GammaUser 2014 Intercomparison Exercise

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ICELANDIC RADIATION SAFETY AUTHORITY

Overview

- Participants
- Exercise I
- Exercise II
- Exercise III

Participants

- 40 registered participants
  - 16 registered in intercomparison
    - 12 „Yes, all“
    - 8 requested samples sent
  - 5 reported for the results for sent sampes
  - 2 reports on spectra 1
  - 1 report on spectra 2

Exercise I (spectrum 1)

- Sample was a glass fiber air filter in a polystyrene beaker
- Distributed spectra in .chn and .phd
  - Background spectrum
  - Calibration spectrum
  - Sample spectrum
- Geometry specified for calibration and for sample
- Detector: HPGe, p-type, coaxial
- Coincidence summing correction
- Number of reports: 2 labs

Exercise I
reference value

- Not the „truth“ but best estimate.
- Radionuclides (by mass number):
  - Be-7, K-40, Zr-95, Nb-95, Zr-97, Nb-97, Tc-99m, Mo-99, Ru-103, Rh-105, Ru-106, Te-132, I-131, I-132, I-133, Cs-134, Cs-136, Cs-137, Ba-140, La-140, Ce-141, Ce-143, Ce-144, Nd-147, U-237, Np-239
- Top 12 radionuclides (by activity in Bq/m3)
  - Np-239 (9.61E-03), La-140 (4.95E-03), K-40 (2.94E-03), Mo-99 (1.84E-03), Tc-99m (1.72E-03), I-132 (1.66E-03), Te-132 (1.65E-03), I-133 (1.41E-03), Ru-103 (1.35E-03), Nb-95 (1.17E-03), Ba-140 (1.11E-03), Be-7 (1.10E-03)

Exercise I Results:

Nuclide	Reference value	Lab 3 [Bq/m3]	Lab 5 [Bq/m3]
Be-7	1.10E-03	1,04E-03	1,71E-03
K-40	2.94E-03	2,83E-03	2,44E-03
Cr-51		3,23E-04	
Nb-95	1.17E-03	1,32E-03	1,02E-02
Zr-95	8.71E-04	7,25E-04	4,41E-03
Nb-97	5.30E-04	3,26E-04	
Zr-97	7.27E-04		
Mo-99	1.84E-03	4,69E-04	6,03E-04
Tc-99m	1.72E-03	2,49E-03	
Ru-103	1.35E-03	1,31E-03	1,58E-02
Rh-105	9.65E-04		
Ru-106	6.91E-04	5,15E-04	
Cd-109		1,77E-04	3,14E-05

Nuclide	Reference value	Lab 3 [Bq/m3]	Lab 5 [Bq/m3]
I-131	8.72E-04	7,01E-04	3,94E-04
I-132	1.66E-03	1,01E-02	1,17E-03
Te-132	1.65E-03	1,34E-03	
I-133	1.41E-03	1,50E-04	7,90E-04
Xe-133		7,81E-04	2,83E-03
Cs-134	2.50E-04	2,02E-04	5,95E-04
Cs-136	5.86E-05	3,44E-05	
Cs-137	3.78E-04	4,48E-04	3,56E-03
Ba-140	1.11E-03	8,95E-04	7,80E-04
La-140	4.95E-03	8,06E-04	1,46E-03
Ce-141	8.05E-04	8,04E-04	1,16E-02
Ce-143	6.77E-04		
Ce-144	8.00E-04	6,91E-04	
Nd-147	1.70E-04		
Eu-152		2,13E-04	
Tl-208		1,70E-04	
Bi-212		2,16E-04	
Pb-212		1,01E-04	
Pb-214		1,41E-04	
U-237	3.80E-04		
Np-239	9.61E-03		7,80E-03
Am-241		1,61E-04	5,52E-04

Exercise II (spectrum 2)

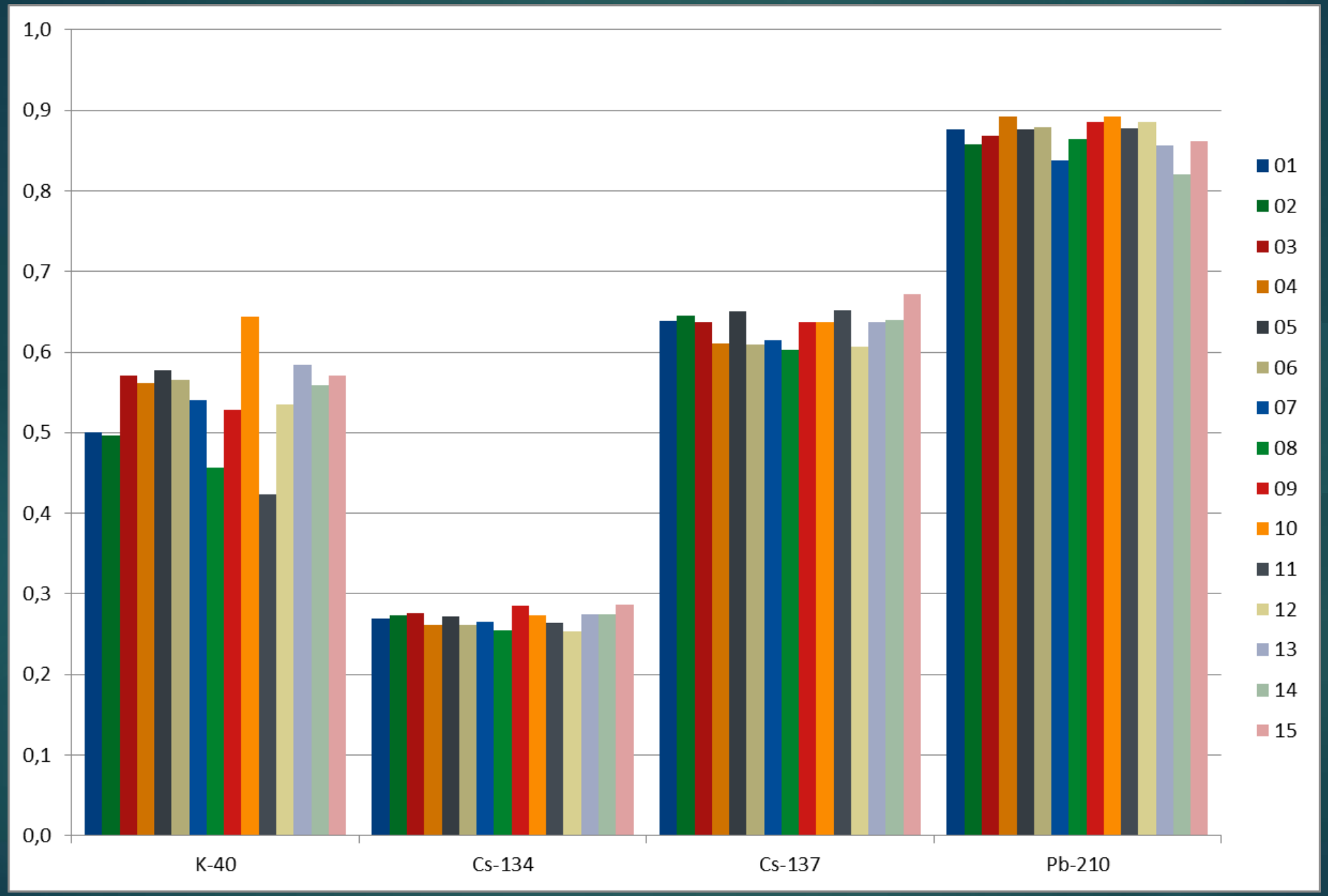
- Sample was of unknown origin,
- Distributed spectra in .chn
- Detector: HPGe, p-type, coaxial
- Reference analysis found:
  - Th-227, Pb-211, Ra-223, Rn-219, Bi-211, Po-215, Bi-214, Tl-207, K-40, Bi-212a
- Number of reports: 1 lab
- Results:
  - K-40, Bi-211, Pb-211, Ra-223, Rn-219, Th-227, Tl-207
- Sample is Ac-227, most likely artficially produced.

Exercise III (physical sample)

- Physical samples
  - cut up in 15 pieces, measured, analysed and shipped to participants
- Number of reports: 5 labs

Reference value

	weight	height	K-40	unc. (1σ)		Cs-134	unc. (1σ)		Cs-137	unc. (1σ)		Pb-210	unc. (1σ)	
Sample	[g]	[mm]	Bq/g	rel.	abs.	Bq/g	rel.	abs.	Bq/g	rel.	abs.	Bq/g	rel.	abs.
01	2,015	7	0,500	9	0,045	0,269	5	0,013	0,638	4	0,026	0,876	8	0,070
02	2,014	7	0,496	8	0,040	0,274	5	0,014	0,645	4	0,026	0,857	8	0,069
03	2,016	7	0,571	8	0,046	0,276	5	0,014	0,638	4	0,026	0,868	8	0,069
04	2,015	7	0,562	7	0,039	0,261	5	0,013	0,611	4	0,024	0,892	7	0,062
05	2,015	7	0,577	6	0,035	0,272	5	0,014	0,651	4	0,026	0,876	7	0,061
06	2,016	7	0,566	8	0,045	0,262	5	0,013	0,609	4	0,024	0,878	8	0,070
07	2,015	7	0,540	8	0,043	0,265	5	0,013	0,614	4	0,025	0,838	8	0,067
08	2,015	7	0,457	9	0,041	0,255	5	0,013	0,603	4	0,024	0,864	8	0,069
09	2,014	7	0,528	9	0,047	0,286	5	0,014	0,637	5	0,032	0,885	8	0,071
10	2,016	7	0,644	7	0,045	0,274	5	0,014	0,637	4	0,025	0,892	7	0,062
11	2,014	7	0,423	10	0,042	0,265	5	0,013	0,652	4	0,026	0,878	8	0,070
12	2,015	7	0,535	7	0,037	0,253	5	0,013	0,607	4	0,024	0,885	7	0,062
13	2,015	7	0,584	8	0,047	0,275	5	0,014	0,637	4	0,025	0,856	8	0,068
14	2,016	7	0,558	8	0,045	0,274	4	0,011	0,640	4	0,026	0,820	8	0,066
15	2,015	7	0,570	4	0,023	0,286	5	0,014	0,671	4	0,027	0,862	8	0,069


1,0
0,9
0,8
0,7
0,6
0,5
0,4
0,3
0,2
0,1
0,0
K-40
Cs-134
Cs-137
Pb-210
01
02
03
04
05
06
07
08
09
10
11
12
13
14
15

Execise III, results

Lab 3 (sample 10)	Reference			measurement			Ratio
K-40 [Bq/g]	0,644	±	0,045	0,596	±		-8%
Cs-134 [Bq/g]	0,2737	±	0,014	0,295	±		8%
Cs-137 [Bq/g]	0,637	±	0,025	0,736	±		16%
Pb-210 [Bq/g]	0,892	±	0,062	0,101	±		-89%
Also found Pb212, Pb214 and Bi 214							

Lab 1 (sample ?)	Reference			measurement			Ratio
K-40 [Bq/g]	0,553	±	0,049	0,496	±	0,038	-10%
Cs-134 [Bq/g]	0,274	±	0,006	0,278	±	0,004	1%
Cs-137 [Bq/g]	0,636	±	0,009	0,609	±	0,009	-4%
Pb-210 [Bq/g]	0,862	±	0,024	1,083	±	0,097	26%
Also found Pb212, Pb214 and Bi 214							

Lab 4 (sample 14)	Reference			measurement			Ratio
K-40 [Bq/g]	0,558	±	0,045	0,420	±		-25%
Cs-134 [Bq/g]	0,2739	±	0,011	0,250	±		-9%
Cs-137 [Bq/g]	0,640	±	0,026	0,590	±		-8%
Pb-210 [Bq/g]	0,820	±	0,066	0,800	±		-2%
Also found Tl-208,Pb-212, Ac-228, Th-234							

Lab 2 (sample 9)	Reference			measurement			Ratio
K-40 [Bq/g]	0,528	±	0,047	0,805	±	0,071	53%
Cs-134 [Bq/g]	0,2857	±	0,014	0,168	±	0,005	-41%
Cs-137 [Bq/g]	0,637	±	0,032	0,721	±	0,019	13%
Pb-210 [Bq/g]	0,885	±	0,071	0,786	±	0,041	-11%
Also found Pb212, Pb214 and Bi 214							

Lab 5 (sample 13)	Reference			measurement			Ratio
K-40 [Bq/g]	0,584	±	0,068	DNQ	±		
Cs-134 [Bq/g]	0,2749	±	0,068	0,348	±	0,008	26%
Cs-137 [Bq/g]	0,637	±	0,068	0,329	±	0,036	-48%
Pb-210 [Bq/g]	0,856	±	0,068	DNQ	±		