SSDL Note 2013:04

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Norwegian Radiation Protection Authority

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To: CCRI(I)

Progress report from the SSDL of the NRPA

Highlights from x-ray diagnostic calibration methods.

The method used for calibration of clinical reference KAP meters is described in the IAEA TRS 457 Dosimetry in Diagnostic Radiology: An International Code of Practice. We find the best procedure in using the substitution method. Then a calibrated KAP meter is needed. The method is based on the method used in the primary standard dosimetry lab. PTB (Germany). The calibration factor is produced by substituting KAP-chambers in the x-ray beam.

The setup is given in figure 1.

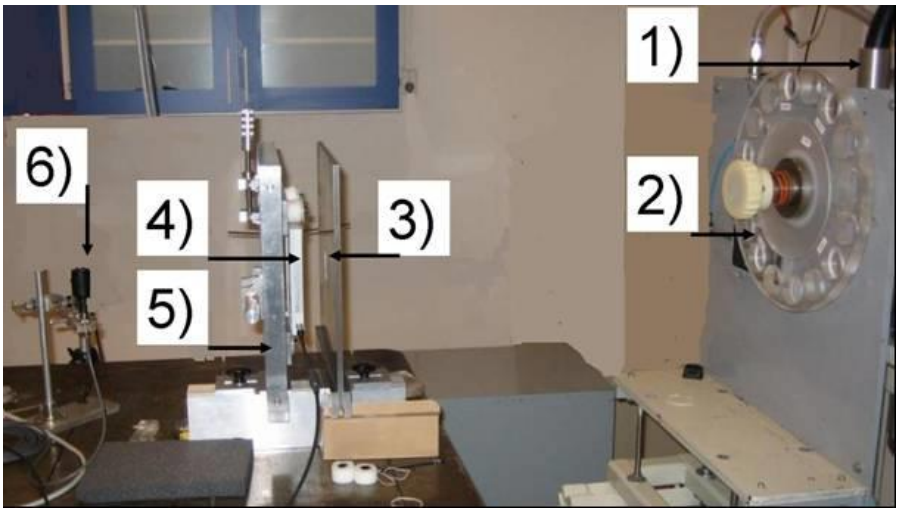

Figure 1 Calibration setup at Norwegian SSDL. 1) x-ray tube, 2) rotating filter wheel, 3) 50 mm x 50 mm lead collimator, 4) the KAP-chamber, 5) movable housing for KAP-meter positioning 6) monitor ion chamber.

The results from calibrations are given in figure 2 and 3. The calibration factor for an individual chamber has a common behavior, except that some have a steeper curve to the higher energies. The variation within the chambers is 25 %.

The transmission factor is also measured with a chamber, number 6 in figure 1. The behavior of the curve as a function of energy is predicable, and the value has a variation depending on thickness and material in the chamber walls.

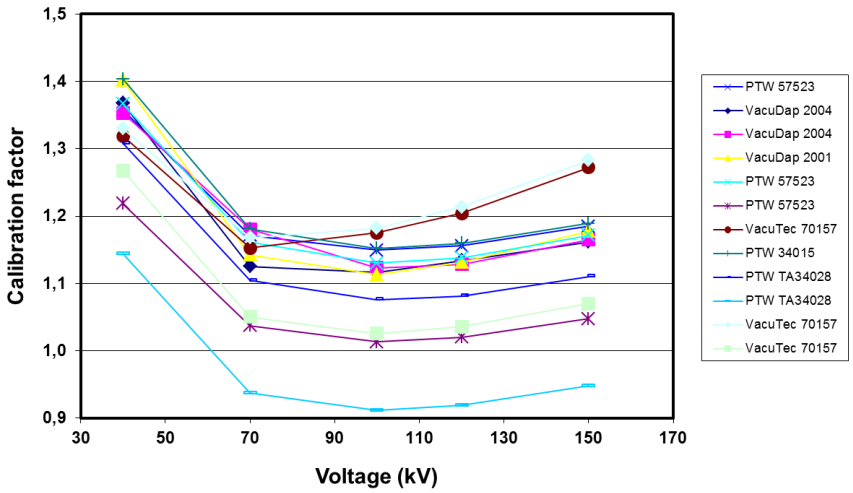

Figure 2 Results from the calibration of reference KAP meters used out in the clinic.

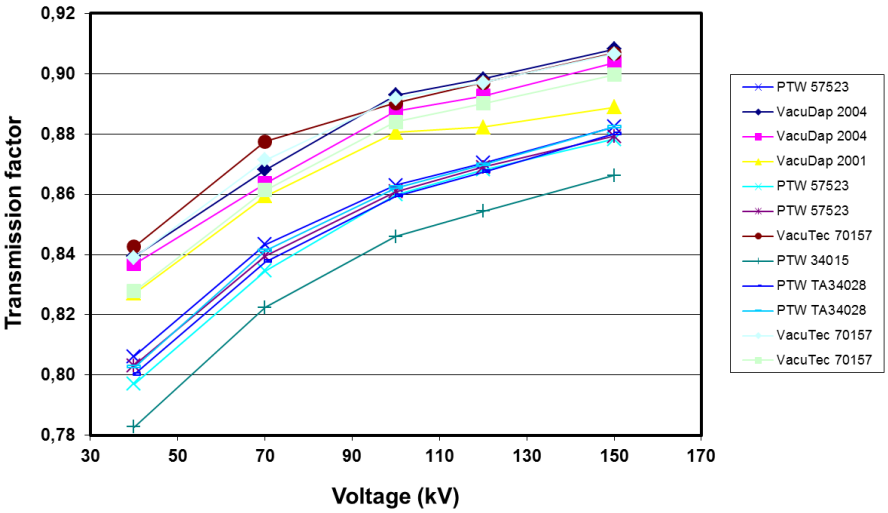

Figure 3 Results from the measurements of the transmission factor of the KAP meters.

A work is under way to make a set up for kerma length product for the CT pencil chambers. The same principles will be used here for the method based on calibration method at primary standard dosimetry lab. PTB (Germany).

The methods can be validated using a chamber for measuring the kerma rate and multiplying by the area or length of the collimator for KAP and KLP, respectively.

The uncertainty in the calibration of KAP meters is about 3 %, but we state 4 % in our certificates. For KLP the uncertainty budget gives a lower value, but we have not decided what we will use for our regular results. The substitution method is robust and gives reproducible results.

Publications.

1. Bjerke H et al. Source calibration. In: Venselaar JLM et al. Comprehensive brachytherapy - physical and clinical aspects. Boca Raton: CRC Press, 2013: 61-74.
2. Bjerke H et al. Radiation survey meters used for environmental monitoring. NKS-257. Roskilde: Nordic Nuclear Safety Research (NKS), 2012.
3. Hellebust TP, Levernes SG, Heikkelä IE, Johannessen DC, Bjerke H, Sundqvist E, Olerud HM, Frykholm G. The Norwegian program on quality assurance in radiotherapy (KVIST): Organisation, benefits and experiences. S4-3. I: Alara and the medical sector, 13th European ALARA Network, Oscarsborg Fortress, Norway 7-10th June 2011. http://www.eu-alara.net/index.php/component/docman/doc_download/44-43-tp-hellebust.html

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