Proposals for future CCRI(II) key comparisons of activity

P.J. Allisy-Roberts, G. Ratel and C. Michotte, BIPM

Introduction

A questionnaire was circulated to CCRI(II) Members on 16 March inviting the selection of radionuclides from twenty-four proposed which could be of possible interest for future CCRI(II) activity comparisons. The radionuclides proposed included some for medical use, some of environmental interest and some in use for spectrometer calibration.

At the same time, it was noted that the comparisons of ^{89}Sr and ^{238}Pu were in progress and the results of the latter comparison are now awaited. In addition it was reported that the Working Group for the ^{204}Tl comparison were considering a new trial comparison for this radionuclide once the experimental work was completed, to be followed by a new key comparison once the trial comparison produced consistent results across the different methods.

Results

Responses to the questionnaire have been received from 15 NMIs and Table 1 shows these NMIs' interests. Six radionuclides received support from at least 50 % of the Membership of CCRI(II).

The eight radionuclides which received the strongest support are shown in Table 2 as a shortlist for discussion at the CCRI(II) meeting in May. In this table, the primary measurement methods commonly used to measure the activity of each radionuclide are indicated, together with some challenges which the absolute activity measurements present. Some comments are also made on the additional benefits of the particular selection.

The questionnaire also produced some comment from the NMIs and a discussion paper from the NPL is included in the meeting papers.

Conclusion

Three CCRI(II) key comparisons have been made during the last 2 years, ^{152}Eu, ^{89}Sr and ^{238}Pu. The results of the ^{152}Eu and ^{89}Sr comparisons are being communicated to the participants and will be presented at the ICRM and CCRI(II) meetings. The CCRI(II) is invited to decide how many CCRI(II) key comparisons it can make over the next two years. The BIPM is prepared to act as the pilot laboratory for not more than four comparisons during this period.

In view of the selection of radionuclides made by the CCRI(II) Members, it is proposed that the choice for key comparisons to be made in the immediate future be taken from the radionuclides shown in Table 2. During the discussion of the choice, the half-life and the availability of the radionuclides also need to be considered.

Table 1 Radionuclides of possible interest for future CCRI(II) activity comparisons

Nuclide	Half life	Reason	SIR	Recent CC comp.	NMIs interest	Votes
^{32}P	14.3 d	Medical use			AIST, BIPM, CIEMAT, ENEA, IRMM, KRISS, NIST, NPL, RC	9
^{54}Mn	312. d	Ge calibration	Yes		ANSTO, CSIR, ENEA, IRMM, KRISS, LNHB, NIST, OMH, RC	9
^{60}Co	1926. d	Ge calibration	Yes		ANSTO, NIST	2
^{65}Zn	244. d	Ge calibration	Yes		CSIR, ENEA, KRISS, LNHB, NIST, NPL, OMH, RC	8
^{67}Ga	3.26 d	Medical use	Yes		ANSTO, CIEMAT, CSIR, IRD, IRK, NPL	6
^{85}Sr	64.8 d	Ge calibration	Yes		AIST, CSIR, ENEA, IRD, IRK, KRISS, NIST, OMH, RC	9
^{88}Y	107. d	Ge calibration	Yes		CSIR, ENEA, IRK, IRMM, NIST, OMH	6
^{99}Tc^{m}	6.01 h	Medical use	Yes		ANSTO, CIEMAT, ENEA, IRD, NPL	5
^{109}Cd	463. d	Ge calibration	Yes	1986	IRD, NIST	2
^{111}In	2.80 d	Medical use	Yes		**AIST**, BIPM, CIEMAT, ENEA, IRD, IRMM, NPL	7+
^{113}Sn	115. d	Ge calibration	Yes		AIST, BIPM, IRK, KRISS, LNHB	5
^{123}I	13.2 h	Medical use	Yes		**ANSTO**, ENEA, IRD, IRMM, NPL	5+
^{125}I	59.4 d	Medical use	Yes	1988	BIPM, CIEMAT, LNHB, OMH	4
^{137}Cs	11.0×10^{3} d	Ge calibration	Yes	1982	ANSTO, IRMM	2
^{139}Ce	138. d	Ge calibration	Yes		CSIR, KRISS, LNHB, NIST, OMH, RC	6
^{153}Sm	1.93 d	Medical use	Yes		ANSTO, IRD, LNHB, NIST, NPL	5
^{177}Lu	6.65 d	Medical use	Yes		IRK, IRMM, **LNHB**	3+
^{186}Re	3.72 d	Medical use			AIST, ENEA, IRK,IRMM, LNHB, NPL	6
^{192}Ir	74.0 d	Medical use	Yes		ANSTO, CIEMAT, CSIR, IRD, IRK, IRMM, KRISS, OMH	8
^{201}Tl	3.04 d	Medical use	Yes		AIST, ANSTO, BIPM, CIEMAT, CSIR, LNHB, NPL	7
^{203}Hg	46.6 d	Ge calibration	Yes		AIST, CSIR, IRD, IRK, KRISS, OMH	6
^{228}Th	698. d	environmental	Yes		CIEMAT, IRK, NIST, NPL	4
^{235}U	7.04×10^{8} a	environmental			CIEMAT, ENEA, IRMM, KRISS, OMH	5
^{241}Am	1.58×10^{5} d	Ge calibration	Yes		AIST, ANSTO, CIEMAT, CSIR, IRD, IRK, KRISS, LNHB, OMH, RC	10

Table 2 Shortlist of radionuclides for future CCRI(II) key comparisons

Nuclide	Half life / d	NMIs interest	Application	SIR entries / withdrawn	Primary measurement methods	Challenges	Comments
^{241}Am	1.58×10^5	10	Ge calibration	9	$4\pi\alpha$(PC or LS) $-\gamma$ coinc.; $4\pi\alpha$(PC or LS)		Extended SIR ?
^{32}P	14.3	9	Medical use	-	$4\pi\beta$(PC or LS) $-\gamma$ coinc. with tracer; $4\pi\beta$(LS)		SIR β effic. curve Extended SIR ? Measurement of $T_{1/2}$
^{54}Mn	312.	9	Ge calibration	23 / 3	4π (x,e_A)(PC or LS) $-\gamma$ coinc.; 4π (x,e_A) LS	Low-energy x rays LS calculations for EC	
^{85}Sr	64.8	9	Ge calibration	18	4π (x,e_A)(PC or LS) $-\gamma$ coinc.; 4π (x,e_A) LS	1 µs metastable state LS calculations for EC	Measurement of p_γ
^{65}Zn	244.	8	Ge calibration	13	4π (x,e_A)(PC or LS) $-\gamma$ coinc.; 4π (x,e_A) LS	Low-energy x rays LS calculations for EC Weak β^+ branch	Measurement of p_γ
^{192}Ir	74.0	8	Medical use	11	$4\pi\beta$(PC) $-\gamma$ coinc.; $4\pi\gamma$ (well-NaI); $4\pi\beta$(PC) – $4\pi\gamma$ coinc.; $4\pi\beta\gamma$ (CsI); $4\pi\beta$(LS)	Complex decay-scheme	Dispersion of 0.7 % in the trial comp.
^{111}In	2.80	7+	Medical use	8 / 1	4π (x,e_A)(PC or LS) $-\gamma$ coinc.; 4π (x,e_A) LS; γ–γ coinc.; sum peak	Short half life LS calculations for EC	^{114}In^m impurity
^{201}Tl	3.04	7	Medical use	10 / 1	4π (x,e_A)(PC or LS) $-\gamma$ coinc.; 4π (x,e_A) LS	Short half life LS calculations for EC	^{202}Tl impurity Meas. of p_γ and $T_{1/2}$
^{88}Y	107.	6	Ge calibration	24 / 1	4π (x,e_A)(PC or LS) $-\gamma$ coinc.; 4π (x,e_A) LS; γ–γ coinc.; sum peak	LS calculations for EC	Measurement of p_γ
^{139}Ce	138.	6	Ge calibration	16 / 1	4π (x,e_A)(PC or LS) $-\gamma$ coinc.; 4π (x,e_A) LS	LS calculations for EC	
^{203}Hg	46.6	6	Ge calibration	12 / 1	$4\pi\beta$(PC or LS) $-\gamma$ coinc.; $4\pi\beta$(LS)		