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BEV LABORATORY REPORT 2003-2005 ON RESEARCH ACTIVITIES IN RADIATION DOSIMETRY STANDARDS AND FACILITIES

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Change of air kerma standards

As it was announced [1], due to the change of correction factors of cylindrical graphite chamber BEV has changed its air kerma standards for ^{137}Cs and ^{60}Co γ -rays from January 1st, 2004. All calibration factors in calibration certificates of the BEV, which are issued after this date and which are traceable to these standards, are increased by 1.00 % and 0.80 % for ^{137}Cs and ^{60}Co γ -rays, respectively. The quantities ambient dose equivalent $H^*(10)$, directional dose equivalent $H'(0,07)$ and personal dose equivalent $H_p(10)$ and $H_p(0,07)$, which are derived from air kerma, are changed by the same amount.

Standards for Radiation Therapy

The ^{60}Co source of the teletherapy irradiation unit was changed and the unit itself was refurbished. The nominal activity of the source is 72 TBq. After finishing of all necessary radiation field measurements and setting of actual values of air kerma and absorbed dose to water it was again put into operation at the end of 2004.

Standards for Diagnostic Radiology

In this field BEV continued the development of a national standard. A new Seifert Isovolt 160 kV X-ray machine was put into operation. The X-ray facility is equipped with filters according to the *draft IEC 61267* (RQA and RQR qualities) and the *IAEA Code of Practice* [2]. Radiation qualities were checked by HVL measurements. Reconstruction of the older free air chamber “PKM” was finished and necessary correction factors were calculated by Monte Carlo code *PENELOPE*. The main dimensions are as follows:

Aperture diameter:	10 mm or 20 mm
Attenuation length:	110 mm
Collector length:	56 mm
Electrode separation:	115 mm
Electrode width:	130 mm

Internal comparison with the large free air chamber “PKG” was done with acceptable results up to 120 kV. The same was done for “BIPM therapy qualities”, with good agreement too up to this energy region. It seems that the calculation of the effect of scatter in the beam limiting entrance aperture is the reason of discrepancy at higher energies. This effect will be studied further using special construction of aperture as well as a modification of calculation.

Based on the results of the *EUROMET 526* project, BEV has standardised its mammography X-ray qualities using W anode soft X-ray machine with the proper set of Rh, Mo and Pd, filtrations [3].

Participation in Euromet 738

In 2004 the dosimetry laboratory of the BEV took part in the project *EUROMET 738 - Intercomparison of the personal dose equivalent for photon radiation*. The laboratory calibrated the transfer instrument at the following radiation qualities and radiation incidence:

N-15 and 0°
N-20 and 45°
N-30 and 75°
N-60 and 0°
N-120 and 0°

For the different radiation qualities the conventionally true value of $H_p(10)$ was determined from air kerma applying conversion coefficients. For the radiation quality N-120 the conversion coefficient was taken from the International Standard *ISO 4037-3:1999*. For the radiation qualities N-15, N-20, N-30 and N-60 the conversion coefficients were determined by the spectroscopic method according to the International Standard *ISO/FDIS 4037-4:2004*. For this purpose the photon spectra were measured with a HPGe planar detector, which was kindly supplied by the Dosimetry Laboratory of the International Atomic Energy Agency Laboratories, Seibersdorf, Austria. The spectrum deconvolution was accomplished by the well known stripping procedure using the response matrix of the Ge-detector, which was calculated by the MC code *PENELOPE*.

Participation in Euromet 545

In 2004 the dosimetry laboratory of the BEV took part in the project *EUROMET 545 – Intercomparison of NMI air kerma standards for ISO 4037 narrow spectrum series radiation qualities* (Tube Potentials from 30 kV to 300 kV). The laboratory calibrated 4 transfer chambers according to the project protocol.

Cooperation with IAEA

BEV dosimetry laboratory periodically performs reference irradiations for the *IAEA/WHO postal dose quality audit service* for ^{60}Co therapy level as well as for ^{137}Cs radiation protection level. BEV participated in the calibration of 4 ionisation chambers for the IAEA project *Pilot study for the comparison of calibration coefficients of ionization chambers at ISO 4037 narrow-spectra x-ray beam qualities*.

References

- [1] Witzani J, Gabris F, Leitner A, Change of air kerma standards of the BEV for ^{137}Cs and ^{60}Co γ -rays, *Metrologia* 41, L1-L2 (2004)
- [2] Working Material, Dosimetry in Diagnostic Radiology, An International Code of Practice, Private communication, F.Pernicka, IAEA
- [3] Witzani J, et al., Calibration of Dosemeters used in Mammography with Different X Ray Qualities: EUROMET Project No. 526, *Rad.Prot.Dos.* 108(1) (2004)