EURAMET activities in the field of neutron measurements

Reporting period: 2007 - 2009
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European metrology institutes involved in neutron measurements

EURAMET metrology institutes dealing with neutron measurements:

CMI, Czech Republic
ENEA, Italy
LNE, France: LNHB, Saclay – emission rates of radionuclide neutron sources,
IRSN, Cadarache - calibrations in terms of dose equivalent quantities.
NPL, UK
PTB, Germany
SMU, Slovakia

European institutes (not metrology) involved in neutron measurements:

SCK/CEN, Belgium
JRC-IRMM, Belgium
IAE, Poland

EURAMET CMC tables

The team of reviewers for EURAMET neutron CMCs:
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Miloslav Kralik, CMI, (convenor),
Laurent Van-Ryckeghem, IRSN.
Andreas Zimbal, PTB.

CMI	Czech Republic	(12 entries)
ENEA	Italy	(9 entries)
LNE	France	(15 entries)
NPL	UK	(37 entries)
PTB	Germany	(26 entries)
SMU	Slovakia	(9 entries)

CMI, ENEA, LNE, NPL and PTB neutron CMCs were placed in May 2005 at the JCRB web site. CMCs of SMU were added in 2008.

Participation of EURAMET-laboratories in CCRI(III)- and EURAMET-comparison exercises

EUROMET-laboratories engaged in neutron metrology and dosimetry participate in various recently completed, actually running or planned CCRI- or RMO-comparison exercises in order to compare their national standards and/or to support their calibration measurement capabilities (to be) listed in App. C of the BIPM-KCDB (see attached table)

Present status of Neutron measurements at EURAMET

The activities in the field of neutron measurements are summarized in the attached table.

All laboratories offer services with well-characterised radionuclide neutron sources, chiefly for the calibration of neutron survey meters and partly also for proficiency tests of national personal dosimetry services.

Four laboratories are able to determine the emission rate of encapsulated radionuclide neutron sources: CMI, ENEA, LNE/LNHB, NPL.

Three laboratories can determine the energy dependent response of neutron sensitive devices with almost monoenergetic neutrons in a wide neutron energy range from thermal up to 20 MeV: LNE/IRSN, NPL and PTB.

PTB offers the unique service, calibrations in high energy (E_n>20 MeV) neutron fields

Only CMI offers measurement of the spectral fluence in the field, e.g. at workplaces for radiation protection purposes.

NEUTRON CALIBRATION MEASUREMENT CAPABILITIES OF EURAMET LABORATORIES		
Quantity	**Neutron source**	**Laboratories**
Emission rate of sealed sources	^{252}Cf Am-B Am-Be Am-F Am-Li Pu-Be Etc.	CMI ENEA LNE/LNHB NPL
Fluence rate	Mono-energetic ISO (24 keV - 19 MeV)	NPL PTB
	Quasi-monoenergetic, (20 MeV - 70 MeV)	PTB/UCL
	Thermal neutron beam	NPL PTB
	Thermal standard (cavity)	ENEA
	Radionuclide neutron sources	CMI ENEA LNE/IRSN NPL PTB
Spectral fluence rate	Workplace neutron field (thermal - 20 MeV)	CMI
Ambient dose equivalent rate	mono-energetic ISO (24 keV - 19 MeV)	NPL*) PTB*)
	quasi-monoenergetic (20 MeV - 70 MeV)	PTB/UCL
	Radionuclide neutron sources (also ^{252}Cf (D_2O-mod.)	LNE/IRSN CMI ENEA NPL PTB SMU
	Workplace field	CMI
Personal dose equivalent rate	Mono-energetic ISO (24 keV - 19 MeV)	NPL*) PTB*)
	Radionuclide neutron sources (also ^{252}Cf (D_2O-mod.))	LNE/IRSN CMI ENEA NPL PTB SMU

*) No separate CMCs listed in the KCDB. The values of dosimetric quantities are simply calculated from the fluence (rate) by multiplication with internationally agreed conversion factors.

Participation of EURAMET-laboratories in key- and supplementary comparisons organised by CCRI(III) and EURAMET

CCRI(III)-K1	
Title:	Comparison of 24.5 keV neutron fluence measurements
Pilot laboratory:	NPL (V. Lewis)
Participants from EURAMET	NPL, PTB (2 out of 6)
Status:	Completed. Report in progress.

CCRI(III)-K8	
Title:	Comparison of thermal neutron fluence measurements
Pilot laboratory:	PTB (R.Nolte)
Participants from EURAMET	SCK/CEN, NPL, PTB (3 out of 7)
Status:	Running.

CCRI(III)-K9.AmBe	
Title:	Comparison of measurements of the emission rate of an Am/Be-neutron source
Pilot laboratory:	NPL (N. Roberts)
Participants from EURAMET	LNE/LNHB, CMI, NPL (3 out of 7)
Status:	Completed, the draft B of the final report available.

CCRI(III)-K10	
Title:	Comparison of fluence measurements in mono-energetic neutron fields with neutron energies of 144 keV, 1.2 MeV, 5.0 MeV and 14.8 MeV
Pilot laboratory:	PTB (R.Nolte, H. Klein)
Participants from EURAMET	JRC-IRMM, NPL, PTB (3 out of 7)
Status:	Completed.

EURAMET.RI-S2	
Title:	Comparison of fluence measurements in mono-energetic neutron fields with neutron energies from 15.5 MeV to 19 MeV
Pilot laboratory:	PTB (R. Nolte)
Participants from EURAMET	JRC-IRMM, NPL, PTB (3 out of 3)
Status:	Measurements completed; evaluation in progress.

EURAMET.RI-S1	
Title:	Comparison of the calibration of neutron survey instruments in the fields of radio-nuclide neutron sources
Pilot laboratory:	IRSN (L. van Ryckeghem)
Participants from EURAMET	CMI, LNE/IRSN, NPL, PTB, SMU, IAE, JRC-IRMM (7 out of 10)
Status:	Due to technical problems interrupted. Only 6 participants have finished their measurements. Draft of final report was released in January 2009.

Comments to **EURAMET.RI-S1:**

Non EURAMET participants: KRISS, VNIIM, CIAE,

First round – 2003:
Two instruments: Studsvik 2202D and Harwell Monitor N91
Finished in May 2004 due to problems with Studsvik 2202D.
Results deleted.

Second round – 2006:
One instrument: Harwell Monitor N91
Finished in March 2007 due to irreparable HV source of Harwell Monitor N91.

6 participants managed to complete their measurements: IRSN, SCK/CEN, KRISS, IAE, SMU, CMI.
In January 2009 draft with partial results was released.

Third round – 2003:
Proposed Instrument: LB6411 – Dr. Alfred Klett from Lab. Berthold promised to provide LB6411 and UMo LB123 with additional pulse output. (Measurement of dead time ?.)

Pilot laboratory: ???
Participants: ???
Programme/Schedule: ???

New comparison:

To support CMCs it is necessary to organize key/supplementary:
Comparison of the calibration of active personal neutron dosimeters in the fields of radio-nuclide neutron sources.

Personal dosimeters: ???
Pilot laboratory: ???
Participants: ???
Programme/Schedule: ???

New projects:

Development of neutron fluence, spectrometry and cross sections measurements related to nuclear fusion

Project proposal prepared by the IR TC EMRP task group within the "Targeted Program" ENERGY" being part of the EMRP will be funded (50%) by EC in the FP 7 based on the Article 169. The EoI is scheduled in summer 2009.