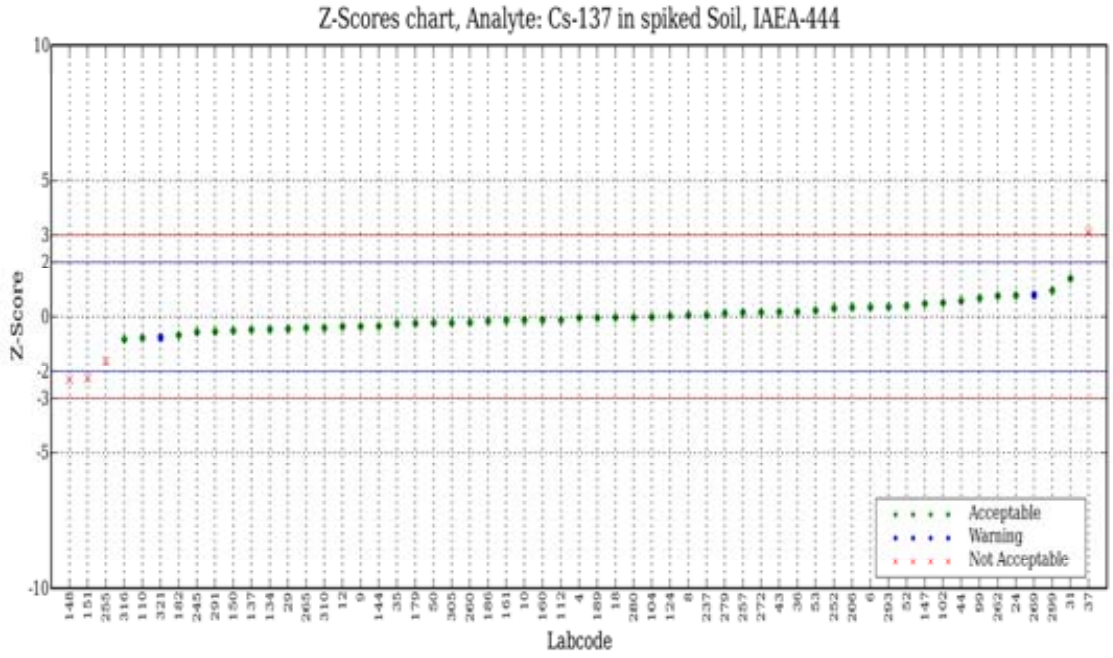
Analyte: Cs-134 in spiked Soil, IAEA-444

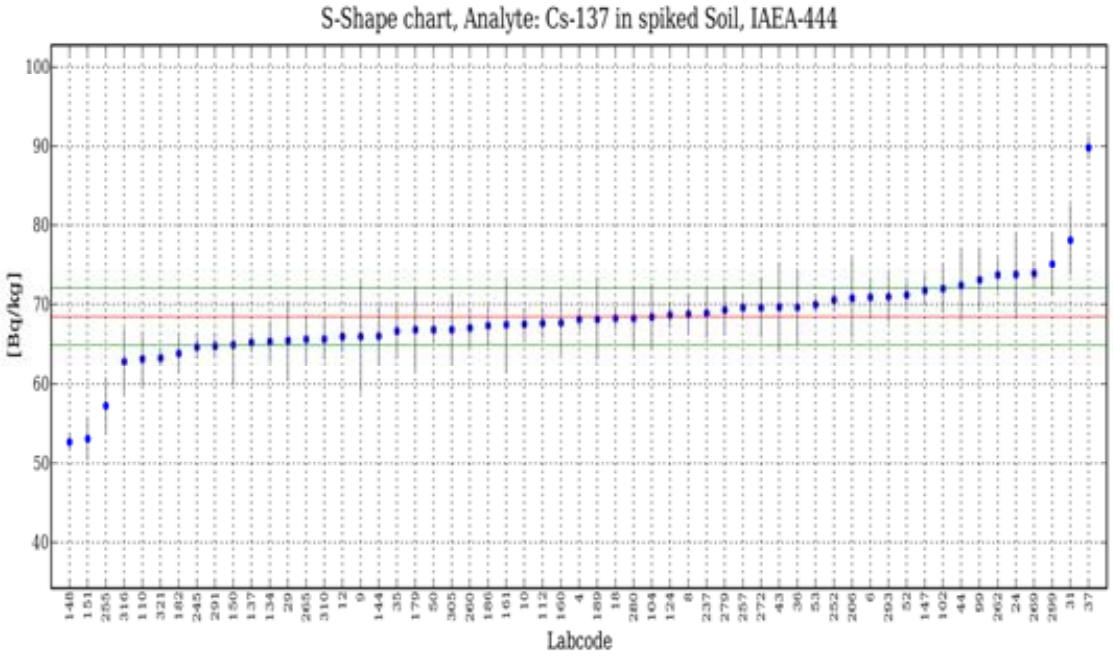
Lab code	Rep. Value	Rep. Unc.	Unc. [%]	Rel. Bias	A1	A2	True	P	Prec.	Final Score
4	57.70	1.20	2.08	-2.86	1.70	5.43	A	3.58	A	A
6	56.00	2.00	3.57	-5.72	3.40	6.82	A	4.61	A	A
8	56.35	1.41	2.50	-5.13	3.05	5.76	A	3.84	A	A
9	58.00	6.00	10.34	-2.36	1.40	16.11	A	10.75	A	A
10	55.76	1.52	2.73	-6.13	3.64	5.94	A	3.99	A	A
12	53.00	5.00	9.43	-10.7	6.40	13.65	A	9.87	A	A
18	52.70	3.00	5.69	-11.2	6.70	8.93	A	6.39	A	A
24	65.00	3.80	5.85	9.43	5.60	10.77	A	6.53	A	A
29	57.30	4.60	8.03	-3.54	2.10	12.68	A	8.54	A	A
31	65.37	3.48	5.32	10.05	5.97	10.03	A	6.07	A	A
35	54.60	6.20	11.36	-8.08	4.80	16.61	A	11.72	A	A
36	56.44	3.47	6.15	-4.98	2.96	10.00	A	6.80	A	A
37	65.38	1.00	1.54	10.07	5.98	5.16	N	3.29	A	W
43	54.66	4.32	7.90	-7.98	4.74	12.01	A	8.42	A	A
44	57.80	2.90	5.02	-2.69	1.60	8.71	A	5.80	A	A
50	55.20	1.60	2.90	-7.07	4.20	6.08	A	4.11	A	A
52	50.00	0.76	1.52	-15.8	9.40	4.88	N	3.29	A	N
53	58.60	1.00	1.71	-1.35	0.80	5.16	A	3.38	A	A
99	56.90	3.00	5.27	-4.21	2.50	8.93	A	6.02	A	A
102	52.00	2.00	3.85	-12.46	7.40	6.82	N	4.82	A	W
104	61.50	3.70	6.02	3.54	2.10	10.54	A	6.68	A	A
110	48.84	2.58	5.28	-17.78	10.56	8.01	N	6.03	A	N
112	58.10	1.40	2.41	-2.19	1.30	5.74	A	3.78	A	A
124	53.94	1.43	2.65	-9.19	5.46	5.79	A	3.94	A	A
134	59.10	2.50	4.23	-0.51	0.30	7.84	A	5.14	A	A
137	56.40	1.00	1.77	-5.05	3.00	5.16	A	3.41	A	A
144	52.80	2.70	5.11	-11.11	6.60	8.27	A	5.88	A	A
147	56.60	1.50	2.65	-4.71	2.80	5.91	A	3.94	A	A
148	43.06	0.78	1.81	-27.51	16.34	4.90	N	3.43	A	N
150	56.00	4.00	7.14	-5.72	3.40	11.24	A	7.71	A	A
151	61.90	2.00	3.23	4.21	2.50	6.82	A	4.35	A	A
160	51.75	2.26	4.37	-12.88	7.65	7.34	N	5.25	A	W
161	55.80	4.40	7.89	-6.06	3.60	12.20	A	8.41	A	A
179	55.11	4.20	7.62	-7.22	4.29	11.72	A	8.16	A	A
182	52.80	3.27	6.19	-11.11	6.60	9.54	A	6.84	A	A
186	56.10	1.40	2.50	-5.56	3.30	5.74	A	3.84	A	A
189	60.10	5.20	8.65	1.18	0.70	14.14	A	9.13	A	A
206	59.10	4.10	6.94	-0.51	0.30	11.48	A	7.52	A	A
237	56.60	2.40	4.24	-4.71	2.80	7.63	A	5.14	A	A

Lab code	Rep. Value	Rep. Unc.	Unc. [%]	Rel. Bias	A1	A2	True	P	Prec.	Final Score
245	56.00	1.54	2.75	-5.72	3.40	5.98	A	4.01	A	A
252	55.60	1.40	2.52	-6.40	3.80	5.74	A	3.85	A	A
255	49.89	2.96	5.93	-16.01	9.51	8.85	N	6.61	A	N
257	55.00	2.30	4.18	-7.41	4.40	7.43	A	5.10	A	A
260	57.30	3.00	5.24	-3.54	2.10	8.93	A	5.99	A	A
262	63.00	4.00	6.35	6.06	3.60	11.24	A	6.99	A	A
265	53.65	2.19	4.08	-9.68	5.75	7.20	A	5.01	A	A
269	54.46	0.74	1.36	-8.32	4.94	4.85	N	3.21	A	W
272	59.00	3.40	5.76	-0.67	0.40	9.84	A	6.46	A	A
279	55.80	2.60	4.66	-6.06	3.60	8.06	A	5.49	A	A
280	50.79	1.75	3.45	-14.49	8.61	6.35	N	4.51	A	W
291	52.20	1.20	2.30	-12.12	7.20	5.43	N	3.71	A	W
293	55.60	2.20	3.96	-6.40	3.80	7.22	A	4.91	A	A
299	49.20	2.60	5.28	-17.17	10.20	8.06	N	6.03	A	N
305	51.40	3.30	6.42	-13.47	8.00	9.61	A	7.05	A	A
310	54.80	1.20	2.19	-7.74	4.60	5.43	A	3.64	A	A
316	44.70	1.70	3.80	-24.75	14.70	6.26	N	4.79	A	N
321	53.49	0.93	1.74	-9.95	5.91	5.07	N	3.39	A	W

Analyte: Cs-137 in spiked Soil, IAEA-444

Target Value: 68.5 ± 1.38 [Bq/kg]





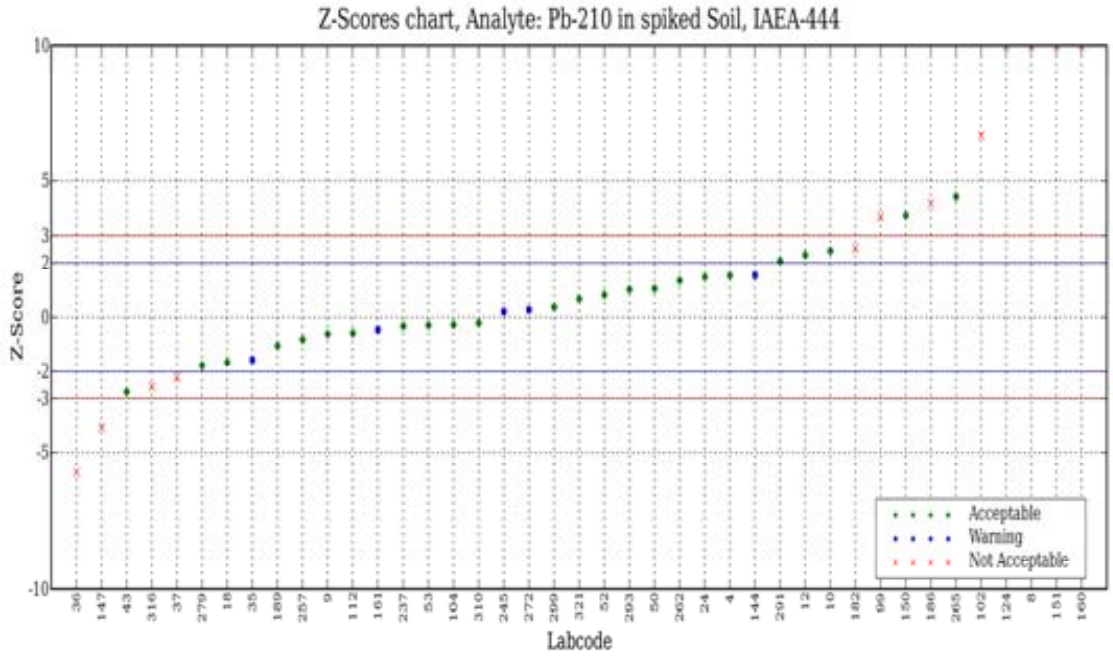
Analyte: Cs-137 in spiked Soil, IAEA-444

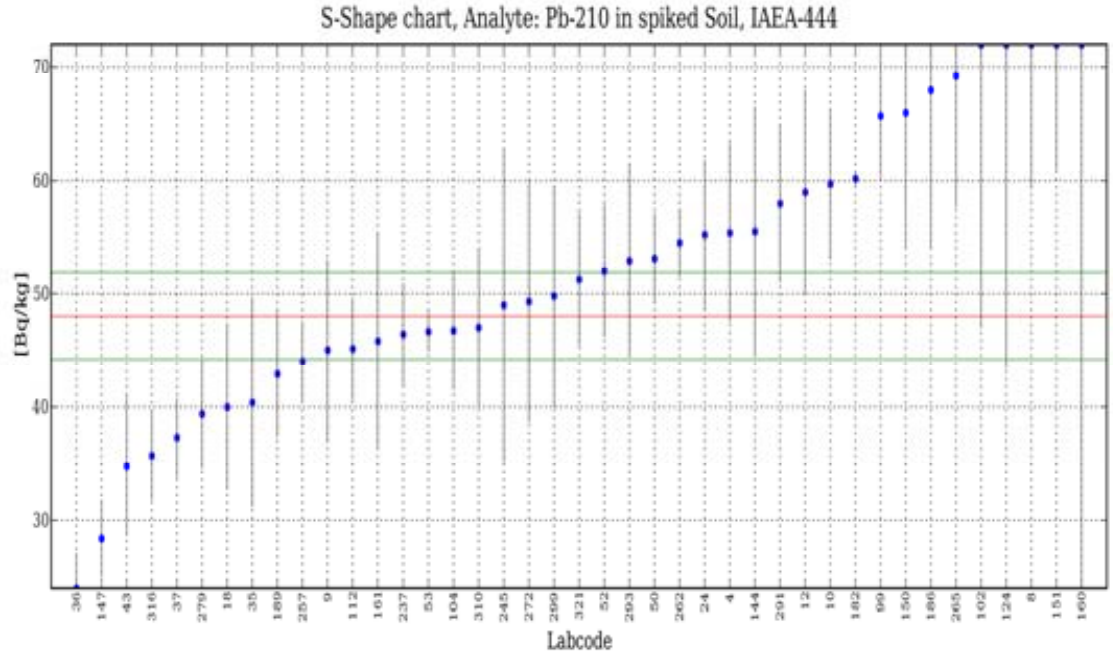
Lab code	Rep. Value	Rep. Unc.	Unc. [%]	Rel. Bias	A1	A2	True	P	Prec.	Final Score
4	68.20	1.40	2.05	-0.44	0.30	5.07	A	2.88	A	A
6	70.90	2.50	3.53	3.50	2.40	7.37	A	4.06	A	A
8	68.81	2.46	3.58	0.45	0.31	7.28	A	4.10	A	A
9	66.00	7.00	10.61	-3.65	2.50	18.41	A	10.80	A	A
10	67.58	1.95	2.89	-1.34	0.92	6.16	A	3.52	A	A
12	66.00	2.00	3.03	-3.65	2.50	6.27	A	3.64	A	A
18	68.30	1.47	2.15	-0.29	0.20	5.20	A	2.95	A	A
24	73.80	5.20	7.05	7.74	5.30	13.88	A	7.33	A	A
29	65.50	4.90	7.48	-4.38	3.00	13.13	A	7.75	A	A
31	78.11	4.41	5.65	14.03	9.61	11.92	A	5.99	A	A
35	66.70	3.50	5.25	-2.63	1.80	9.71	A	5.62	A	A
36	69.67	4.69	6.73	1.71	1.17	12.61	A	7.03	A	A
37	89.81	1.41	1.57	31.11	21.31	5.09	N	2.56	A	N
43	69.66	5.60	8.04	1.69	1.16	14.88	A	8.29	A	A
44	72.40	4.50	6.22	5.69	3.90	12.14	A	6.53	A	A
50	66.90	1.70	2.54	-2.34	1.60	5.65	A	3.24	A	A
52	71.20	1.64	2.30	3.94	2.70	5.53	A	3.06	A	A
53	70.00	1.00	1.43	2.19	1.50	4.40	A	2.47	A	A
99	73.10	3.70	5.06	6.72	4.60	10.19	A	5.45	A	A
102	72.00	3.00	4.17	5.11	3.50	8.52	A	4.63	A	A
104	68.50	4.10	5.99	0.00	0.00	11.16	A	6.32	A	A
110	63.20	3.34	5.28	-7.74	5.30	9.32	A	5.66	A	A
112	67.70	1.90	2.81	-1.17	0.80	6.06	A	3.45	A	A
124	68.70	1.60	2.33	0.29	0.20	5.45	A	3.08	A	A
134	65.40	2.50	3.82	-4.53	3.10	7.37	A	4.32	A	A
137	65.30	1.20	1.84	-4.67	3.20	4.72	A	2.73	A	A
144	66.10	3.70	5.60	-3.50	2.40	10.19	A	5.95	A	A
147	71.80	1.90	2.65	4.82	3.30	6.06	A	3.33	A	A
148	52.71	1.06	2.01	-23.05	15.79	4.49	N	2.85	A	N
150	65.00	5.00	7.69	-5.11	3.50	13.38	A	7.95	A	A
151	53.10	2.70	5.08	-22.48	15.40	7.82	N	5.47	A	N
160	67.71	4.10	6.06	-1.15	0.79	11.16	A	6.38	A	A
161	67.50	5.90	8.74	-1.46	1.00	15.63	A	8.97	A	A
179	66.86	5.04	7.54	-2.39	1.64	13.48	A	7.80	A	A
182	63.90	2.49	3.90	-6.72	4.60	7.34	A	4.39	A	A
186	67.40	2.40	3.56	-1.61	1.10	7.14	A	4.09	A	A
189	68.20	5.10	7.48	-0.44	0.30	13.63	A	7.74	A	A
206	70.80	5.00	7.06	3.36	2.30	13.38	A	7.34	A	A

Lab code	Rep. Value	Rep. Unc.	Unc. [%]	Rel. Bias	A1	A2	True	P	Prec.	Final Score
237	68.90	3.10	4.50	0.58	0.40	8.75	A	4.93	A	A
245	64.70	1.43	2.21	-5.55	3.80	5.13	A	2.99	A	A
252	70.60	1.40	1.98	3.07	2.10	5.07	A	2.83	A	A
255	57.29	3.52	6.14	-16.36	11.21	9.75	N	6.47	A	N
257	69.60	1.60	2.30	1.61	1.10	5.45	A	3.06	A	A
260	67.10	2.50	3.73	-2.04	1.40	7.37	A	4.24	A	A
262	73.70	2.10	2.85	7.59	5.20	6.48	A	3.49	A	A
265	65.69	3.02	4.60	-4.10	2.81	8.57	A	5.02	A	A
269	73.92	1.54	2.08	7.91	5.42	5.34	N	2.90	A	W
272	69.60	3.70	5.32	1.61	1.10	10.19	A	5.69	A	A
279	69.30	3.10	4.47	1.17	0.80	8.75	A	4.91	A	A
280	68.31	4.00	5.86	-0.28	0.19	10.92	A	6.19	A	A
291	64.80	1.40	2.16	-5.40	3.70	5.07	A	2.95	A	A
293	71.00	3.20	4.51	3.65	2.50	8.99	A	4.94	A	A
299	75.10	3.90	5.19	9.64	6.60	10.67	A	5.57	A	A
305	66.90	4.30	6.43	-2.34	1.60	11.65	A	6.74	A	A
310	65.70	2.60	3.96	-4.09	2.80	7.59	A	4.44	A	A
316	62.90	4.10	6.52	-8.18	5.60	11.16	A	6.82	A	A
321	63.36	1.04	1.64	-7.50	5.14	4.46	N	2.60	A	W

Analyte: Pb-210 in spiked Soil, IAEA-444

Target Value: 48.0 ± 1.5 [Bq/kg]





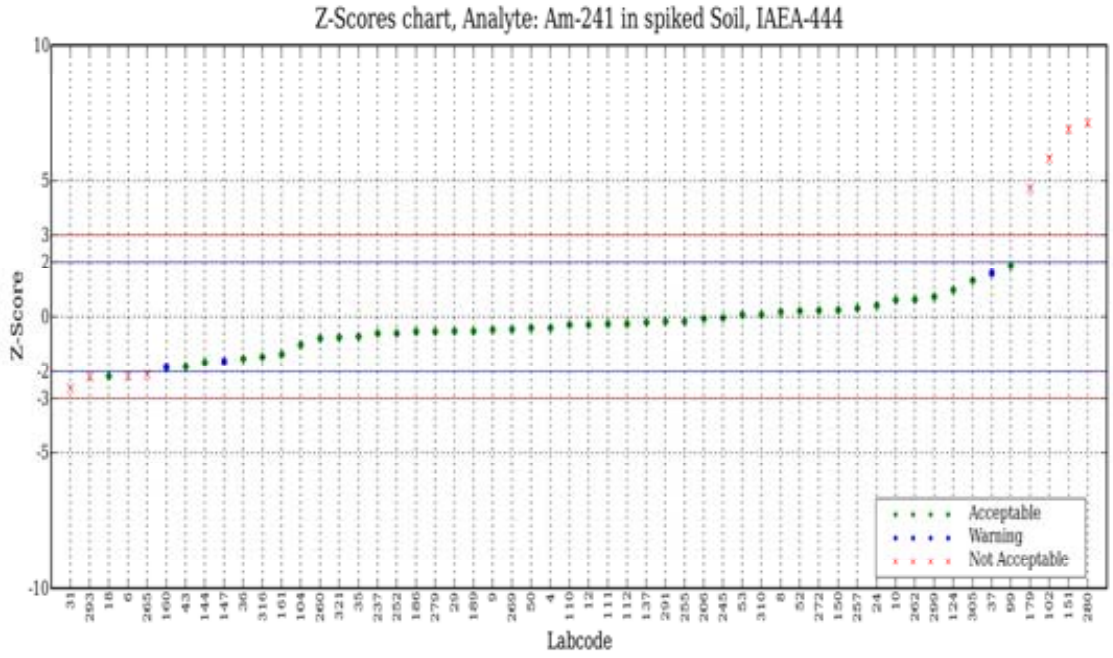
Analyte: Pb-210 in spiked Soil, IAEA-444

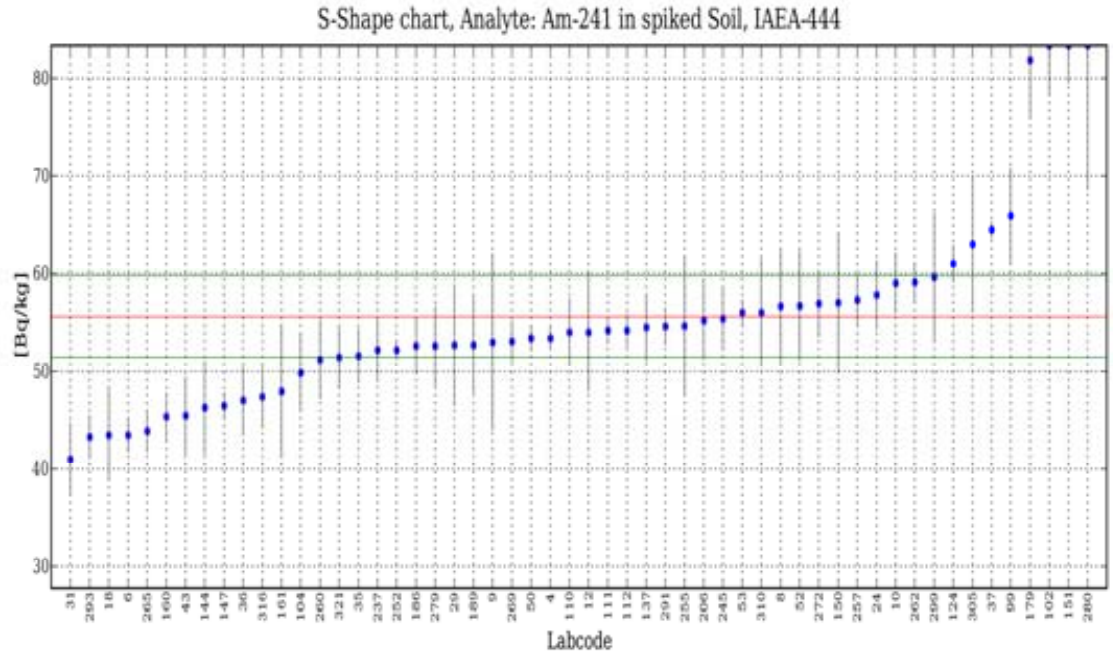
Lab code	Rep. Value	Rep. Unc.	Unc. [%]	Rel. Bias	A1	A2	True	P	Prec.	Final Score
4	55.40	7.90	14.26	15.42	7.40	20.75	A	14.60	A	A
8	218.30	12.70	5.82	354.79	170.30	32.99	N	6.60	A	N
9	45.00	8.00	17.78	-6.25	3.00	21.00	A	18.05	A	A
10	59.69	6.66	11.16	24.35	11.69	17.61	A	11.59	A	A
12	59.00	9.00	15.25	22.92	11.00	23.54	A	15.57	A	A
18	40.00	7.31	18.27	-16.67	8.00	19.25	A	18.54	A	A
24	55.20	6.60	11.96	15.00	7.20	17.46	A	12.36	A	A
35	40.40	9.20	22.77	-15.83	7.60	24.05	A	22.99	N	W
36	20.52	3.10	15.11	-57.25	27.48	8.89	N	15.43	A	N
37	37.29	3.50	9.39	-22.32	10.71	9.82	N	9.89	A	N
43	34.80	6.16	17.70	-27.50	13.20	16.36	A	17.97	A	A
50	53.10	4.00	7.53	10.63	5.10	11.02	A	8.16	A	A
52	52.00	5.87	11.29	8.33	4.00	15.63	A	11.71	A	A
53	46.60	1.80	3.86	-2.92	1.40	6.05	A	4.97	A	A
99	65.70	5.40	8.22	36.88	17.70	14.46	N	8.79	A	N
102	80.00	25.00	31.25	66.67	32.00	64.62	A	31.41	N	N
104	46.70	5.20	11.13	-2.71	1.30	13.96	A	11.57	A	A
112	45.10	4.50	9.98	-6.04	2.90	12.24	A	10.46	A	A
124	167.60	28.60	17.06	249.17	119.60	73.89	N	17.35	A	N
137	<40									
144	55.50	11.00	19.82	15.62	7.50	28.64	A	20.06	N	W
147	28.40	3.40	11.97	-40.83	19.60	9.59	N	12.37	A	N
150	66.00	12.00	18.18	37.50	18.00	31.20	A	18.45	A	A
151	235.00	11.00	4.68	389.58	187.00	28.64	N	5.63	A	N
160	260.25	63.29	24.32	442.19	212.25	163.33	N	24.52	N	N
161	45.80	9.50	20.74	-4.58	2.20	24.81	A	20.98	N	W
182	60.17	0.66	1.10	25.35	12.17	4.23	N	3.31	A	N
186	68.00	14.00	20.59	41.67	20.00	36.33	A	20.82	N	N
189	42.90	5.50	12.82	-10.63	5.10	14.71	A	13.20	A	A
237	46.40	4.50	9.70	-3.33	1.60	12.24	A	10.19	A	A
245	49.00	13.80	28.16	2.08	1.00	35.81	A	28.34	N	W
257	44.00	3.50	7.95	-8.33	4.00	9.82	A	8.55	A	A
262	54.50	3.00	5.50	13.54	6.50	8.65	A	6.33	A	A
265	69.24	11.61	16.77	44.25	21.24	30.20	A	17.06	A	A
272	49.30	10.60	21.50	2.71	1.30	27.62	A	21.73	N	W
279	39.40	4.80	12.18	-17.92	8.60	12.97	A	12.58	A	A
291	58.00	7.00	12.07	20.83	10.00	18.47	A	12.47	A	A
293	52.90	8.50	16.07	10.21	4.90	22.27	A	16.37	A	A
299	49.80	9.80	19.68	3.75	1.80	25.58	A	19.93	A	A

Lab code	Rep. Value	Rep. Unc.	Unc. [%]	Rel. Bias	A1	A2	True	P	Prec.	Final Score
310	47.00	7.00	14.89	-2.08	1.00	18.47	A	15.22	A	A
316	35.70	3.90	10.92	-25.62	12.30	10.78	N	11.36	A	N
321	51.24	5.90	11.51	6.75	3.24	15.71	A	11.93	A	A

Analyte: Am-241 in spiked Soil, IAEA-444

Target Value: 55.6 ± 1.6 [Bq/kg]





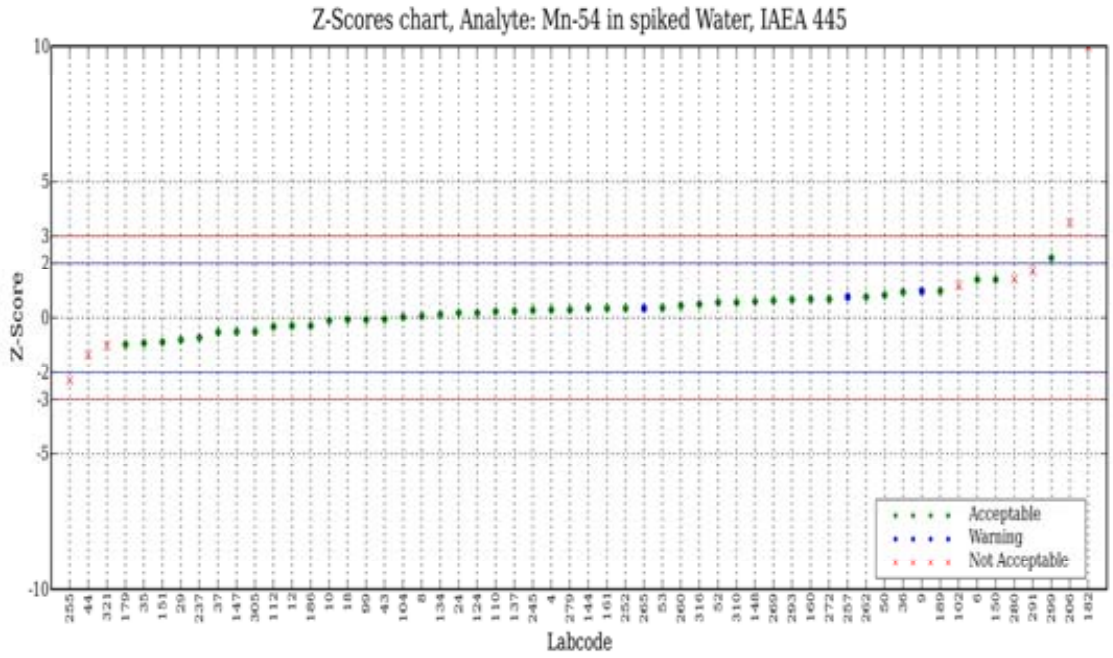
Analyte: Am-241 in spiked Soil, IAEA-444

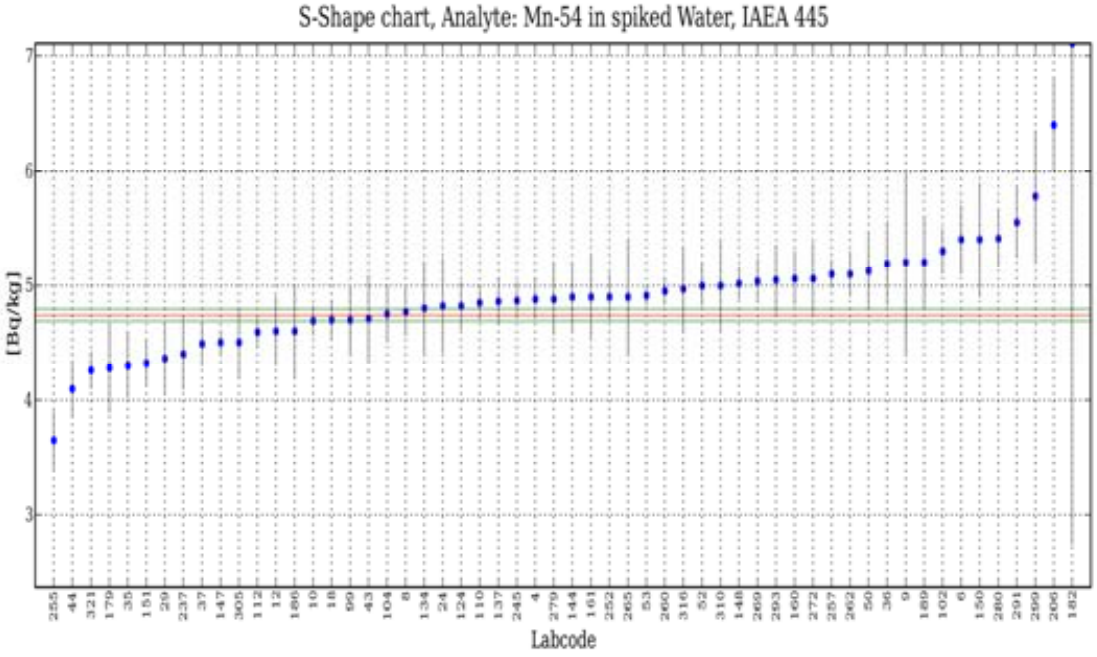
Lab code	Rep. Value	Rep. Unc.	Unc. [%]	Rel. Bias	A1	A2	True	P	Prec.	Final Score
4	53.40	1.20	2.25	-3.96	2.20	5.16	A	3.65	A	A
6	43.50	1.80	4.14	-21.76	12.10	6.21	N	5.04	A	N
8	56.62	5.70	10.07	1.83	1.02	15.27	A	10.47	A	A
9	53.00	9.00	16.98	-4.68	2.60	23.58	A	17.22	A	A
10	59.00	3.10	5.25	6.12	3.40	9.00	A	5.99	A	A
12	54.00	6.00	11.11	-2.88	1.60	16.02	A	11.48	A	A
18	43.50	4.68	10.76	-21.76	12.10	12.76	A	11.14	A	A
24	57.80	3.50	6.06	3.96	2.20	9.93	A	6.70	A	A
29	52.70	6.20	11.76	-5.22	2.90	16.52	A	12.11	A	A
31	41.00	3.75	9.15	-26.26	14.60	10.52	N	9.59	A	N
35	51.60	2.80	5.43	-7.19	4.00	8.32	A	6.14	A	A
36	47.06	3.60	7.65	-15.36	8.54	10.16	A	8.17	A	A
37	64.46	0.86	1.34	15.94	8.86	4.69	N	3.17	A	W
43	45.47	4.00	8.80	-18.22	10.13	11.11	A	9.26	A	A
50	53.40	1.30	2.43	-3.96	2.20	5.32	A	3.77	A	A
52	56.70	5.58	9.84	1.98	1.10	14.98	A	10.25	A	A
53	56.00	1.30	2.32	0.72	0.40	5.32	A	3.70	A	A
99	65.90	4.90	7.44	18.53	10.30	13.30	A	7.97	A	A
102	88.00	5.00	5.68	58.27	32.40	13.54	N	6.37	A	N
104	49.90	4.00	8.02	-10.25	5.70	11.11	A	8.52	A	A
110	54.00	3.42	6.33	-2.88	1.60	9.74	A	6.96	A	A
111	54.20	1.40	2.58	-2.52	1.40	5.49	A	3.87	A	A
112	54.20	1.70	3.14	-2.52	1.40	6.02	A	4.26	A	A
124	61.00	1.90	3.11	9.71	5.40	6.41	A	4.24	A	A
137	54.50	3.40	6.24	-1.98	1.10	9.69	A	6.87	A	A
144	46.30	4.80	10.37	-16.73	9.30	13.05	A	10.76	A	A
147	46.50	1.40	3.01	-16.37	9.10	5.49	N	4.16	A	W
150	57.00	7.00	12.28	2.52	1.40	18.53	A	12.61	A	A
151	94.00	3.90	4.15	69.06	38.40	10.88	N	5.05	A	N
160	45.38	2.48	5.46	-18.38	10.22	7.61	N	6.18	A	W
161	48.00	6.80	14.17	-13.67	7.60	18.02	A	14.46	A	A
179	81.91	5.90	7.20	47.32	26.31	15.77	N	7.76	A	N
186	52.60	2.90	5.51	-5.40	3.00	8.55	A	6.22	A	A
189	52.70	4.90	9.30	-5.22	2.90	13.30	A	9.73	A	A
206	55.20	4.00	7.25	-0.72	0.40	11.11	A	7.80	A	A
237	52.20	3.20	6.13	-6.12	3.40	9.23	A	6.77	A	A
245	55.40	3.20	5.78	-0.36	0.20	9.23	A	6.45	A	A
252	52.20	1.00	1.92	-6.12	3.40	4.87	A	3.46	A	A

Lab code	Rep. Value	Rep. Unc.	Unc. [%]	Rel. Bias	A1	A2	True	P	Prec.	Final Score
255	54.64	7.10	12.99	-1.73	0.96	18.78	A	13.31	A	A
257	57.30	2.60	4.54	3.06	1.70	7.88	A	5.37	A	A
260	51.20	4.00	7.81	-7.91	4.40	11.11	A	8.33	A	A
262	59.10	2.00	3.38	6.29	3.50	6.61	A	4.44	A	A
265	43.89	2.20	5.01	-21.06	11.71	7.02	N	5.78	A	N
269	53.09	2.09	3.94	-4.51	2.51	6.79	A	4.88	A	A
272	56.90	3.40	5.98	2.34	1.30	9.69	A	6.63	A	A
279	52.60	4.00	7.60	-5.40	3.00	11.11	A	8.13	A	A
280	95.30	14.85	15.58	71.40	39.70	38.53	N	15.85	A	N
291	54.60	1.90	3.48	-1.80	1.00	6.41	A	4.52	A	A
293	43.30	2.20	5.08	-22.12	12.30	7.02	N	5.84	A	N
299	59.60	6.60	11.07	7.19	4.00	17.52	A	11.44	A	A
305	63.00	7.00	11.11	13.31	7.40	18.53	A	11.48	A	A
310	56.00	5.50	9.82	0.72	0.40	14.78	A	10.23	A	A
316	47.40	3.20	6.75	-14.75	8.20	9.23	A	7.34	A	A
321	51.45	3.20	6.22	-7.46	4.15	9.23	A	6.85	A	A

Analyte: Mn-54 in spiked Water, IAEA 445

Target Value: 4.74 ± 0.02 [Bq/kg]





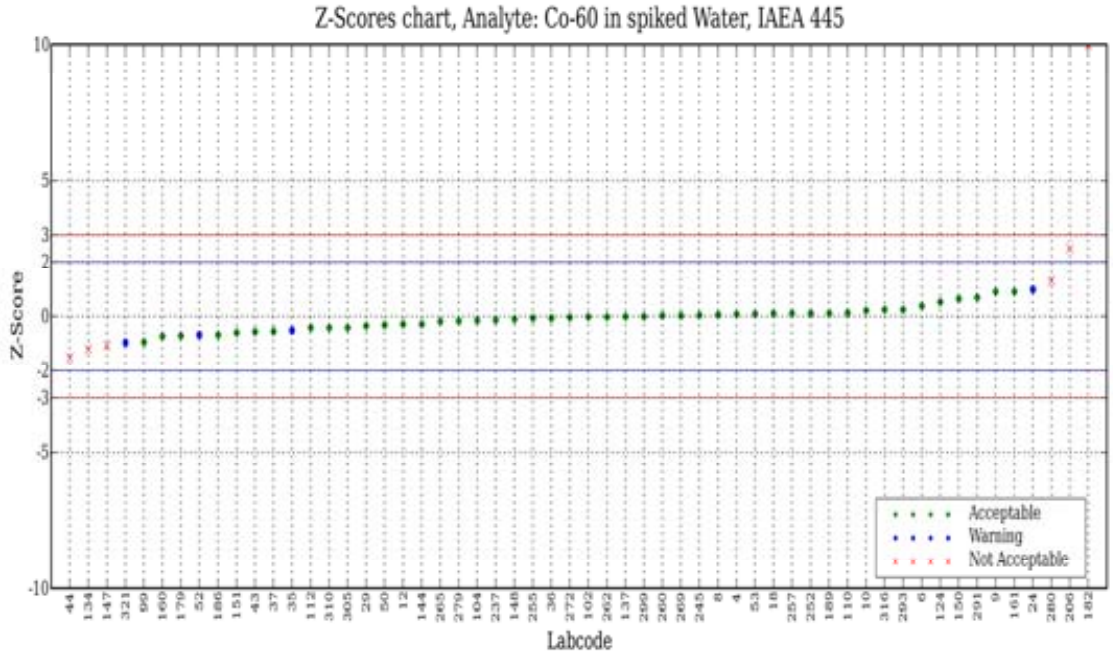
Analyte: Mn-54 in spiked Water, IAEA 445

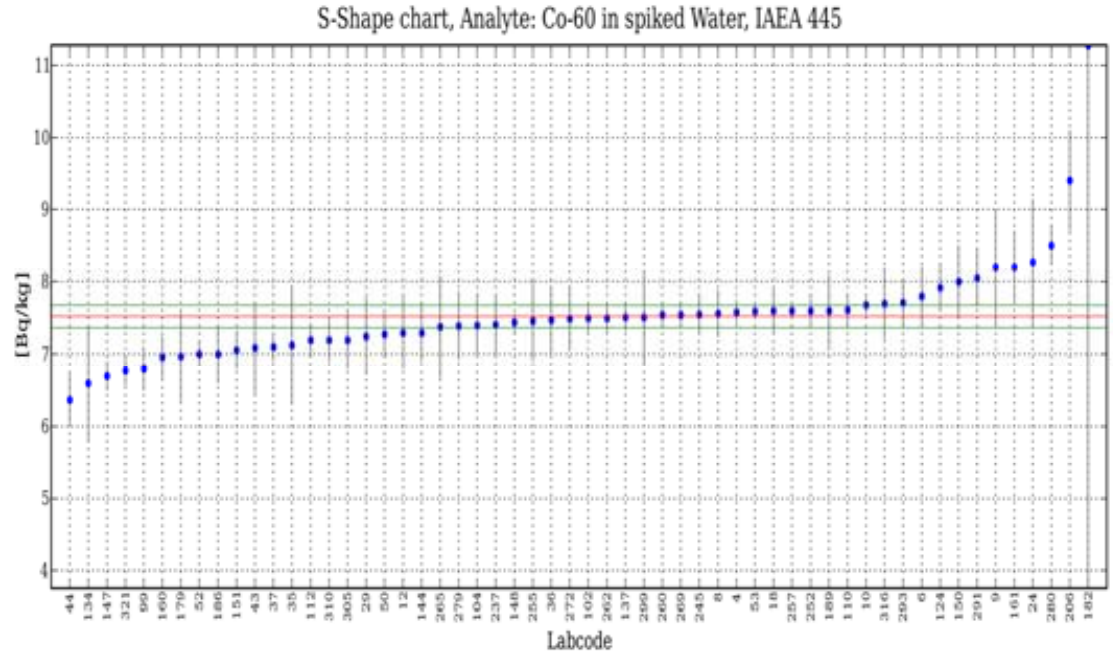
Lab code	Rep. Value	Rep. Unc.	Unc. [%]	Rel. Bias	A1	A2	True	P	Prec.	Final Score
4	4.88	0.17	3.48	2.95	0.14	0.44	A	3.51	A	A
6	5.40	0.30	5.56	13.92	0.66	0.78	A	5.57	A	A
8	4.77	0.21	4.40	0.63	0.03	0.54	A	4.42	A	A
9	5.20	0.80	15.38	9.70	0.46	2.06	A	15.39	N	W
10	4.69	0.13	2.77	-1.05	0.05	0.34	A	2.80	A	A
12	4.60	0.30	6.52	-2.95	0.14	0.78	A	6.54	A	A
18	4.70	0.17	3.62	-0.84	0.04	0.44	A	3.64	A	A
24	4.82	0.41	8.51	1.69	0.08	1.06	A	8.52	A	A
29	4.36	0.32	7.34	-8.02	0.38	0.83	A	7.35	A	A
35	4.30	0.28	6.51	-9.28	0.44	0.72	A	6.53	A	A
36	5.19	0.37	7.13	9.49	0.45	0.96	A	7.14	A	A
37	4.49	0.19	4.27	-5.29	0.25	0.50	A	4.29	A	A
43	4.71	0.38	8.07	-0.63	0.03	0.98	A	8.08	A	A
44	4.10	0.24	5.85	-13.50	0.64	0.62	N	5.87	A	N
50	5.13	0.33	6.43	8.23	0.39	0.85	A	6.45	A	A
52	5.00	0.18	3.60	5.49	0.26	0.47	A	3.62	A	A
53	4.91	0.09	1.83	3.59	0.17	0.24	A	1.88	A	A
99	4.70	0.30	6.38	-0.84	0.04	0.78	A	6.40	A	A
102	5.30	0.20	3.77	11.81	0.56	0.52	N	3.80	A	N
104	4.75	0.25	5.26	0.21	0.01	0.65	A	5.28	A	A
110	4.85	0.15	3.09	2.32	0.11	0.39	A	3.12	A	A
112	4.59	0.12	2.61	-3.16	0.15	0.31	A	2.65	A	A
124	4.82	0.21	4.36	1.69	0.08	0.54	A	4.38	A	A
134	4.80	0.40	8.33	1.27	0.06	1.03	A	8.34	A	A
137	4.86	0.20	4.12	2.53	0.12	0.52	A	4.14	A	A
144	4.90	0.30	6.12	3.38	0.16	0.78	A	6.14	A	A
147	4.50	0.10	2.22	-5.06	0.24	0.26	A	2.26	A	A
148	5.02	0.14	2.79	5.91	0.28	0.36	A	2.82	A	A
150	5.40	0.50	9.26	13.92	0.66	1.29	A	9.27	A	A
151	4.32	0.20	4.63	-8.86	0.42	0.52	A	4.65	A	A
160	5.06	0.24	4.74	6.75	0.32	0.62	A	4.76	A	A
161	4.90	0.37	7.55	3.38	0.16	0.96	A	7.56	A	A
179	4.28	0.39	9.11	-9.70	0.46	1.01	A	9.12	A	A
182	23.90	4.37	18.28	404.22	19.16	11.27	N	18.29	N	N
186	4.60	0.40	8.70	-2.95	0.14	1.03	A	8.71	A	A
189	5.20	0.40	7.69	9.70	0.46	1.03	A	7.70	A	A
206	6.40	0.40	6.25	35.02	1.66	1.03	N	6.26	A	N
237	4.40	0.31	7.05	-7.17	0.34	0.80	A	7.06	A	A
245	4.87	0.16	3.29	2.74	0.13	0.42	A	3.31	A	A

Lab code	Rep. Value	Rep. Unc.	Unc. [%]	Rel. Bias	A1	A2	True	P	Prec.	Final Score
252	4.90	0.20	4.08	3.38	0.16	0.52	A	4.10	A	A
255	3.65	0.25	6.85	-23.00	1.09	0.65	N	6.86	A	N
257	5.10	0.12	2.35	7.59	0.36	0.31	N	2.39	A	W
260	4.95	0.12	2.42	4.43	0.21	0.31	A	2.46	A	A
262	5.10	0.20	3.92	7.59	0.36	0.52	A	3.94	A	A
265	4.90	0.50	10.20	3.38	0.16	1.29	A	10.21	N	W
269	5.04	0.19	3.77	6.33	0.30	0.49	A	3.79	A	A
272	5.06	0.31	6.13	6.75	0.32	0.80	A	6.14	A	A
279	4.88	0.31	6.35	2.95	0.14	0.80	A	6.37	A	A
280	5.41	0.25	4.62	14.14	0.67	0.65	N	4.64	A	N
291	5.55	0.31	5.59	17.09	0.81	0.80	N	5.60	A	N
293	5.05	0.30	5.94	6.54	0.31	0.78	A	5.96	A	A
299	5.78	0.57	9.86	21.94	1.04	1.47	A	9.87	A	A
305	4.50	0.30	6.67	-5.06	0.24	0.78	A	6.68	A	A
310	5.00	0.40	8.00	5.49	0.26	1.03	A	8.01	A	A
316	4.97	0.37	7.44	4.85	0.23	0.96	A	7.46	A	A
321	4.26	0.16	3.76	-10.13	0.48	0.42	N	3.78	A	N

Analyte: Co-60 in spiked Water, IAEA 445

Target Value: 7.52 ± 0.06 [Bq/kg]





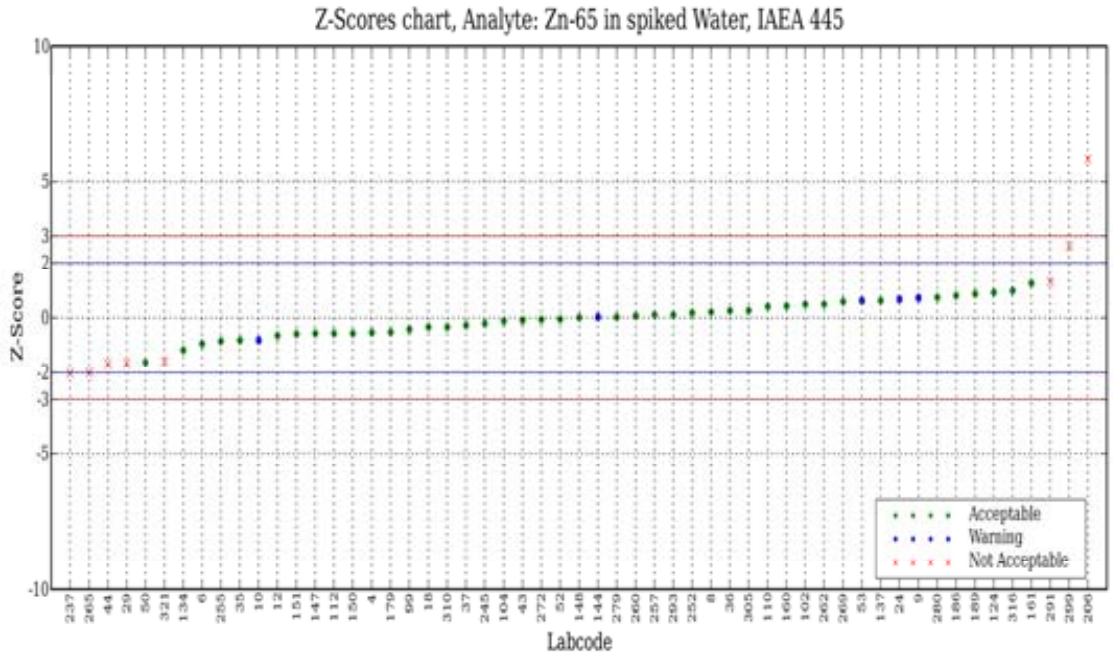
Analyte: Co-60 in spiked Water, IAEA 445

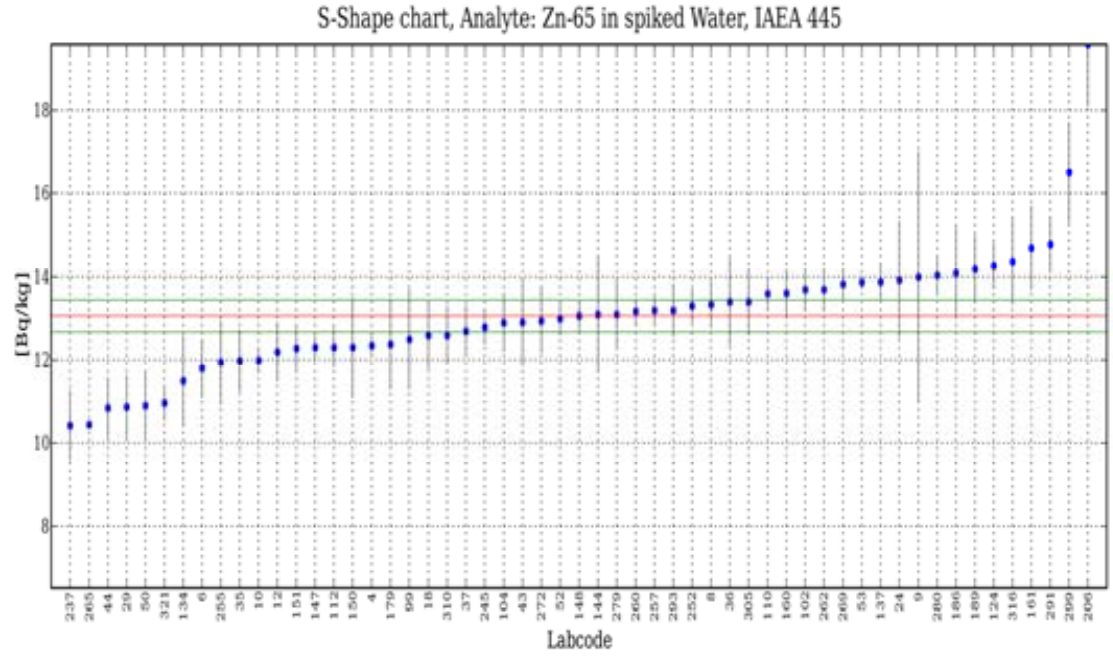
Lab code	Rep. Value	Rep. Unc.	Unc. [%]	Rel. Bias	A1	A2	True	P	Prec.	Final Score
4	7.58	0.16	2.11	0.80	0.06	0.44	A	2.26	A	A
6	7.80	0.40	5.13	3.72	0.28	1.04	A	5.19	A	A
8	7.56	0.32	4.23	0.53	0.04	0.84	A	4.31	A	A
9	8.20	0.80	9.76	9.04	0.68	2.07	A	9.79	A	A
10	7.68	0.14	1.82	2.13	0.16	0.39	A	1.99	A	A
12	7.30	0.50	6.85	-2.93	0.22	1.30	A	6.90	A	A
18	7.60	0.30	3.95	1.06	0.08	0.79	A	4.03	A	A
24	8.27	0.87	10.52	9.97	0.75	2.25	A	10.55	N	W
29	7.25	0.53	7.31	-3.59	0.27	1.38	A	7.35	A	A
35	7.13	0.82	11.50	-5.19	0.39	2.12	A	11.53	N	W
36	7.47	0.45	6.02	-0.66	0.05	1.17	A	6.08	A	A
37	7.10	0.19	2.73	-5.54	0.42	0.52	A	2.84	A	A
43	7.09	0.63	8.89	-5.72	0.43	1.63	A	8.92	A	A
44	6.37	0.36	5.65	-15.29	1.15	0.94	N	5.71	A	N
50	7.28	0.30	4.12	-3.19	0.24	0.79	A	4.20	A	A
52	7.00	0.16	2.29	-6.91	0.52	0.44	N	2.42	A	W
53	7.59	0.09	1.19	0.93	0.07	0.28	A	1.43	A	A
99	6.80	0.30	4.41	-9.57	0.72	0.79	A	4.48	A	A
102	7.50	0.20	2.67	-0.27	0.02	0.54	A	2.78	A	A
104	7.40	0.40	5.41	-1.60	0.12	1.04	A	5.46	A	A
110	7.61	0.21	2.76	1.20	0.09	0.56	A	2.87	A	A
112	7.20	0.23	3.19	-4.26	0.32	0.61	A	3.29	A	A
124	7.92	0.31	3.91	5.32	0.40	0.81	A	3.99	A	A
134	6.60	0.80	12.12	-12.23	0.92	2.07	A	12.15	N	N
137	7.51	0.18	2.40	-0.13	0.01	0.49	A	2.53	A	A
144	7.30	0.40	5.48	-2.93	0.22	1.04	A	5.54	A	A
147	6.70	0.20	2.99	-10.90	0.82	0.54	N	3.09	A	N
148	7.44	0.13	1.75	-1.06	0.08	0.37	A	1.92	A	A
150	8.00	0.50	6.25	6.38	0.48	1.30	A	6.30	A	A
151	7.06	0.26	3.68	-6.12	0.46	0.69	A	3.77	A	A
160	6.96	0.29	4.17	-7.45	0.56	0.76	A	4.24	A	A
161	8.20	0.50	6.10	9.04	0.68	1.30	A	6.15	A	A
179	6.97	0.62	8.90	-7.31	0.55	1.61	A	8.93	A	A
182	42.20	8.14	19.29	461.17	34.68	21.00	N	19.31	N	N
186	7.00	0.40	5.71	-6.91	0.52	1.04	A	5.77	A	A
189	7.60	0.50	6.58	1.06	0.08	1.30	A	6.63	A	A
206	9.40	0.70	7.45	25.00	1.88	1.81	N	7.49	A	N
237	7.41	0.41	5.53	-1.46	0.11	1.07	A	5.59	A	A

Lab code	Rep. Value	Rep. Unc.	Unc. [%]	Rel. Bias	A1	A2	True	P	Prec.	Final Score
245	7.55	0.24	3.18	0.40	0.03	0.64	A	3.28	A	A
252	7.60	0.20	2.63	1.06	0.08	0.54	A	2.75	A	A
255	7.46	0.55	7.37	-0.80	0.06	1.43	A	7.42	A	A
257	7.60	0.11	1.45	1.06	0.08	0.32	A	1.65	A	A
260	7.54	0.15	1.99	0.27	0.02	0.42	A	2.14	A	A
262	7.50	0.20	2.67	-0.27	0.02	0.54	A	2.78	A	A
265	7.38	0.70	9.49	-1.86	0.14	1.81	A	9.52	A	A
269	7.54	0.17	2.25	0.27	0.02	0.47	A	2.39	A	A
272	7.49	0.43	5.74	-0.40	0.03	1.12	A	5.80	A	A
279	7.39	0.47	6.36	-1.73	0.13	1.22	A	6.41	A	A
280	8.50	0.26	3.06	13.03	0.98	0.69	N	3.16	A	N
291	8.05	0.39	4.84	7.05	0.53	1.02	A	4.91	A	A
293	7.71	0.33	4.28	2.53	0.19	0.87	A	4.35	A	A
299	7.51	0.64	8.52	-0.13	0.01	1.66	A	8.56	A	A
305	7.20	0.40	5.56	-4.26	0.32	1.04	A	5.61	A	A
310	7.20	0.30	4.17	-4.26	0.32	0.79	A	4.24	A	A
316	7.70	0.49	6.36	2.39	0.18	1.27	A	6.41	A	A
321	6.78	0.21	3.10	-9.84	0.74	0.56	N	3.20	A	W

Analyte: Zn-65 in spiked Water, IAEA 445

Target Value: 13.06 ± 0.15 [Bq/kg]





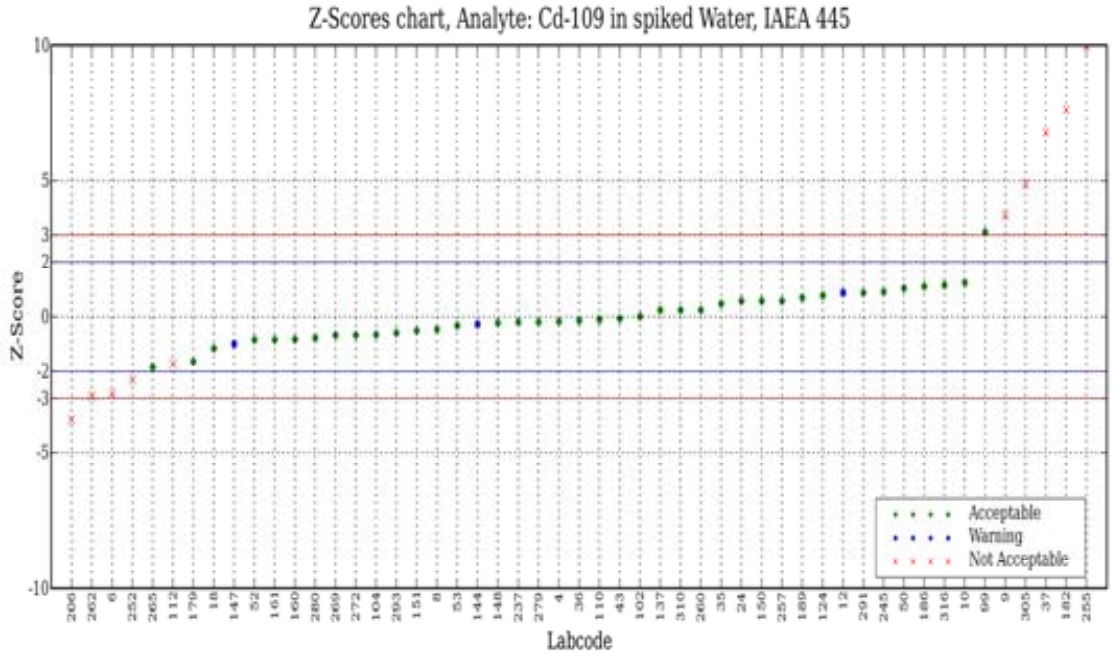
Analyte: Zn-65 in spiked Water, IAEA 445

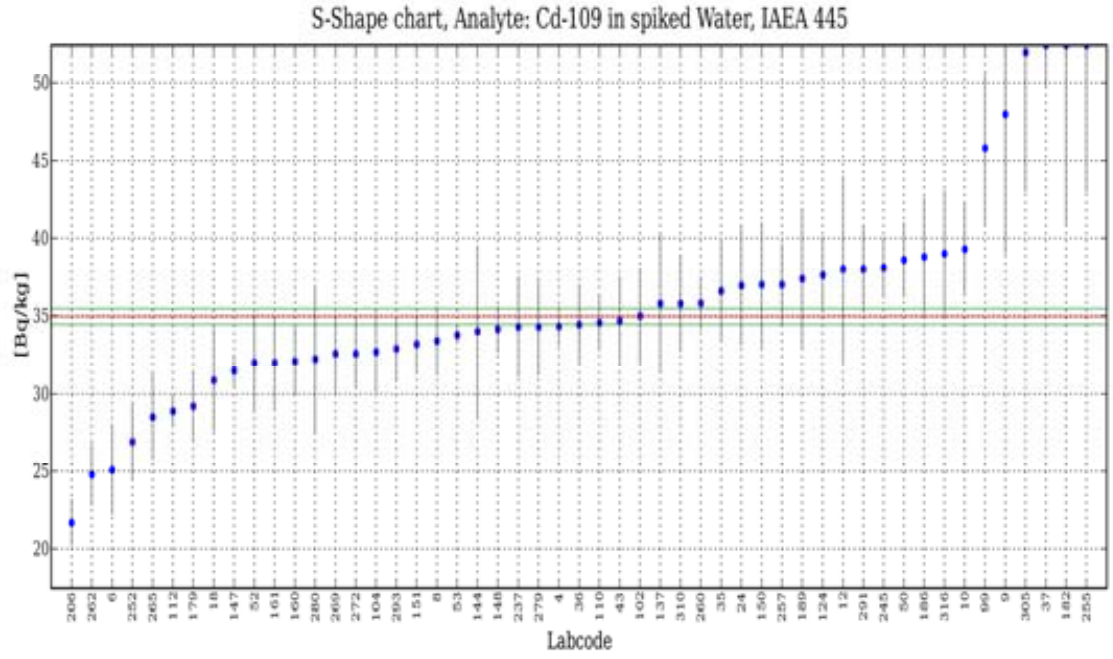
Lab code	Rep. Value	Rep. Unc.	Unc. [%]	Rel. Bias	A1	A2	True	P	Prec.	Final Score
4	12.35	0.27	2.19	-5.44	0.71	0.80	A	2.47	A	A
6	11.80	0.70	5.93	-9.65	1.26	1.85	A	6.04	A	A
8	13.34	0.56	4.20	2.14	0.28	1.50	A	4.35	A	A
9	14.00	3.00	21.43	7.20	0.94	7.75	A	21.46	N	W
10	11.99	0.30	2.50	-8.19	1.07	0.87	N	2.75	A	W
12	12.20	0.70	5.74	-6.58	0.86	1.85	A	5.85	A	A
18	12.60	0.81	6.43	-3.52	0.46	2.13	A	6.53	A	A
24	13.93	1.41	10.12	6.66	0.87	3.66	A	10.19	N	W
29	10.87	0.76	6.99	-16.77	2.19	2.00	N	7.09	A	N
35	11.98	0.74	6.18	-8.27	1.08	1.95	A	6.28	A	A
36	13.40	1.05	7.84	2.60	0.34	2.74	A	7.92	A	A
37	12.70	0.62	4.87	-2.77	0.36	1.64	A	5.00	A	A
43	12.91	1.05	8.13	-1.15	0.15	2.74	A	8.21	A	A
44	10.84	0.73	6.73	-17.00	2.22	1.92	N	6.83	A	N
50	10.90	0.83	7.61	-16.54	2.16	2.18	A	7.70	A	A
52	13.00	0.40	3.08	-0.46	0.06	1.10	A	3.28	A	A
53	13.87	0.16	1.15	6.20	0.81	0.57	N	1.63	A	W
99	12.50	1.20	9.60	-4.29	0.56	3.12	A	9.67	A	A
102	13.70	0.50	3.65	4.90	0.64	1.35	A	3.83	A	A
104	12.90	0.70	5.43	-1.23	0.16	1.85	A	5.55	A	A
110	13.60	0.40	2.94	4.13	0.54	1.10	A	3.16	A	A
112	12.30	0.48	3.90	-5.82	0.76	1.30	A	4.07	A	A
124	14.27	0.55	3.85	9.26	1.21	1.47	A	4.02	A	A
134	11.50	1.10	9.57	-11.94	1.56	2.86	A	9.63	A	A
137	13.88	0.43	3.10	6.28	0.82	1.17	A	3.30	A	A
144	13.10	1.40	10.69	0.31	0.04	3.63	A	10.75	N	W
147	12.30	0.30	2.44	-5.82	0.76	0.87	A	2.70	A	A
148	13.07	0.36	2.75	0.08	0.01	1.01	A	2.98	A	A
150	12.30	1.20	9.76	-5.82	0.76	3.12	A	9.82	A	A
151	12.28	0.54	4.40	-5.97	0.78	1.45	A	4.54	A	A
160	13.61	0.57	4.19	4.21	0.55	1.52	A	4.34	A	A
161	14.70	1.00	6.80	12.56	1.64	2.61	A	6.90	A	A
179	12.38	1.10	8.89	-5.21	0.68	2.86	A	8.96	A	A
186	14.10	1.10	7.80	7.96	1.04	2.86	A	7.89	A	A
189	14.20	0.80	5.63	8.73	1.14	2.10	A	5.75	A	A
206	20.70	1.50	7.25	58.50	7.64	3.89	N	7.34	A	N
237	10.42	0.85	8.16	-20.21	2.64	2.23	N	8.24	A	N
245	12.79	0.41	3.21	-2.07	0.27	1.13	A	3.41	A	A
252	13.30	0.40	3.01	1.84	0.24	1.10	A	3.22	A	A

Lab code	Rep. Value	Rep. Unc.	Unc. [%]	Rel. Bias	A1	A2	True	P	Prec.	Final Score
255	11.94	1.01	8.46	-8.58	1.12	2.63	A	8.54	A	A
257	13.20	0.32	2.42	1.07	0.14	0.91	A	2.68	A	A
260	13.17	0.30	2.28	0.84	0.11	0.87	A	2.55	A	A
262	13.70	0.50	3.65	4.90	0.64	1.35	A	3.83	A	A
265	10.44	0.10	0.96	-20.06	2.62	0.47	N	1.50	A	N
269	13.83	0.37	2.68	5.90	0.77	1.03	A	2.91	A	A
272	12.95	0.78	6.02	-0.84	0.11	2.05	A	6.13	A	A
279	13.10	0.80	6.11	0.31	0.04	2.10	A	6.21	A	A
280	14.04	0.44	3.13	7.50	0.98	1.20	A	3.34	A	A
291	14.78	0.62	4.19	13.17	1.72	1.65	N	4.35	A	N
293	13.20	0.63	4.77	1.07	0.14	1.67	A	4.91	A	A
299	16.50	1.20	7.27	26.34	3.44	3.12	N	7.36	A	N
305	13.40	0.80	5.97	2.60	0.34	2.10	A	6.08	A	A
310	12.60	0.70	5.56	-3.52	0.46	1.85	A	5.67	A	A
316	14.37	1.03	7.17	10.03	1.31	2.69	A	7.26	A	A
321	10.96	0.41	3.74	-16.08	2.10	1.13	N	3.91	A	N

Analyte: Cd-109 in spiked Water, IAEA 445

Target Value: 34.96 ± 0.2 [Bq/kg]





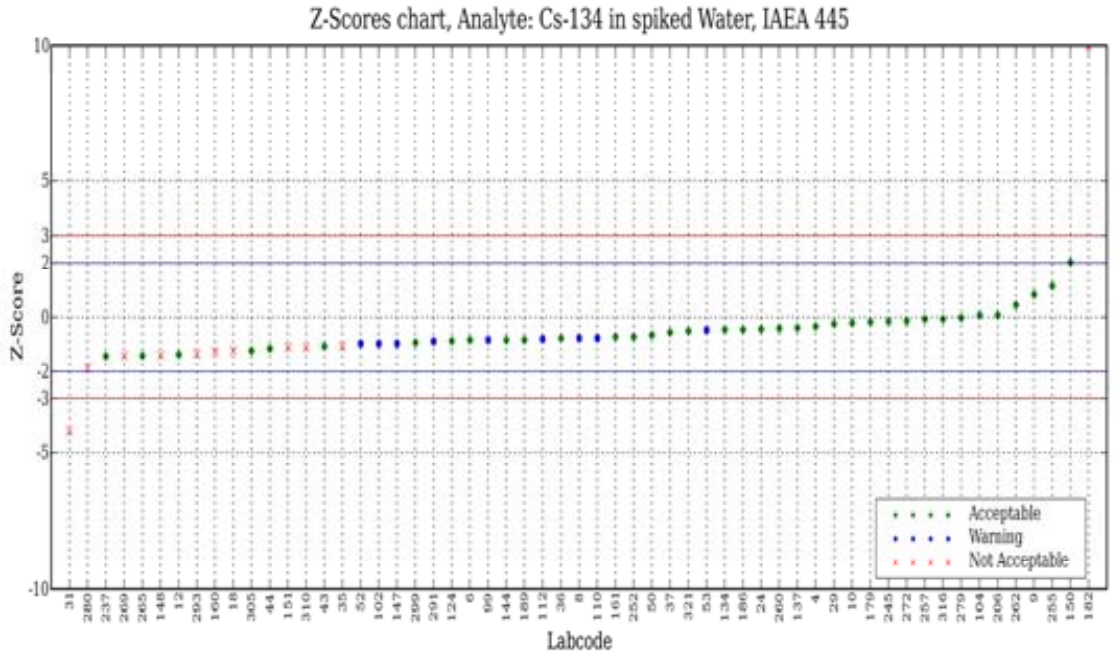
Analyte: Cd-109 in spiked Water, IAEA 445

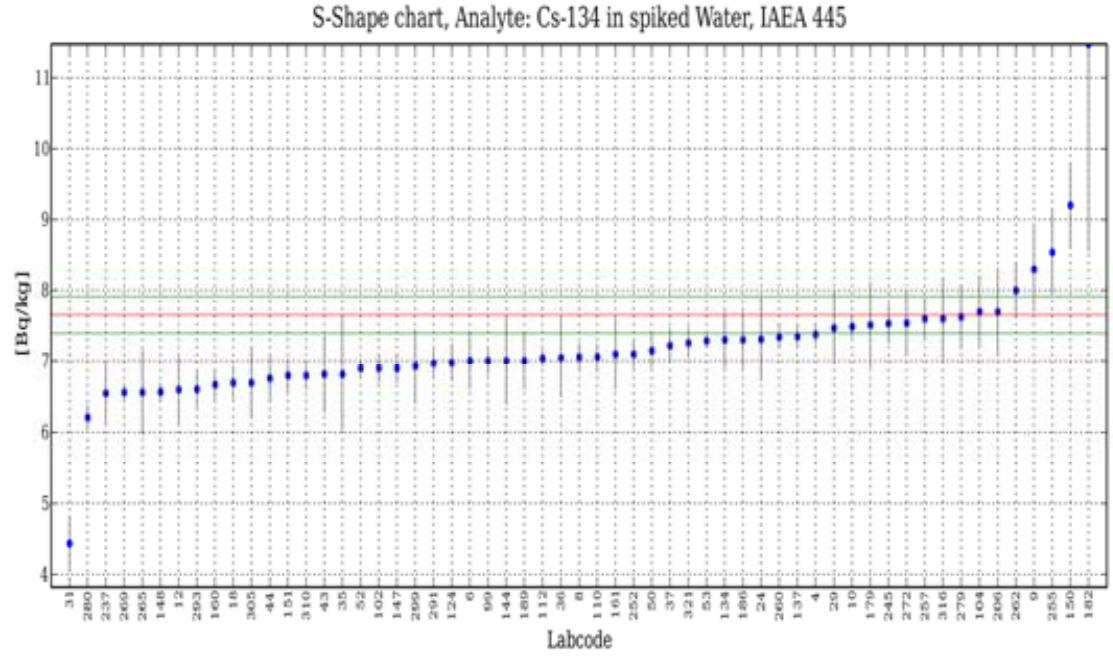
Lab code	Rep. Value	Rep. Unc.	Unc. [%]	Rel. Bias	A1	A2	True	P	Prec.	Final Score
4	34.34	1.28	3.73	-1.77	0.62	3.34	A	3.77	A	A
6	25.10	2.90	11.55	-28.20	9.86	7.50	N	11.57	A	N
8	33.40	2.19	6.56	-4.46	1.56	5.67	A	6.58	A	A
9	48.00	9.00	18.75	37.30	13.04	23.23	A	18.76	N	N
10	39.30	3.00	7.63	12.41	4.34	7.76	A	7.65	A	A
12	38.00	6.00	15.79	8.70	3.04	15.49	A	15.80	N	W
18	30.90	3.32	10.74	-11.61	4.06	8.58	A	10.76	A	A
24	36.97	3.82	10.33	5.75	2.01	9.87	A	10.35	A	A
35	36.60	3.20	8.74	4.69	1.64	8.27	A	8.76	A	A
36	34.46	2.56	7.43	-1.43	0.50	6.62	A	7.45	A	A
37	58.69	2.65	4.52	67.87	23.73	6.86	N	4.55	A	N
43	34.67	2.88	8.31	-0.83	0.29	7.45	A	8.33	A	A
50	38.60	2.40	6.22	10.41	3.64	6.21	A	6.24	A	A
52	32.00	3.16	9.88	-8.47	2.96	8.17	A	9.89	A	A
53	33.79	0.57	1.69	-3.35	1.17	1.56	A	1.78	A	A
99	45.80	4.90	10.70	31.01	10.84	12.65	A	10.71	A	A
102	35.00	3.00	8.57	0.11	0.04	7.76	A	8.59	A	A
104	32.70	2.60	7.95	-6.46	2.26	6.73	A	7.97	A	A
110	34.57	1.76	5.09	-1.12	0.39	4.57	A	5.12	A	A
112	28.90	0.99	3.43	-17.33	6.06	2.61	N	3.47	A	N
124	37.64	2.42	6.43	7.67	2.68	6.26	A	6.45	A	A
137	35.80	4.40	12.29	2.40	0.84	11.36	A	12.30	A	A
144	34.00	5.50	16.18	-2.75	0.96	14.20	A	16.19	N	W
147	31.50	1.00	3.17	-9.90	3.46	2.63	N	3.23	A	W
148	34.15	1.50	4.39	-2.32	0.81	3.90	A	4.43	A	A
150	37.00	4.00	10.81	5.84	2.04	10.33	A	10.83	A	A
151	33.20	1.90	5.72	-5.03	1.76	4.93	A	5.75	A	A
160	32.10	2.19	6.82	-8.18	2.86	5.67	A	6.85	A	A
161	32.00	3.00	9.38	-8.47	2.96	7.76	A	9.39	A	A
179	29.21	2.30	7.87	-16.45	5.75	5.96	A	7.89	A	A
182	61.60	11.52	18.70	76.20	26.64	29.73	A	18.71	N	N
186	38.80	3.80	9.79	10.98	3.84	9.82	A	9.81	A	A
189	37.40	4.50	12.03	6.98	2.44	11.62	A	12.05	A	A
206	21.70	1.50	6.91	-37.93	13.26	3.90	N	6.94	A	N
237	34.30	3.20	9.33	-1.89	0.66	8.27	A	9.35	A	A
245	38.10	1.93	5.07	8.98	3.14	5.01	A	5.10	A	A
252	26.90	2.50	9.29	-23.05	8.06	6.47	N	9.31	A	N
255	72.89	9.47	12.99	108.50	37.93	24.44	N	13.00	A	N

Lab code	Rep. Value	Rep. Unc.	Unc. [%]	Rel. Bias	A1	A2	True	P	Prec.	Final Score
257	37.00	2.60	7.03	5.84	2.04	6.73	A	7.05	A	A
260	35.81	1.70	4.75	2.43	0.85	4.42	A	4.78	A	A
262	24.80	2.00	8.06	-29.06	10.16	5.19	N	8.08	A	N
265	28.52	2.80	9.82	-18.42	6.44	7.24	A	9.83	A	A
269	32.59	2.55	7.82	-6.78	2.37	6.60	A	7.85	A	A
272	32.60	2.30	7.06	-6.75	2.36	5.96	A	7.08	A	A
279	34.30	3.10	9.04	-1.89	0.66	8.01	A	9.06	A	A
280	32.25	4.71	14.60	-7.75	2.71	12.16	A	14.62	A	A
291	38.00	2.80	7.37	8.70	3.04	7.24	A	7.39	A	A
293	32.90	2.10	6.38	-5.89	2.06	5.44	A	6.41	A	A
305	52.00	9.00	17.31	48.74	17.04	23.23	A	17.32	N	N
310	35.80	3.10	8.66	2.40	0.84	8.01	A	8.68	A	A
316	39.00	4.06	10.41	11.56	4.04	10.49	A	10.43	A	A

Analyte: Cs-134 in spiked Water, IAEA 445

Target Value: 7.65 ± 0.1 [Bq/kg]





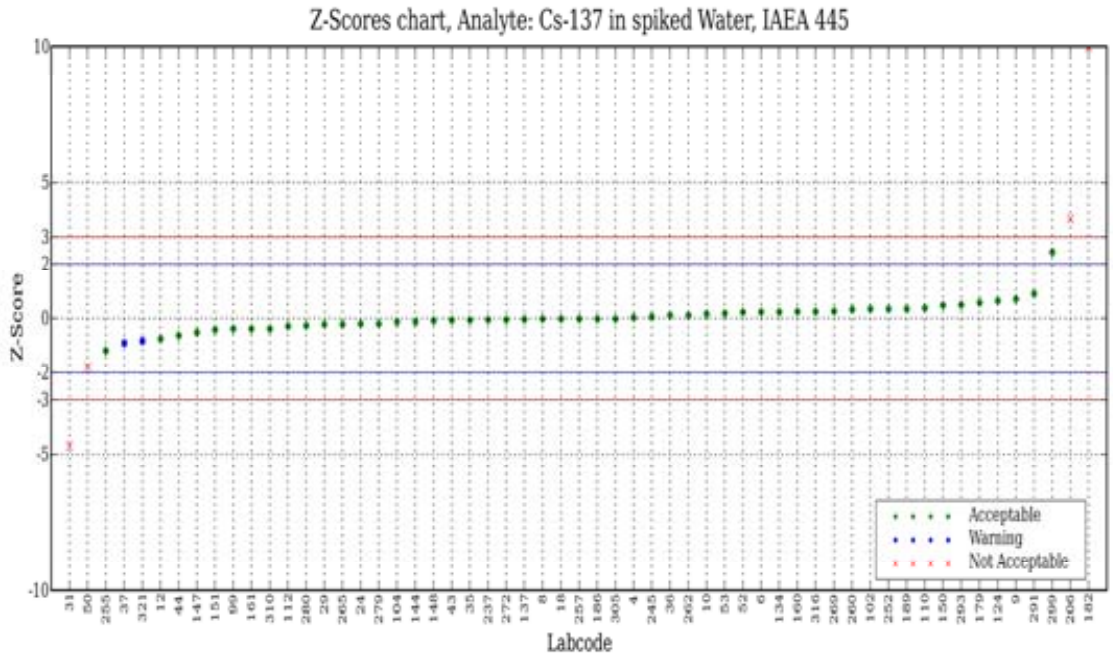
Analyte: Cs-134 in spiked Water, IAEA 445

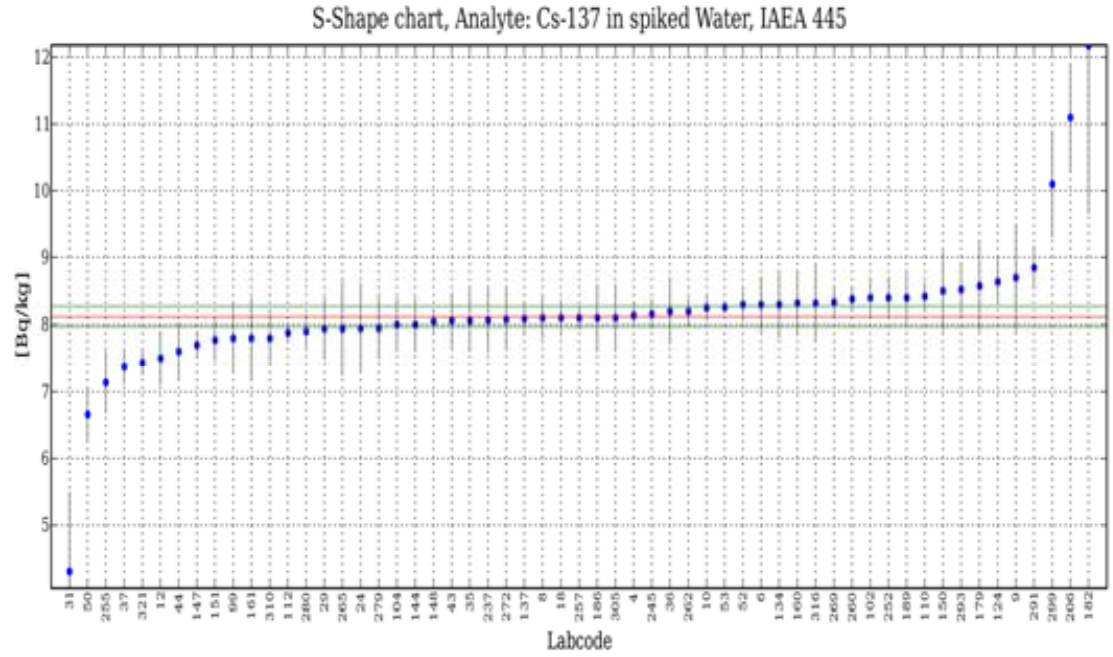
Lab code	Rep. Value	Rep. Unc.	Unc. [%]	Rel. Bias	A1	A2	True	P	Prec	Final Score
4	7.38	0.15	2.03	-3.53	0.27	0.47	A	2.42	A	A
6	7.00	0.40	5.71	-8.50	0.65	1.06	A	5.86	A	A
8	7.06	0.19	2.69	-7.71	0.59	0.55	N	2.99	A	W
9	8.30	0.60	7.23	8.50	0.65	1.57	A	7.35	A	A
10	7.49	0.15	2.00	-2.09	0.16	0.47	A	2.39	A	A
12	6.60	0.50	7.58	-13.73	1.05	1.32	A	7.69	A	A
18	6.70	0.23	3.43	-12.42	0.95	0.65	N	3.67	A	N
24	7.31	0.59	8.07	-4.44	0.34	1.54	A	8.18	A	A
29	7.47	0.52	6.96	-2.35	0.18	1.37	A	7.08	A	A
31	4.44	0.38	8.56	-41.96	3.21	1.01	N	8.66	A	N
35	6.82	0.78	11.44	-10.85	0.83	2.03	A	11.51	N	N
36	7.05	0.55	7.80	-7.84	0.60	1.44	A	7.91	A	A
37	7.22	0.25	3.41	-5.65	0.43	0.69	A	3.65	A	A
43	6.82	0.54	7.92	-10.85	0.83	1.42	A	8.03	A	A
44	6.76	0.34	5.03	-11.63	0.89	0.91	A	5.20	A	A
50	7.15	0.24	3.36	-6.54	0.50	0.67	A	3.60	A	A
52	6.90	0.13	1.88	-9.80	0.75	0.42	N	2.29	A	W
53	7.29	0.08	1.10	-4.71	0.36	0.33	N	1.71	A	W
99	7.00	0.20	2.86	-8.50	0.65	0.58	N	3.14	A	W
102	6.90	0.20	2.90	-9.80	0.75	0.58	N	3.18	A	W
104	7.70	0.50	6.49	0.65	0.05	1.32	A	6.62	A	A
110	7.06	0.17	2.41	-7.71	0.59	0.51	N	2.74	A	W
112	7.04	0.12	1.70	-7.97	0.61	0.40	N	2.15	A	W
124	6.98	0.26	3.72	-8.76	0.67	0.72	A	3.95	A	A
134	7.30	0.40	5.48	-4.58	0.35	1.06	A	5.63	A	A
137	7.35	0.17	2.31	-3.92	0.30	0.51	A	2.66	A	A
144	7.00	0.60	8.57	-8.50	0.65	1.57	A	8.67	A	A
147	6.90	0.20	2.90	-9.80	0.75	0.58	N	3.18	A	W
148	6.57	0.12	1.83	-14.12	1.08	0.40	N	2.25	A	N
150	9.20	0.60	6.52	20.26	1.55	1.57	A	6.65	A	A
151	6.80	0.23	3.38	-11.11	0.85	0.65	N	3.63	A	N
160	6.67	0.21	3.15	-12.81	0.98	0.60	N	3.41	A	N
161	7.10	0.50	7.04	-7.19	0.55	1.32	A	7.16	A	A
179	7.51	0.60	7.99	-1.83	0.14	1.57	A	8.10	A	A
182	26.30	2.92	11.10	243.79	18.65	7.54	N	11.18	N	N
186	7.30	0.40	5.48	-4.58	0.35	1.06	A	5.63	A	A
189	7.00	0.40	5.71	-8.50	0.65	1.06	A	5.86	A	A
206	7.70	0.60	7.79	0.65	0.05	1.57	A	7.90	A	A
237	6.55	0.45	6.87	-14.38	1.10	1.19	A	6.99	A	A

Lab code	Rep. Value	Rep. Unc.	Unc. [%]	Rel. Bias	A1	A2	True	P	Prec	Final Score
245	7.53	0.27	3.59	-1.57	0.12	0.74	A	3.82	A	A
252	7.10	0.20	2.82	-7.19	0.55	0.58	A	3.11	A	A
255	8.54	0.58	6.79	11.63	0.89	1.52	A	6.92	A	A
257	7.60	0.28	3.68	-0.65	0.05	0.77	A	3.91	A	A
260	7.34	0.16	2.18	-4.05	0.31	0.49	A	2.54	A	A
262	8.00	0.40	5.00	4.58	0.35	1.06	A	5.17	A	A
265	6.56	0.60	9.15	-14.25	1.09	1.57	A	9.24	A	A
269	6.56	0.12	1.83	-14.25	1.09	0.40	N	2.25	A	N
272	7.54	0.46	6.10	-1.44	0.11	1.21	A	6.24	A	A
279	7.63	0.45	5.90	-0.26	0.02	1.19	A	6.04	A	A
280	6.21	0.17	2.74	-18.82	1.44	0.51	N	3.03	A	N
291	6.97	0.21	3.01	-8.89	0.68	0.60	N	3.28	A	W
293	6.61	0.25	3.78	-13.59	1.04	0.69	N	4.00	A	N
299	6.93	0.52	7.50	-9.41	0.72	1.37	A	7.62	A	A
305	6.70	0.50	7.46	-12.42	0.95	1.32	A	7.58	A	A
310	6.80	0.20	2.94	-11.11	0.85	0.58	N	3.22	A	N
316	7.60	0.57	7.50	-0.65	0.05	1.49	A	7.61	A	A
321	7.26	0.22	3.03	-5.10	0.39	0.62	A	3.30	A	A

Analyte: Cs-137 in spiked Water, IAEA 445

Target Value: 8.12 ± 0.06 [Bq/kg]





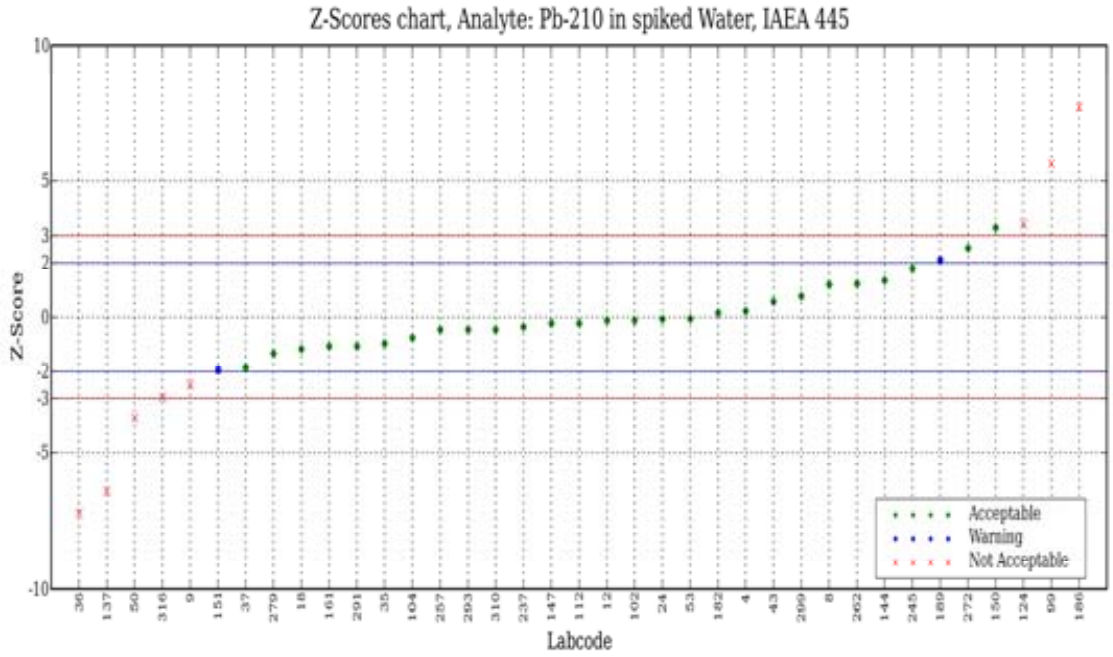
Analyte: Cs-137 in spiked Water, IAEA 445

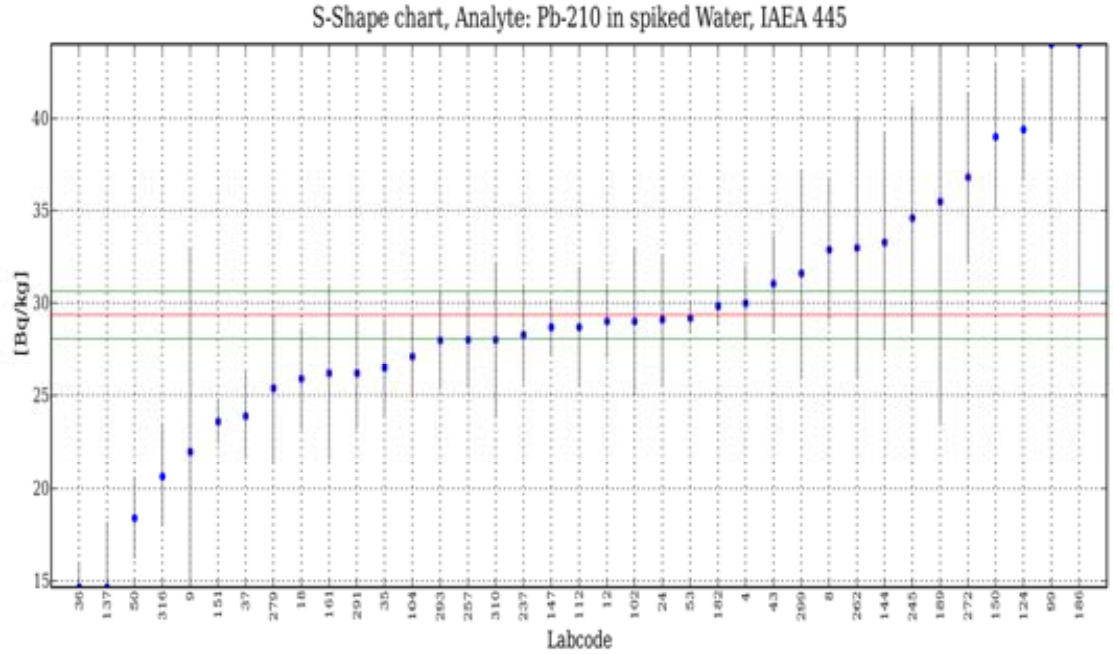
Lab code	Rep. Value	Rep. Unc.	Unc. [%]	Rel. Bias	A1	A2	True	P	Prec	Final Score
4	8.14	0.17	2.09	0.25	0.02	0.47	A	2.22	A	A
6	8.30	0.40	4.82	2.22	0.18	1.04	A	4.88	A	A
8	8.10	0.31	3.83	-0.25	0.02	0.81	A	3.90	A	A
9	8.70	0.80	9.20	7.14	0.58	2.07	A	9.23	A	A
10	8.25	0.20	2.42	1.60	0.13	0.54	A	2.53	A	A
12	7.50	0.40	5.33	-7.64	0.62	1.04	A	5.38	A	A
18	8.10	0.27	3.33	-0.25	0.02	0.71	A	3.41	A	A
24	7.95	0.66	8.30	-2.09	0.17	1.71	A	8.33	A	A
29	7.94	0.46	5.79	-2.22	0.18	1.20	A	5.84	A	A
31	4.31	1.18	27.38	-46.92	3.81	3.05	N	27.39	N	N
35	8.06	0.46	5.71	-0.74	0.06	1.20	A	5.75	A	A
36	8.20	0.49	5.98	0.99	0.08	1.27	A	6.02	A	A
37	7.38	0.26	3.51	-9.15	0.74	0.69	N	3.59	A	W
43	8.06	0.40	4.96	-0.74	0.06	1.04	A	5.02	A	A
44	7.60	0.43	5.66	-6.40	0.52	1.12	A	5.71	A	A
50	6.66	0.40	6.01	-17.98	1.46	1.04	N	6.05	A	N
52	8.30	0.25	3.01	2.22	0.18	0.66	A	3.10	A	A
53	8.26	0.10	1.21	1.72	0.14	0.30	A	1.42	A	A
99	7.80	0.50	6.41	-3.94	0.32	1.30	A	6.45	A	A
102	8.40	0.30	3.57	3.45	0.28	0.79	A	3.65	A	A
104	8.00	0.40	5.00	-1.48	0.12	1.04	A	5.05	A	A
110	8.42	0.21	2.49	3.69	0.30	0.56	A	2.60	A	A
112	7.88	0.15	1.90	-2.96	0.24	0.42	A	2.04	A	A
124	8.64	0.34	3.94	6.40	0.52	0.89	A	4.00	A	A
134	8.30	0.50	6.02	2.22	0.18	1.30	A	6.07	A	A
137	8.09	0.25	3.09	-0.37	0.03	0.66	A	3.18	A	A
144	8.00	0.40	5.00	-1.48	0.12	1.04	A	5.05	A	A
147	7.70	0.20	2.60	-5.17	0.42	0.54	A	2.70	A	A
148	8.05	0.16	1.99	-0.86	0.07	0.44	A	2.12	A	A
150	8.50	0.60	7.06	4.68	0.38	1.56	A	7.10	A	A
151	7.77	0.30	3.86	-4.31	0.35	0.79	A	3.93	A	A
160	8.32	0.48	5.77	2.46	0.20	1.25	A	5.82	A	A
161	7.80	0.60	7.69	-3.94	0.32	1.56	A	7.73	A	A
179	8.58	0.68	7.93	5.67	0.46	1.76	A	7.96	A	A
182	33.70	2.53	7.51	315.02	25.58	6.53	N	7.54	A	N
186	8.10	0.50	6.17	-0.25	0.02	1.30	A	6.22	A	A
189	8.40	0.40	4.76	3.45	0.28	1.04	A	4.82	A	A
206	11.10	0.80	7.21	36.70	2.98	2.07	N	7.24	A	N

Lab code	Rep. Value	Rep. Unc.	Unc. [%]	Rel. Bias	A1	A2	True	P	Prec	Final Score
237	8.07	0.49	6.07	-0.62	0.05	1.27	A	6.12	A	A
245	8.16	0.22	2.70	0.49	0.04	0.59	A	2.80	A	A
252	8.40	0.30	3.57	3.45	0.28	0.79	A	3.65	A	A
255	7.14	0.46	6.44	-12.07	0.98	1.20	A	6.48	A	A
257	8.10	0.18	2.22	-0.25	0.02	0.49	A	2.34	A	A
260	8.38	0.17	2.03	3.20	0.26	0.47	A	2.16	A	A
262	8.20	0.20	2.44	0.99	0.08	0.54	A	2.55	A	A
265	7.94	0.70	8.82	-2.22	0.18	1.81	A	8.85	A	A
269	8.33	0.24	2.88	2.59	0.21	0.64	A	2.97	A	A
272	8.08	0.45	5.57	-0.49	0.04	1.17	A	5.62	A	A
279	7.95	0.46	5.79	-2.09	0.17	1.20	A	5.83	A	A
280	7.90	0.26	3.29	-2.71	0.22	0.69	A	3.37	A	A
291	8.85	0.32	3.62	8.99	0.73	0.84	A	3.69	A	A
293	8.52	0.40	4.69	4.93	0.40	1.04	A	4.75	A	A
299	10.10	0.80	7.92	24.38	1.98	2.07	A	7.96	A	A
305	8.10	0.50	6.17	-0.25	0.02	1.30	A	6.22	A	A
310	7.80	0.40	5.13	-3.94	0.32	1.04	A	5.18	A	A
316	8.32	0.57	6.85	2.46	0.20	1.48	A	6.89	A	A
321	7.43	0.18	2.42	-8.50	0.69	0.49	N	2.53	A	W

Analyte: Pb-210 in spiked Water, IAEA 445

Target Value: 29.34 ± 0.5 [Bq/kg]



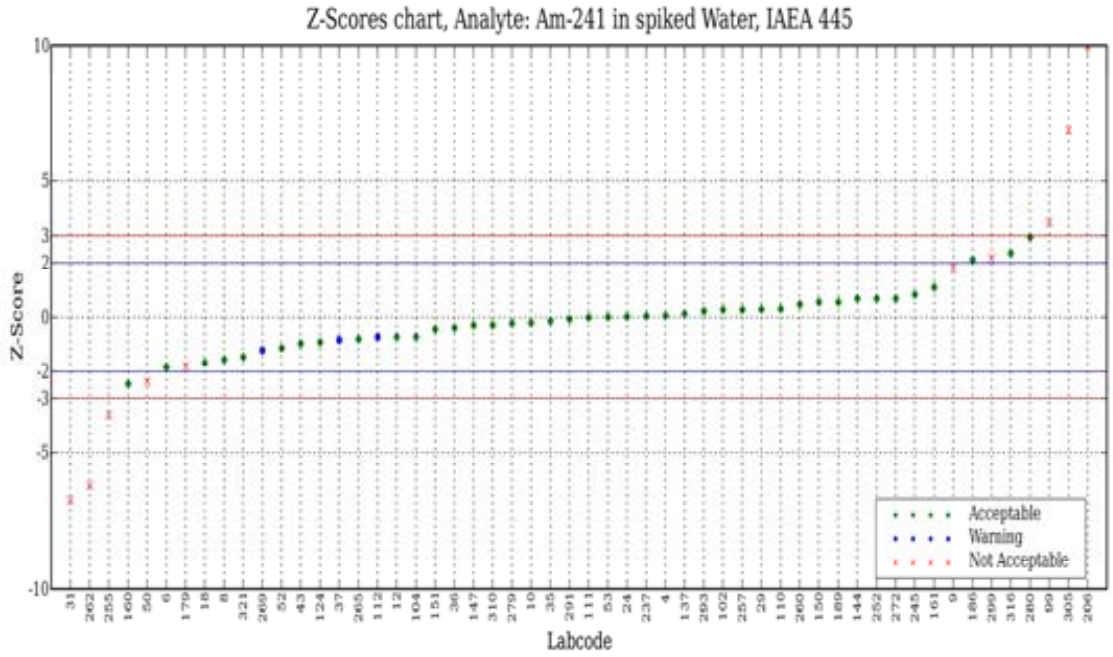


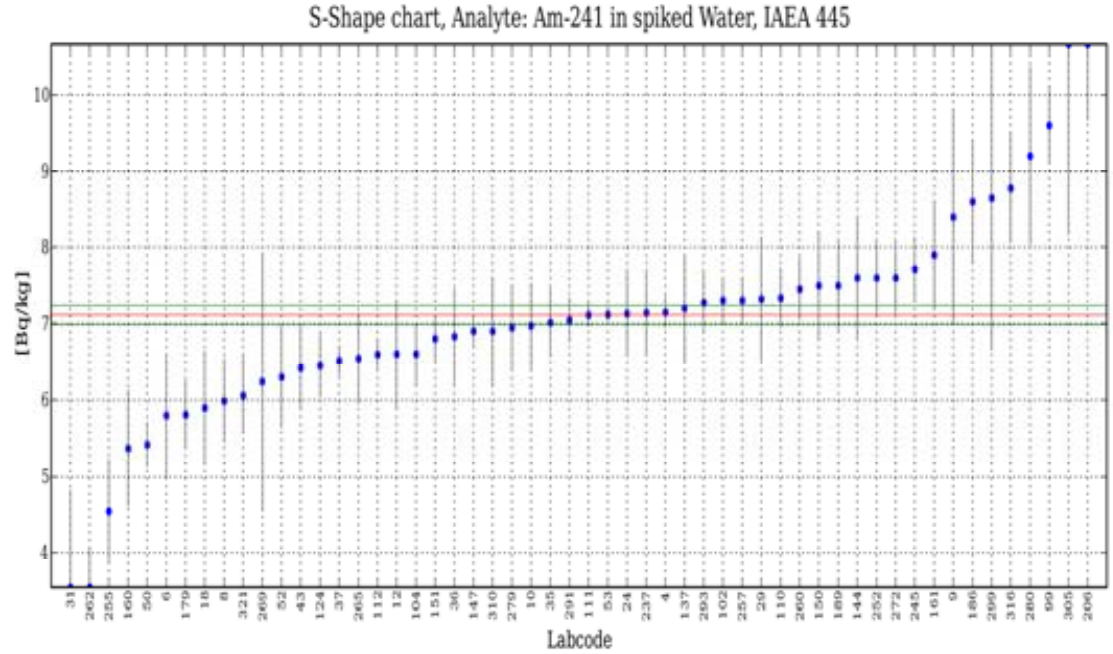
Analyte: Pb-210 in spiked Water, IAEA 445

Lab code	Rep. Value	Rep. Unc.	Unc. [%]	Rel. Bias	A1	A2	True	P	Prec	Final Score
4	30.00	2.00	6.67	2.25	0.66	5.32	A	6.88	A	A
8	32.90	3.83	11.64	12.13	3.56	9.97	A	11.77	A	A
9	22.00	11.00	50.00	-25.02	7.34	28.41	A	50.03	N	N
12	29.00	2.00	6.90	-1.16	0.34	5.32	A	7.10	A	A
18	25.90	2.74	10.58	-11.72	3.44	7.19	A	10.72	A	A
24	29.11	3.50	12.02	-0.78	0.23	9.12	A	12.14	A	A
35	26.50	2.60	9.81	-9.68	2.84	6.83	A	9.96	A	A
36	8.15	1.20	14.72	-72.22	21.19	3.35	N	14.82	A	N
37	23.91	2.30	9.63	-18.51	5.43	6.08	A	9.78	A	A
43	31.05	2.61	8.41	5.83	1.71	6.86	A	8.58	A	A
50	18.40	2.20	11.96	-37.29	10.94	5.82	N	12.08	A	N
53	29.18	0.73	2.50	-0.55	0.16	2.28	A	3.03	A	A
99	45.90	5.40	11.76	56.44	16.56	13.99	N	11.89	A	N
102	29.00	4.00	13.79	-1.16	0.34	10.40	A	13.90	A	A
104	27.10	2.20	8.12	-7.63	2.24	5.82	A	8.30	A	A
112	28.70	3.20	11.15	-2.18	0.64	8.36	A	11.28	A	A
124	39.40	2.80	7.11	34.29	10.06	7.34	N	7.31	A	N
137	10.50	3.50	33.33	-64.21	18.84	9.12	N	33.38	N	N
144	33.30	5.90	17.72	13.50	3.96	15.28	A	17.80	A	A
147	28.70	1.50	5.23	-2.18	0.64	4.08	A	5.50	A	A
150	39.00	4.00	10.26	32.92	9.66	10.40	A	10.40	A	A
151	23.60	1.20	5.08	-19.56	5.74	3.35	N	5.36	A	W
161	26.20	4.70	17.94	-10.70	3.14	12.19	A	18.02	A	A
182	29.81	1.02	3.42	1.60	0.47	2.93	A	3.82	A	A
186	52.00	14.00	26.92	77.23	22.66	36.14	A	26.98	N	N
189	35.50	12.00	33.80	21.00	6.16	30.99	A	33.85	N	W
237	28.27	2.60	9.20	-3.65	1.07	6.83	A	9.35	A	A
245	34.60	6.10	17.63	17.93	5.26	15.79	A	17.71	A	A
257	28.00	2.60	9.29	-4.57	1.34	6.83	A	9.44	A	A
262	33.00	7.00	21.21	12.47	3.66	18.11	A	21.28	A	A
272	36.80	4.60	12.50	25.43	7.46	11.94	A	12.62	A	A
279	25.40	4.00	15.75	-13.43	3.94	10.40	A	15.84	A	A
291	26.20	3.00	11.45	-10.70	3.14	7.85	A	11.58	A	A
293	27.99	2.68	9.57	-4.60	1.35	7.03	A	9.73	A	A
299	31.60	5.60	17.72	7.70	2.26	14.51	A	17.80	A	A
310	28.00	4.10	14.64	-4.57	1.34	10.66	A	14.74	A	A
316	20.66	2.70	13.07	-29.58	8.68	7.08	N	13.18	A	N

Analyte: Am-241 in spiked Water, IAEA 445

Target Value: 7.11 ± 0.05 [Bq/kg]





Analyte: Am-241 in spiked Water, IAEA 445

Lab code	Rep. Value	Rep. Unc.	Unc. [%]	Rel. Bias	A1	A2	True	P	Prec	Final Score
4	7.15	0.21	2.94	0.56	0.04	0.56	A	3.02	A	A
6	5.80	0.80	13.79	-18.42	1.31	2.07	A	13.81	A	A
8	5.99	0.54	9.02	-15.75	1.12	1.40	A	9.04	A	A
9	8.40	1.40	16.67	18.14	1.29	3.61	A	16.68	N	N
10	6.97	0.56	8.03	-1.97	0.14	1.45	A	8.07	A	A
12	6.60	0.70	10.61	-7.17	0.51	1.81	A	10.63	A	A
18	5.90	0.74	12.54	-17.02	1.21	1.91	A	12.56	A	A
24	7.13	0.56	7.85	0.28	0.02	1.45	A	7.89	A	A
29	7.32	0.81	11.07	2.95	0.21	2.09	A	11.09	A	A
31	2.32	1.27	54.74	-67.37	4.79	3.28	N	54.75	N	N
35	7.01	0.45	6.42	-1.41	0.10	1.17	A	6.46	A	A
36	6.83	0.62	9.08	-3.94	0.28	1.60	A	9.10	A	A
37	6.51	0.19	2.96	-8.42	0.60	0.51	N	3.04	A	W
43	6.42	0.54	8.41	-9.70	0.69	1.40	A	8.44	A	A
50	5.42	0.29	5.35	-23.77	1.69	0.76	N	5.40	A	N
52	6.30	0.66	10.48	-11.39	0.81	1.71	A	10.50	A	A
53	7.12	0.10	1.40	0.14	0.01	0.29	A	1.57	A	A
99	9.60	0.50	5.21	35.02	2.49	1.30	N	5.26	A	N
102	7.30	0.30	4.11	2.67	0.19	0.78	A	4.17	A	A
104	6.60	0.40	6.06	-7.17	0.51	1.04	A	6.10	A	A
110	7.33	0.39	5.32	3.09	0.22	1.01	A	5.37	A	A
111	7.11	0.15	2.11	0.00	0.00	0.41	A	2.22	A	A
112	6.59	0.18	2.73	-7.31	0.52	0.48	N	2.82	A	W
124	6.45	0.41	6.36	-9.28	0.66	1.07	A	6.40	A	A
137	7.20	0.70	9.72	1.27	0.09	1.81	A	9.75	A	A
144	7.60	0.80	10.53	6.89	0.49	2.07	A	10.55	A	A
147	6.90	0.20	2.90	-2.95	0.21	0.53	A	2.98	A	A
150	7.50	0.70	9.33	5.49	0.39	1.81	A	9.36	A	A
151	6.80	0.30	4.41	-4.36	0.31	0.78	A	4.47	A	A
160	5.37	0.76	14.15	-24.47	1.74	1.97	A	14.17	A	A
161	7.90	0.70	8.86	11.11	0.79	1.81	A	8.89	A	A
179	5.81	0.44	7.57	-18.28	1.30	1.14	N	7.61	A	N
186	8.60	0.80	9.30	20.96	1.49	2.07	A	9.33	A	A
189	7.50	0.60	8.00	5.49	0.39	1.55	A	8.03	A	A
206	14.80	1.00	6.76	108.16	7.69	2.58	N	6.79	A	N
237	7.14	0.55	7.70	0.42	0.03	1.42	A	7.74	A	A
245	7.71	0.43	5.58	8.44	0.60	1.12	A	5.62	A	A

Lab code	Rep. Value	Rep. Unc.	Unc. [%]	Rel. Bias	A1	A2	True	P	Prec	Final Score
252	7.60	0.50	6.58	6.89	0.49	1.30	A	6.62	A	A
255	4.55	0.68	14.95	-36.01	2.56	1.76	N	14.96	A	N
257	7.30	0.29	3.97	2.67	0.19	0.76	A	4.03	A	A
260	7.45	0.41	5.50	4.78	0.34	1.07	A	5.55	A	A
262	2.70	0.50	18.52	-62.03	4.41	1.30	N	18.53	N	N
265	6.54	0.60	9.17	-8.02	0.57	1.55	A	9.20	A	A
269	6.24	1.69	27.08	-12.24	0.87	4.36	A	27.09	N	W
272	7.60	0.47	6.18	6.89	0.49	1.22	A	6.22	A	A
279	6.95	0.55	7.91	-2.25	0.16	1.42	A	7.94	A	A
280	9.20	1.17	12.72	29.40	2.09	3.02	A	12.74	A	A
291	7.05	0.29	4.11	-0.84	0.06	0.76	A	4.17	A	A
293	7.27	0.40	5.50	2.25	0.16	1.04	A	5.55	A	A
299	8.65	2.00	23.12	21.66	1.54	5.16	A	23.13	N	N
305	12.00	2.50	20.83	68.78	4.89	6.45	A	20.85	N	N
310	6.90	0.70	10.14	-2.95	0.21	1.81	A	10.17	A	A
316	8.78	0.72	8.20	23.49	1.67	1.86	A	8.23	A	A
321	6.06	0.50	8.25	-14.77	1.05	1.30	A	8.28	A	A

APPENDIX III
LIST OF PARTICIPATING LABORATORIES

Note: Only those laboratories who reported their results to the IAEA were reported in the list of participating laboratories

AUSTRALIA

Labcode: 35

RADIOANALYTICAL SERVICES
AUSTRALIAN RADIATION PROTECTION AND NUCLEAR SAFETY AGENCY (ARPANSA)
LOWER PLENTY ROAD 619
YALLAMBIE, VICTORIA 3085
AUSTRALIA

BELGIUM

Labcode: 186

NUCLEAR SPECTROMETRY
BELGIAN NUCLEAR RESEARCH CENTRE
BOERETANG 200
B-2400, MOL
BELGIUM

BRAZIL

Labcode: 18

POCOS DE CALDAS LABORATORY - LAPOC
BRAZILIAN NUCLEAR ENERGY COMMISSION - CNEN
RODOVIA POCOS DE CALDAS / ANDRADAS KM 13,
37701-970, POCOS DE CALDAS, MG
BRAZIL

Labcode: 265

DEPARTAMENTO DE PROTECAO RADIOLOGICA AMBIENTAL
INSTITUTO DE RADIOPROTECAO E DOSIMETRIA - C.N.E.N.
AVENIDA SALVADOR ALLENDE S/NO.
JACAREPAGUA
CEP-22.780-160, RIO DE JANEIRO
BRAZIL

BULGARIA

Labcode: 53

RADIOACTIVITY MEASUREMENT LABORATORY,
EXECUTIVE ENVIRONMENT AGENCY,
MINISTRY OF ENVIRONMENT AND WATER
136 TZAR BORIS III, BLVD.
BG-1618, SOFIA
BULGARIA

Labcode: 260

LAB. MEASUREMENT OF RADIO-ACTIVITY
KOZLODUY NUCLEAR POWER PLANT
KOZLODUY, 3321
BULGARIA

BELARUS

Labcode: 50

RESEARCH DEPARTMENT OF RADIATIVE METROLOGY (RDRM)
BELARUSSIAN STATE INSTITUTE OF METROLOGY
STAROVILENSKI TRAKT 93
220053, MINSK
BELARUS

CHINA

Labcode: 245

RADIOMETROLOGY CENTER
CHINA INSTITUTE OF ATOMIC ENERGY
P.O. BOX 275 (20)
BEIJING, 102413
CHINA

CUBA

Labcode: 134

CENTRO DE ISOTOPOS (CENTIS)
AVENIDA MONUMENTAL Y CARRETERA
LA RADA, KM. 3 1/2
GUANABACOA,
CIUDAD DE LA HABANA,
CUBA

CYPRUS

Labcode: 160

STATE GENERAL LABORATORY
MINISTRY OF HEALTH
44 KIMONOS STREET, ACROPOLIS
1451, NICOSIA
CYPRUS

DENMARK

Labcode: 9

RADIATION RESEARCH DEPARTMENT
RISOE NATIONAL LABORATORY
BUILDING 204
FREDERIKSBORGVEJ, 399
DK-4000, ROSKILDE
DENMARK

ESTONIA

Labcode: 252

ESTONIAN RADIATION PROTECTION CENTRE
KOPLI 76
10416, TALLINN
ESTONIA

FINLAND

Labcode: 279

RESEARCH AND ENVIRONMENTAL SURVEILLANCE
RADIATION AND NUCLEAR SAFETY AUTHORITY (STUK)
LAIPPATIE 4
00880, HELSINKI
FINLAND

GERMANY

Labcode: 237

CENTER FOR ADVANCED TECHNOLOGIC. AND
ENVIRONMENTAL TRAINING
RESEARCH CENTER KARLSRUHE
HERMANN-VON-HELMHOLTZ-PLATZ 1
POSTFACH 3640
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