IAEA CRP

REFERENCE DATA BASE FOR NEUTRON ACTIVATION ANALYSIS

2nd CRM MAY 2007

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(k0 and related nuclear data)

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REFERENCE DATABASE FOR NEUTRON ACTIVATION ANALYSIS

An IAEA Nuclear Data Section Co-ordinated Research Project 2005-2009

Project Officer: Mark A. Kellett

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Tasks from the 1st RCM: 3 - 5 October 2005

Participant	Date	Task	Status
Gamma spectrum peak evaluation test			
Menno Blaauw	11 July 2006	Coordinate activity.	
	5 Dec 2005	Provide standard spectra for purpose to participants.	
All participants	30 Apr 2006	Submit results to coordinator.	FDC: done
Menno Blaauw	Next RCM	Summarize contributions.	

Spectrum	name		ac_now11-	[ac_now11-AC02]					
Spectrum	Type		ID						
Number	of		channels	4096					
Collection	start		38894	0,603137					
Collection	end		38894	0,612859					
Truetime		840	sec						
Livetime		763	sec						
Use program:						**Use program:**			
hyperlab						**Hypermet**			
Energy	Energy unc		Area	Area unc		Energy	Energy unc	Area	Area unc
66,701	0,269		4825	413		66,708	0,034	3945	134
68,493	0,259		6694	409		68,553	0,02	7722	170
77,584	0,256		3581	113		77,708	0,03	3471	108
79,989	0,265		958	94		80,021	0,083	1101	87
121,825	0,247		32163	220	Eu-152	121,934	0,02	30947	712
245,912	0,222		13132	135	Eu-152	245,994	0,015	13180	145
252,67	0,346		188	68	Eu-152	252,833	0,264	211	66
297,225	0,243		480	71	Eu-152	297,293	0,157	517	118
345,446	0,204		53187	253	Eu-152	345,539	0,009	53368	374

Detector efficiency calibration		
Zsolt Revay	May 2006	Coordinate activity. Provide standard calibration spectra and calibration data to participants.
All participants	31 Oct 2006	Submit results according to specifications to coordinator. FDC: done
Zsolt Revay	Next RCM	Summarize contributions.

Isotope	Energy	Calc. Value	Lower Limit	Upper Limit
Ba-133	53,162	1,00285E-03	9,39182E-04	1,07083E-03
Ra-226	53,2275	1,00582E-03	9,42137E-04	1,07381E-03
Ba-133	80,998	1,98873E-03	1,88304E-03	2,10035E-03
Eu-152	121,782	2,34700E-03	2,22038E-03	2,48084E-03
Ba-133	160,612	2,18879E-03	2,09943E-03	2,28194E-03
Ra-226	186,211	2,03352E-03	1,96035E-03	2,10941E-03
Ra-226	241,997	1,73558E-03	1,63974E-03	1,83702E-03
Eu-152	244,697	1,72362E-03	1,62474E-03	1,82853E-03
Ba-133	276,399	1,58339E-03	1,56008E-03	1,60704E-03
Ra-226	295,224	1,50726E-03	1,48616E-03	1,52867E-03
Eu-152	295,939	1,50449E-03	1,48345E-03	1,52582E-03
Ba-133	302,851	1,47806E-03	1,45757E-03	1,49883E-03
Eu-152	344,279	1,33479E-03	1,31618E-03	1,35367E-03
Ra-226	351,932	1,31097E-03	1,29256E-03	1,32964E-03

Neutron spectrum characterization

Andrej Trkov	Next RCM	Coordinate activity.
Frans De Corte	Dec 2005 FDC: done	Provide recommendations for other candidate materials that have suitable capture and threshold reactions.
All participants	Dec 2006	Monitoring material from the k0-IAEA package to be used by all participants for spectrum characterization of their irradiation facility, in addition to any other available monitor materials. Determine f and a by conventional methods.
All participants	Dec 2006	If available, also provide neutron spectra in 640 group structure from statistical model calculations or from direct measurements. To be sent to Andrej Trkov for further analysis.
Andrej Trkov	Next RCM	Further analysis of spectrum characterization results.
Andrej Trkov	Next RCM	Summarize contributions.

RESPONSE TO TASK ASSIGMENTS: FRANS DE CORTE

1. Neutron spectrum characterization: provide recommendations for other candidate materials that

have suitable capture and threshold reactions.

• Au, Zr and Lu are already available as components of k0-IAEA.

• Additionally recommended:

[prices depend on foil sizes and quantities; see:

http://www.goodfellow.com/scripts/web.wl?MGWLPN=MNT&PROG=GOTOSTAT&LAN=A&CTR

Y=100 (index go to element foil click code number prices)]

Goodfellow IN000200, indium 99.999 %, foil 0.05 mm thick [~0.29 mg In per 1mm diam. foil]

115In(n,n') 115mIn [T½ = 4.486 h; E = 336.2 keV, 45.9 %]

~ 0.025 MBq /mg·f (= 1x1011). tirr (=5 h)

~ 12000 ·s-1 / mg·f (= 1x1011) ·tirr (=5 h)

Neutron spectrum characterization

Andrej Trkov	Next RCM	Coordinate activity.
Frans De Corte	Dec 2005 FDC: done	Provide recommendations for other candidate materials that have suitable capture and threshold reactions.
All participants	Dec 2006	Monitoring material from the k0-IAEA package to
All participants		Andrej Trkov for further analysis.
Andrej Trkov	Next RCM	Further analysis of spectrum characterization results.
Andrej Trkov	Next RCM	Summarize contributions.

FDC: reactor Thetis Ghent decomissioned December 2003

Materials analysis test

Maria Arribere	Next RCM	Coordinate activity.
All participants	Next RCM	To perform a materials analysis test.

FDC: reactor Thetis decommissioned December 2003

Frans De Corte	Dec 2005	To review the availability and appropriateness of using synthetic multi-element standard materials (SMELS) or a suitable substitute. To look into the future possibility of SMELS production.

FDC: done

2. Materials analysis test: to review the availability and appropriateness of using synthetic multi-element

standard materials (SMELS) or a suitable substitute; to look into the future possibility of SMELS

production.

I contacted Peter Vermaercke (SCK, Mol) and reported him about the situation as I experienced it at the 1rst

CRM (Vienna, 3-5 October 2005):

a/ Several people, when going to determine elementary concentrations in the SMELS, expressed at the CRM

their intention to use radionuclides and/or gamma-lines which were not considered in the characterization of the

SMELS (cf the SMELS “Certificate of Analysis”).

Nuclear Data

Andrej Trkov	7 Jan 2006	Provide definitions of nuclear constants and their relation to differential data. Calculate: a) self-shielding factors as a function of the Bondarenko dilution cross section, b) effective resonance energies and c) effective g-factors from the same data source.
Andrej Trkov	Sep 2006	Data currently in the k0 database to be intercompared with equivalent data from other sources to identify discrepant data that may require re-evaluation or new measurements.

Andrej Trkov	Sep 2006
	Data currently in the k0 database to be intercompared with equivalent data from other sources to identify discrepant data that may require re-evaluation or new measurements.
Richard Firestone	Dec 2006
	Compare and evaluate Pg and k0 values for the EGAF library. Data from the k0 database, ENSDF, DDEP, EGAF, and the literature to be considered.
Frans De Corte	Oct 2005
FDC: done	Provide half-life data from the k0 database to M. Kellett.
Mark Kellett	Jan 2006
	Compare half-life data from the k0 database with values from the evaluated databases.

Following from my previous email which gave details of the comparison exercise I undertook concerning the half-lives used in the k0 database and those available from JEFF-3.1 and other appropriate sources, I wondered if you have had the opportunity to look at these and to draw any conclusions.

I appreciate that many of the half-lives in the k0 database seemed to be consistent with NUBASE/ENSDF, but there were a small number which I think warranted some investigation/comment.

I am particularly interested to know if you have used data from NAA style analysis to justify the value in the k0 database. Clearly this is an extra source of experimental validation not open to many and as such is of great interest to others in the decay data field, myself in particular.

I hope that you might have some time to have a look at this in the near future.

Comments on the comparison of half-life data in the Y2K k_0-database

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In general, there is no particular reason why, for use in k_0-NAA, the half-life data listed in the Y2K paper were chosen, other than that they are originating from the regularly updated internet database that is freely available via Isotope Explorer (S.Y. Chu, H. Nordberg, R.B. Firestone, L.P. Ekström, Isotope Explorer 2.23, January 28, 1999). The most important consideration here was our belief in the reliability of this database, as it was experienced during many years of development and application of parametric (k_0-)NAA

1. As to Table 1:

   New data in IE2.23 (scanned 12.May 2006), as compared to the Y2K paper:

   ^{105m}Rh: IE2.23 gives 40 s, with no uncertainty quoted [Y2K: 45 s]
   ^{109}Pd: IE2.23 gives 2 values: 13.46 ± 0.02 h, 13.7012 ± 0.0024 h [Y2K: 13.46 h]
   ^{177}Lu: 6.647 ± 0.004 d [Y2K: 6.73 d]

   As to Table 2:

   New data in IE2.23 (scanned 12.May 2006), as compared to the Y2K paper:

   ^{41}Ar: IE2.23 gives 1.8268 ± 0.0007 h [Y2K: 1.822 h]

Thanks