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ABSTRACTS**

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Establishing W/Al mammography radiation qualities in Secondary Standard Dosimetry Laboratory

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In mammography clinical practice, various radiation fields are used, produced using different X-ray tube anode and filtration setups. It is important to calibrate diagnostic dosimeters in different radiation qualities as these dosimeters are used for quality control tests and most dosimeters have significant dependence of response on radiation spectra. TRS 457 Code of Practice [1] is an IAEA document which recommends calibration of diagnostic dosimeters in reference radiation fields established according to IEC 61267:2005 international standard [2], which considers the Mo/Mo anode-filter combination (abbreviated as the RQR-M series). Other, non-standard beam qualities are also used for calibration, such as the beams with W/Al anode-filter combination, used by Vinca Institute Secondary Standard Dosimetry Laboratory. Traceability is established to IAEA Dosimetry Laboratory, and radiation qualities are established by adding 0.5 mm Al additional filtration, following the IAEA procedure [3]. Mammography radiation qualities can be validated by determining the half-value layer (HVL) of the radiation beam. To determine HVL we measured incident air kerma at 1 m distance using a 1 cm³ plane parallel ionization chamber, by successively adding Al attenuators of different thickness. The Al attenuators have been placed at 0.5 m distance, equidistantly from the radiation source and the ionization chamber. HVL was obtained using a linear regression for the additional filtration values near the expected HVL value. Calculated HVL was 0.326 mm Al, 0.367 mm Al, 0.395 mm Al, 0.456 mm Al for tube voltages 25 kV, 28 kV, 30 kV and 35 kV, respectively. The results were compared with the values given by IAEA SSDL [3] (deviation for all qualities was less than 5%) and PTB Primary Standard Dosimetry Laboratory (PSDL) [4]. Radiation qualities established in this manner allow proper calibration and traceability of diagnostic dosimeters in W/Al radiation qualities to be used for routine QC tests in mammography.

Keywords: Mammography, HVL, diagnostic dosimeters, radiation quality

References

[1] International Atomic Energy Agency, 2007. Dosimetry in Diagnostic Radiology: An International Code of Practice, Technical Report Series No. 457, IAEA TRS 457.

[2] International Electrotechnical Commission, 2005. Medical Diagnostic X-Ray Equipment – Radiation Conditions for Use in the Determination of Characteristics, IEC 61267.

[3] International Atomic Energy Agency, 2020, Appendix to IAEA calibration certificate. Calibration of reference dosimeters for diagnostic radiology at the IAEA dosimetry laboratory, https://ssdl.iaea.org/Content/DOLP_013_Appendix_2.pdf

[4] https://www.ptb.de/cms/fileadmin/internet/fachabteilungen/abteilung_6/6.2/6.25/ptb_rad_qual_2015_01_07.pdf (accessed 12.04.2022.)

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