



Laboratory: Inspectorate for Ionising Radiation, Radiová 1, 102 00 Prague 10
Laboratory of Spectrometry, tel. +420 266 020 497, fax. +420 266 020 466

TECHNICAL PROTOCOL OF BILATERAL INTERCOMPARISON

9011-PT-GEO01/2011

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Participant 1: Czech Metrology Institute (CMI), Radiová 1, CZ-102 00 Prague 10 , Czech Republic
(piloting laboratory)

Measuring instrument: Germanium spectrometer: HPGe detector GC4018 Canberra S/N b 03085, DSP 9660 Canberra, AIM 556A Canberra, evaluation software Genie 2000 Canberra. Spectrometer is traceable to the Czech national standard of activity of radionuclides. Spectrometer is used as secondary standard for measurement of activity of radionuclides.

Participant 2: Georgian National Agency for Standards, Technical Regulations and Metrology (LEPL), 67 Chargali str. 0141, Tbilisi, Georgia

Measuring instrument: Germanium spectrometer: HPGe detector GC4018 Canberra S/N 12973916, InSpector Canberra, evaluation software Genie 2000. Spectrometer is used as secondary standard for measurement of activity of radionuclides.

The results of the calibration have been obtained following the procedures reported in this Certificate and are related only to the date, place and conditions of the calibration.

Date of comparison: February 21 to 25, 2011

Place of comparison: Czech Metrology Institute – Inspectorate for Ionising Radiation,
Laboratory of Spectrometry, Radiová 1, CZ-102 00 Prague 10

Performed by:

Ing. Petr Kovář

Head of the Department:

RNDr. Pavel Dryák, CSc.

Dr. Simon Sukhishvili

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Measurement standards used: EFS Am No. 856-03, EFS Eu No. 1139-04, EFS Ba No. 1138005, EFS Cs No. 954-02, MBSS No. 1265021, MBSS No. 1314002, MBSS No. 679-07

Procedure: The comparison was performed using standards traceable to the Czech national standard of activity of radionuclides. Both participants measured activity of radionuclides Am-241 (59,5 keV), Ba-133 (81 keV, 355 keV), Cs-137 (661 keV), Eu-152 (121 keV, 344 keV, 778 keV, 964 keV, 1408 keV), Ra-226 and Th-228 in measurement geometries Marinelli beakers 500 ml and 1000 ml and point source 3 cm, 10 cm and 25 cm from the detector using their own measuring instruments and determined the mean value and the uncertainty using their own measuring procedures and uncertainty budgets. Measurements were performed under the same ambient conditions.

Differences in the values determined by both participants were then evaluated using the following formula:

$$e = \frac{|A_1 - A_2|}{\sqrt{(u_1^2 + u_2^2)}}, \quad \text{where}$$

A_1, A_2 are the mean activity values of individual participants 1 and 2, u_1, u_2 are the expanded ($k=2$) combined uncertainties of stated values.

Ambient conditions: Air pressure: 981 to 989 hPa
Ambient temperature: 21.0 to 22.0 °C
Relative humidity: 28 to 32 %

Uncertainty budget: Participant 1

Spectrometer GC4018, S/N b 03085		
source of uncertainty	u_B (%)	u_A (%)
detection efficiency	1.5 to 2.0	
net peak area	0.2	0.3
photon yield		0.1 to 0.3
expanded combined uncertainty u_1 ($k=2$)	1.6 to 2.1	

Participant 2

Spectrometer GC4018, S/N 12973916		
source of uncertainty	u_B (%)	u_A (%)
detection efficiency	2.0 to 3.0	
net peak area	0.2	0.3
yield		0.1 to 0.3
expanded combined uncertainty u_2 ($k=2$)	2.1 to 3.1	

Measured and evaluated data:

nuclide	A ₂ [Bq]	u ₂ [%]	u ₂ [Bq]	A ₁ [Bq]	u ₁ [%]	u ₁ [Bq]	A ₂ -A ₁ [Bq]	e
Am-241	85077	3.1	2637	85510	2.1	1796	433	0.14
Eu-152	41600	2.9	1206	42050	2.0	841	450	0.31
Cs-137	62653	2.1	1316	62750	1.6	1004	97	0.06
Ba-133	267630	2.4	6423	269246	2.0	5385	1616	0.19
Ra-226	157	2.5	3.9	158	2.1	3.3	1	0.20
Th-228	150	2.5	3.8	151	2.1	3.2	1	0.20

Criterion:

The measurement results of the participants are considered equivalent, if the value of **e** is in the range of 0 to 1.

Result of comparison:

Based on the evaluation of measured data of both participants it was found, that the measured results of both participants are equivalent.

End of the protocol.

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