

## Progress Report on Radiation Dosimetry at the MKEH (OMH)

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### Organisation

- By order of the Hungarian Government, 260/2006(XII.20), according to the ongoing reorganisation program of the Hungarian civil service, **the OMH has merged into the Hungarian Trade Licensing Office, MKEH; <http://www.mkeh.gov.hu>**. controlled by the Ministry of Economy and Transport. With the 1st January 2007 the legal successor of the OMH became the MKEH. The Metrology Department of MKEH having three sections with the same infrastructure of laboratories and calibration service running at the same location, meet the requirements to function as the Hungarian NMI, maintaining the national measuring standards, MRA business etc. The Metrology Department has remained 30 scientific staff members including the 6 dealing with ionising radiation.

### Gamma-ray dosimetry

- The decayed  $^{60}\text{Co}$  source of the therapy level irradiation facility has been replaced with a new 100 TBq source. The beam profile was checked experimentally. The scattered component determined by MC calculation was found to be 25% in term of energy fluence. The  $k_{\text{wall}} = 1.0212$  and  $k_{\text{an}} = 0.9999$  correction factors of the primary standard graphite cavity chamber type **ND 1005** were recalculated again with MC technique (CAV RZnrc V1 rev. 1.6) by Dr Hans Rabus at the PTB. During the calculations of the new values  **$k_{\text{wall}} = 1.0216(7)$  and  $k_{\text{an}} = 0.9998(8)$**  there were taking into account the real source diameter, its uncertainties are based on three different realistic input photon spectra. In addition, 0.02% and 0.04% relative uncertainty components coming from the uncertainty of graphite ionisation potentials 78(7) eV were calculated for the  $k_{\text{wall}}$  and  $k_{\text{an}}$  respectively.
- All the three thirty years old ND 1005 type chambers as primary realization of air kerma at OMH have been compared against the BIPM CH5-1 chamber in the "Picker" and "SIS Bio"  $^{60}\text{Co}$  beams at the BIPM in 2006. The results, expressed as a ratio of air kerma determination by OMH and BIPM standards, were 1.0106(22) and 1.0097(22) respectively. The average comparison ratio of the similar six other national primary standard  $1\text{cm}^3$  graphite cavity chambers measured in the "Picker" beam is 1.0086(18).
- In the frame of Euromet project No. 813 the double key comparison **EUROMET.RI(I)-K1 and EUROMET.RI(I)-K4**. has launched in January 2005 with 26 participants, coordinated by the Dosimetry Laboratory. The title is '*Comparison of air kerma and absorbed dose to water measurements of Co-60 radiation in radiotherapy*'. All the 13 participants having secondary standard of air kerma and/or absorbed dose to water have already completed their measurements. **Interim Draft A report are being circulated** among them not divulging the absolute values of calibration coefficients of transfer chambers. The interim report includes the temporary degrees of equivalence to support the relevant CMC claims have already published. Additional 6 primary dosimetry laboratories have also completed the calibration measurements. The transfer instruments have shown excellent stability so far. However, the water has got into the ND 1006 type chamber during the measurement in water phantom at NPL. The scheduled lasting of the comparison measurements is March 2008.

### X-ray dosimetry

- The correction factors of the XE-3 free-air chambers depending on the incident photon spectra established for the diagnostic radiation qualities, RQR; RQA; RQC and the mammographic qualities (25-35) kV, W anode +60  $\mu\text{m}$  Mo filter, have been recalculated. The free-air chamber as primary standard of air kerma for mammographic X-ray beam qualities will be proposed to compare against the similar new BIPM chamber.

- The result of EUROMET.RI(I)-S3 'Comparison of the air kerma for ISO 4037 narrow spectra spectrum series (30 kV-300 kV) has conveyed a degree of equivalence being well within the stated standard uncertainties for all the 10 beam qualities. However, some components of the uncertainty budget of the XE-1 free-air chamber as primary standard of air kerma for these X-ray qualities might be overestimated and are under re-evaluation. Feasibility study to extend of energy range of this Wyckoff Attix design free –air chamber up to 400 keV is also an ongoing project.

### **Legal metrology**

- The national type testing and verification procedures for rad. prot. dosimeters were updated according to the new edition of the relevant ISO and IEC standards.
- Type testing of therapy ionisation chambers type PTW M30002; M30012; M31013; NE2581 on the basis of IEC 60731 , a Hungarian compact TLD dosimeters "PorTLD"; on the basis of IEC 601066, and the MGP GIM202-2 GIM204-1 monitors on the basis of IEC 60532 standard have been type tested. A new compact Hungarian electrometer type PAM 2006 has also been tested.
- The biannual verification of all survey meters, EPDs and environmental monitors used in Hungary the most significant part of the workload of the staff. Reference irradiations and performance tests involving mixed (gamma+X-ray+different angles) radiations for the Hungarian personal dosimetry service are being carried out.

### **Quality assurance**

- The Certification body, SGS Hungaria kft, during the scheduled assessment of the Metrology Department of the MKEH did not find any non-conformities on the basis of ISO 9001:2000 at the Dosimetry laboratory in February 2007.

### **International activities**

- The extension of dosimetry CMC claims published at the BIPM database are under revision.
- The air kerma irradiations of TLDs for the IAEA SSDL service have being continued.

### **Future works**

- Calibration of therapy chamber used in high energy photon beams in the range of 6-18 MeV at hospitals is going to start based on secondary standard chamber calibrated against the water calorimeter in the METAS accelerator's beam.
- Determination of diagnostic X-ray spectra by Compton spectrometry is planned

### **Publications**

- I.Csete, G. Machula, I. Apáthy, S. Deme, I. Pázmándi: New compact thermoluminescent dosimeter for radiation protection measurements. 31st Annual Meeting Roland Ethos Physical Society, 2006
- P.J. Allisy, I. Csete, C. Kessler, G. Machula, P. Roger, D.T. Burns, H. Rabus: Comparison of the standards for air kerma of the OMH and the BIPM for  $^{60}\text{Co}$   $\gamma$  rays (BIPM Rapport 06/07)
- I. Csete Introduction to the ionisation radiation metrology: Radiation protection seminar at PAKS NPP 2005

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