IAEA-RML-2017-01 PROFICIENCY TEST FOR DETERMINATION OF RADIONUCLIDES IN SEA WATER

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IAEA-RML-2017-01 PROFICIENCY TEST FOR DETERMINATION OF RADIONUCLIDES IN SEA WATER

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FOREWORD

The Radiometrics Laboratory of the IAEA Environment Laboratories has been providing quality support products and services for the last 50 years. These include the organization of proficiency tests and laboratory comparisons, and the production of certified reference materials, including a wide range of marine sample matrices and radionuclide levels.

As part of these activities, a Proficiency Test (PT) was organized at the request of the Nuclear Regulation Authority (NRA) of Japan to test the performance of participating laboratories in an analysis of radionuclides in a sea water sample. This exercise was initiated to support laboratories in sea water analyses of ^{3}H, ^{60}Co, ^{90}Sr, ^{134}Cs and ^{137}Cs in relation to the accident at the Fukushima Daiichi nuclear power station, in March 2011, and subsequent contamination of the marine environment. Earlier exercises are described in IAEA Analytical Quality in Nuclear Applications Series Nos 40 – 43.

The IAEA wishes to thank all the participants and laboratories who took part in this proficiency test. The IAEA is also grateful to the Government of the Principality of Monaco for its support. We thank our IAEA colleagues M. Pham and O. Blinova for the technical assistance.

The IAEA officers responsible for this publication are A.V. Harms, I. Osvath, D. Osborn and P. Ivanov of the IAEA Environment Laboratories.

CONTENTS

1. INTRODUCTION

1.1. BACKGROUND

The IAEA Environment Laboratories (IAEA-EL) in Monaco and Seibersdorf regularly organize proficiency tests (PT) for radionuclides in environmental samples to support laboratories in IAEA Member States.

1.2. OBJECTIVES

This proficiency test was initiated to support laboratories in sea water analyses of ^{3}H, ^{60}Co, ^{90}Sr, ^{134}Cs and ^{137}Cs. The results of this exercise allowed the participating laboratories to evaluate their performance in the analysis of these radionuclides for this sample type.

1.3. SCOPE

This publication describes the organization and the results of a proficiency test organized in cooperation with the Nuclear Regulation Authority (NRA) in Japan. A total of 74 laboratories from 43 countries participated in this exercise during the period October – December 2017. This included 23 laboratories from Japan and 51 laboratories from other IAEA Member States. The full list of participants is given on pages 79–89. Results of similar earlier exercises are described in IAEA Analytical Quality in Nuclear Applications Series Nos 40–43, 51 and 58 [1–6] and in Refs [7] and [8].

1.4. STRUCTURE

This publication contains a description of material offered and the reporting requirements (Section 2), the performance criteria (Section 3), the results of the exercise and discussion (Section 4), an appendix presenting the performance evaluation sorted by radionuclide (Appendix I), an appendix presenting the performance evaluation sorted by participant (Appendix II) and a list of participants (Appendix III).

2. MATERIAL AND METHODS

2.1. MATERIAL DISTRIBUTION AND REPORTING REQUIREMENTS

A sample containing 5 L of filtered Mediterranean Sea water spiked by the IAEA with the radionuclides ^{3}H, ^{60}Co, ^{90}Sr, ^{134}Cs and ^{137}Cs was distributed to the participants, with the massic activities only known to the IAEA. The massic activities were traceable to a standard provided by the Czech Metrology Institute ČMI. The combined massic activities in the exercise samples were lower than the natural activity level of ^{40}K in sea water (which is approximately 12 Bq kg^{-1}). The ^{3}H, ^{60}Co, ^{90}Sr, ^{134}Cs and ^{137}Cs massic activities for the samples were approximately 3.1, 0.16, 0.27, 0.19 and 0.31 Bq kg^{-1}, respectively. The sample also contained a non-active Co-carrier and Cs-carrier, both at 10 mg kg^{-1}, in order to stabilize the solution and to avoid adsorption of Co and Cs to the container walls. No Sr was added to the sample as non-active Sr present naturally in sea water will act as a carrier for ^{90}Sr.

The participants were required to report to the IAEA the ^{3}H, ^{60}Co, ^{90}Sr, ^{134}Cs and ^{137}Cs massic activities (in Bq kg^{-1}) of the proficiency test sample combined with the associated uncertainties (also in Bq kg^{-1}). Additionally, the participants were asked to submit the following:

– A short description of the analytical method used for the sample analysis. The Information Sheet sent to the participants suggested for ^{3}H distillation followed by liquid scintillation counting. For ^{90}Sr, precipitation from sea water as mixed Ca/Sr oxalate or carbonate follow by a standard ^{90}Sr procedure (e.g. a radiochemical procedure such as precipitation with fuming nitric acid, liquid-liquid extraction or extraction chromatography followed by a measurement technique such as gas-flow proportional counting or liquid scintillation counting). For ^{134}Cs and ^{137}Cs, three methods were suggested: (i) direct gamma spectrometry, (ii) adsorption on AMP (ammonium molybdophosphate, $(NH_4)_3PO_4Mo_{12}O_{36}$) and subsequent gamma spectrometry or (iii) adsorption on copper hexacyanoferrate ($Cu_2[Fe(CN)_6]$) and subsequent gamma spectrometry;

- Type of calibration and software used for gamma ray spectrometry;
- Nuclear data used;
- An uncertainty budget for the measurement results.

The reference date for reporting massic activities was set at 1 October 2017. At this date, the ranges for the traceable massic activities in the proficiency test exercise samples sent to the participants were 3.09–3.16 Bq kg^{-1} ^{3}H, 0.1594–0.1629 Bq kg^{-1} ^{60}Co, 0.2721–0.2780 Bq kg^{-1} ^{90}Sr, 0.1923–0.1965 Bq kg^{-1} ^{134}Cs and 0.3047–0.3112 Bq kg^{-1} ^{137}Cs, respectively (see Table 1).

TABLE 1. IAEA ASSIGNED VALUES

Participant	^{3}H massic activity (Bq kg^{-1})	^{60}Co massic activity (Bq kg^{-1})	^{90}Sr massic activity (Bq kg^{-1})	^{134}Cs massic activity (Bq kg^{-1})	^{137}Cs massic activity (Bq kg^{-1})
1*	3.14 ± 0.06	0.1621 ± 0.0007	0.2767 ± 0.0019	0.1956 ± 0.0008	0.3098 ± 0.0019
2*	3.12 ± 0.06	0.1610 ± 0.0006	0.2748 ± 0.0019	0.1942 ± 0.0008	0.3077 ± 0.0019
3*	3.13 ± 0.06	0.1615 ± 0.0006	0.2757 ± 0.0019	0.1948 ± 0.0008	0.3086 ± 0.0019
4*	3.14 ± 0.06	0.1620 ± 0.0007	0.2766 ± 0.0019	0.1954 ± 0.0008	0.3096 ± 0.0019
5*	3.11 ± 0.06	0.1601 ± 0.0006	0.2733 ± 0.0019	0.1931 ± 0.0008	0.3059 ± 0.0019
6*	3.13 ± 0.06	0.1612 ± 0.0006	0.2752 ± 0.0019	0.1945 ± 0.0008	0.3081 ± 0.0019
7*	3.12 ± 0.06	0.1610 ± 0.0006	0.2748 ± 0.0019	0.1942 ± 0.0008	0.3076 ± 0.0019
8*	3.11 ± 0.06	0.1601 ± 0.0006	0.2732 ± 0.0019	0.1931 ± 0.0008	0.3059 ± 0.0019
9*	3.13 ± 0.06	0.1616 ± 0.0006	0.2759 ± 0.0019	0.1945 ± 0.0008	0.3088 ± 0.0019
10*	3.11 ± 0.06	0.1605 ± 0.0006	0.2739 ± 0.0019	0.1935 ± 0.0008	0.3066 ± 0.0019
11*	3.13 ± 0.06	0.1616 ± 0.0006	0.2758 ± 0.0019	0.1949 ± 0.0008	0.3087 ± 0.0019
12*	3.12 ± 0.06	0.1607 ± 0.0006	0.2742 ± 0.0019	0.1938 ± 0.0008	0.3070 ± 0.0019
13*	3.13 ± 0.06	0.1612 ± 0.0006	0.2752 ± 0.0019	0.1944 ± 0.0008	0.3080 ± 0.0019
14*	3.12 ± 0.06	0.1609 ± 0.0006	0.2747 ± 0.0019	0.1941 ± 0.0008	0.3075 ± 0.0019
15*	3.15 ± 0.06	0.1626 ± 0.0007	0.2776 ± 0.0019	0.1961 ± 0.0008	0.3107 ± 0.0019
16*	3.11 ± 0.06	0.1604 ± 0.0006	0.2737 ± 0.0019	0.1934 ± 0.0008	0.3064 ± 0.0019
17*	3.13 ± 0.06	0.1616 ± 0.0006	0.2758 ± 0.0019	0.1949 ± 0.0008	0.3087 ± 0.0019
18*	3.12 ± 0.06	0.1606 ± 0.0006	0.2742 ± 0.0019	0.1937 ± 0.0008	0.3069 ± 0.0019
19*	3.12 ± 0.06	0.1611 ± 0.0006	0.2750 ± 0.0019	0.1943 ± 0.0008	0.3079 ± 0.0019
20*	3.12 ± 0.06	0.1611 ± 0.0006	0.2750 ± 0.0019	0.1943 ± 0.0008	0.3078 ± 0.0019
21*	3.12 ± 0.06	0.1607 ± 0.0006	0.2744 ± 0.0019	0.1939 ± 0.0008	0.3071 ± 0.0019
22*	3.12 ± 0.06	0.1610 ± 0.0006	0.2748 ± 0.0019	0.1942 ± 0.0008	0.3077 ± 0.0019
23*	3.14 ± 0.06	0.1619 ± 0.0007	0.2764 ± 0.0019	0.1953 ± 0.0008	0.3094 ± 0.0019
24	3.13 ± 0.06	0.1616 ± 0.0006	0.2757 ± 0.0019	0.1948 ± 0.0008	0.3087 ± 0.0019
25	3.16 ± 0.06	0.1629 ± 0.0007	0.2780 ± 0.0019	0.1965 ± 0.0008	0.3112 ± 0.0019
26	3.10 ± 0.06	0.1597 ± 0.0006	0.2726 ± 0.0019	0.1926 ± 0.0008	0.3052 ± 0.0019
27	3.12 ± 0.06	0.1610 ± 0.0006	0.2749 ± 0.0019	0.1942 ± 0.0008	0.3077 ± 0.0019
28	3.12 ± 0.06	0.1611 ± 0.0006	0.2749 ± 0.0019	0.1943 ± 0.0008	0.3078 ± 0.0019
29	3.13 ± 0.06	0.1615 ± 0.0006	0.2756 ± 0.0019	0.1947 ± 0.0008	0.3085 ± 0.0019
30	3.12 ± 0.06	0.1610 ± 0.0006	0.2748 ± 0.0019	0.1941 ± 0.0008	0.3076 ± 0.0019

TABLE 1. IAEA ASSIGNED VALUES (cont.)

Participant	^{3}H massic activity (Bq kg^{-1})	^{60}Co massic activity (Bq kg^{-1})	^{90}Sr massic activity (Bq kg^{-1})	^{134}Cs massic activity (Bq kg^{-1})	^{137}Cs massic activity (Bq kg^{-1})
31	3.14 ± 0.06	0.1620 ± 0.0006	0.2765 ± 0.0019	0.1954 ± 0.0008	0.3095 ± 0.0019
32	3.12 ± 0.06	0.1608 ± 0.0006	0.2745 ± 0.0019	0.1940 ± 0.0008	0.3073 ± 0.0019
33	3.10 ± 0.06	0.1600 ± 0.0006	0.2731 ± 0.0019	0.1929 ± 0.0008	0.3057 ± 0.0019
34	3.13 ± 0.06	0.1616 ± 0.0006	0.2758 ± 0.0019	0.1949 ± 0.0008	0.3088 ± 0.0019
35	3.12 ± 0.06	0.1608 ± 0.0006	0.2744 ± 0.0019	0.1939 ± 0.0008	0.3072 ± 0.0019
36	3.14 ± 0.06	0.1618 ± 0.0006	0.2762 ± 0.0019	0.1951 ± 0.0008	0.3091 ± 0.0019
37	3.11 ± 0.06	0.1605 ± 0.0006	0.2740 ± 0.0019	0.1936 ± 0.0008	0.3068 ± 0.0019
38	3.12 ± 0.06	0.1606 ± 0.0006	0.2742 ± 0.0019	0.1937 ± 0.0008	0.3070 ± 0.0019
39	3.13 ± 0.06	0.1613 ± 0.0006	0.2754 ± 0.0019	0.1946 ± 0.0008	0.3082 ± 0.0019
40	3.12 ± 0.06	0.1610 ± 0.0006	0.2748 ± 0.0019	0.1942 ± 0.0008	0.3076 ± 0.0019
41	3.12 ± 0.06	0.1608 ± 0.0006	0.2744 ± 0.0019	0.1939 ± 0.0008	0.3072 ± 0.0019
42	3.13 ± 0.06	0.1616 ± 0.0006	0.2757 ± 0.0019	0.1948 ± 0.0008	0.3087 ± 0.0019
43	3.15 ± 0.06	0.1623 ± 0.0007	0.2770 ± 0.0019	0.1957 ± 0.0008	0.3101 ± 0.0019
44	3.13 ± 0.06	0.1612 ± 0.0006	0.2752 ± 0.0019	0.1945 ± 0.0008	0.3081 ± 0.0019
45	3.13 ± 0.06	0.1613 ± 0.0006	0.2754 ± 0.0019	0.1946 ± 0.0008	0.3083 ± 0.0019
46	3.11 ± 0.06	0.1603 ± 0.0006	0.2736 ± 0.0019	0.1933 ± 0.0008	0.3063 ± 0.0019
47	3.10 ± 0.06	0.1597 ± 0.0006	0.2726 ± 0.0019	0.1926 ± 0.0008	0.3052 ± 0.0019
48	3.09 ± 0.06	0.1594 ± 0.0006	0.2721 ± 0.0019	0.1923 ± 0.0008	0.3047 ± 0.0019
49	3.13 ± 0.06	0.1612 ± 0.0006	0.2751 ± 0.0019	0.1944 ± 0.0008	0.3080 ± 0.0019
50	3.14 ± 0.06	0.1618 ± 0.0007	0.2762 ± 0.0019	0.1952 ± 0.0008	0.3092 ± 0.0019
51	3.14 ± 0.06	0.1618 ± 0.0007	0.2761 ± 0.0019	0.1951 ± 0.0008	0.3091 ± 0.0019
52	3.11 ± 0.06	0.1604 ± 0.0006	0.2737 ± 0.0019	0.1934 ± 0.0008	0.3064 ± 0.0019
53	3.10 ± 0.06	0.1600 ± 0.0006	0.2730 ± 0.0019	0.1929 ± 0.0008	0.3057 ± 0.0019
54	3.12 ± 0.06	0.1609 ± 0.0006	0.2746 ± 0.0019	0.1940 ± 0.0008	0.3074 ± 0.0019
55	3.14 ± 0.06	0.1619 ± 0.0007	0.2763 ± 0.0019	0.1952 ± 0.0008	0.3093 ± 0.0019
56	3.15 ± 0.06	0.1623 ± 0.0007	0.2771 ± 0.0019	0.1958 ± 0.0008	0.3101 ± 0.0019
57	3.13 ± 0.06	0.1612 ± 0.0006	0.2751 ± 0.0019	0.1944 ± 0.0008	0.3080 ± 0.0019
58	3.14 ± 0.06	0.1620 ± 0.0007	0.2764 ± 0.0019	0.1953 ± 0.0008	0.3095 ± 0.0019
59	3.12 ± 0.06	0.1606 ± 0.0006	0.2741 ± 0.0019	0.1937 ± 0.0008	0.3069 ± 0.0019
60	3.11 ± 0.06	0.1602 ± 0.0006	0.2735 ± 0.0019	0.1933 ± 0.0008	0.3062 ± 0.0019
61	3.16 ± 0.06	0.1629 ± 0.0007	0.2780 ± 0.0020	0.1964 ± 0.0008	0.3112 ± 0.0019
62	3.13 ± 0.06	0.1616 ± 0.0006	0.2759 ± 0.0019	0.1949 ± 0.0008	0.3088 ± 0.0019
63	3.12 ± 0.06	0.1610 ± 0.0006	0.2748 ± 0.0019	0.1941 ± 0.0008	0.3076 ± 0.0019
64	3.12 ± 0.06	0.1610 ± 0.0006	0.2747 ± 0.0019	0.1941 ± 0.0008	0.3075 ± 0.0019
65	3.15 ± 0.06	0.1626 ± 0.0007	0.2776 ± 0.0019	0.1961 ± 0.0008	0.3107 ± 0.0019
66	3.12 ± 0.06	0.1609 ± 0.0006	0.2746 ± 0.0019	0.1940 ± 0.0008	0.3074 ± 0.0019
67	3.12 ± 0.06	0.1608 ± 0.0006	0.2744 ± 0.0019	0.1939 ± 0.0008	0.3072 ± 0.0019
68	3.10 ± 0.06	0.1598 ± 0.0006	0.2727 ± 0.0019	0.1927 ± 0.0008	0.3053 ± 0.0019
69	3.15 ± 0.06	0.1627 ± 0.0007	0.2777 ± 0.0019	0.1963 ± 0.0008	0.3109 ± 0.0019

TABLE 1. IAEA ASSIGNED VALUES (cont.)

Participant	^{3}H massic activity (Bq kg^{-1})	^{60}Co massic activity (Bq kg^{-1})	^{90}Sr massic activity (Bq kg^{-1})	^{134}Cs massic activity (Bq kg^{-1})	^{137}Cs massic activity (Bq kg^{-1})
70	3.13 ± 0.06	0.1614 ± 0.0006	0.2756 ± 0.0019	0.1947 ± 0.0008	0.3085 ± 0.0019
71	3.11 ± 0.06	0.1605 ± 0.0006	0.2739 ± 0.0019	0.1936 ± 0.0008	0.3067 ± 0.0019
72	3.14 ± 0.06	0.1618 ± 0.0007	0.2761 ± 0.0019	0.1951 ± 0.0008	0.3091 ± 0.0019
73	3.12 ± 0.06	0.1611 ± 0.0006	0.2751 ± 0.0019	0.1944 ± 0.0008	0.3079 ± 0.0019
74	3.13 ± 0.06	0.1614 ± 0.0006	0.2755 ± 0.0019	0.1947 ± 0.0008	0.3084 ± 0.0019

* Participant from Japan

3. PERFORMANCE CRITERIA

The methodology adopted for this exercise is described in Ref. [7] and was slightly updated from the existing IAEA methodology [8]. (i.e., in this exercise a k value of 2.58 instead of 2.56 was used and a normalisation factor was introduced to the trueness equation; see Equation 5 below). The scoring system took into account the accuracy, precision and trueness of the reported data and included in the evaluation both the combined standard uncertainty of the IAEA value and the combined standard uncertainty reported by the participating laboratories. The IAEA values, which were used for the data evaluation, were the certified values of radionuclides at the reference date. A result must pass three tests to be assigned the status 'Accepted', otherwise it was assigned the status 'Warning' or 'Not accepted'.

3.1. ACCURACY
The first step in producing a score for a result $Value_{\text{Analyst}}$ was the estimation of the bias. The relative bias between the Analyst's value and the IAEA target value was calculated as follows and expressed as a percentage:

$$Bias_{\text{relative}} = \frac{Value_{\text{Analyst}} - Value_{\text{IAEA}}}{Value_{\text{IAEA}}} \times 100\% \tag{1}$$

The absolute value of the relative bias was compared to the Maximal Accepted Relative Bias (MARB). Participants' results were scored as 'Pass' for accuracy when:

$$|Bias_{\text{relative}}| \leq \text{MARB} \tag{2}$$

The MARB values used in this evaluation were 20% for ^{60}Co, ^{134}Cs and ^{137}Cs and 25% for both ^{3}H and ^{90}Sr.

3.2. PRECISION AND TRUENESS
The precision P for each result was calculated according to the following equation:

$$P = \sqrt{\left(\frac{unc_{\text{IAEA}}}{Value_{\text{IAEA}}}\right)^2 + \left(\frac{unc_{\text{Analyst}}}{Value_{\text{Analyst}}}\right)^2} \times 100\% \tag{3}$$

The precision P was compared to the Limit of Accepted Precision (LAP). The participants' results were scored as 'Pass' for precision when:

$$P \leq \text{LAP} \tag{4}$$

The LAP values used in this evaluation were 20% for ^{60}Co, ^{134}Cs and ^{137}Cs and 25% for both ^{3}H and ^{90}Sr.

The participants' results for trueness were scored as 'Pass' when:

$$|Bias_{\text{relative}}| \leq \frac{Value_{\text{Analyst}}}{Value_{\text{IAEA}}} \, 2.58 \, P \tag{5}$$

3.3. FINAL EVALUATION

For the final evaluation, all three scores were combined (see Table 2). The result was considered as 'Accepted' if it passed all three tests. If the accuracy test was failed, the result was considered as 'Not accepted'. If the accuracy test was passed but one of the other two tests was failed, the result was assigned the 'Warning' status. The 'Warning' status will reflect cases in which the reported result was close enough to the assigned property value, but its associated uncertainty was deemed to be either too small or too large.

TABLE 2. PERFORMANCE EVALUATION CRITERIA

Accuracy	Precision	Trueness	Final evaluation
Pass	Pass	Pass	Accepted
Pass	Fail	Pass	Warning
Pass	Pass	Fail	Warning
Fail	Pass/Fail	Pass/Fail	Not accepted

These evaluation criteria can also be illustrated by plotting the relative bias against the relative uncertainty of the participants' result (see Figure 1). In the illustrated case, a relative uncertainty of 1% for the IAEA value is assumed with MARB and LAP limits of 20%.
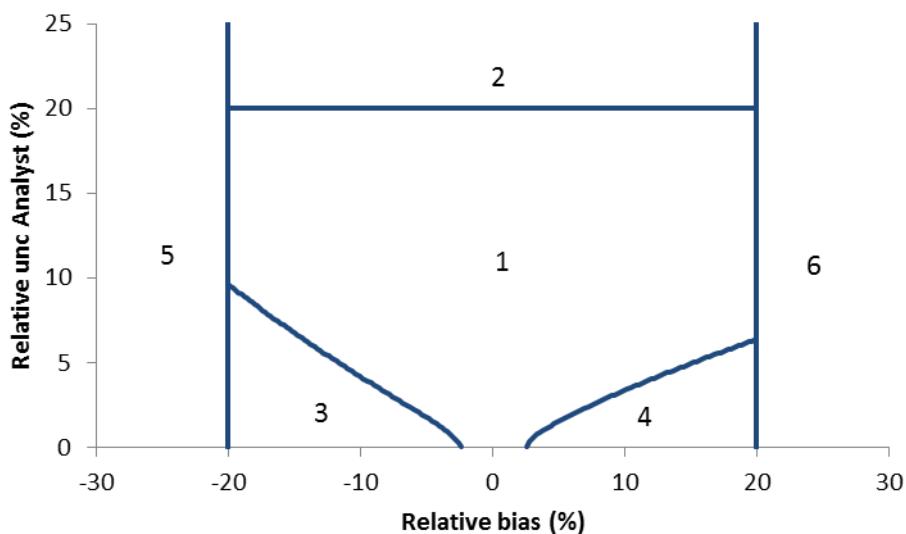
FIG. 1. Visualization of performance evaluation criteria.

The plot consists of six zones (Zone 1 'Accepted'; Zones 2, 3 and 4 'Warning'; Zones 5 and 6 'Not accepted'), whose areas are defined by the three tests used above to evaluate the data. The areas of Zones 1, 3 and 4 are finite, while the areas of Zones 2, 5 and 6 are infinite. A result located in Zone 1 passes all three tests (evaluation 'Accepted'). A result located in Zone 2 fails only the precision test as its associated uncertainty is deemed to be too large (evaluation: 'Warning'). A result located in Zones 3 and 4 fails only the trueness test as its associated uncertainty is deemed to be too small (evaluation: 'Warning'). A result located in Zones 5 and 6 fails (at least) the accuracy test as its relative bias is larger than the MARB (evaluation: 'Not accepted').

3.4. COMPARISON OF PARTICIPANTS' VALUES WITH THE IAEA VALUES

The means and the uncertainties for the combined participants' results were calculated according to a method developed by Cox (i.e. the weighted mean of the largest consistent subset containing p results) [9] and subsequently compared with the IAEA values. The mean of the combined participants' results, $Value_{\text{Combined}}$, was tested against the IAEA value, $Value_{\text{IAEA}}$, using this equation:

$$t = \frac{Value_{\text{Combined}} - Value_{\text{IAEA}}}{\sqrt{(unc_{\text{Combined}})^2 + (unc_{\text{IAEA}})^2}} \tag{6}$$

The effective degrees of freedom v_{eff} were determined with the Welch-Satterthwaite equation. The effective degrees of freedom v_{eff} were rounded and the critical value t_{crit} for this value was identified.

The criterion for passing the t test was:

$$|t| < t_{\text{crit}} \tag{7}$$

If the absolute value of t was greater than the critical value t_{crit}, this indicates there was a significant difference between the combined participants' results and the IAEA value.

4. RESULTS AND DISCUSSION

In total 264 measurement results were reported by 74 laboratories from 43 countries for ^{3}H, ^{60}Co, ^{90}Sr, ^{134}Cs and ^{137}Cs. The evaluation of these results showed that 72% of all reported results were 'Accepted', while 19% of the individual measurement results were 'Not accepted' with the remaining 9% having the 'Warning' status. The performance evaluation for ^{3}H, ^{60}Co, ^{90}Sr, ^{134}Cs and ^{137}Cs is summarized in Table 3. The subset of the 81 Japanese participants' results showed that 86% of all reported results were 'Accepted', while 5% of the results were 'Not accepted', with the remaining 9% having the 'Warning' status.

TABLE 3. SUMMARY EVALUATION OF THE RADIONUCLIDES REPORTED

Radionuclide	Number of submitted results	Accepted	Warning	Not accepted
^{3}H	34 (13)	25 (13)	3 (0)	6 (0)
^{60}Co	61 (17)	41 (15)	3 (1)	17 (1)
^{90}Sr	32 (9)	24 (9)	3 (0)	5 (0)
^{134}Cs	68 (21)	51 (19)	5 (1)	12 (1)
^{137}Cs	69 (21)	49 (14)	9 (5)	11 (2)

NOTE: The numbers in brackets represent the subset of Japanese results

For all radionuclides, no significant bias of the combined participants' results was observed (see Table 4).

TABLE 4. COMPARISON OF THE COMBINED PARTICIPANTS' RESULTS WITH THE IAEA VALUE

Nuclide	Combined participants' result (Bq kg^{-1})	IAEA value (Bq kg^{-1})	Size of the LCS* (%)	t-value	Critical t-value	Bias (%)
^{3}H	3.12 ± 0.04	3.12 ± 0.06	30 (88%)	−0.08	2.02	−0.2
^{60}Co	0.1639 ± 0.0018	0.1612 ± 0.0007	51 (84%)	1.29	2.00	1.7
^{90}Sr	0.283 ± 0.003	0.2750 ± 0.0019	23 (72%)	1.68	2.03	2.8
^{134}Cs	0.1907 ± 0.0015	0.1944 ± 0.0008	57 (84%)	−1.92	1.99	−1.9
^{137}Cs	0.309 ± 0.003	0.3080 ± 0.0019	58 (84%)	0.42	1.98	0.5

*Size of the LCS (largest consistent subset) denotes the percentage of the returned results contributing to combined participants' results

For ^{3}H, ^{60}Co, ^{90}Sr and ^{137}Cs about half of the participants' results showed a negative bias (59%, 48%, 44% and 46% of the results, respectively), while for ^{134}Cs the 47 out of 68 participants' results (69% of the results) showed a negative bias. Coincidence summing is a problem for ^{134}Cs as it leads to signal loss and hence underestimation of the activity levels for this radionuclide. It is clear from the results that some participants did not make a sufficient correction for coincidence summing. For the combined Japanese results, there were no significant relative differences with the IAEA values for all four radionuclides. Table 5 summarizes the data evaluation sorted by laboratory code.

TABLE 5. SUMMARY EVALUATION

Lab code	^{3}H	^{60}Co	^{90}Sr	^{134}Cs	^{137}Cs
1*				A	A
2*	A	A	A	A	A
3*	A	W		A	W
4*				NA	NA
5*		A		A	A
6*	A	A	A	A	A
7*	A				
8*		NA		A	W
9*	A				
10*		A		A	A
11*				W	W
12*	A	A	A	A	A
13*		A		A	W
14*	A	A	A	A	A
15*	A	A	A	A	A
16*	A	A	A	A	A
17*		A		A	W
18*		A		A	NA
19*	A	A		A	A
20*				A	A
21*	A	A	A	A	A
22*	A	A	A	A	A
23*	A	A	A	A	A
24		A		A	A
25	A	A	A	A	A
26		W		NA	A
27	A	A		A	A
28		A		A	NA
29	W	A		A	A
30	A	A		W	A
31	A	A	A	NA	A
32	W	NA		A	A
33	A	A	A	A	A
34		A	NA	A	A
35	A	A	A	W	W
36	A	A	A	W	A
37		A	A	A	A
38		NA	A	A	A

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TABLE 5. SUMMARY EVALUATION (cont.)

Lab code	^{3}H	^{60}Co	^{90}Sr	^{134}Cs	^{137}Cs
39		A	A	A	A
40		NA		NA	NA
41	A	A	A	A	A
42	NA	NA	W	A	A
43		W	A	A	A
44				NA	
45				NA	NA
46					
47		NA		NA	NA
48		NA		NA	NA
49		A		A	A
50		NA		A	NA
51		NA		W	W
52		NA		NA	NA
53		NA			W
54		A		A	A
55					
56	NA	A	A	A	A
57		A		A	A
58		NA		A	A
59	NA	A		A	A
60	A	NA	NA	NA	W
61		A		A	A
62		NA	A	A	A
63	W	A	W	A	A
64		NA			NA
65		A		A	A
66	NA	A	A	A	A
67	A		A		
68	NA	NA		A	A
69			NA	A	A
70	A	A	A	A	A
71			NA	A	A
72	NA	NA	NA	NA	A
73	A	A	W	NA	NA
74		A		A	A

A indicates 'Accepted', W indicates 'Warning' and NA indicates 'Not accepted'
* Participant from Japan

The performance evaluation sorted by radionuclide and the bias plots are presented in Appendix I (see Tables 6–10 and Figures 2–11). In the bias plots, the 'Accepted' results are represented by dark blue points. 'Warning' and 'Not accepted' results are represented by the yellow and red points, respectively. The error bars represent the standard uncertainties of the bias (with a coverage factor of $k = 1$). The dotted lines represent a relative bias of $\pm 25\%$ (Maximum Accepted Bias for ^{3}H and ^{90}Sr) or $\pm 20\%$ (Maximum Accepted Bias for ^{60}Co, ^{134}Cs and ^{137}Cs). The performance evaluation sorted by laboratory code is presented in Appendix II. All laboratories reported their values with standard uncertainties ($k = 1$). However, a large spread in the submitted uncertainties was observed with relative uncertainties (at $k = 1$) ranging from 1.9% to 29% for ^{3}H, from 3.0% to 76% for ^{60}Co, from 2.3% to 23% for ^{90}Sr, from 1.0% to 86% for ^{134}Cs and from 1.5% to 72% for ^{137}Cs. However, most reported relative uncertainties were in the range of 5% – 15% (^{3}H and ^{60}Co), 5% – 10% (^{90}Sr) and 3% – 10% (^{134}Cs and ^{137}Cs).

For ^{3}H, practically all participants performed a distillation of the sea water samples, followed by liquid scintillation counting (LSC). Eight participants (2*, 9*, 12*, 30, 60, 63, 67 and 73) performed electrolytic enrichment after distillation (and obtained in general excellent results with in general small uncertainties of less than 7% at $k = 1$). The direct measurements after distillation yielded slightly larger uncertainties generally between 5% and 20%.

For ^{90}Sr, the large majority of participants used gas-flow proportional counting (GPC) of chemically separated ^{90}Y as the analysis technique, except Participants 25, 36, 37, 39, 42, 43, 70 and 72 who used LSC/Cherenkov counting. Chemical separation techniques used included precipitations of Sr-oxalate, Sr-phosphate or Sr-carbonate, barium chromate precipitations, iron hydroxide precipitation, nitric acid precipitations, cation-exchange chromatography, Sr-extraction chromatography and direct liquid-liquid extraction of ^{90}Y with HDEHP (di-(2-ethylhexyl)phosphoric acid). No significant difference between the performances of the chemical separation techniques is apparent.

For ^{60}Co, a large majority of the participants measured the sea water samples directly with gamma spectrometry, while the remaining laboratories either used a pre-concentration technique (e.g. co-precipitation with hydroxide or MnO_2) to separate ^{60}Co from the sea water matrix followed by gamma spectrometry (Participants 2*, 3*, 15*, 17*, 21* and 41), evaporation of the sample followed by gamma spectrometry (Participants 23*, 32, 57, 58, 63, 65 and 66) or used a combination of techniques. No significant difference in the performance between the two techniques is apparent.

For ^{134}Cs and ^{137}Cs, a large majority of the participants measured the sea water samples directly with gamma spectrometry, while the remaining laboratories either used a pre-concentration technique (e.g. adsorption on ammonium molybdophosphate or Ni/Cu cyanoferrate) to separate the caesium radionuclides from the sea water matrix followed by gamma spectrometry (Participants 2*, 3*, 4*, 11*, 12*, 15*, 17*, 20*, 21*, 27, 39, 41, 43, 69, 71, 72 and 73), evaporation of the sample followed by gamma spectrometry (Participants 23*, 32, 57, 58, 63, 65 and 66) or used a combination of techniques. No significant difference in the performance between the two techniques is apparent.

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APPENDIX I. PERFORMANCE EVALUATION TABLES SORTED BY RADIONUCLIDE

TABLE 6. EVALUATION RESULTS FOR ^{3}H

Lab code	Lab value (Bq kg^{-1})	Lab uncert. (Bq kg^{-1})	IAEA value (Bq kg^{-1})	IAEA uncert. (Bq kg^{-1})	Relative bias (%)	P (%)	Trueness limit (%)	Accuracy	Precision	Trueness	Final score
1*	–	–	3.14	0.06	–	–	–	–	–	–	Not reported
2*	3.08	0.10	3.12	0.06	–1	3.8	10	Pass	Pass	Pass	Accepted
3*	3.15	0.17	3.13	0.06	1	5.8	15	Pass	Pass	Pass	Accepted
4*	–	–	3.14	0.06	–	–	–	–	–	–	Not reported
5*	–	–	3.11	0.06	–	–	–	–	–	–	Not reported
6*	2.76	0.17	3.13	0.06	–12	6.5	15	Pass	Pass	Pass	Accepted
7*	2.86	0.24	3.12	0.06	–8	8.6	20	Pass	Pass	Pass	Accepted
8*	–	–	3.11	0.06	–	–	–	–	–	–	Not reported
9*	3.27	0.15	3.13	0.06	4	5.0	13	Pass	Pass	Pass	Accepted
10*	–	–	3.11	0.06	–	–	–	–	–	–	Not reported
11*	–	–	3.13	0.06	–	–	–	–	–	–	Not reported
12*	3.10	0.15	3.12	0.06	–1	5.3	13	Pass	Pass	Pass	Accepted
13*	–	–	3.13	0.06	–	–	–	–	–	–	Not reported
14*	3.10	0.17	3.12	0.06	–1	5.9	15	Pass	Pass	Pass	Accepted
15*	2.83	0.19	3.15	0.06	–10	7.1	17	Pass	Pass	Pass	Accepted
16*	3.03	0.16	3.11	0.06	–3	5.6	14	Pass	Pass	Pass	Accepted
17*	–	–	3.13	0.06	–	–	–	–	–	–	Not reported
18*	–	–	3.12	0.06	–	–	–	–	–	–	Not reported

TABLE 6. EVALUATION RESULTS FOR ^{3}H (cont.)

Lab code	Lab value (Bq kg^{-1})	Lab uncert. (Bq kg^{-1})	IAEA value (Bq kg^{-1})	IAEA uncert. (Bq kg^{-1})	Relative bias (%)	P (%)	Trueness limit (%)	Accuracy	Precision	Trueness	Final score
19*	3.1	0.3	3.12	0.06	0	8.7	22	Pass	Pass	Pass	Accepted
20*	–	–	3.12	0.06	–	–	–	–	–	–	Not reported
21*	3.2	0.3	3.12	0.06	3	9.4	25	Pass	Pass	Pass	Accepted
22*	2.97	0.18	3.12	0.06	–5	6.4	16	Pass	Pass	Pass	Accepted
23*	2.98	0.24	3.14	0.06	–5	8.4	21	Pass	Pass	Pass	Accepted
24	–	–	3.13	0.06	–	–	–	–	–	–	Not reported
25	3.0	0.3	3.16	0.06	–5	11	27	Pass	Pass	Pass	Accepted
26	–	–	3.10	0.06	–	–	–	–	–	–	Not reported
27	2.5	0.4	3.12	0.06	–20	16	33	Pass	Pass	Pass	Accepted
28	–	–	3.12	0.06	–	–	–	–	–	–	Not reported
29	3.2	0.9	3.13	0.06	1	28	74	Pass	Fail	Pass	Warning
30	3.20	0.06	3.12	0.06	3	2.8	7.2	Pass	Pass	Pass	Accepted
31	3.7	0.7	3.14	0.06	17	18	55	Pass	Pass	Pass	Accepted
32	2.5	0.7	3.12	0.06	–20	27	56	Pass	Fail	Pass	Warning
33	3.28	0.10	3.10	0.06	6	3.7	10	Pass	Pass	Pass	Accepted
34	<5.5	–	3.13	0.06	–	–	–	–	–	–	Not evaluated
35	2.9	0.4	3.12	0.06	–8	13	32	Pass	Pass	Pass	Accepted
36	3.9	0.8	3.14	0.06	24	21	66	Pass	Pass	Pass	Accepted
37	–	–	3.11	0.06	–	–	–	–	–	–	Not reported

TABLE 6. EVALUATION RESULTS FOR ^{3}H (cont.)

Lab code	Lab value (Bq kg^{-1})	Lab uncert. (Bq kg^{-1})	IAEA value (Bq kg^{-1})	IAEA uncert. (Bq kg^{-1})	Relative bias (%)	P (%)	Trueness limit (%)	Accuracy	Precision	Trueness	Final score
38	–	–	3.12	0.06	–	–	–	–	–	–	Not reported
39	–	–	3.13	0.06	–	–	–	–	–	–	Not reported
40	–	–	3.12	0.06	–	–	–	–	–	–	Not reported
41	3.1	0.5	3.12	0.06	–1	17	43	Pass	Pass	Pass	Accepted
42	4.3	0.7	3.13	0.06	36	16	57	Fail	Pass	Pass	Not accepted
43	–	–	3.15	0.06	–	–	–	–	–	–	Not reported
44	–	–	3.13	0.06	–	–	–	–	–	–	Not reported
45	–	–	3.13	0.06	–	–	–	–	–	–	Not reported
46	–	–	3.11	0.06	–	–	–	–	–	–	Not reported
47	–	–	3.10	0.06	–	–	–	–	–	–	Not reported
48	–	–	3.09	0.06	–	–	–	–	–	–	Not reported
49	–	–	3.13	0.06	–	–	–	–	–	–	Not reported
50	<0.007	–	3.14	0.06	–	–	–	–	–	–	Not evaluated
51	–	–	3.14	0.06	–	–	–	–	–	–	Not reported
52	–	–	3.11	0.06	–	–	–	–	–	–	Not reported
53	–	–	3.10	0.06	–	–	–	–	–	–	Not reported
54	–	–	3.12	0.06	–	–	–	–	–	–	Not reported
55	–	–	3.14	0.06	–	–	–	–	–	–	Not reported

TABLE 6. EVALUATION RESULTS FOR ^{3}H (cont.)

Lab code	Lab value (Bq kg^{-1})	Lab uncert. (Bq kg^{-1})	IAEA value (Bq kg^{-1})	IAEA uncert. (Bq kg^{-1})	Relative bias (%)	P (%)	Trueness limit (%)	Accuracy	Precision	Trueness	Final score
56	4.3	0.5	3.15	0.06	37	12	41	Fail	Pass	Pass	Not accepted
57	–	–	3.13	0.06	–	–	–	–	–	–	Not reported
58	–	–	3.14	0.06	–	–	–	–	–	–	Not reported
59	1.20	0.17	3.12	0.06	–61	14	15	Fail	Pass	Fail	Not accepted
60	2.95	0.18	3.11	0.06	–5	6.4	16	Pass	Pass	Pass	Accepted
61	–	–	3.16	0.06	–	–	–	–	–	–	Not reported
62	–	–	3.13	0.06	–	–	–	–	–	–	Not reported
63	2.45	0.16	3.12	0.06	–22	6.7	13	Pass	Pass	Fail	Warning
64	–	–	3.12	0.06	–	–	–	–	–	–	Not reported
65	–	–	3.15	0.06	–	–	–	–	–	–	Not reported
66	4.8	0.4	3.12	0.06	53	8.8	34	Fail	Pass	Fail	Not accepted
67	2.80	0.20	3.12	0.06	–10	7.4	17	Pass	Pass	Pass	Accepted
68	3.90	0.12	3.10	0.06	26	3.7	11	Fail	Pass	Fail	Not accepted
69	–	–	3.15	0.06	–	–	–	–	–	–	Not reported
70	2.9	0.4	3.13	0.06	–7	14	33	Pass	Pass	Pass	Accepted
71	–	–	3.11	0.06	–	–	–	–	–	–	Not reported
72	5.1	1.5	3.14	0.06	63	29	123	Fail	Fail	Pass	Not accepted
73	3.4	0.3	3.12	0.06	9	9.3	26	Pass	Pass	Pass	Accepted
74	–	–	3.13	0.06	–	–	–	–	–	–	Not reported

TABLE 7. EVALUATION RESULTS FOR ^{60}Co

Lab code	Lab value (Bq kg^{-1})	Lab uncert. (Bq kg^{-1})	IAEA value (Bq kg^{-1})	IAEA uncert. (Bq kg^{-1})	Relative bias (%)	P (%)	Trueness limit (%)	Accuracy	Precision	Trueness	Final score
1*	–	–	0.1621	0.0007	–	–	–	–	–	–	Not reported
2*	0.161	0.009	0.1610	0.0006	0	5.6	14	Pass	Pass	Pass	Accepted
3*	0.144	0.005	0.1615	0.0006	–11	3.3	7.6	Pass	Pass	Fail	Warning
4*	–	–	0.1620	0.0007	–	–	–	–	–	–	Not reported
5*	0.178	0.022	0.1601	0.0006	11	12	35	Pass	Pass	Pass	Accepted
6*	0.159	0.017	0.1612	0.0006	–1	11	27	Pass	Pass	Pass	Accepted
7*	–	–	0.1610	0.0006	–	–	–	–	–	–	Not reported
8*	0.123	0.019	0.1601	0.0006	–23	16	31	Fail	Pass	Pass	Not accepted
9*	–	–	0.1616	0.0006	–	–	–	–	–	–	Not reported
10*	0.155	0.017	0.1605	0.0006	–3	11	27	Pass	Pass	Pass	Accepted
11*	–	–	0.1616	0.0006	–	–	–	–	–	–	Not reported
12*	0.170	0.025	0.1607	0.0006	6	15	40	Pass	Pass	Pass	Accepted
13*	0.148	0.013	0.1612	0.0006	–8	8.8	21	Pass	Pass	Pass	Accepted
14*	0.160	0.019	0.1609	0.0006	–1	12	30	Pass	Pass	Pass	Accepted
15*	0.178	0.013	0.1626	0.0006	9	7.3	21	Pass	Pass	Pass	Accepted
16*	0.161	0.009	0.1604	0.0006	0	5.6	14	Pass	Pass	Pass	Accepted
17*	0.171	0.005	0.1616	0.0007	6	3.0	8.2	Pass	Pass	Pass	Accepted
18*	0.156	0.021	0.1606	0.0006	–3	13	34	Pass	Pass	Pass	Accepted
19*	0.156	0.011	0.1611	0.0006	–3	7.2	18	Pass	Pass	Pass	Accepted

TABLE 7. EVALUATION RESULTS FOR ^{60}Co (cont.)

Lab code	Lab value (Bq kg^{-1})	Lab uncert. (Bq kg^{-1})	IAEA value (Bq kg^{-1})	IAEA uncert. (Bq kg^{-1})	Relative bias (%)	P (%)	Trueness limit (%)	Accuracy	Precision	Trueness	Final score
20*	–	–	0.1611	0.0006	–	–	–	–	–	–	Not reported
21*	0.163	0.011	0.1607	0.0006	1	6.5	17	Pass	Pass	Pass	Accepted
22*	0.156	0.019	0.1610	0.0006	–3	12	30	Pass	Pass	Pass	Accepted
23*	0.163	0.014	0.1619	0.0007	1	8.6	22	Pass	Pass	Pass	Accepted
24	0.176	0.015	0.1616	0.0006	9	8.6	24	Pass	Pass	Pass	Accepted
25	0.158	0.009	0.1629	0.0007	–3	5.7	14	Pass	Pass	Pass	Accepted
26	0.15	0.04	0.1597	0.0006	–6	27	65	Pass	Fail	Pass	Warning
27	0.160	0.015	0.1610	0.0006	–1	9.4	24	Pass	Pass	Pass	Accepted
28	0.177	0.023	0.1611	0.0006	10	13	37	Pass	Pass	Pass	Accepted
29	0.168	0.015	0.1615	0.0006	4	8.7	23	Pass	Pass	Pass	Accepted
30	0.153	0.014	0.1610	0.0006	–5	9.2	22	Pass	Pass	Pass	Accepted
31	0.19	0.03	0.1620	0.0007	17	14	43	Pass	Pass	Pass	Accepted
32	0.089	0.011	0.1608	0.0006	–45	12	18	Fail	Pass	Fail	Not accepted
33	0.163	0.011	0.1600	0.0006	2	6.9	18	Pass	Pass	Pass	Accepted
34	0.161	0.012	0.1616	0.0006	0	7.5	19	Pass	Pass	Pass	Accepted
35	0.184	0.012	0.1608	0.0006	14	6.5	19	Pass	Pass	Pass	Accepted
36	0.163	0.011	0.1618	0.0007	1	6.8	18	Pass	Pass	Pass	Accepted
37	0.170	0.010	0.1605	0.0006	6	5.9	16	Pass	Pass	Pass	Accepted
38	0.223	0.016	0.1606	0.0006	39	7.2	26	Fail	Pass	Fail	Not accepted

TABLE 7. EVALUATION RESULTS FOR ^{60}Co (cont.)

Lab code	Lab value (Bq kg⁻¹)	Lab uncert. (Bq kg⁻¹)	IAEA value (Bq kg⁻¹)	IAEA uncert. (Bq kg⁻¹)	Relative bias (%)	P (%)	Trueness limit (%)	Accuracy	Precision	Trueness	Final score
39	0.150	0.013	0.1613	0.0006	–7	8.5	20	Pass	Pass	Pass	Accepted
40	0.09	0.07	0.1610	0.0006	–47	76	104	Fail	Fail	Pass	Not accepted
41	0.159	0.014	0.1608	0.0006	–1	8.8	22	Pass	Pass	Pass	Accepted
42	0.099	0.021	0.1616	0.0006	–39	21	34	Fail	Fail	Fail	Not accepted
43	0.138	0.008	0.1623	0.0007	–15	5.8	13	Pass	Pass	Fail	Warning
44	–	–	0.1612	0.0006	–	–	–	–	–	–	Not reported
45	–	–	0.1613	0.0006	–	–	–	–	–	–	Not reported
46	–	–	0.1603	0.0006	–	–	–	–	–	–	Not reported
47	0.23	0.04	0.1597	0.0006	46	15	57	Fail	Pass	Pass	Not accepted
48	24	3	0.1594	0.0006	14671	13	4815	Fail	Pass	Fail	Not accepted
49	0.150	0.020	0.1612	0.0006	–7	13	32	Pass	Pass	Pass	Accepted
50	0.25	0.09	0.1618	0.0007	57	36	146	Fail	Fail	Pass	Not accepted
51	0.23	0.10	0.1618	0.0007	43	43	159	Fail	Fail	Pass	Not accepted
52	0.075	0.010	0.1604	0.0006	–53	13	16	Fail	Pass	Fail	Not accepted
53	0.23	0.07	0.1600	0.0006	47	29	109	Fail	Fail	Pass	Not accepted
54	0.19	0.04	0.1609	0.0006	15	19	58	Pass	Pass	Pass	Accepted
55	<0.29	–	0.1619	0.0007	–	–	–	–	–	–	Not evaluated
56	0.180	0.010	0.1623	0.0007	11	5.6	16	Pass	Pass	Pass	Accepted
57	0.145	0.012	0.1612	0.0006	–10	8.3	19	Pass	Pass	Pass	Accepted

TABLE 7. EVALUATION RESULTS FOR ^{60}Co (cont.)

Lab code	Lab value (Bq kg^{-1})	Lab uncert. (Bq kg^{-1})	IAEA value (Bq kg^{-1})	IAEA uncert. (Bq kg^{-1})	Relative bias (%)	P (%)	Trueness limit (%)	Accuracy	Precision	Trueness	Final score
58	0.195	0.017	0.1620	0.0007	20	8.7	27	Fail	Pass	Pass	Not accepted
59	0.160	0.020	0.1606	0.0006	0	13	32	Pass	Pass	Pass	Accepted
60	0.041	0.017	0.1602	0.0006	–74	41	27	Fail	Fail	Fail	Not accepted
61	0.170	0.019	0.1629	0.0007	4	11	30	Pass	Pass	Pass	Accepted
62	0.210	0.020	0.1616	0.0006	30	9.5	32	Fail	Pass	Pass	Not accepted
63	0.180	0.018	0.1610	0.0006	12	10	29	Pass	Pass	Pass	Accepted
64	0.073	0.025	0.1610	0.0006	–55	35	40	Fail	Fail	Fail	Not accepted
65	0.165	0.013	0.1626	0.0007	1	7.9	21	Pass	Pass	Pass	Accepted
66	0.173	0.019	0.1609	0.0006	8	11	30	Pass	Pass	Pass	Accepted
67	–	–	0.1608	0.0006	–	–	–	–	–	–	Not reported
68	0.23	0.03	0.1598	0.0006	44	12	45	Fail	Pass	Pass	Not accepted
69	–	–	0.1627	0.0007	–	–	–	–	–	–	Not reported
70	0.180	0.010	0.1614	0.0006	11	5.6	16	Pass	Pass	Pass	Accepted
71	–	–	0.1605	0.0006	–	–	–	–	–	–	Not reported
72	0.112	0.017	0.1618	0.0007	–31	15	27	Fail	Pass	Fail	Not accepted
73	0.151	0.008	0.1611	0.0006	–6	5.2	13	Pass	Pass	Pass	Accepted
74	0.175	0.012	0.1614	0.0006	8	6.9	19	Pass	Pass	Pass	Accepted

TABLE 8. EVALUATION RESULTS FOR [90]Sr

Lab code	Lab value (Bq kg⁻¹)	Lab uncert. (Bq kg⁻¹)	IAEA value (Bq kg⁻¹)	IAEA uncert. (Bq kg⁻¹)	Relative bias (%)	P (%)	Trueness limit (%)	Accuracy	Precision	Trueness	Final score
1*	–	–	0.2767	0.0019	–	–	–	–	–	–	Not reported
2*	0.282	0.018	0.2748	0.0019	3	6.4	17	Pass	Pass	Pass	Accepted
3*	–	–	0.2757	0.0019	–	–	–	–	–	–	Not reported
4*	–	–	0.2766	0.0019	–	–	–	–	–	–	Not reported
5*	–	–	0.2733	0.0019	–	–	–	–	–	–	Not reported
6*	0.289	0.007	0.2752	0.0019	5	2.4	6.5	Pass	Pass	Pass	Accepted
7*	–	–	0.2748	0.0019	–	–	–	–	–	–	Not reported
8*	–	–	0.2732	0.0019	–	–	–	–	–	–	Not reported
9*	–	–	0.2759	0.0019	–	–	–	–	–	–	Not reported
10*	–	–	0.2739	0.0019	–	–	–	–	–	–	Not reported
11*	–	–	0.2758	0.0019	–	–	–	–	–	–	Not reported
12*	0.288	0.015	0.2742	0.0019	5	5.3	14	Pass	Pass	Pass	Accepted
13*	–	–	0.2752	0.0019	–	–	–	–	–	–	Not reported
14*	0.283	0.017	0.2747	0.0019	3	6.0	16	Pass	Pass	Pass	Accepted
15*	0.280	0.019	0.2776	0.0019	1	6.8	18	Pass	Pass	Pass	Accepted
16*	0.276	0.023	0.2737	0.0019	1	8.4	22	Pass	Pass	Pass	Accepted
17*	–	–	0.2758	0.0019	–	–	–	–	–	–	Not reported
18*	–	–	0.2742	0.0019	–	–	–	–	–	–	Not reported
19*	–	–	0.2750	0.0019	–	–	–	–	–	–	Not reported

TABLE 8. EVALUATION RESULTS FOR [90]Sr (cont.)

Lab code	Lab value (Bq kg⁻¹)	Lab uncert. (Bq kg⁻¹)	IAEA value (Bq kg⁻¹)	IAEA uncert. (Bq kg⁻¹)	Relative bias (%)	P (%)	Trueness limit (%)	Accuracy	Precision	Trueness	Final score
20*	–	–	0.2750	0.0019	–	–	–	–	–	–	Not reported
21*	0.275	0.019	0.2744	0.0019	0	7.0	18	Pass	Pass	Pass	Accepted
22*	0.240	0.016	0.2748	0.0019	–13	6.7	15	Pass	Pass	Pass	Accepted
23*	0.294	0.014	0.2764	0.0019	6	4.8	13	Pass	Pass	Pass	Accepted
24	–	–	0.2757	0.0019	–	–	–	–	–	–	Not reported
25	0.305	0.013	0.2780	0.0020	10	4.3	12	Pass	Pass	Pass	Accepted
26	–	–	0.2726	0.0019	–	–	–	–	–	–	Not reported
27	–	–	0.2749	0.0019	–	–	–	–	–	–	Not reported
28	–	–	0.2749	0.0019	–	–	–	–	–	–	Not reported
29	–	–	0.2756	0.0019	–	–	–	–	–	–	Not reported
30	–	–	0.2748	0.0019	–	–	–	–	–	–	Not reported
31	0.241	0.017	0.2765	0.0019	–13	7.1	16	Pass	Pass	Pass	Accepted
32	–	–	0.2745	0.0019	–	–	–	–	–	–	Not reported
33	0.238	0.014	0.2731	0.0019	–13	5.9	13	Pass	Pass	Pass	Accepted
34	0.159	0.012	0.2758	0.0019	–42	7.6	11	Fail	Pass	Fail	Not accepted
35	0.304	0.018	0.2744	0.0019	11	6.0	17	Pass	Pass	Pass	Accepted
36	0.281	0.018	0.2762	0.0019	2	6.4	17	Pass	Pass	Pass	Accepted
37	0.230	0.020	0.2740	0.0019	–16	8.7	19	Pass	Pass	Pass	Accepted
38	0.31	0.04	0.2742	0.0019	11	12	35	Pass	Pass	Pass	Accepted

TABLE 8. EVALUATION RESULTS FOR ^{90}Sr (cont.)

Lab code	Lab value (Bq kg^{-1})	Lab uncert. (Bq kg^{-1})	IAEA value (Bq kg^{-1})	IAEA uncert. (Bq kg^{-1})	Relative bias (%)	P (%)	Trueness limit (%)	Accuracy	Precision	Trueness	Final score
39	0.276	0.016	0.2754	0.0019	0	6.0	15	Pass	Pass	Pass	Accepted
40	–	–	0.2748	0.0019	–	–	–	–	–	–	Not reported
41	0.272	0.017	0.2744	0.0019	–1	6.3	16	Pass	Pass	Pass	Accepted
42	0.249	0.009	0.2757	0.0019	–10	3.8	8.8	Pass	Pass	Fail	Warning
43	0.26	0.03	0.2770	0.0019	–5	13	32	Pass	Pass	Pass	Accepted
44	–	–	0.2752	0.0019	–	–	–	–	–	–	Not reported
45	–	–	0.2754	0.0019	–	–	–	–	–	–	Not reported
46	–	–	0.2736	0.0019	–	–	–	–	–	–	Not reported
47	–	–	0.2726	0.0019	–	–	–	–	–	–	Not reported
48	–	–	0.2721	0.0019	–	–	–	–	–	–	Not reported
49	–	–	0.2751	0.0019	–	–	–	–	–	–	Not reported
50	–	–	0.2762	0.0019	–	–	–	–	–	–	Not reported
51	–	–	0.2761	0.0019	–	–	–	–	–	–	Not reported
52	–	–	0.2737	0.0019	–	–	–	–	–	–	Not reported
53	–	–	0.2730	0.0019	–	–	–	–	–	–	Not reported
54	–	–	0.2746	0.0019	–	–	–	–	–	–	Not reported
55	–	–	0.2763	0.0019	–	–	–	–	–	–	Not reported
56	0.32	0.04	0.2771	0.0019	16	13	37	Pass	Pass	Pass	Accepted
57	–	–	0.2751	0.0019	–	–	–	–	–	–	Not reported

TABLE 8. EVALUATION RESULTS FOR ^{90}Sr (cont.)

Lab code	Lab value (Bq kg^{-1})	Lab uncert. (Bq kg^{-1})	IAEA value (Bq kg^{-1})	IAEA uncert. (Bq kg^{-1})	Relative bias (%)	P (%)	Trueness limit (%)	Accuracy	Precision	Trueness	Final score
58	–	–	0.2764	0.0019	–	–	–	–	–	–	Not reported
59	–	–	0.2741	0.0019	–	–	–	–	–	–	Not reported
60	0.0022	0.0005	0.2735	0.0019	–99	23	1.9	Fail	Pass	Fail	Not accepted
61	–	–	0.2780	0.0020	–	–	–	–	–	–	Not reported
62	0.286	0.012	0.2759	0.0019	4	4.2	11	Pass	Pass	Pass	Accepted
63	0.222	0.015	0.2748	0.0019	–19	6.8	14	Pass	Pass	Fail	Warning
64	–	–	0.2747	0.0019	–	–	–	–	–	–	Not reported
65	–	–	0.2776	0.0019	–	–	–	–	–	–	Not reported
66	0.32	0.04	0.2746	0.0019	15	12	37	Pass	Pass	Pass	Accepted
67	0.260	0.020	0.2744	0.0019	–5	7.7	19	Pass	Pass	Pass	Accepted
68	–	–	0.2727	0.0019	–	–	–	–	–	–	Not reported
69	0.21	0.03	0.2777	0.0020	–25	15	28	Fail	Pass	Pass	Not accepted
70	0.33	0.04	0.2756	0.0019	20	12	37	Pass	Pass	Pass	Accepted
71	0.42	0.04	0.2739	0.0019	53	9.5	38	Fail	Pass	Fail	Not accepted
72	0.13	0.03	0.2761	0.0019	–53	20	24	Fail	Pass	Fail	Not accepted
73	0.230	0.010	0.2751	0.0019	–16	4.4	10	Pass	Pass	Fail	Warning
74	–	–	0.2755	0.0019	–	–	–	–	–	–	Not reported

TABLE 9. EVALUATION RESULTS FOR ^{134}Cs

Lab code	Lab value (Bq kg^{-1})	Lab uncert. (Bq kg^{-1})	IAEA value (Bq kg^{-1})	IAEA uncert. (Bq kg^{-1})	Relative bias (%)	P (%)	Trueness limit (%)	Accuracy	Precision	Trueness	Final score
1*	0.170	0.020	0.1956	0.0008	–13	12	26	Pass	Pass	Pass	Accepted
2*	0.189	0.009	0.1942	0.0008	–3	4.8	12	Pass	Pass	Pass	Accepted
3*	0.190	0.004	0.1948	0.0008	–2	2.1	5.4	Pass	Pass	Pass	Accepted
4*	0.148	0.003	0.1954	0.0008	–24	2.2	4.3	Fail	Pass	Fail	Not accepted
5*	0.219	0.021	0.1931	0.0008	13	9.6	28	Pass	Pass	Pass	Accepted
6*	0.171	0.015	0.1945	0.0008	–12	8.8	20	Pass	Pass	Pass	Accepted
7*	–	–	0.1942	0.0008	–	–	–	–	–	–	Not reported
8*	0.163	0.018	0.1931	0.0008	–16	11	24	Pass	Pass	Pass	Accepted
9*	–	–	0.1949	0.0008	–	–	–	–	–	–	Not reported
10*	0.191	0.015	0.1935	0.0008	–1	7.8	20	Pass	Pass	Pass	Accepted
11*	0.213	0.005	0.1949	0.0008	9	2.2	6.2	Pass	Pass	Fail	Warning
12*	0.182	0.011	0.1938	0.0008	–6	6.1	15	Pass	Pass	Pass	Accepted
13*	0.189	0.012	0.1944	0.0008	–3	6.3	16	Pass	Pass	Pass	Accepted
14*	0.180	0.020	0.1941	0.0008	–7	11	27	Pass	Pass	Pass	Accepted
15*	0.217	0.015	0.1961	0.0008	11	6.9	20	Pass	Pass	Pass	Accepted
16*	0.196	0.009	0.1934	0.0008	1	4.6	12	Pass	Pass	Pass	Accepted
17*	0.199	0.005	0.1949	0.0008	2	2.3	6.2	Pass	Pass	Pass	Accepted
18*	0.201	0.017	0.1937	0.0008	4	8.5	23	Pass	Pass	Pass	Accepted
19*	0.181	0.010	0.1943	0.0008	–7	5.8	14	Pass	Pass	Pass	Accepted

TABLE 9. EVALUATION RESULTS FOR [134]Cs (cont.)

Lab code	Lab value (Bq kg⁻¹)	Lab uncert. (Bq kg⁻¹)	IAEA value (Bq kg⁻¹)	IAEA uncert. (Bq kg⁻¹)	Relative bias (%)	P (%)	Trueness limit (%)	Accuracy	Precision	Trueness	Final score
20*	0.215	0.011	0.1943	0.0008	11	5.0	14	Pass	Pass	Pass	Accepted
21*	0.193	0.012	0.1939	0.0008	0	6.1	16	Pass	Pass	Pass	Accepted
22*	0.164	0.017	0.1942	0.0008	−16	10	23	Pass	Pass	Pass	Accepted
23*	0.189	0.017	0.1953	0.0008	−3	9.0	22	Pass	Pass	Pass	Accepted
24	0.189	0.015	0.1948	0.0008	−3	7.7	19	Pass	Pass	Pass	Accepted
25	0.183	0.011	0.1965	0.0008	−7	6.0	14	Pass	Pass	Pass	Accepted
26	0.150	0.010	0.1926	0.0008	−22	6.7	13	Fail	Pass	Fail	Not accepted
27	0.211	0.015	0.1942	0.0008	9	7.1	20	Pass	Pass	Pass	Accepted
28	0.21	0.03	0.1943	0.0008	7	13	36	Pass	Pass	Pass	Accepted
29	0.194	0.015	0.1947	0.0008	−1	8.0	20	Pass	Pass	Pass	Accepted
30	0.170	0.008	0.1941	0.0008	−12	4.7	11	Pass	Pass	Fail	Warning
31	0.145	0.022	0.1954	0.0008	−26	15	29	Fail	Pass	Pass	Not accepted
32	0.197	0.014	0.1940	0.0008	2	7.1	19	Pass	Pass	Pass	Accepted
33	0.188	0.010	0.1929	0.0008	−3	5.4	14	Pass	Pass	Pass	Accepted
34	0.189	0.014	0.1949	0.0008	−3	7.4	19	Pass	Pass	Pass	Accepted
35	0.157	0.012	0.1939	0.0008	−19	7.7	16	Pass	Pass	Fail	Warning
36	0.160	0.009	0.1951	0.0008	−18	5.6	12	Pass	Pass	Fail	Warning
37	0.200	0.010	0.1936	0.0008	3	5.0	13	Pass	Pass	Pass	Accepted
38	0.207	0.015	0.1937	0.0008	7	7.3	20	Pass	Pass	Pass	Accepted

TABLE 9. EVALUATION RESULTS FOR ^{134}Cs (cont.)

Lab code	Lab value (Bq kg^{-1})	Lab uncert. (Bq kg^{-1})	IAEA value (Bq kg^{-1})	IAEA uncert. (Bq kg^{-1})	Relative bias (%)	P (%)	Trueness limit (%)	Accuracy	Precision	Trueness	Final score
39	0.173	0.014	0.1946	0.0008	−11	8.2	19	Pass	Pass	Pass	Accepted
40	0.11	0.06	0.1942	0.0008	−42	49	73	Fail	Fail	Pass	Not accepted
41	0.182	0.017	0.1939	0.0008	−6	9.3	23	Pass	Pass	Pass	Accepted
42	0.180	0.025	0.1948	0.0008	−8	14	33	Pass	Pass	Pass	Accepted
43A	0.181	0.017	0.1957	0.0008	−8	9.4	22	Pass	Pass	Pass	Accepted
43B	0.190	0.011	0.1957	0.0008	−3	5.8	15	Pass	Pass	Pass	Accepted
44	0.1200	0.0012	0.1945	0.0008	−38	1.1	1.9	Fail	Pass	Fail	Not accepted
45	0.35	0.05	0.1946	0.0008	80	14	66	Fail	Pass	Fail	Not accepted
46	–	–	0.1933	0.0008	–	–	–	–	–	–	Not reported
47	0.28	0.03	0.1926	0.0008	44	12	44	Fail	Pass	Pass	Not accepted
48	1.16	0.14	0.1923	0.0008	503	12	188	Fail	Pass	Fail	Not accepted
49	0.22	0.03	0.1944	0.0008	13	14	40	Pass	Pass	Pass	Accepted
50	0.17	0.03	0.1952	0.0008	−13	20	44	Pass	Pass	Pass	Accepted
51	0.23	0.20	0.1951	0.0008	19	86	264	Pass	Fail	Pass	Warning
52	0.048	0.007	0.1934	0.0008	−75	14	9.0	Fail	Pass	Fail	Not accepted
53	–	–	0.1929	0.0008	–	–	–	–	–	–	Not reported
54	0.18	0.03	0.1940	0.0008	−6	18	44	Pass	Pass	Pass	Accepted
55	<0.28	–	0.1952	0.0008	–	–	–	–	–	–	Not evaluated
56	0.180	0.010	0.1958	0.0008	−8	5.6	13	Pass	Pass	Pass	Accepted

TABLE 9. EVALUATION RESULTS FOR ^{134}Cs (cont.)

Lab code	Lab value (Bq kg^{-1})	Lab uncert. (Bq kg^{-1})	IAEA value (Bq kg^{-1})	IAEA uncert. (Bq kg^{-1})	Relative bias (%)	P (%)	Trueness limit (%)	Accuracy	Precision	Trueness	Final score
57	0.163	0.013	0.1944	0.0008	−16	8.0	17	Pass	Pass	Pass	Accepted
58	0.217	0.014	0.1953	0.0008	11	6.5	18	Pass	Pass	Pass	Accepted
59	0.190	0.020	0.1937	0.0008	−2	11	27	Pass	Pass	Pass	Accepted
60	0.046	0.015	0.1933	0.0008	−76	33	20	Fail	Fail	Fail	Not accepted
61	0.190	0.018	0.1964	0.0008	−3	9.5	24	Pass	Pass	Pass	Accepted
62	0.210	0.010	0.1949	0.0008	8	4.8	13	Pass	Pass	Pass	Accepted
63	0.183	0.019	0.1941	0.0008	−6	10	25	Pass	Pass	Pass	Accepted
64	–	–	0.1941	0.0008	–	–	–	–	–	–	Not reported
65	0.196	0.012	0.1961	0.0008	0	6.1	16	Pass	Pass	Pass	Accepted
66	0.193	0.019	0.1940	0.0008	−1	9.9	25	Pass	Pass	Pass	Accepted
67	–	–	0.1939	0.0008	–	–	–	–	–	–	Not reported
68	0.23	0.03	0.1927	0.0008	18	12	37	Pass	Pass	Pass	Accepted
69	0.183	0.010	0.1963	0.0008	−7	5.5	13	Pass	Pass	Pass	Accepted
70	0.190	0.010	0.1947	0.0008	−2	5.3	13	Pass	Pass	Pass	Accepted
71	0.190	0.007	0.1936	0.0008	−2	3.7	9.4	Pass	Pass	Pass	Accepted
72	0.15	0.03	0.1951	0.0008	−21	19	38	Fail	Pass	Pass	Not accepted
73	0.258	0.007	0.1944	0.0008	33	2.7	9.3	Fail	Pass	Fail	Not accepted
74	0.192	0.008	0.1947	0.0008	−1	4.2	11	Pass	Pass	Pass	Accepted

TABLE 10. EVALUATION RESULTS FOR ^{137}Cs

Lab code	Lab value (Bq kg^{-1})	Lab uncert. (Bq kg^{-1})	IAEA value (Bq kg^{-1})	IAEA uncert. (Bq kg^{-1})	Relative bias (%)	P (%)	Trueness limit (%)	Accuracy	Precision	Trueness	Final score
1*	0.315	0.022	0.3098	0.0019	2	7.0	18	Pass	Pass	Pass	Accepted
2*	0.310	0.011	0.3077	0.0019	1	3.6	9.3	Pass	Pass	Pass	Accepted
3*	0.279	0.005	0.3086	0.0019	–10	1.7	4.1	Pass	Pass	Fail	Warning
4*	0.239	0.004	0.3096	0.0019	–23	1.6	3.3	Fail	Pass	Fail	Not accepted
5*	0.35	0.03	0.3059	0.0019	16	8.5	25	Pass	Pass	Pass	Accepted
6*	0.328	0.020	0.3081	0.0019	6	6.1	17	Pass	Pass	Pass	Accepted
7*	–	–	0.3076	0.0019	–	–	–	–	–	–	Not reported
8*	0.251	0.021	0.3059	0.0019	–18	8.3	18	Pass	Pass	Fail	Warning
9*	–	–	0.3088	0.0019	–	–	–	–	–	–	Not reported
10*	0.308	0.019	0.3066	0.0019	0	6.2	16	Pass	Pass	Pass	Accepted
11*	0.347	0.006	0.3087	0.0019	12	1.7	4.9	Pass	Pass	Fail	Warning
12*	0.292	0.013	0.3070	0.0019	–5	4.5	11	Pass	Pass	Pass	Accepted
13*	0.263	0.013	0.3080	0.0019	–15	4.8	11	Pass	Pass	Fail	Warning
14*	0.330	0.022	0.3075	0.0019	7	6.7	18	Pass	Pass	Pass	Accepted
15*	0.317	0.018	0.3107	0.0019	2	5.7	15	Pass	Pass	Pass	Accepted
16*	0.291	0.013	0.3064	0.0019	–5	4.5	11	Pass	Pass	Pass	Accepted
17*	0.326	0.005	0.3087	0.0019	6	1.7	4.7	Pass	Pass	Fail	Warning
18*	0.380	0.019	0.3069	0.0019	24	5.0	16	Fail	Pass	Fail	Not accepted
19*	0.325	0.015	0.3079	0.0019	6	4.7	13	Pass	Pass	Pass	Accepted

TABLE 10. EVALUATION RESULTS FOR [137]Cs (cont.)

Lab code	Lab value (Bq kg^{-1})	Lab uncert. (Bq kg^{-1})	IAEA value (Bq kg^{-1})	IAEA uncert. (Bq kg^{-1})	Relative bias (%)	P (%)	Trueness limit (%)	Accuracy	Precision	Trueness	Final score
20*	0.336	0.017	0.3078	0.0019	9	5.0	14	Pass	Pass	Pass	Accepted
21*	0.290	0.017	0.3071	0.0019	−6	5.9	14	Pass	Pass	Pass	Accepted
22*	0.302	0.021	0.3077	0.0019	−2	7.0	18	Pass	Pass	Pass	Accepted
23*	0.310	0.021	0.3094	0.0019	0	6.8	18	Pass	Pass	Pass	Accepted
24	0.31	0.03	0.3087	0.0019	0	9.0	23	Pass	Pass	Pass	Accepted
25	0.293	0.022	0.3112	0.0019	−6	7.5	18	Pass	Pass	Pass	Accepted
26	0.290	0.020	0.3052	0.0019	−5	6.9	17	Pass	Pass	Pass	Accepted
27	0.332	0.023	0.3077	0.0019	8	7.0	19	Pass	Pass	Pass	Accepted
28	0.40	0.04	0.3078	0.0019	31	9.4	32	Fail	Pass	Pass	Not accepted
29	0.322	0.024	0.3085	0.0019	4	7.3	20	Pass	Pass	Pass	Accepted
30	0.303	0.021	0.3076	0.0019	−1	7.0	18	Pass	Pass	Pass	Accepted
31	0.28	0.03	0.3095	0.0019	−11	10	23	Pass	Pass	Pass	Accepted
32	0.309	0.020	0.3073	0.0019	1	6.5	17	Pass	Pass	Pass	Accepted
33	0.289	0.016	0.3057	0.0019	−5	5.7	14	Pass	Pass	Pass	Accepted
34	0.310	0.025	0.3088	0.0019	0	8.1	21	Pass	Pass	Pass	Accepted
35	0.360	0.020	0.3072	0.0019	17	5.6	17	Pass	Pass	Fail	Warning
36	0.289	0.018	0.3091	0.0019	−7	6.3	15	Pass	Pass	Pass	Accepted
37	0.280	0.020	0.3068	0.0019	−9	7.2	17	Pass	Pass	Pass	Accepted
38	0.304	0.022	0.3070	0.0019	−1	7.3	19	Pass	Pass	Pass	Accepted

TABLE 10. EVALUATION RESULTS FOR ^{137}Cs (cont.)

Lab code	Lab value (Bq kg^{-1})	Lab uncert. (Bq kg^{-1})	IAEA value (Bq kg^{-1})	IAEA uncert. (Bq kg^{-1})	Relative bias (%)	P (%)	Trueness limit (%)	Accuracy	Precision	Trueness	Final score
39	0.298	0.017	0.3082	0.0019	–3	5.6	14	Pass	Pass	Pass	Accepted
40	0.17	0.05	0.3076	0.0019	–46	32	44	Fail	Fail	Fail	Not accepted
41	0.32	0.03	0.3072	0.0019	3	8.6	23	Pass	Pass	Pass	Accepted
42	0.315	0.024	0.3087	0.0019	2	7.6	20	Pass	Pass	Pass	Accepted
43A	0.294	0.024	0.3101	0.0019	–5	8.2	20	Pass	Pass	Pass	Accepted
43B	0.307	0.019	0.3101	0.0019	–1	6.2	16	Pass	Pass	Pass	Accepted
44	–	–	0.3081	0.0019	–	–	–	–	–	–	Not reported
45	0.43	0.06	0.3083	0.0019	39	14	50	Fail	Pass	Pass	Not accepted
46	<11	–	0.3063	0.0019	–	–	–	–	–	–	Not evaluated
47	0.40	0.04	0.3052	0.0019	33	9.3	32	Fail	Pass	Fail	Not accepted
48	1.82	0.22	0.3047	0.0019	497	12	186	Fail	Pass	Fail	Not accepted
49	0.25	0.03	0.3080	0.0019	–19	12	25	Pass	Pass	Pass	Accepted
50	0.42	0.07	0.3092	0.0019	36	17	61	Fail	Pass	Pass	Not accepted
51	0.28	0.20	0.3091	0.0019	–10	72	167	Pass	Fail	Pass	Warning
52	0.073	0.017	0.3064	0.0019	–76	24	15	Fail	Fail	Fail	Not accepted
53	0.32	0.09	0.3057	0.0019	5	28	75	Pass	Fail	Pass	Warning
54	0.26	0.04	0.3074	0.0019	–15	14	30	Pass	Pass	Pass	Accepted
55	<0.4	–	0.3093	0.0019	–	–	–	–	–	–	Not evaluated
56	0.320	0.020	0.3101	0.0019	3	6.3	17	Pass	Pass	Pass	Accepted

TABLE 10. EVALUATION RESULTS FOR ^{137}Cs (cont.)

| Lab code	Lab value (Bq kg^{-1})	Lab uncert. (Bq kg^{-1})	IAEA value (Bq kg^{-1})	IAEA uncert. (Bq kg^{-1})	Relative bias (%)	P (%)	Trueness limit (%)	Accuracy	Precision	Trueness	Final score
57	0.280	0.020	0.3080	0.0019	–9	7.2	17	Pass	Pass	Pass	Accepted
58	0.307	0.015	0.3095	0.0019	–1	4.9	13	Pass	Pass	Pass	Accepted
59	0.302	0.022	0.3069	0.0019	–2	7.3	19	Pass	Pass	Pass	Accepted
60	0.25	0.06	0.3062	0.0019	–19	23	49	Pass	Fail	Pass	Warning
61	0.315	0.024	0.3112	0.0019	1	7.6	20	Pass	Pass	Pass	Accepted
62	0.310	0.010	0.3088	0.0019	0	3.3	8.5	Pass	Pass	Pass	Accepted
63	0.31	0.03	0.3076	0.0019	2	10	27	Pass	Pass	Pass	Accepted
64	0.107	0.018	0.3075	0.0019	–65	17	15	Fail	Pass	Fail	Not accepted
65	0.313	0.021	0.3107	0.0019	1	6.7	17	Pass	Pass	Pass	Accepted
66	0.335	0.024	0.3074	0.0019	9	7.2	20	Pass	Pass	Pass	Accepted
67	–	–	0.3072	0.0019	–	–	–	–	–	–	Not reported
68	0.33	0.03	0.3053	0.0019	9	9.9	28	Pass	Pass	Pass	Accepted
69	0.299	0.014	0.3109	0.0019	–4	4.7	12	Pass	Pass	Pass	Accepted
70	0.330	0.020	0.3085	0.0019	7	6.1	17	Pass	Pass	Pass	Accepted
71	0.328	0.011	0.3067	0.0019	7	3.4	9.4	Pass	Pass	Pass	Accepted
72	0.30	0.05	0.3091	0.0019	–2	15	38	Pass	Pass	Pass	Accepted
73	0.131	0.005	0.3079	0.0019	–57	4.0	4.6	Fail	Pass	Fail	Not accepted
74	0.309	0.015	0.3084	0.0019	0	4.9	13	Pass	Pass	Pass	Accepted
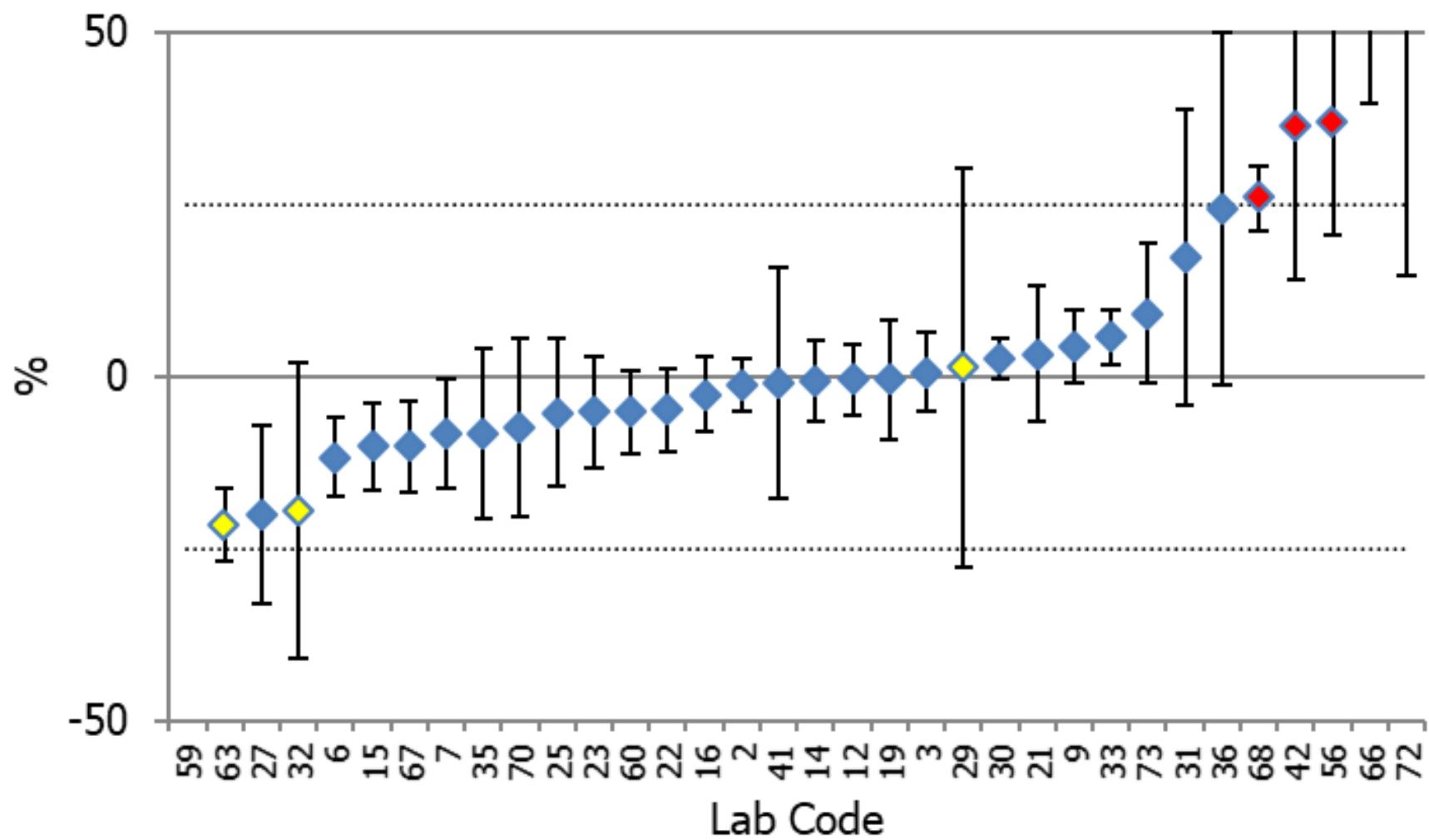
FIG. 2. H-3 bias.
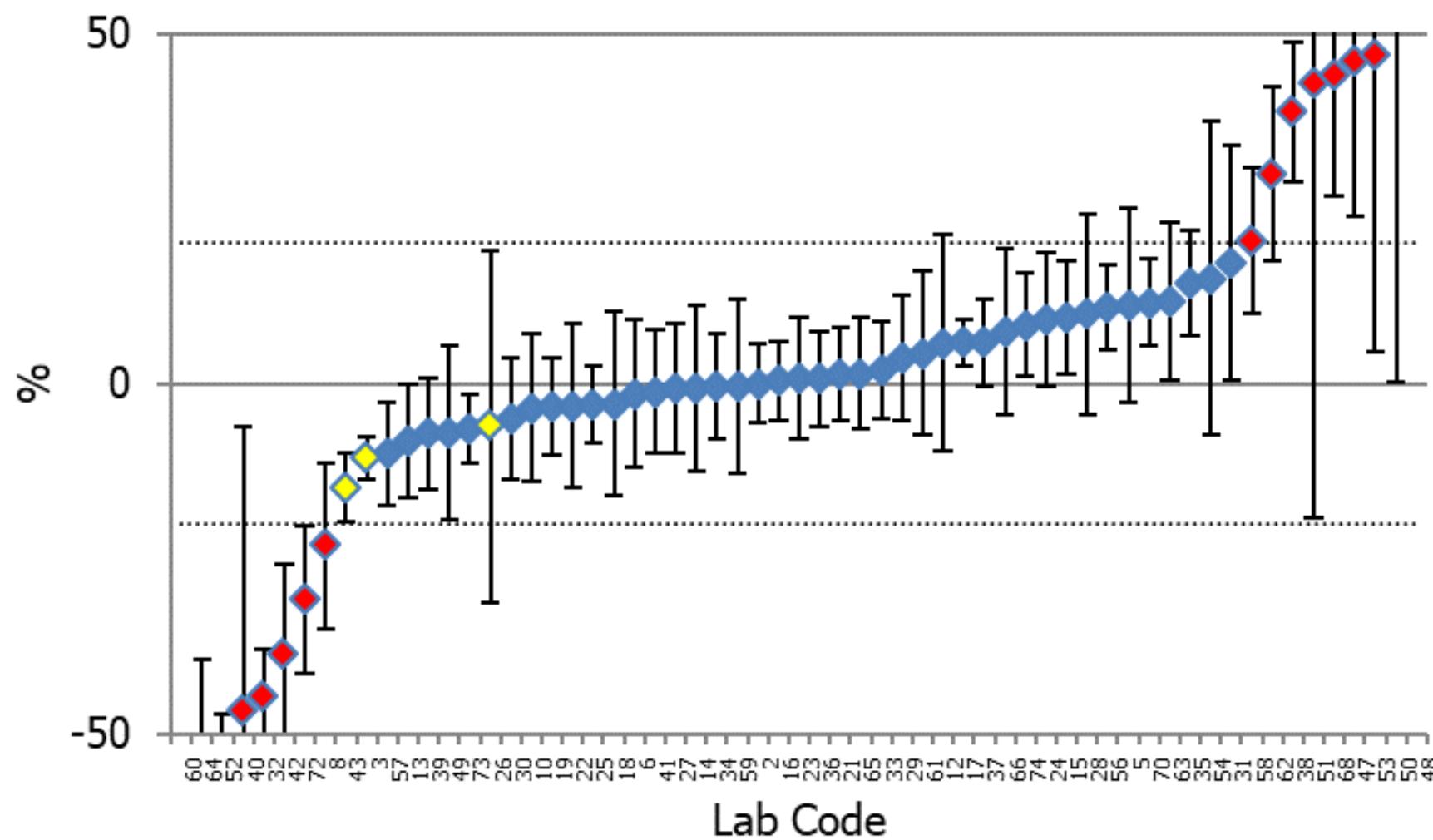
FIG. 3. Co-60 bias.
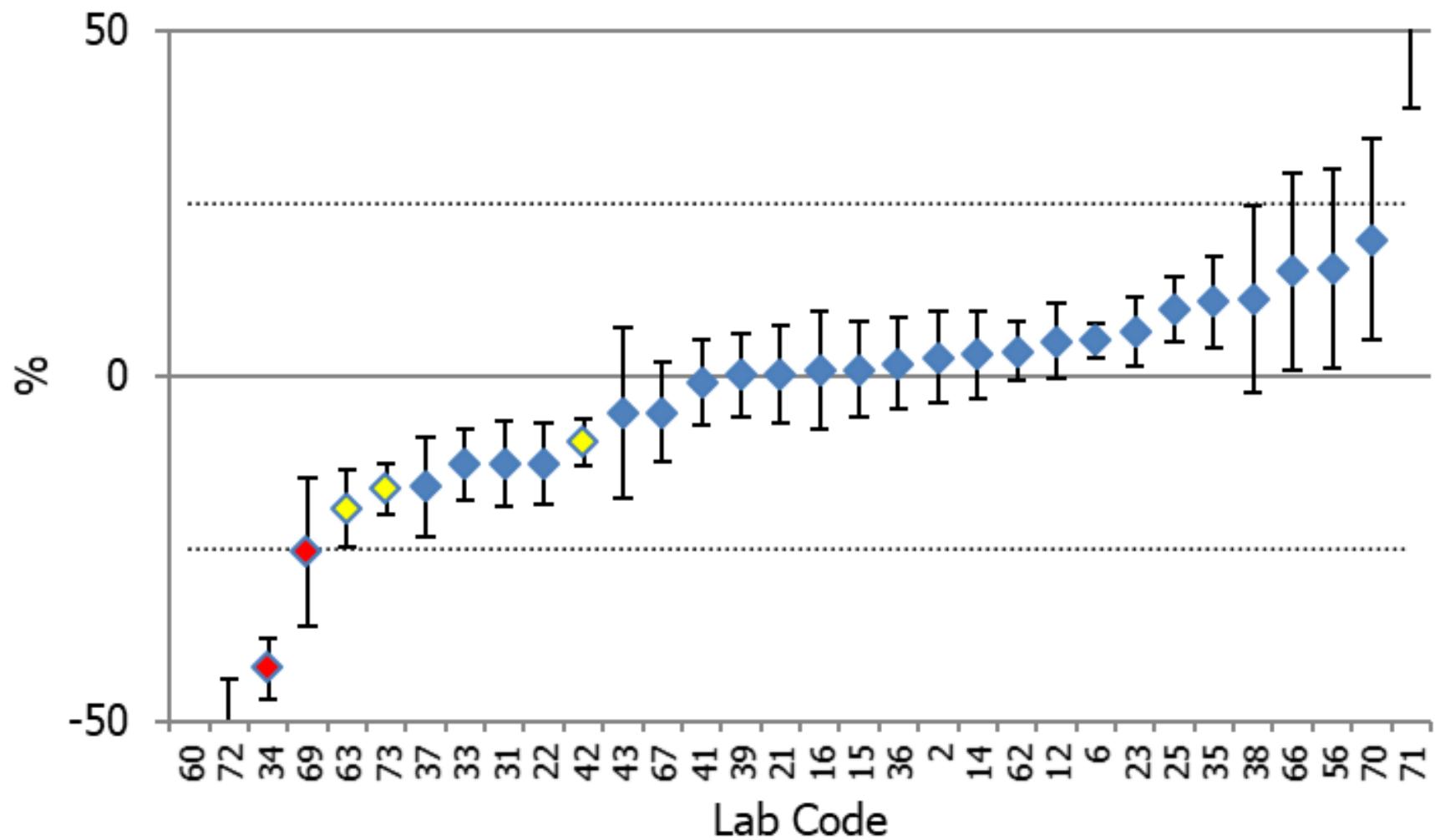
FIG. 4. Sr-90 bias.
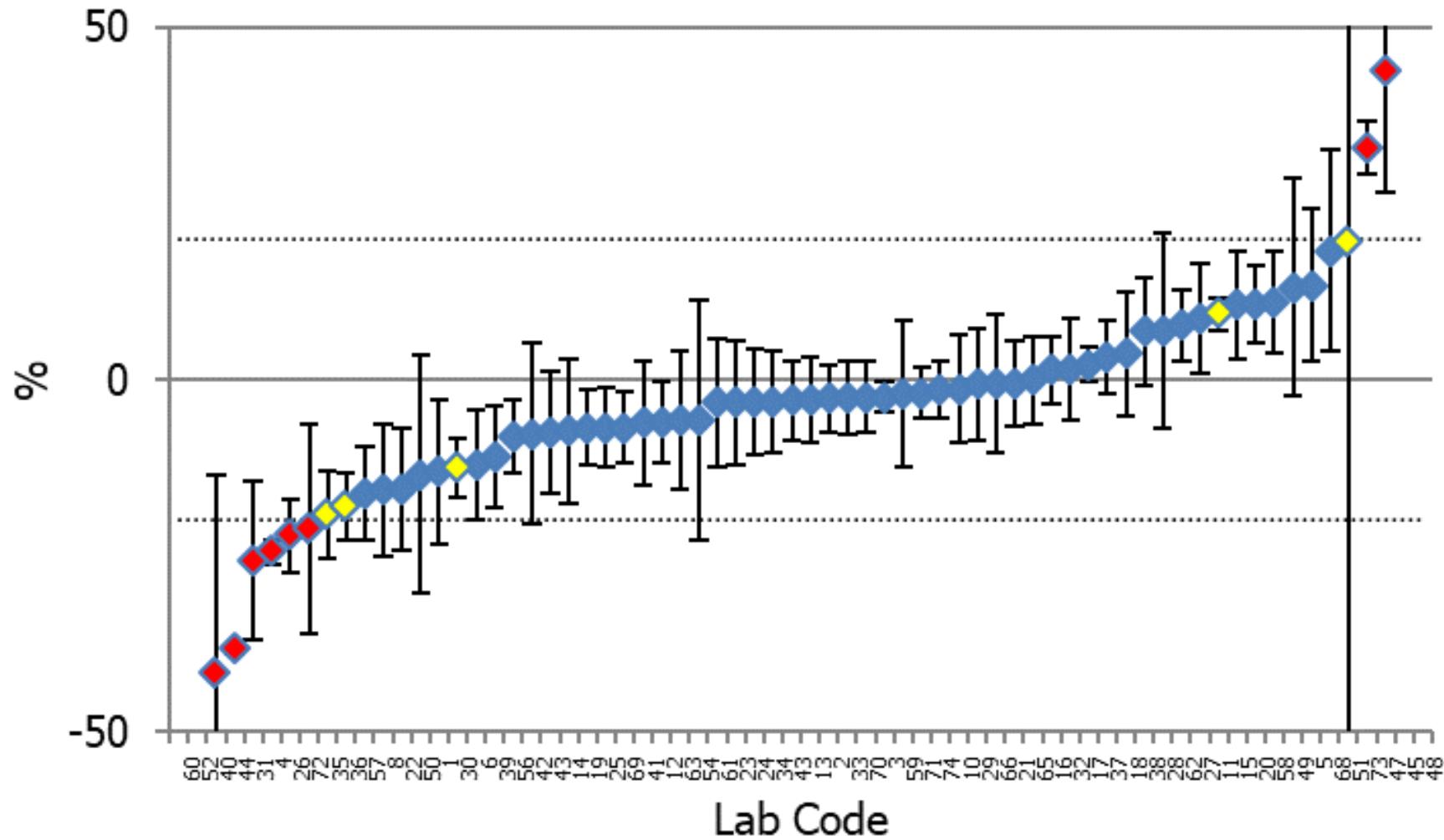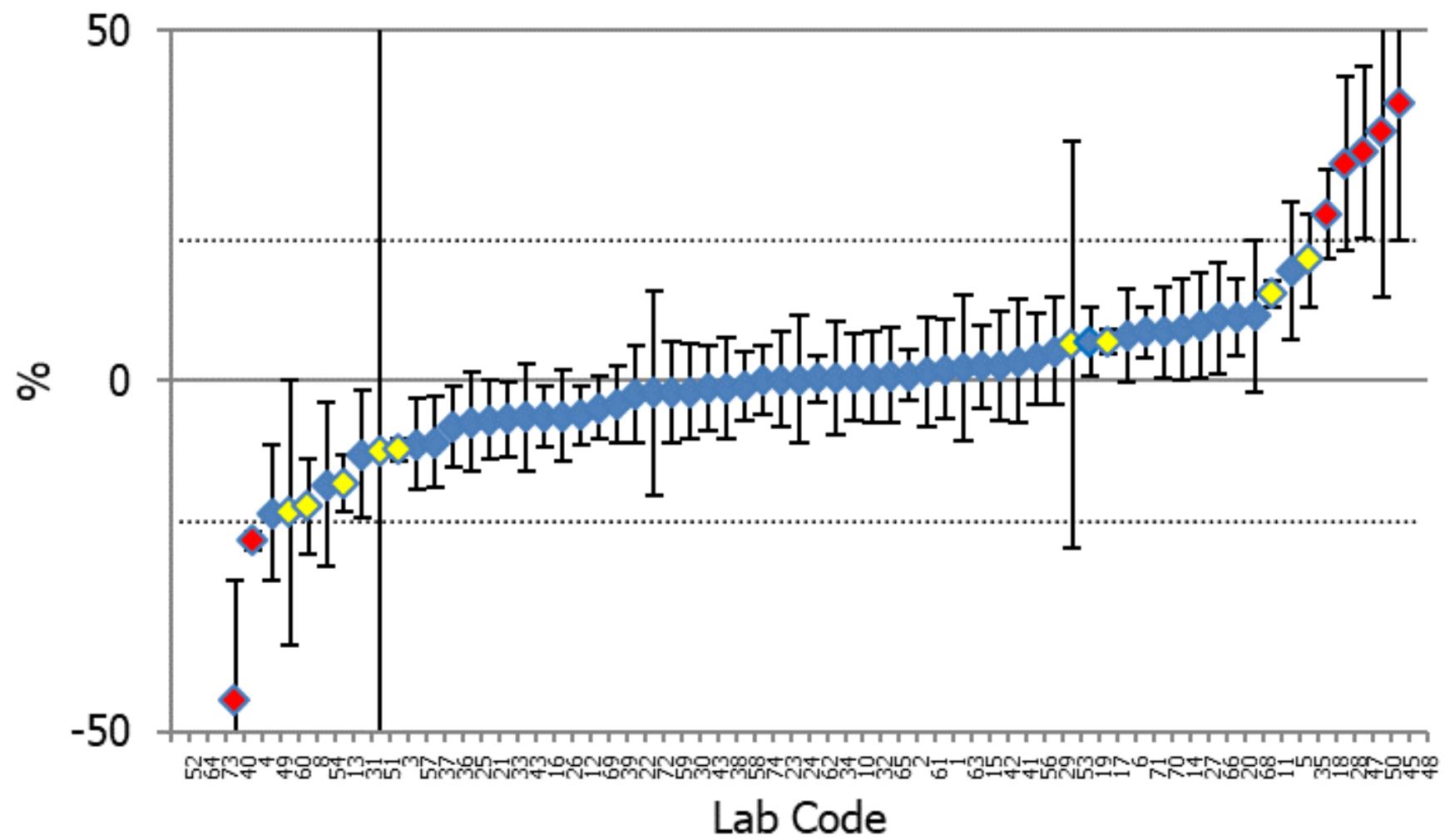
FIG. 5. Cs-134 bias.

FIG. 6. Cs-137 bias.
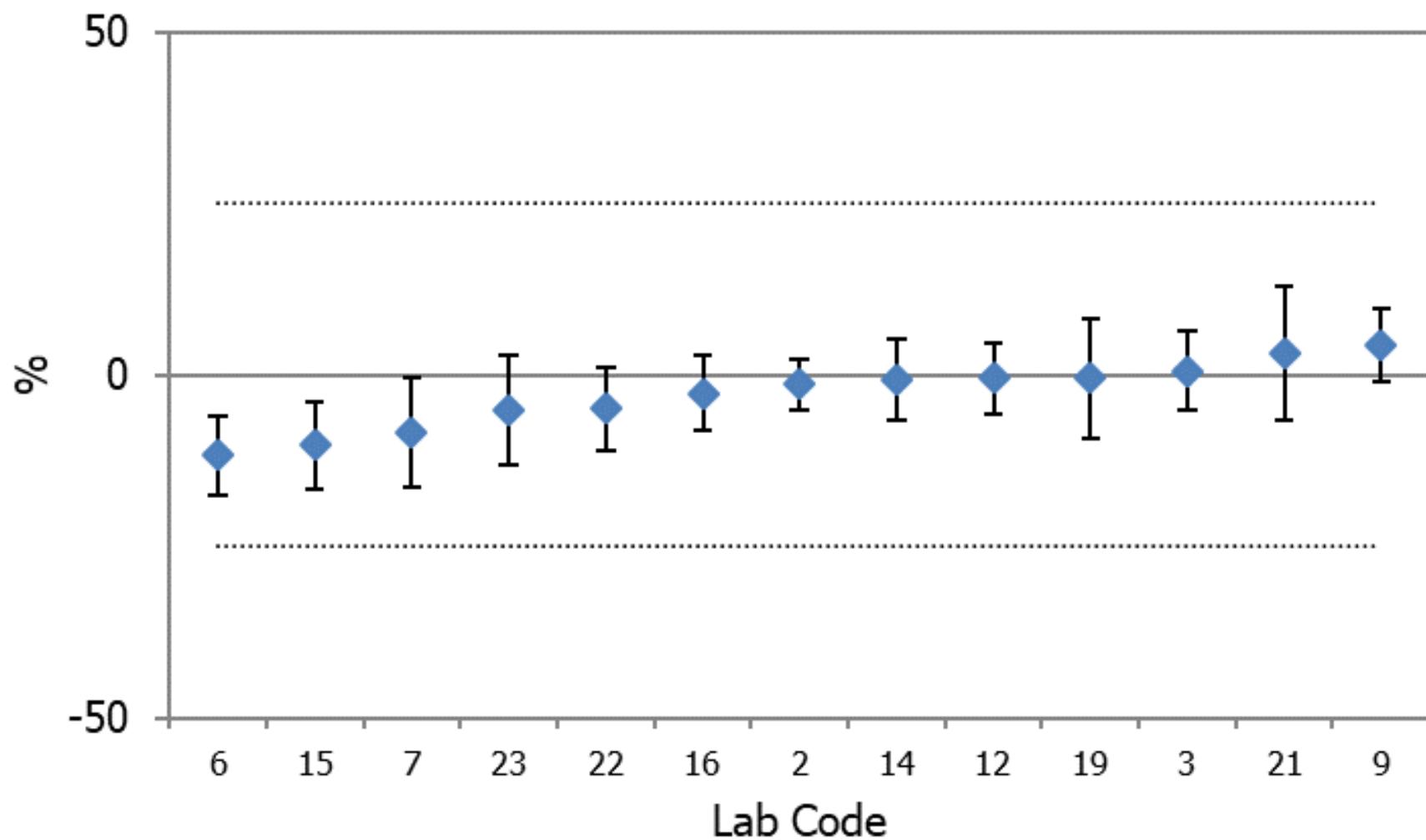
FIG. 7. H-3 bias Japanese participants.
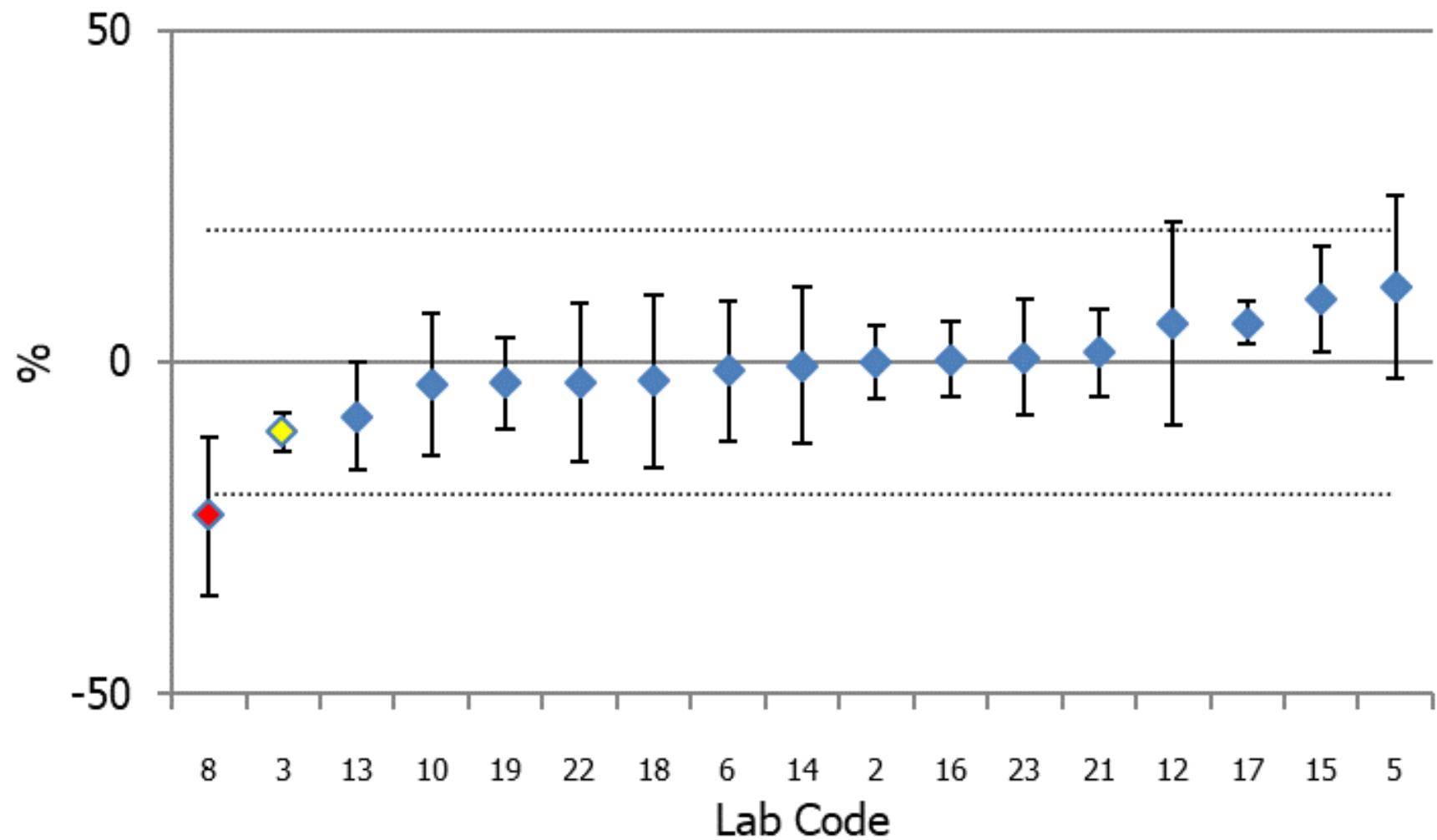
FIG. 8. Co-60 bias Japanese participants.
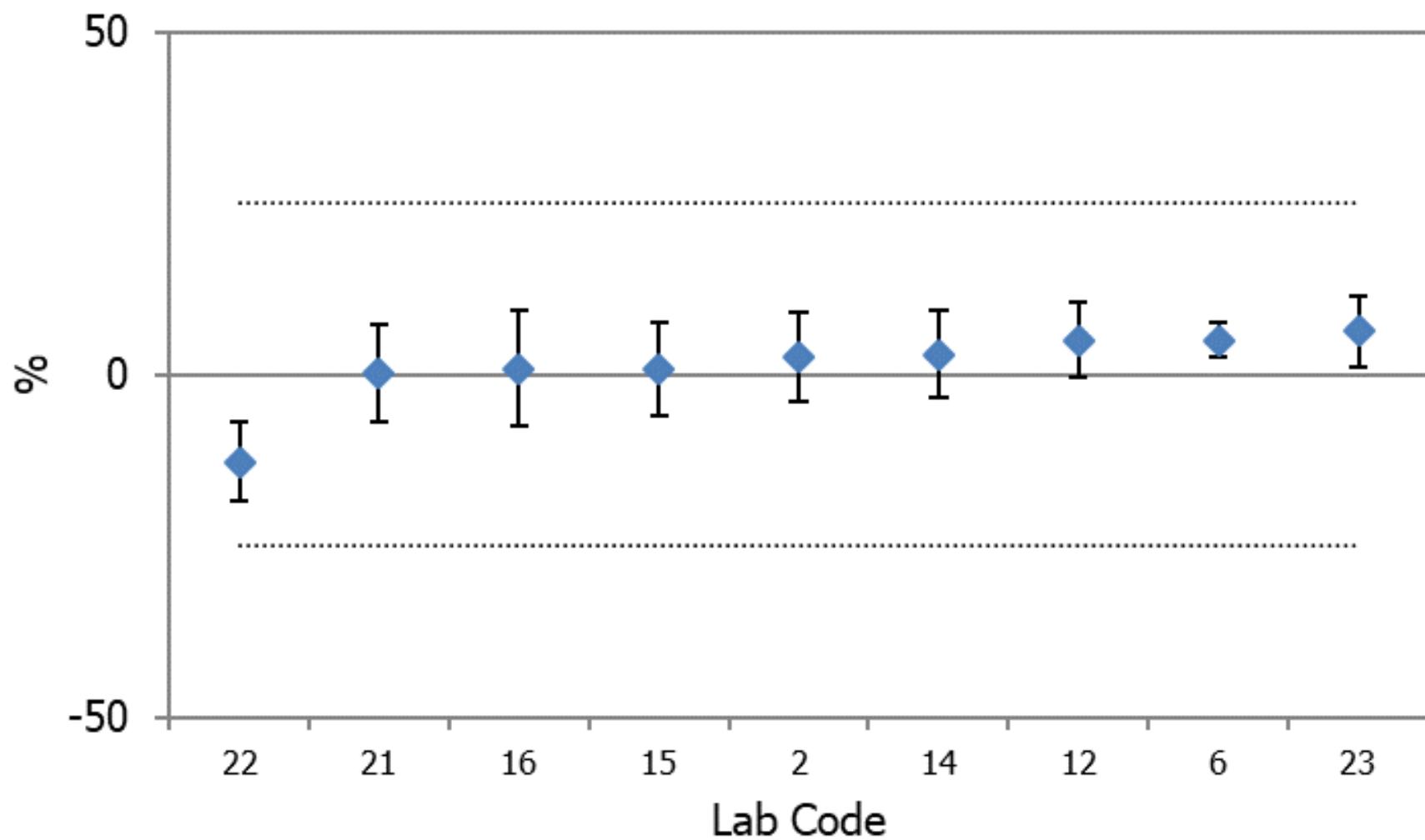
FIG. 9. Sr-90 bias Japanese participants.
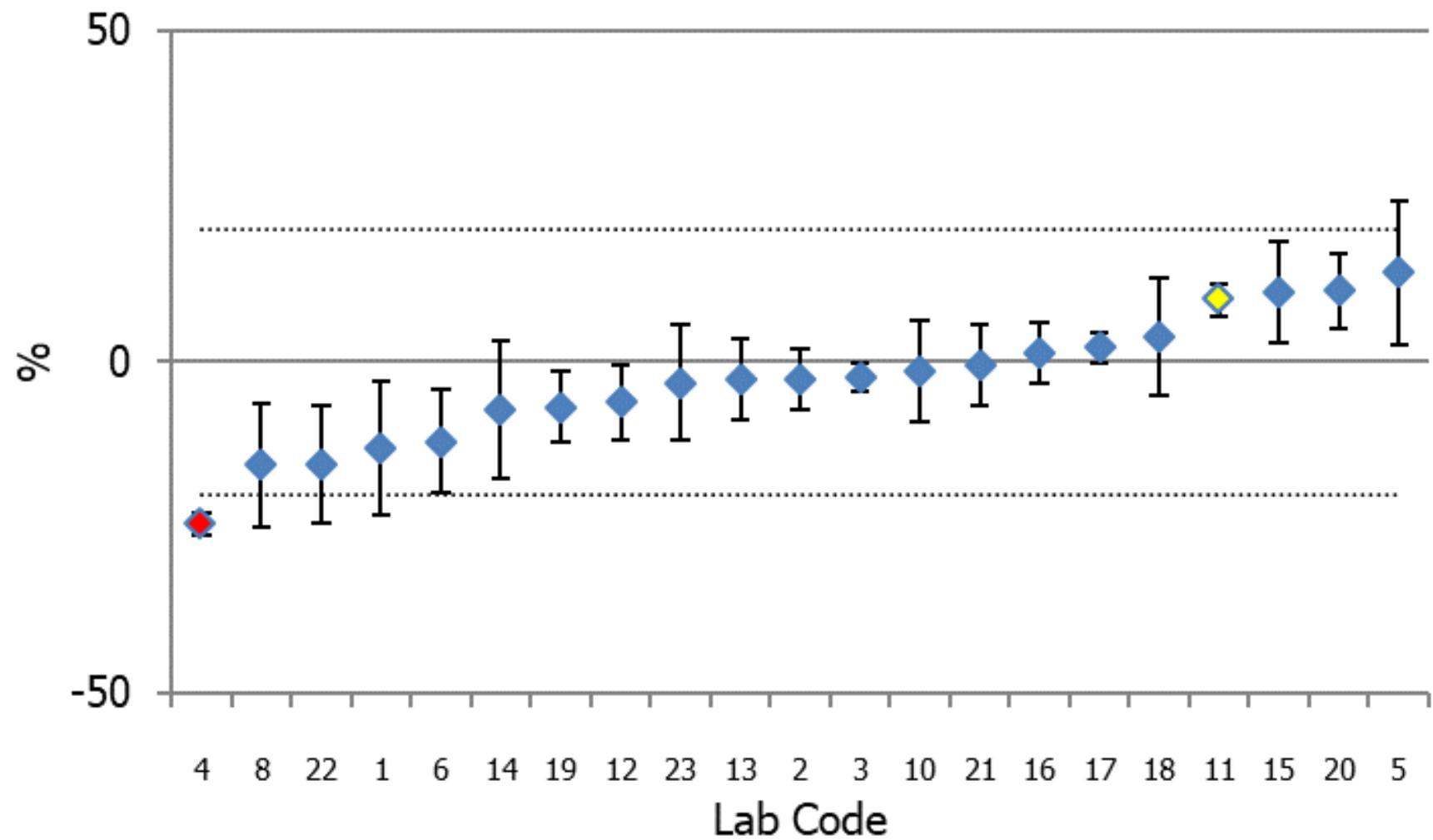
FIG. 10. Cs-134 bias Japanese participants.
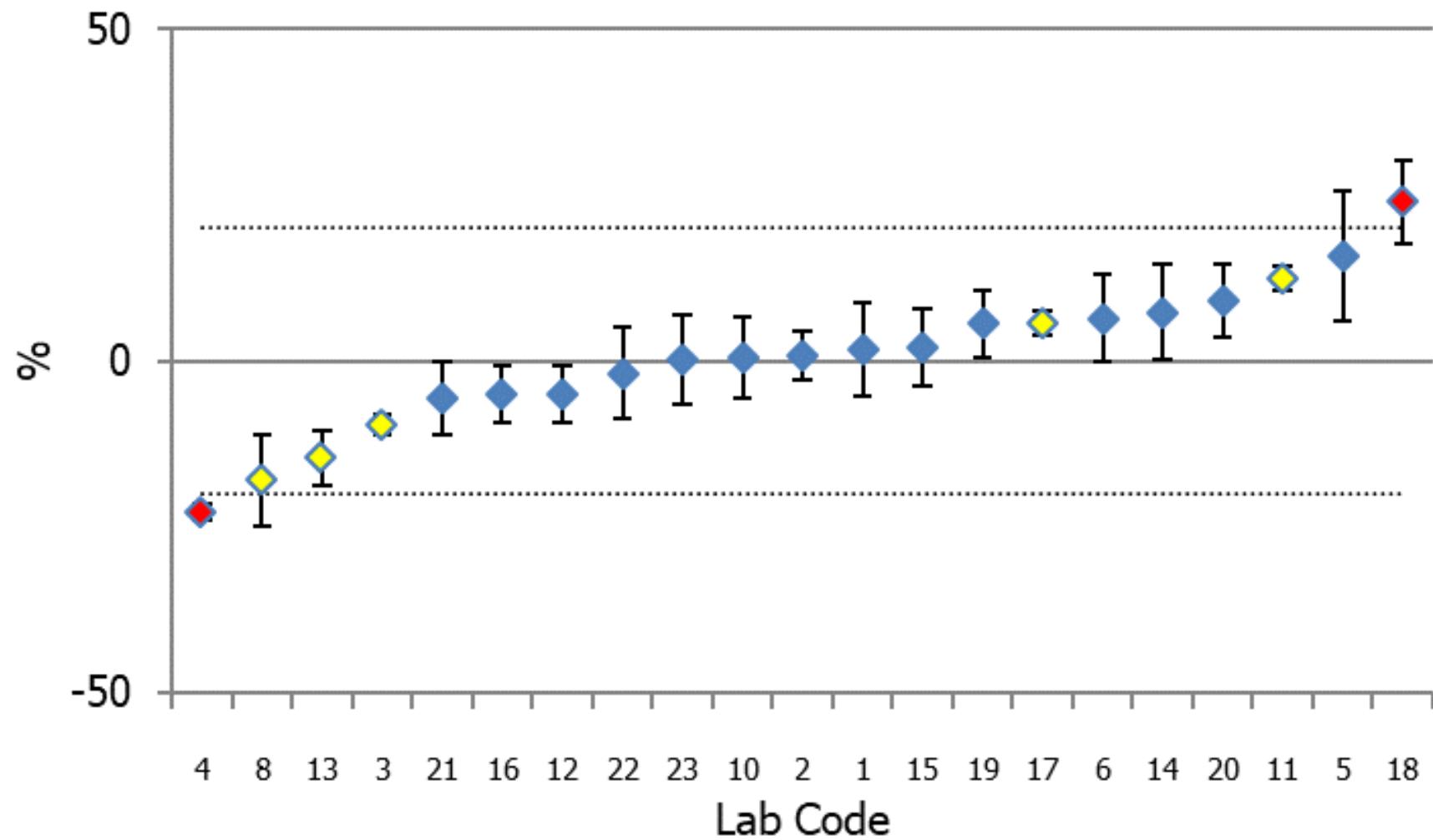
FIG. 11. Cs-137 bias Japanese participants.

APPENDIX II. PERFORMANCE EVALUATION TABLES SORTED BY LABORATORY CODE

TABLE 11. LABORATORY CODE 1

Radio-nuclide	Lab value (Bq kg^{-1})	Lab uncert. (Bq kg^{-1})	IAEA value (Bq kg^{-1})	IAEA uncert. (Bq kg^{-1})	Relative bias (%)	P (%)	Trueness limit (%)	Accuracy	Precision	Trueness	Final score
^{3}H	–	–	3.14	0.06	–	–	–	–	–	–	Not reported
^{60}Co	–	–	0.1621	0.0007	–	–	–	–	–	–	Not reported
^{90}Sr	–	–	0.2767	0.0019	–	–	–	–	–	–	Not reported
^{134}Cs	0.170	0.020	0.1956	0.0008	–13	12	26	Pass	Pass	Pass	Accepted
^{137}Cs	0.315	0.022	0.3098	0.0019	2	7.0	18	Pass	Pass	Pass	Accepted

TABLE 12. LABORATORY CODE 2

Radio-nuclide	Lab value (Bq kg^{-1})	Lab uncert. (Bq kg^{-1})	IAEA value (Bq kg^{-1})	IAEA uncert. (Bq kg^{-1})	Relative bias (%)	P (%)	Trueness limit (%)	Accuracy	Precision	Trueness	Final score
^{3}H	3.08	0.10	3.12	0.06	–1	3.8	10	Pass	Pass	Pass	Accepted
^{60}Co	0.161	0.009	0.1610	0.0006	0	5.6	14	Pass	Pass	Pass	Accepted
^{90}Sr	0.282	0.018	0.2748	0.0019	3	6.4	17	Pass	Pass	Pass	Accepted
^{134}Cs	0.189	0.009	0.1942	0.0008	–3	4.8	12	Pass	Pass	Pass	Accepted
^{137}Cs	0.310	0.011	0.3077	0.0019	1	3.6	9.3	Pass	Pass	Pass	Accepted

TABLE 13. LABORATORY CODE 3

Radio-nuclide	Lab value (Bq kg^{-1})	Lab uncert. (Bq kg^{-1})	IAEA value (Bq kg^{-1})	IAEA uncert. (Bq kg^{-1})	Relative bias (%)	P (%)	Trueness limit (%)	Accuracy	Precision	Trueness	Final score
^{3}H	3.15	0.17	3.13	0.06	1	5.8	15	Pass	Pass	Pass	Accepted
^{60}Co	0.144	0.005	0.1615	0.0006	−11	3.3	7.6	Pass	Pass	Fail	Warning
^{90}Sr	–	–	0.2757	0.0019	–	–	–	–	–	–	Not reported
^{134}Cs	0.190	0.004	0.1948	0.0008	−2	2.1	5.4	Pass	Pass	Pass	Accepted
^{137}Cs	0.279	0.005	0.3086	0.0019	−10	1.7	4.1	Pass	Pass	Fail	Warning

TABLE 14. LABORATORY CODE 4

Radio-nuclide	Lab value (Bq kg^{-1})	Lab uncert. (Bq kg^{-1})	IAEA value (Bq kg^{-1})	IAEA uncert. (Bq kg^{-1})	Relative bias (%)	P (%)	Trueness limit (%)	Accuracy	Precision	Trueness	Final score
^{3}H	–	–	3.14	0.06	–	–	–	–	–	–	Not reported
^{60}Co	–	–	0.1620	0.0007	–	–	–	–	–	–	Not reported
^{90}Sr	–	–	0.2766	0.0019	–	–	–	–	–	–	Not reported
^{134}Cs	0.148	0.003	0.1954	0.0008	−24	2.2	4.3	Fail	Pass	Fail	Not accepted
^{137}Cs	0.239	0.004	0.3096	0.0019	−23	1.6	3.3	Fail	Pass	Fail	Not accepted

TABLE 15. LABORATORY CODE 5

Radio-nuclide	Lab value (Bq kg^{-1})	Lab uncert. (Bq kg^{-1})	IAEA value (Bq kg^{-1})	IAEA uncert. (Bq kg^{-1})	Relative bias (%)	P (%)	Trueness limit (%)	Accuracy	Precision	Trueness	Final score
^{3}H	–	–	3.11	0.06	–	–	–	–	–	–	Not reported
^{60}Co	0.178	0.022	0.1601	0.0006	11	12	35	Pass	Pass	Pass	Accepted
^{90}Sr	–	–	0.2733	0.0019	–	–	–	–	–	–	Not reported
^{134}Cs	0.219	0.021	0.1931	0.0008	13	9.6	28	Pass	Pass	Pass	Accepted
^{137}Cs	0.35	0.03	0.3059	0.0019	16	8.5	25	Pass	Pass	Pass	Accepted

TABLE 16. LABORATORY CODE 6

Radio-nuclide	Lab value (Bq kg^{-1})	Lab uncert. (Bq kg^{-1})	IAEA value (Bq kg^{-1})	IAEA uncert. (Bq kg^{-1})	Relative bias (%)	P (%)	Trueness limit (%)	Accuracy	Precision	Trueness	Final score
^{3}H	2.76	0.17	3.13	0.06	–12	6.5	15	Pass	Pass	Pass	Accepted
^{60}Co	0.159	0.017	0.1612	0.0006	–1	11	27	Pass	Pass	Pass	Accepted
^{90}Sr	0.289	0.007	0.2752	0.0019	5	2.4	6.5	Pass	Pass	Pass	Accepted
^{134}Cs	0.171	0.015	0.1945	0.0008	–12	8.8	20	Pass	Pass	Pass	Accepted
^{137}Cs	0.328	0.020	0.3081	0.0019	6	6.1	17	Pass	Pass	Pass	Accepted

TABLE 17. LABORATORY CODE 7

Radio-nuclide	Lab value (Bq kg^{-1})	Lab uncert. (Bq kg^{-1})	IAEA value (Bq kg^{-1})	IAEA uncert. (Bq kg^{-1})	Relative bias (%)	P (%)	Trueness limit (%)	Accuracy	Precision	Trueness	Final score
^{3}H	2.86	0.24	3.12	0.06	–8	8.6	20	Pass	Pass	Pass	Accepted
^{60}Co	–	–	0.1610	0.0006	–	–	–	–	–	–	Not reported
^{90}Sr	–	–	0.2748	0.0019	–	–	–	–	–	–	Not reported
^{134}Cs	–	–	0.1942	0.0008	–	–	–	–	–	–	Not reported
^{137}Cs	–	–	0.3076	0.0019	–	–	–	–	–	–	Not reported

TABLE 18. LABORATORY CODE 8

Radio-nuclide	Lab value (Bq kg^{-1})	Lab uncert. (Bq kg^{-1})	IAEA value (Bq kg^{-1})	IAEA uncert. (Bq kg^{-1})	Relative bias (%)	P (%)	Trueness limit (%)	Accuracy	Precision	Trueness	Final score
^{3}H	–	–	3.11	0.06	–	–	–	–	–	–	Not reported
^{60}Co	0.123	0.019	0.1601	0.0006	–23	16	31	Fail	Pass	Pass	Not accepted
^{90}Sr	–	–	0.2732	0.0019	–	–	–	–	–	–	Not reported
^{134}Cs	0.163	0.018	0.1931	0.0008	–16	11	24	Pass	Pass	Pass	Accepted
^{137}Cs	0.251	0.021	0.3059	0.0019	–18	8.3	18	Pass	Pass	Fail	Warning

TABLE 19. LABORATORY CODE 9

Radio-nuclide	Lab value (Bq kg^{-1})	Lab uncert. (Bq kg^{-1})	IAEA value (Bq kg^{-1})	IAEA uncert. (Bq kg^{-1})	Relative bias (%)	P (%)	Trueness limit (%)	Accuracy	Precision	Trueness	Final score
^{3}H	3.27	0.15	3.13	0.06	4	5.0	13	Pass	Pass	Pass	Accepted
^{60}Co	–	–	0.1616	0.0006	–	–	–	–	–	–	Not reported
^{90}Sr	–	–	0.2759	0.0019	–	–	–	–	–	–	Not reported
^{134}Cs	–	–	0.1949	0.0008	–	–	–	–	–	–	Not reported
^{137}Cs	–	–	0.3088	0.0019	–	–	–	–	–	–	Not reported

TABLE 20. LABORATORY CODE 10

Radio-nuclide	Lab value (Bq kg^{-1})	Lab uncert. (Bq kg^{-1})	IAEA value (Bq kg^{-1})	IAEA uncert. (Bq kg^{-1})	Relative bias (%)	P (%)	Trueness limit (%)	Accuracy	Precision	Trueness	Final score
^{3}H	–	–	3.11	0.06	–	–	–	–	–	–	Not reported
^{60}Co	0.155	0.017	0.1605	0.0006	–3	11	27	Pass	Pass	Pass	Accepted
^{90}Sr	–	–	0.2739	0.0019	–	–	–	–	–	–	Not reported
^{134}Cs	0.191	0.015	0.1935	0.0008	–1	7.8	20	Pass	Pass	Pass	Accepted
^{137}Cs	0.308	0.019	0.3066	0.0019	0	6.2	16	Pass	Pass	Pass	Accepted

TABLE 21. LABORATORY CODE 11

Radio-nuclide	Lab value (Bq kg^{-1})	Lab uncert. (Bq kg^{-1})	IAEA value (Bq kg^{-1})	IAEA uncert. (Bq kg^{-1})	Relative bias (%)	P (%)	Trueness limit (%)	Accuracy	Precision	Trueness	Final score
^{3}H	–	–	3.13	0.06	–	–	–	–	–	–	Not reported
^{60}Co	–	–	0.1616	0.0006	–	–	–	–	–	–	Not reported
^{90}Sr	–	–	0.2758	0.0019	–	–	–	–	–	–	Not reported
^{134}Cs	0.213	0.005	0.1949	0.0008	9	2.2	6.2	Pass	Pass	Fail	Warning
^{137}Cs	0.347	0.006	0.3087	0.0019	12	1.7	4.9	Pass	Pass	Fail	Warning

TABLE 22. LABORATORY CODE 12

Radio-nuclide	Lab value (Bq kg^{-1})	Lab uncert. (Bq kg^{-1})	IAEA value (Bq kg^{-1})	IAEA uncert. (Bq kg^{-1})	Relative bias (%)	P (%)	Trueness limit (%)	Accuracy	Precision	Trueness	Final score
^{3}H	3.10	0.15	3.12	0.06	–1	5.3	13	Pass	Pass	Pass	Accepted
^{60}Co	0.170	0.025	0.1607	0.0006	6	15	40	Pass	Pass	Pass	Accepted
^{90}Sr	0.288	0.015	0.2742	0.0019	5	5.3	14	Pass	Pass	Pass	Accepted
^{134}Cs	0.182	0.011	0.1938	0.0008	–6	6.1	15	Pass	Pass	Pass	Accepted
^{137}Cs	0.292	0.013	0.3070	0.0019	–5	4.5	11	Pass	Pass	Pass	Accepted

TABLE 23. LABORATORY CODE 13

Radio-nuclide	Lab value (Bq kg^{-1})	Lab uncert. (Bq kg^{-1})	IAEA value (Bq kg^{-1})	IAEA uncert. (Bq kg^{-1})	Relative bias (%)	P (%)	Trueness limit (%)	Accuracy	Precision	Trueness	Final score
^{3}H	–	–	3.13	0.06	–	–	–	–	–	–	Not reported
^{60}Co	0.148	0.013	0.1612	0.0006	–8	8.8	21	Pass	Pass	Pass	Accepted
^{90}Sr	–	–	0.2752	0.0019	–	–	–	–	–	–	Not reported
^{134}Cs	0.189	0.012	0.1944	0.0008	–3	6.3	16	Pass	Pass	Pass	Accepted
^{137}Cs	0.263	0.013	0.3080	0.0019	–15	4.8	11	Pass	Pass	Fail	Warning

TABLE 24. LABORATORY CODE 14

Radio-nuclide	Lab value (Bq kg^{-1})	Lab uncert. (Bq kg^{-1})	IAEA value (Bq kg^{-1})	IAEA uncert. (Bq kg^{-1})	Relative bias (%)	P (%)	Trueness limit (%)	Accuracy	Precision	Trueness	Final score
^{3}H	3.10	0.17	3.12	0.06	–1	5.9	15	Pass	Pass	Pass	Accepted
^{60}Co	0.160	0.019	0.1609	0.0006	–1	12	30	Pass	Pass	Pass	Accepted
^{90}Sr	0.283	0.017	0.2747	0.0019	3	6.0	16	Pass	Pass	Pass	Accepted
^{134}Cs	0.180	0.020	0.1941	0.0008	–7	11	27	Pass	Pass	Pass	Accepted
^{137}Cs	0.330	0.022	0.3075	0.0019	7	6.7	18	Pass	Pass	Pass	Accepted

TABLE 25. LABORATORY CODE 15

Radio-nuclide	Lab value (Bq kg^{-1})	Lab uncert. (Bq kg^{-1})	IAEA value (Bq kg^{-1})	IAEA uncert. (Bq kg^{-1})	Relative bias (%)	P (%)	Trueness limit (%)	Accuracy	Precision	Trueness	Final score
^{3}H	2.83	0.19	3.15	0.06	–10	7.1	17	Pass	Pass	Pass	Accepted
^{60}Co	0.178	0.013	0.1626	0.0006	9	7.3	21	Pass	Pass	Pass	Accepted
^{90}Sr	0.280	0.019	0.2776	0.0019	1	6.8	18	Pass	Pass	Pass	Accepted
^{134}Cs	0.217	0.015	0.1961	0.0008	11	6.9	20	Pass	Pass	Pass	Accepted
^{137}Cs	0.317	0.018	0.3107	0.0019	2	5.7	15	Pass	Pass	Pass	Accepted

TABLE 26. LABORATORY CODE 16

Radio-nuclide	Lab value (Bq kg^{-1})	Lab uncert. (Bq kg^{-1})	IAEA value (Bq kg^{-1})	IAEA uncert. (Bq kg^{-1})	Relative bias (%)	P (%)	Trueness limit (%)	Accuracy	Precision	Trueness	Final score
^{3}H	3.03	0.16	3.11	0.06	–3	5.6	14	Pass	Pass	Pass	Accepted
^{60}Co	0.161	0.009	0.1604	0.0006	0	5.6	14	Pass	Pass	Pass	Accepted
^{90}Sr	0.276	0.023	0.2737	0.0019	1	8.4	22	Pass	Pass	Pass	Accepted
^{134}Cs	0.196	0.009	0.1934	0.0008	1	4.6	12	Pass	Pass	Pass	Accepted
^{137}Cs	0.291	0.013	0.3064	0.0019	–5	4.5	11	Pass	Pass	Pass	Accepted

TABLE 27. LABORATORY CODE 17

Radio-nuclide	Lab value (Bq kg⁻¹)	Lab uncert. (Bq kg⁻¹)	IAEA value (Bq kg⁻¹)	IAEA uncert. (Bq kg⁻¹)	Relative bias (%)	P (%)	Trueness limit (%)	Accuracy	Precision	Trueness	Final score
^{3}H	–	–	3.13	0.06	–	–	–	–	–	–	Not reported
^{60}Co	0.171	0.005	0.1616	0.0007	6	3.0	8.2	Pass	Pass	Pass	Accepted
^{90}Sr	–	–	0.2758	0.0019	–	–	–	–	–	–	Not reported
^{134}Cs	0.199	0.005	0.1949	0.0008	2	2.3	6.2	Pass	Pass	Pass	Accepted
^{137}Cs	0.326	0.005	0.3087	0.0019	6	1.7	4.7	Pass	Pass	Fail	Warning

TABLE 28. LABORATORY CODE 18

Radio-nuclide	Lab value (Bq kg⁻¹)	Lab uncert. (Bq kg⁻¹)	IAEA value (Bq kg⁻¹)	IAEA uncert. (Bq kg⁻¹)	Relative bias (%)	P (%)	Trueness limit (%)	Accuracy	Precision	Trueness	Final score
^{3}H	–	–	3.12	0.06	–	–	–	–	–	–	Not reported
^{60}Co	0.156	0.021	0.1606	0.0006	–3	13	34	Pass	Pass	Pass	Accepted
^{90}Sr	–	–	0.2742	0.0019	–	–	–	–	–	–	Not reported
^{134}Cs	0.201	0.017	0.1937	0.0008	4	8.5	23	Pass	Pass	Pass	Accepted
^{137}Cs	0.380	0.019	0.3069	0.0019	24	5.0	16	Fail	Pass	Fail	Not accepted

TABLE 29. LABORATORY CODE 19

Radio-nuclide	Lab value (Bq kg^{-1})	Lab uncert. (Bq kg^{-1})	IAEA value (Bq kg^{-1})	IAEA uncert. (Bq kg^{-1})	Relative bias (%)	P (%)	Trueness limit (%)	Accuracy	Precision	Trueness	Final score
^{3}H	3.1	0.3	3.12	0.06	0	8.7	22	Pass	Pass	Pass	Accepted
^{60}Co	0.156	0.011	0.1611	0.0006	–3	7.2	18	Pass	Pass	Pass	Accepted
^{90}Sr	–	–	0.2750	0.0019	–	–	–	–	–	–	Not reported
^{134}Cs	0.181	0.010	0.1943	0.0008	–7	5.8	14	Pass	Pass	Pass	Accepted
^{137}Cs	0.325	0.015	0.3079	0.0019	6	4.7	13	Pass	Pass	Pass	Accepted

TABLE 30. LABORATORY CODE 20

Radio-nuclide	Lab value (Bq kg^{-1})	Lab uncert. (Bq kg^{-1})	IAEA value (Bq kg^{-1})	IAEA uncert. (Bq kg^{-1})	Relative bias (%)	P (%)	Trueness limit (%)	Accuracy	Precision	Trueness	Final score
^{3}H	–	–	3.12	0.06	–	–	–	–	–	–	Not reported
^{60}Co	–	–	0.1611	0.0006	–	–	–	–	–	–	Not reported
^{90}Sr	–	–	0.2750	0.0019	–	–	–	–	–	–	Not reported
^{134}Cs	0.215	0.011	0.1943	0.0008	11	5.0	14	Pass	Pass	Pass	Accepted
^{137}Cs	0.336	0.017	0.3078	0.0019	9	5.0	14	Pass	Pass	Pass	Accepted

TABLE 31. LABORATORY CODE 21

Radio-nuclide	Lab value (Bq kg^{-1})	Lab uncert. (Bq kg^{-1})	IAEA value (Bq kg^{-1})	IAEA uncert. (Bq kg^{-1})	Relative bias (%)	P (%)	Trueness limit (%)	Accuracy	Precision	Trueness	Final score
^{3}H	3.2	0.3	3.12	0.06	3	9.4	25	Pass	Pass	Pass	Accepted
^{60}Co	0.163	0.011	0.1607	0.0006	1	6.5	17	Pass	Pass	Pass	Accepted
^{90}Sr	0.275	0.019	0.2744	0.0019	0	7.0	18	Pass	Pass	Pass	Accepted
^{134}Cs	0.193	0.012	0.1939	0.0008	0	6.1	16	Pass	Pass	Pass	Accepted
^{137}Cs	0.290	0.017	0.3071	0.0019	−6	5.9	14	Pass	Pass	Pass	Accepted

TABLE 32. LABORATORY CODE 22

Radio-nuclide	Lab value (Bq kg^{-1})	Lab uncert. (Bq kg^{-1})	IAEA value (Bq kg^{-1})	IAEA uncert. (Bq kg^{-1})	Relative bias (%)	P (%)	Trueness limit (%)	Accuracy	Precision	Trueness	Final score
^{3}H	2.97	0.18	3.12	0.06	−5	6.4	16	Pass	Pass	Pass	Accepted
^{60}Co	0.156	0.019	0.1610	0.0006	−3	12	30	Pass	Pass	Pass	Accepted
^{90}Sr	0.240	0.016	0.2748	0.0019	−13	6.7	15	Pass	Pass	Pass	Accepted
^{134}Cs	0.164	0.017	0.1942	0.0008	−16	10	23	Pass	Pass	Pass	Accepted
^{137}Cs	0.302	0.021	0.3077	0.0019	−2	7.0	18	Pass	Pass	Pass	Accepted

TABLE 33. LABORATORY CODE 23

Radio-nuclide	Lab value (Bq kg^{-1})	Lab uncert. (Bq kg^{-1})	IAEA value (Bq kg^{-1})	IAEA uncert. (Bq kg^{-1})	Relative bias (%)	P (%)	Trueness limit (%)	Accuracy	Precision	Trueness	Final score
^{3}H	2.98	0.24	3.14	0.06	−5	8.4	21	Pass	Pass	Pass	Accepted
^{60}Co	0.163	0.014	0.1619	0.0007	1	8.6	22	Pass	Pass	Pass	Accepted
^{90}Sr	0.294	0.014	0.2764	0.0019	6	4.8	13	Pass	Pass	Pass	Accepted
^{134}Cs	0.189	0.017	0.1953	0.0008	−3	9.0	22	Pass	Pass	Pass	Accepted
^{137}Cs	0.310	0.021	0.3094	0.0019	0	6.8	18	Pass	Pass	Pass	Accepted

TABLE 34. LABORATORY CODE 24

Radio-nuclide	Lab value (Bq kg^{-1})	Lab uncert. (Bq kg^{-1})	IAEA value (Bq kg^{-1})	IAEA uncert. (Bq kg^{-1})	Relative bias (%)	P (%)	Trueness limit (%)	Accuracy	Precision	Trueness	Final score
^{3}H	−	−	3.13	0.06	−	−	−	−	−	−	Not reported
^{60}Co	0.176	0.015	0.1616	0.0006	9	8.6	24	Pass	Pass	Pass	Accepted
^{90}Sr	−	−	0.2757	0.0019	−	−	−	−	−	−	Not reported
^{134}Cs	0.189	0.015	0.1948	0.0008	−3	7.7	19	Pass	Pass	Pass	Accepted
^{137}Cs	0.31	0.03	0.3087	0.0019	0	9.0	23	Pass	Pass	Pass	Accepted

TABLE 35. LABORATORY CODE 25

Radio-nuclide	Lab value (Bq kg^{-1})	Lab uncert. (Bq kg^{-1})	IAEA value (Bq kg^{-1})	IAEA uncert. (Bq kg^{-1})	Relative bias (%)	P (%)	Trueness limit (%)	Accuracy	Precision	Trueness	Final score
^{3}H	3.0	0.3	3.16	0.06	−5	11	27	Pass	Pass	Pass	Accepted
^{60}Co	0.158	0.009	0.1629	0.0007	−3	5.7	14	Pass	Pass	Pass	Accepted
^{90}Sr	0.305	0.013	0.2780	0.0020	10	4.3	12	Pass	Pass	Pass	Accepted
^{134}Cs	0.183	0.011	0.1965	0.0008	−7	6.0	14	Pass	Pass	Pass	Accepted
^{137}Cs	0.293	0.022	0.3112	0.0019	−6	7.5	18	Pass	Pass	Pass	Accepted

TABLE 36. LABORATORY CODE 26

Radio-nuclide	Lab value (Bq kg^{-1})	Lab uncert. (Bq kg^{-1})	IAEA value (Bq kg^{-1})	IAEA uncert. (Bq kg^{-1})	Relative bias (%)	P (%)	Trueness limit (%)	Accuracy	Precision	Trueness	Final score
^{3}H	−	−	3.10	0.06	−	−	−	−	−	−	Not reported
^{60}Co	0.15	0.04	0.1597	0.0006	−6	27	65	Pass	Fail	Pass	Warning
^{90}Sr	−	−	0.2726	0.0019	−	−	−	−	−	−	Not reported
^{134}Cs	0.150	0.010	0.1926	0.0008	−22	6.7	13	Fail	Pass	Fail	Not accepted
^{137}Cs	0.290	0.020	0.3052	0.0019	−5	6.9	17	Pass	Pass	Pass	Accepted

TABLE 37. LABORATORY CODE 27

Radio-nuclide	Lab value (Bq kg^{-1})	Lab uncert. (Bq kg^{-1})	IAEA value (Bq kg^{-1})	IAEA uncert. (Bq kg^{-1})	Relative bias (%)	P (%)	Trueness limit (%)	Accuracy	Precision	Trueness	Final score
^{3}H	2.5	0.4	3.12	0.06	−20	16	33	Pass	Pass	Pass	Accepted
^{60}Co	0.160	0.015	0.1610	0.0006	−1	9.4	24	Pass	Pass	Pass	Accepted
^{90}Sr	–	–	0.2749	0.0019	–	–	–	–	–	–	Not reported
^{134}Cs	0.211	0.015	0.1942	0.0008	9	7.1	20	Pass	Pass	Pass	Accepted
^{137}Cs	0.332	0.023	0.3077	0.0019	8	7.0	19	Pass	Pass	Pass	Accepted

TABLE 38. LABORATORY CODE 28

Radio-nuclide	Lab value (Bq kg^{-1})	Lab uncert. (Bq kg^{-1})	IAEA value (Bq kg^{-1})	IAEA uncert. (Bq kg^{-1})	Relative bias (%)	P (%)	Trueness limit (%)	Accuracy	Precision	Trueness	Final score
^{3}H	–	–	3.12	0.06	–	–	–	–	–	–	Not reported
^{60}Co	0.177	0.023	0.1611	0.0006	10	13	37	Pass	Pass	Pass	Accepted
^{90}Sr	–	–	0.2749	0.0019	–	–	–	–	–	–	Not reported
^{134}Cs	0.21	0.03	0.1943	0.0008	7	13	36	Pass	Pass	Pass	Accepted
^{137}Cs	0.40	0.04	0.3078	0.0019	31	9.4	32	Fail	Pass	Pass	Not accepted

TABLE 39. LABORATORY CODE 29

Radio-nuclide	Lab value (Bq kg^{-1})	Lab uncert. (Bq kg^{-1})	IAEA value (Bq kg^{-1})	IAEA uncert. (Bq kg^{-1})	Relative bias (%)	P (%)	Trueness limit (%)	Accuracy	Precision	Trueness	Final score
^{3}H	3.2	0.9	3.13	0.06	1	28	74	Pass	Fail	Pass	Warning
^{60}Co	0.168	0.015	0.1615	0.0006	4	8.7	23	Pass	Pass	Pass	Accepted
^{90}Sr	–	–	0.2756	0.0019	–	–	–	–	–	–	Not reported
^{134}Cs	0.194	0.015	0.1947	0.0008	–1	8.0	20	Pass	Pass	Pass	Accepted
^{137}Cs	0.322	0.024	0.3085	0.0019	4	7.3	20	Pass	Pass	Pass	Accepted

TABLE 40. LABORATORY CODE 30

Radio-nuclide	Lab value (Bq kg^{-1})	Lab uncert. (Bq kg^{-1})	IAEA value (Bq kg^{-1})	IAEA uncert. (Bq kg^{-1})	Relative bias (%)	P (%)	Trueness limit (%)	Accuracy	Precision	Trueness	Final score
^{3}H	3.20	0.06	3.12	0.06	3	2.8	7.2	Pass	Pass	Pass	Accepted
^{60}Co	0.153	0.014	0.1610	0.0006	–5	9.2	22	Pass	Pass	Pass	Accepted
^{90}Sr	–	–	0.2748	0.0019	–	–	–	–	–	–	Not reported
^{134}Cs	0.170	0.008	0.1941	0.0008	–12	4.7	11	Pass	Pass	Fail	Warning
^{137}Cs	0.303	0.021	0.3076	0.0019	–1	7.0	18	Pass	Pass	Pass	Accepted

TABLE 41. LABORATORY CODE 31

Radio-nuclide	Lab value (Bq kg^{-1})	Lab uncert. (Bq kg^{-1})	IAEA value (Bq kg^{-1})	IAEA uncert. (Bq kg^{-1})	Relative bias (%)	P (%)	Trueness limit (%)	Accuracy	Precision	Trueness	Final score
^{3}H	3.7	0.7	3.14	0.06	17	18	55	Pass	Pass	Pass	Accepted
^{60}Co	0.19	0.03	0.1620	0.0007	17	14	43	Pass	Pass	Pass	Accepted
^{90}Sr	0.241	0.017	0.2765	0.0019	−13	7.1	16	Pass	Pass	Pass	Accepted
^{134}Cs	0.145	0.022	0.1954	0.0008	−26	15	29	Fail	Pass	Pass	Not accepted
^{137}Cs	0.28	0.03	0.3095	0.0019	−11	10	23	Pass	Pass	Pass	Accepted

TABLE 42. LABORATORY CODE 32

Radio-nuclide	Lab value (Bq kg^{-1})	Lab uncert. (Bq kg^{-1})	IAEA value (Bq kg^{-1})	IAEA uncert. (Bq kg^{-1})	Relative bias (%)	P (%)	Trueness limit (%)	Accuracy	Precision	Trueness	Final score
^{3}H	2.5	0.7	3.12	0.06	−20	27	56	Pass	Fail	Pass	Warning
^{60}Co	0.089	0.011	0.1608	0.0006	−45	12	18	Fail	Pass	Fail	Not accepted
^{90}Sr	–	–	0.2745	0.0019	–	–	–	–	–	–	Not reported
^{134}Cs	0.197	0.014	0.1940	0.0008	2	7.1	19	Pass	Pass	Pass	Accepted
^{137}Cs	0.309	0.020	0.3073	0.0019	1	6.5	17	Pass	Pass	Pass	Accepted

TABLE 43. LABORATORY CODE 33

Radio-nuclide	Lab value (Bq kg⁻¹)	Lab uncert. (Bq kg⁻¹)	IAEA value (Bq kg⁻¹)	IAEA uncert. (Bq kg⁻¹)	Relative bias (%)	P (%)	Trueness limit (%)	Accuracy	Precision	Trueness	Final score
^{3}H	3.28	0.10	3.10	0.06	6	3.7	10	Pass	Pass	Pass	Accepted
^{60}Co	0.163	0.011	0.1600	0.0006	2	6.9	18	Pass	Pass	Pass	Accepted
^{90}Sr	0.238	0.014	0.2731	0.0019	−13	5.9	13	Pass	Pass	Pass	Accepted
^{134}Cs	0.188	0.010	0.1929	0.0008	−3	5.4	14	Pass	Pass	Pass	Accepted
^{137}Cs	0.289	0.016	0.3057	0.0019	−5	5.7	14	Pass	Pass	Pass	Accepted

TABLE 44. LABORATORY CODE 34

Radio-nuclide	Lab value (Bq kg⁻¹)	Lab uncert. (Bq kg⁻¹)	IAEA value (Bq kg⁻¹)	IAEA uncert. (Bq kg⁻¹)	Relative bias (%)	P (%)	Trueness limit (%)	Accuracy	Precision	Trueness	Final score
^{3}H	<5.5	–	3.13	0.06	–	–	–	–	–	–	Not evaluated
^{60}Co	0.161	0.012	0.1616	0.0006	0	7.5	19	Pass	Pass	Pass	Accepted
^{90}Sr	0.159	0.012	0.2758	0.0019	−42	7.6	11	Fail	Pass	Fail	Not accepted
^{134}Cs	0.189	0.014	0.1949	0.0008	−3	7.4	19	Pass	Pass	Pass	Accepted
^{137}Cs	0.310	0.025	0.3088	0.0019	0	8.1	21	Pass	Pass	Pass	Accepted

TABLE 45. LABORATORY CODE 35

Radio-nuclide	Lab value (Bq kg^{-1})	Lab uncert. (Bq kg^{-1})	IAEA value (Bq kg^{-1})	IAEA uncert. (Bq kg^{-1})	Relative bias (%)	P (%)	Trueness limit (%)	Accuracy	Precision	Trueness	Final score
^{3}H	2.9	0.4	3.12	0.06	–8	13	32	Pass	Pass	Pass	Accepted
^{60}Co	0.184	0.012	0.1608	0.0006	14	6.5	19	Pass	Pass	Pass	Accepted
^{90}Sr	0.304	0.018	0.2744	0.0019	11	6.0	17	Pass	Pass	Pass	Accepted
^{134}Cs	0.157	0.012	0.1939	0.0008	–19	7.7	16	Pass	Pass	Fail	Warning
^{137}Cs	0.360	0.020	0.3072	0.0019	17	5.6	17	Pass	Pass	Fail	Warning

TABLE 46. LABORATORY CODE 36

Radio-nuclide	Lab value (Bq kg^{-1})	Lab uncert. (Bq kg^{-1})	IAEA value (Bq kg^{-1})	IAEA uncert. (Bq kg^{-1})	Relative bias (%)	P (%)	Trueness limit (%)	Accuracy	Precision	Trueness	Final score
^{3}H	3.9	0.8	3.14	0.06	24	21	66	Pass	Pass	Pass	Accepted
^{60}Co	0.163	0.011	0.1618	0.0007	1	6.8	18	Pass	Pass	Pass	Accepted
^{90}Sr	0.281	0.018	0.2762	0.0019	2	6.4	17	Pass	Pass	Pass	Accepted
^{134}Cs	0.160	0.009	0.1951	0.0008	–18	5.6	12	Pass	Pass	Fail	Warning
^{137}Cs	0.289	0.018	0.3091	0.0019	–7	6.3	15	Pass	Pass	Pass	Accepted

TABLE 47. LABORATORY CODE 37

Radio-nuclide	Lab value (Bq kg⁻¹)	Lab uncert. (Bq kg⁻¹)	IAEA value (Bq kg⁻¹)	IAEA uncert. (Bq kg⁻¹)	Relative bias (%)	P (%)	Trueness limit (%)	Accuracy	Precision	Trueness	Final score
^{3}H	–	–	3.11	0.06	–	–	–	–	–	–	Not reported
^{60}Co	0.170	0.010	0.1605	0.0006	6	5.9	16	Pass	Pass	Pass	Accepted
^{90}Sr	0.230	0.020	0.2740	0.0019	−16	8.7	19	Pass	Pass	Pass	Accepted
^{134}Cs	0.200	0.010	0.1936	0.0008	3	5.0	13	Pass	Pass	Pass	Accepted
^{137}Cs	0.280	0.020	0.3068	0.0019	−9	7.2	17	Pass	Pass	Pass	Accepted

TABLE 48. LABORATORY CODE 38

Radio-nuclide	Lab value (Bq kg⁻¹)	Lab uncert. (Bq kg⁻¹)	IAEA value (Bq kg⁻¹)	IAEA uncert. (Bq kg⁻¹)	Relative bias (%)	P (%)	Trueness limit (%)	Accuracy	Precision	Trueness	Final score
^{3}H	–	–	3.12	0.06	–	–	–	–	–	–	Not reported
^{60}Co	0.223	0.016	0.1606	0.0006	39	7.2	26	Fail	Pass	Fail	Not accepted
^{90}Sr	0.31	0.04	0.2742	0.0019	11	12	35	Pass	Pass	Pass	Accepted
^{134}Cs	0.207	0.015	0.1937	0.0008	7	7.3	20	Pass	Pass	Pass	Accepted
^{137}Cs	0.304	0.022	0.3070	0.0019	−1	7.3	19	Pass	Pass	Pass	Accepted

TABLE 49. LABORATORY CODE 39

Radio-nuclide	Lab value (Bq kg^{-1})	Lab uncert. (Bq kg^{-1})	IAEA value (Bq kg^{-1})	IAEA uncert. (Bq kg^{-1})	Relative bias (%)	P (%)	Trueness limit (%)	Accuracy	Precision	Trueness	Final score
^{3}H	–	–	3.13	0.06	–	–	–	–	–	–	Not reported
^{60}Co	0.150	0.013	0.1613	0.0006	–7	8.5	20	Pass	Pass	Pass	Accepted
^{90}Sr	0.276	0.016	0.2754	0.0019	0	6.0	15	Pass	Pass	Pass	Accepted
^{134}Cs	0.173	0.014	0.1946	0.0008	–11	8.2	19	Pass	Pass	Pass	Accepted
^{137}Cs	0.298	0.017	0.3082	0.0019	–3	5.6	14	Pass	Pass	Pass	Accepted

TABLE 50. LABORATORY CODE 40

Radio-nuclide	Lab value (Bq kg^{-1})	Lab uncert. (Bq kg^{-1})	IAEA value (Bq kg^{-1})	IAEA uncert. (Bq kg^{-1})	Relative bias (%)	P (%)	Trueness limit (%)	Accuracy	Precision	Trueness	Final score
^{3}H	–	–	3.12	0.06	–	–	–	–	–	–	Not reported
^{60}Co	0.09	0.07	0.1610	0.0006	–47	76	104	Fail	Fail	Pass	Not accepted
^{90}Sr	–	–	0.2748	0.0019	–	–	–	–	–	–	Not reported
^{134}Cs	0.11	0.06	0.1942	0.0008	–42	49	73	Fail	Fail	Pass	Not accepted
^{137}Cs	0.17	0.05	0.3076	0.0019	–46	32	44	Fail	Fail	Fail	Not accepted

TABLE 51. LABORATORY CODE 41

Radio-nuclide	Lab value (Bq kg⁻¹)	Lab uncert. (Bq kg⁻¹)	IAEA value (Bq kg⁻¹)	IAEA uncert. (Bq kg⁻¹)	Relative bias (%)	P (%)	Trueness limit (%)	Accuracy	Precision	Trueness	Final score
^{3}H	3.1	0.5	3.12	0.06	−1	17	43	Pass	Pass	Pass	Accepted
^{60}Co	0.159	0.014	0.1608	0.0006	−1	8.8	22	Pass	Pass	Pass	Accepted
^{90}Sr	0.272	0.017	0.2744	0.0019	−1	6.3	16	Pass	Pass	Pass	Accepted
^{134}Cs	0.182	0.017	0.1939	0.0008	−6	9.3	23	Pass	Pass	Pass	Accepted
^{137}Cs	0.32	0.03	0.3072	0.0019	3	8.6	23	Pass	Pass	Pass	Accepted

TABLE 52. LABORATORY CODE 42

Radio-nuclide	Lab value (Bq kg⁻¹)	Lab uncert. (Bq kg⁻¹)	IAEA value (Bq kg⁻¹)	IAEA uncert. (Bq kg⁻¹)	Relative bias (%)	P (%)	Trueness limit (%)	Accuracy	Precision	Trueness	Final score
^{3}H	4.3	0.7	3.13	0.06	36	16	57	Fail	Pass	Pass	Not accepted
^{60}Co	0.099	0.021	0.1616	0.0006	−39	21	34	Fail	Fail	Fail	Not accepted
^{90}Sr	0.249	0.009	0.2757	0.0019	−10	3.8	8.8	Pass	Pass	Fail	Warning
^{134}Cs	0.180	0.025	0.1948	0.0008	−8	14	33	Pass	Pass	Pass	Accepted
^{137}Cs	0.315	0.024	0.3087	0.0019	2	7.6	20	Pass	Pass	Pass	Accepted

TABLE 53. LABORATORY CODE 43

Radio-nuclide	Lab value (Bq kg^{-1})	Lab uncert. (Bq kg^{-1})	IAEA value (Bq kg^{-1})	IAEA uncert. (Bq kg^{-1})	Relative bias (%)	P (%)	Trueness limit (%)	Accuracy	Precision	Trueness	Final score
^{3}H	–	–	3.15	0.06	–	–	–	–	–	–	Not reported
^{60}Co	0.138	0.008	0.1623	0.0007	–15	5.8	13	Pass	Pass	Fail	Warning
^{90}Sr	0.26	0.03	0.2770	0.0019	–5	13	32	Pass	Pass	Pass	Accepted
^{134}Cs	0.181	0.017	0.1957	0.0008	–8	9.4	22	Pass	Pass	Pass	Accepted
^{134}Cs	0.190	0.011	0.1957	0.0008	–3	5.8	15	Pass	Pass	Pass	Accepted
^{137}Cs	0.294	0.024	0.3101	0.0019	–5	8.2	20	Pass	Pass	Pass	Accepted
^{137}Cs	0.307	0.019	0.3101	0.0019	–1	6.2	16	Pass	Pass	Pass	Accepted

TABLE 54. LABORATORY CODE 44

Radio-nuclide	Lab value (Bq kg^{-1})	Lab uncert. (Bq kg^{-1})	IAEA value (Bq kg^{-1})	IAEA uncert. (Bq kg^{-1})	Relative bias (%)	P (%)	Trueness limit (%)	Accuracy	Precision	Trueness	Final score
^{3}H	–	–	3.13	0.06	–	–	–	–	–	–	Not reported
^{60}Co	–	–	0.1612	0.0006	–	–	–	–	–	–	Not reported
^{90}Sr	–	–	0.2752	0.0019	–	–	–	–	–	–	Not reported
^{134}Cs	0.1200	0.0012	0.1945	0.0008	–38	1.1	1.9	Fail	Pass	Fail	Not accepted
^{137}Cs	–	–	0.3081	0.0019	–	–	–	–	–	–	Not reported

TABLE 55. LABORATORY CODE 45

Radio-nuclide	Lab value (Bq kg⁻¹)	Lab uncert. (Bq kg⁻¹)	IAEA value (Bq kg⁻¹)	IAEA uncert. (Bq kg⁻¹)	Relative bias (%)	P (%)	Trueness limit (%)	Accuracy	Precision	Trueness	Final score
^{3}H	–	–	3.13	0.06	–	–	–	–	–	–	Not reported
^{60}Co	–	–	0.1613	0.0006	–	–	–	–	–	–	Not reported
^{90}Sr	–	–	0.2754	0.0019	–	–	–	–	–	–	Not reported
^{134}Cs	0.35	0.05	0.1946	0.0008	80	14	66	Fail	Pass	Fail	Not accepted
^{137}Cs	0.43	0.06	0.3083	0.0019	39	14	50	Fail	Pass	Pass	Not accepted

TABLE 56. LABORATORY CODE 46

Radio-nuclide	Lab value (Bq kg⁻¹)	Lab uncert. (Bq kg⁻¹)	IAEA value (Bq kg⁻¹)	IAEA uncert. (Bq kg⁻¹)	Relative bias (%)	P (%)	Trueness limit (%)	Accuracy	Precision	Trueness	Final score
^{3}H	–	–	3.11	0.06	–	–	–	–	–	–	Not reported
^{60}Co	–	–	0.1603	0.0006	–	–	–	–	–	–	Not reported
^{90}Sr	–	–	0.2736	0.0019	–	–	–	–	–	–	Not reported
^{134}Cs	–	–	0.1933	0.0008	–	–	–	–	–	–	Not reported
^{137}Cs	<11	–	0.3063	0.0019	–	–	–	–	–	–	Not evaluated

TABLE 57. LABORATORY CODE 47

Radio-nuclide	Lab value (Bq kg^{-1})	Lab uncert. (Bq kg^{-1})	IAEA value (Bq kg^{-1})	IAEA uncert. (Bq kg^{-1})	Relative bias (%)	P (%)	Trueness limit (%)	Accuracy	Precision	Trueness	Final score
^{3}H	–	–	3.10	0.06	–	–	–	–	–	–	Not reported
^{60}Co	0.23	0.04	0.1597	0.0006	46	15	57	Fail	Pass	Pass	Not accepted
^{90}Sr	–	–	0.2726	0.0019	–	–	–	–	–	–	Not reported
^{134}Cs	0.28	0.03	0.1926	0.0008	44	12	44	Fail	Pass	Pass	Not accepted
^{137}Cs	0.40	0.04	0.3052	0.0019	33	9.3	32	Fail	Pass	Fail	Not accepted

TABLE 58. LABORATORY CODE 48

Radio-nuclide	Lab value (Bq kg^{-1})	Lab uncert. (Bq kg^{-1})	IAEA value (Bq kg^{-1})	IAEA uncert. (Bq kg^{-1})	Relative bias (%)	P (%)	Trueness limit (%)	Accuracy	Precision	Trueness	Final score
^{3}H	–	–	3.09	0.06	–	–	–	–	–	–	Not reported
^{60}Co	24	3	0.1594	0.0006	14671	13	4815	Fail	Pass	Fail	Not accepted
^{90}Sr	–	–	0.2721	0.0019	–	–	–	–	–	–	Not reported
^{134}Cs	1.16	0.14	0.1923	0.0008	503	12	188	Fail	Pass	Fail	Not accepted
^{137}Cs	1.82	0.22	0.3047	0.0019	497	12	186	Fail	Pass	Fail	Not accepted

TABLE 59. LABORATORY CODE 49

Radio-nuclide	Lab value (Bq kg^{-1})	Lab uncert. (Bq kg^{-1})	IAEA value (Bq kg^{-1})	IAEA uncert. (Bq kg^{-1})	Relative bias (%)	P (%)	Trueness limit (%)	Accuracy	Precision	Trueness	Final score
^{3}H	–	–	3.13	0.06	–	–	–	–	–	–	Not reported
^{60}Co	0.150	0.020	0.1612	0.0006	–7	13	32	Pass	Pass	Pass	Accepted
^{90}Sr	–	–	0.2751	0.0019	–	–	–	–	–	–	Not reported
^{134}Cs	0.22	0.03	0.1944	0.0008	13	14	40	Pass	Pass	Pass	Accepted
^{137}Cs	0.25	0.03	0.3080	0.0019	–19	12	25	Pass	Pass	Pass	Accepted

TABLE 60. LABORATORY CODE 50

Radio-nuclide	Lab value (Bq kg^{-1})	Lab uncert. (Bq kg^{-1})	IAEA value (Bq kg^{-1})	IAEA uncert. (Bq kg^{-1})	Relative bias (%)	P (%)	Trueness limit (%)	Accuracy	Precision	Trueness	Final score
^{3}H	<0.007	–	3.14	0.06	–	–	–	–	–	–	Not evaluated
^{60}Co	0.25	0.09	0.1618	0.0007	57	36	146	Fail	Fail	Pass	Not accepted
^{90}Sr	–	–	0.2762	0.0019	–	–	–	–	–	–	Not reported
^{134}Cs	0.17	0.03	0.1952	0.0008	–13	20	44	Pass	Pass	Pass	Accepted
^{137}Cs	0.42	0.07	0.3092	0.0019	36	17	61	Fail	Pass	Pass	Not accepted

TABLE 61. LABORATORY CODE 51

Radio-nuclide	Lab value (Bq kg⁻¹)	Lab uncert. (Bq kg⁻¹)	IAEA value (Bq kg⁻¹)	IAEA uncert. (Bq kg⁻¹)	Relative bias (%)	P (%)	Trueness limit (%)	Accuracy	Precision	Trueness	Final score
^{3}H	–	–	3.14	0.06	–	–	–	–	–	–	Not reported
^{60}Co	0.23	0.10	0.1618	0.0007	43	43	159	Fail	Fail	Pass	Not accepted
^{90}Sr	–	–	0.2761	0.0019	–	–	–	–	–	–	Not reported
^{134}Cs	0.23	0.20	0.1951	0.0008	19	86	264	Pass	Fail	Pass	Warning
^{137}Cs	0.28	0.20	0.3091	0.0019	–10	72	167	Pass	Fail	Pass	Warning

TABLE 62. LABORATORY CODE 52

Radio-nuclide	Lab value (Bq kg⁻¹)	Lab uncert. (Bq kg⁻¹)	IAEA value (Bq kg⁻¹)	IAEA uncert. (Bq kg⁻¹)	Relative bias (%)	P (%)	Trueness limit (%)	Accuracy	Precision	Trueness	Final score
^{3}H	–	–	3.11	0.06	–	–	–	–	–	–	Not reported
^{60}Co	0.075	0.010	0.1604	0.0006	–53	13	16	Fail	Pass	Fail	Not accepted
^{90}Sr	–	–	0.2737	0.0019	–	–	–	–	–	–	Not reported
^{134}Cs	0.048	0.007	0.1934	0.0008	–75	14	9.0	Fail	Pass	Fail	Not accepted
^{137}Cs	0.073	0.017	0.3064	0.0019	–76	24	15	Fail	Fail	Fail	Not accepted

TABLE 63. LABORATORY CODE 53

Radio-nuclide	Lab value (Bq kg^{-1})	Lab uncert. (Bq kg^{-1})	IAEA value (Bq kg^{-1})	IAEA uncert. (Bq kg^{-1})	Relative bias (%)	P (%)	Trueness limit (%)	Accuracy	Precision	Trueness	Final score
^{3}H	–	–	3.10	0.06	–	–	–	–	–	–	Not reported
^{60}Co	0.23	0.07	0.1600	0.0006	47	29	109	Fail	Fail	Pass	Not accepted
^{90}Sr	–	–	0.2730	0.0019	–	–	–	–	–	–	Not reported
^{134}Cs	–	–	0.1929	0.0008	–	–	–	–	–	–	Not reported
^{137}Cs	0.32	0.09	0.3057	0.0019	5	28	75	Pass	Fail	Pass	Warning

TABLE 64. LABORATORY CODE 54

Radio-nuclide	Lab value (Bq kg^{-1})	Lab uncert. (Bq kg^{-1})	IAEA value (Bq kg^{-1})	IAEA uncert. (Bq kg^{-1})	Relative bias (%)	P (%)	Trueness limit (%)	Accuracy	Precision	Trueness	Final score
^{3}H	–	–	3.12	0.06	–	–	–	–	–	–	Not reported
^{60}Co	0.19	0.04	0.1609	0.0006	15	19	58	Pass	Pass	Pass	Accepted
^{90}Sr	–	–	0.2746	0.0019	–	–	–	–	–	–	Not reported
^{134}Cs	0.18	0.03	0.1940	0.0008	–6	18	44	Pass	Pass	Pass	Accepted
^{137}Cs	0.26	0.04	0.3074	0.0019	–15	14	30	Pass	Pass	Pass	Accepted

TABLE 65. LABORATORY CODE 55

Radio-nuclide	Lab value (Bq kg^{-1})	Lab uncert. (Bq kg^{-1})	IAEA value (Bq kg^{-1})	IAEA uncert. (Bq kg^{-1})	Relative bias (%)	P (%)	Trueness limit (%)	Accuracy	Precision	Trueness	Final score
^{3}H	–	–	3.14	0.06	–	–	–	–	–	–	Not reported
^{60}Co	<0.29	–	0.1619	0.0007	–	–	–	–	–	–	Not evaluated
^{90}Sr	–	–	0.2763	0.0019	–	–	–	–	–	–	Not reported
^{134}Cs	<0.28	–	0.1952	0.0008	–	–	–	–	–	–	Not evaluated
^{137}Cs	<0.4	–	0.3093	0.0019	–	–	–	–	–	–	Not evaluated

TABLE 66. LABORATORY CODE 56

Radio-nuclide	Lab value (Bq kg^{-1})	Lab uncert. (Bq kg^{-1})	IAEA value (Bq kg^{-1})	IAEA uncert. (Bq kg^{-1})	Relative bias (%)	P (%)	Trueness limit (%)	Accuracy	Precision	Trueness	Final score
^{3}H	4.3	0.5	3.15	0.06	37	12	41	Fail	Pass	Pass	Not accepted
^{60}Co	0.180	0.010	0.1623	0.0007	11	5.6	16	Pass	Pass	Pass	Accepted
^{90}Sr	0.32	0.04	0.2771	0.0019	16	13	37	Pass	Pass	Pass	Accepted
^{134}Cs	0.180	0.010	0.1958	0.0008	–8	5.6	13	Pass	Pass	Pass	Accepted
^{137}Cs	0.320	0.020	0.3101	0.0019	3	6.3	17	Pass	Pass	Pass	Accepted

TABLE 67. LABORATORY CODE 57

Radio-nuclide	Lab value (Bq kg^{-1})	Lab uncert. (Bq kg^{-1})	IAEA value (Bq kg^{-1})	IAEA uncert. (Bq kg^{-1})	Relative bias (%)	P (%)	Trueness limit (%)	Accuracy	Precision	Trueness	Final score
^{3}H	–	–	3.13	0.06	–	–	–	–	–	–	Not reported
^{60}Co	0.145	0.012	0.1612	0.0006	–10	8.3	19	Pass	Pass	Pass	Accepted
^{90}Sr	–	–	0.2751	0.0019	–	–	–	–	–	–	Not reported
^{134}Cs	0.163	0.013	0.1944	0.0008	–16	8.0	17	Pass	Pass	Pass	Accepted
^{137}Cs	0.280	0.020	0.3080	0.0019	–9	7.2	17	Pass	Pass	Pass	Accepted

TABLE 68. LABORATORY CODE 58

Radio-nuclide	Lab value (Bq kg^{-1})	Lab uncert. (Bq kg^{-1})	IAEA value (Bq kg^{-1})	IAEA uncert. (Bq kg^{-1})	Relative bias (%)	P (%)	Trueness limit (%)	Accuracy	Precision	Trueness	Final score
^{3}H	–	–	3.14	0.06	–	–	–	–	–	–	Not reported
^{60}Co	0.195	0.017	0.1620	0.0007	20	8.7	27	Fail	Pass	Pass	Not accepted
^{90}Sr	–	–	0.2764	0.0019	–	–	–	–	–	–	Not reported
^{134}Cs	0.217	0.014	0.1953	0.0008	11	6.5	18	Pass	Pass	Pass	Accepted
^{137}Cs	0.307	0.015	0.3095	0.0019	–1	4.9	13	Pass	Pass	Pass	Accepted

TABLE 69. LABORATORY CODE 59

Radio-nuclide	Lab value (Bq kg^{-1})	Lab uncert. (Bq kg^{-1})	IAEA value (Bq kg^{-1})	IAEA uncert. (Bq kg^{-1})	Relative bias (%)	P (%)	Trueness limit (%)	Accuracy	Precision	Trueness	Final score
^{3}H	1.20	0.17	3.12	0.06	−61	14	15	Fail	Pass	Fail	Not accepted
^{60}Co	0.160	0.020	0.1606	0.0006	0	13	32	Pass	Pass	Pass	Accepted
^{90}Sr	–	–	0.2741	0.0019	–	–	–	–	–	–	Not reported
^{134}Cs	0.190	0.020	0.1937	0.0008	−2	11	27	Pass	Pass	Pass	Accepted
^{137}Cs	0.302	0.022	0.3069	0.0019	−2	7.3	19	Pass	Pass	Pass	Accepted

TABLE 70. LABORATORY CODE 60

Radio-nuclide	Lab value (Bq kg^{-1})	Lab uncert. (Bq kg^{-1})	IAEA value (Bq kg^{-1})	IAEA uncert. (Bq kg^{-1})	Relative bias (%)	P (%)	Trueness limit (%)	Accuracy	Precision	Trueness	Final score
^{3}H	2.95	0.18	3.11	0.06	−5	6.4	16	Pass	Pass	Pass	Accepted
^{60}Co	0.041	0.017	0.1602	0.0006	−74	41	27	Fail	Fail	Fail	Not accepted
^{90}Sr	0.0022	0.0005	0.2735	0.0019	−99	23	1.9	Fail	Pass	Fail	Not accepted
^{134}Cs	0.046	0.015	0.1933	0.0008	−76	33	20	Fail	Fail	Fail	Not accepted
^{137}Cs	0.25	0.06	0.3062	0.0019	−19	23	49	Pass	Fail	Pass	Warning

TABLE 71. LABORATORY CODE 61

Radio-nuclide	Lab value (Bq kg⁻¹)	Lab uncert. (Bq kg⁻¹)	IAEA value (Bq kg⁻¹)	IAEA uncert. (Bq kg⁻¹)	Relative bias (%)	P (%)	Trueness limit (%)	Accuracy	Precision	Trueness	Final score
^{3}H	–	–	3.16	0.06	–	–	–	–	–	–	Not reported
^{60}Co	0.170	0.019	0.1629	0.0007	4	11	30	Pass	Pass	Pass	Accepted
^{90}Sr	–	–	0.2780	0.0020	–	–	–	–	–	–	Not reported
^{134}Cs	0.190	0.018	0.1964	0.0008	–3	9.5	24	Pass	Pass	Pass	Accepted
^{137}Cs	0.315	0.024	0.3112	0.0019	1	7.6	20	Pass	Pass	Pass	Accepted

TABLE 72. LABORATORY CODE 62

Radio-nuclide	Lab value (Bq kg⁻¹)	Lab uncert. (Bq kg⁻¹)	IAEA value (Bq kg⁻¹)	IAEA uncert. (Bq kg⁻¹)	Relative bias (%)	P (%)	Trueness limit (%)	Accuracy	Precision	Trueness	Final score
^{3}H	–	–	3.13	0.06	–	–	–	–	–	–	Not reported
^{60}Co	0.210	0.020	0.1616	0.0006	30	9.5	32	Fail	Pass	Pass	Not accepted
^{90}Sr	0.286	0.012	0.2759	0.0019	4	4.2	11	Pass	Pass	Pass	Accepted
^{134}Cs	0.210	0.010	0.1949	0.0008	8	4.8	13	Pass	Pass	Pass	Accepted
^{137}Cs	0.310	0.010	0.3088	0.0019	0	3.3	8.5	Pass	Pass	Pass	Accepted

TABLE 73. LABORATORY CODE 63

Radio-nuclide	Lab value (Bq kg^{-1})	Lab uncert. (Bq kg^{-1})	IAEA value (Bq kg^{-1})	IAEA uncert. (Bq kg^{-1})	Relative bias (%)	P (%)	Trueness limit (%)	Accuracy	Precision	Trueness	Final score
^{3}H	2.45	0.16	3.12	0.06	−22	6.7	13	Pass	Pass	Fail	Warning
^{60}Co	0.180	0.018	0.1610	0.0006	12	10	29	Pass	Pass	Pass	Accepted
^{90}Sr	0.222	0.015	0.2748	0.0019	−19	6.8	14	Pass	Pass	Fail	Warning
^{134}Cs	0.183	0.019	0.1941	0.0008	−6	10	25	Pass	Pass	Pass	Accepted
^{137}Cs	0.31	0.03	0.3076	0.0019	2	10	27	Pass	Pass	Pass	Accepted

TABLE 74. LABORATORY CODE 64

Radio-nuclide	Lab value (Bq kg^{-1})	Lab uncert. (Bq kg^{-1})	IAEA value (Bq kg^{-1})	IAEA uncert. (Bq kg^{-1})	Relative bias (%)	P (%)	Trueness limit (%)	Accuracy	Precision	Trueness	Final score
^{3}H	–	–	3.12	0.06	–	–	–	–	–	–	Not reported
^{60}Co	0.073	0.025	0.1610	0.0006	−55	35	40	Fail	Fail	Fail	Not accepted
^{90}Sr	–	–	0.2747	0.0019	–	–	–	–	–	–	Not reported
^{134}Cs	–	–	0.1941	0.0008	–	–	–	–	–	–	Not reported
^{137}Cs	0.107	0.018	0.3075	0.0019	−65	17	15	Fail	Pass	Fail	Not accepted

TABLE 75. LABORATORY CODE 65

Radio-nuclide	Lab value (Bq kg^{-1})	Lab uncert. (Bq kg^{-1})	IAEA value (Bq kg^{-1})	IAEA uncert. (Bq kg^{-1})	Relative bias (%)	P (%)	Trueness limit (%)	Accuracy	Precision	Trueness	Final score
^{3}H	–	–	3.15	0.06	–	–	–	–	–	–	Not reported
^{60}Co	0.165	0.013	0.1626	0.0007	1	7.9	21	Pass	Pass	Pass	Accepted
^{90}Sr	–	–	0.2776	0.0019	–	–	–	–	–	–	Not reported
^{134}Cs	0.196	0.012	0.1961	0.0008	0	6.1	16	Pass	Pass	Pass	Accepted
^{137}Cs	0.313	0.021	0.3107	0.0019	1	6.7	17	Pass	Pass	Pass	Accepted

TABLE 76. LABORATORY CODE 66

Radio-nuclide	Lab value (Bq kg^{-1})	Lab uncert. (Bq kg^{-1})	IAEA value (Bq kg^{-1})	IAEA uncert. (Bq kg^{-1})	Relative bias (%)	P (%)	Trueness limit (%)	Accuracy	Precision	Trueness	Final score
^{3}H	4.8	0.4	3.12	0.06	53	8.8	34	Fail	Pass	Fail	Not accepted
^{60}Co	0.173	0.019	0.1609	0.0006	8	11	30	Pass	Pass	Pass	Accepted
^{90}Sr	0.32	0.04	0.2746	0.0019	15	12	37	Pass	Pass	Pass	Accepted
^{134}Cs	0.193	0.019	0.1940	0.0008	–1	9.9	25	Pass	Pass	Pass	Accepted
^{137}Cs	0.335	0.024	0.3074	0.0019	9	7.2	20	Pass	Pass	Pass	Accepted

TABLE 77. LABORATORY CODE 67

Radio-nuclide	Lab value (Bq kg^{-1})	Lab uncert. (Bq kg^{-1})	IAEA value (Bq kg^{-1})	IAEA uncert. (Bq kg^{-1})	Relative bias (%)	P (%)	Trueness limit (%)	Accuracy	Precision	Trueness	Final score
^{3}H	2.80	0.20	3.12	0.06	–10	7.4	17	Pass	Pass	Pass	Accepted
^{60}Co	–	–	0.1608	0.0006	–	–	–	–	–	–	Not reported
^{90}Sr	0.260	0.020	0.2744	0.0019	–5	7.7	19	Pass	Pass	Pass	Accepted
^{134}Cs	–	–	0.1939	0.0008	–	–	–	–	–	–	Not reported
^{137}Cs	–	–	0.3072	0.0019	–	–	–	–	–	–	Not reported

TABLE 78. LABORATORY CODE 68

Radio-nuclide	Lab value (Bq kg^{-1})	Lab uncert. (Bq kg^{-1})	IAEA value (Bq kg^{-1})	IAEA uncert. (Bq kg^{-1})	Relative bias (%)	P (%)	Trueness limit (%)	Accuracy	Precision	Trueness	Final score
^{3}H	3.90	0.12	3.10	0.06	26	3.7	11	Fail	Pass	Fail	Not accepted
^{60}Co	0.23	0.03	0.1598	0.0006	44	12	45	Fail	Pass	Pass	Not accepted
^{90}Sr	–	–	0.2727	0.0019	–	–	–	–	–	–	Not reported
^{134}Cs	0.23	0.03	0.1927	0.0008	18	12	37	Pass	Pass	Pass	Accepted
^{137}Cs	0.33	0.03	0.3053	0.0019	9	9.9	28	Pass	Pass	Pass	Accepted

TABLE 79. LABORATORY CODE 69

Radio-nuclide	Lab value (Bq kg^{-1})	Lab uncert. (Bq kg^{-1})	IAEA value (Bq kg^{-1})	IAEA uncert. (Bq kg^{-1})	Relative bias (%)	P (%)	Trueness limit (%)	Accuracy	Precision	Trueness	Final score
^{3}H	–	–	3.15	0.06	–	–	–	–	–	–	Not reported
^{60}Co	–	–	0.1627	0.0007	–	–	–	–	–	–	Not reported
^{90}Sr	0.21	0.03	0.2777	0.0020	–25	15	28	Fail	Pass	Pass	Not accepted
^{134}Cs	0.183	0.010	0.1963	0.0008	–7	5.5	13	Pass	Pass	Pass	Accepted
^{137}Cs	0.299	0.014	0.3109	0.0019	–4	4.7	12	Pass	Pass	Pass	Accepted

TABLE 80. LABORATORY CODE 70

Radio-nuclide	Lab value (Bq kg^{-1})	Lab uncert. (Bq kg^{-1})	IAEA value (Bq kg^{-1})	IAEA uncert. (Bq kg^{-1})	Relative bias (%)	P (%)	Trueness limit (%)	Accuracy	Precision	Trueness	Final score
^{3}H	2.9	0.4	3.13	0.06	–7	14	33	Pass	Pass	Pass	Accepted
^{60}Co	0.180	0.010	0.1614	0.0006	11	5.6	16	Pass	Pass	Pass	Accepted
^{90}Sr	0.33	0.04	0.2756	0.0019	20	12	37	Pass	Pass	Pass	Accepted
^{134}Cs	0.190	0.010	0.1947	0.0008	–2	5.3	13	Pass	Pass	Pass	Accepted
^{137}Cs	0.330	0.020	0.3085	0.0019	7	6.1	17	Pass	Pass	Pass	Accepted

TABLE 81. LABORATORY CODE 71

Radio-nuclide	Lab value (Bq kg^{-1})	Lab uncert. (Bq kg^{-1})	IAEA value (Bq kg^{-1})	IAEA uncert. (Bq kg^{-1})	Relative bias (%)	P (%)	Trueness limit (%)	Accuracy	Precision	Trueness	Final score
^{3}H	–	–	3.11	0.06	–	–	–	–	–	–	Not reported
^{60}Co	–	–	0.1605	0.0006	–	–	–	–	–	–	Not reported
^{90}Sr	0.42	0.04	0.2739	0.0019	53	9.5	38	Fail	Pass	Fail	Not accepted
^{134}Cs	0.190	0.007	0.1936	0.0008	–2	3.7	9.4	Pass	Pass	Pass	Accepted
^{137}Cs	0.328	0.011	0.3067	0.0019	7	3.4	9.4	Pass	Pass	Pass	Accepted

TABLE 82. LABORATORY CODE 72

Radio-nuclide	Lab value (Bq kg^{-1})	Lab uncert. (Bq kg^{-1})	IAEA value (Bq kg^{-1})	IAEA uncert. (Bq kg^{-1})	Relative bias (%)	P (%)	Trueness limit (%)	Accuracy	Precision	Trueness	Final score
^{3}H	5.1	1.5	3.14	0.06	63	29	123	Fail	Fail	Pass	Not accepted
^{60}Co	0.112	0.017	0.1618	0.0007	–31	15	27	Fail	Pass	Fail	Not accepted
^{90}Sr	0.13	0.03	0.2761	0.0019	–53	20	24	Fail	Pass	Fail	Not accepted
^{134}Cs	0.15	0.03	0.1951	0.0008	–21	19	38	Fail	Pass	Pass	Not accepted
^{137}Cs	0.30	0.05	0.3091	0.0019	–2	15	38	Pass	Pass	Pass	Accepted

TABLE 83. LABORATORY CODE 73

Radio-nuclide	Lab value (Bq kg^{-1})	Lab uncert. (Bq kg^{-1})	IAEA value (Bq kg^{-1})	IAEA uncert. (Bq kg^{-1})	Relative bias (%)	P (%)	Trueness limit (%)	Accuracy	Precision	Trueness	Final score
^{3}H	3.4	0.3	3.12	0.06	9	9.3	26	Pass	Pass	Pass	Accepted
^{60}Co	0.151	0.008	0.1611	0.0006	−6	5.2	13	Pass	Pass	Pass	Accepted
^{90}Sr	0.230	0.010	0.2751	0.0019	−16	4.4	10	Pass	Pass	Fail	Warning
^{134}Cs	0.258	0.007	0.1944	0.0008	33	2.7	9.3	Fail	Pass	Fail	Not accepted
^{137}Cs	0.131	0.005	0.3079	0.0019	−57	4.0	4.6	Fail	Pass	Fail	Not accepted

TABLE 84. LABORATORY CODE 74

Radio-nuclide	Lab value (Bq kg^{-1})	Lab uncert. (Bq kg^{-1})	IAEA value (Bq kg^{-1})	IAEA uncert. (Bq kg^{-1})	Relative bias (%)	P (%)	Trueness limit (%)	Accuracy	Precision	Trueness	Final score
^{3}H	–	–	3.13	0.06	–	–	–	–	–	–	Not reported
^{60}Co	0.175	0.012	0.1614	0.0006	8	6.9	19	Pass	Pass	Pass	Accepted
^{90}Sr	–	–	0.2755	0.0019	–	–	–	–	–	–	Not reported
^{134}Cs	0.192	0.008	0.1947	0.0008	−1	4.2	11	Pass	Pass	Pass	Accepted
^{137}Cs	0.309	0.015	0.3084	0.0019	0	4.9	13	Pass	Pass	Pass	Accepted

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