AbstractID: 5523 Title: Air kerma rate measurements from a miniature x-ray source using free-air ionization chambers

Purpose: To measure the air kerma rate from a miniature x-ray source using free-air ionization chambers (FACs), and to transfer the source air kerma rate to a well-type ionization chamber.

Method and Materials: Air kerma rates from several Xoft AXXENT™ miniature x-ray sources were measured in air along their transverse axes using three different FACs, each with a source-to-aperture distance of 100 cm. The sources were operated at 50 kV and 100 μA beam current. The University of Wisconsin (UW) Attix FAC was used for the initial measurements, and follow-up measurements were performed using the Attix and Ritz FACs at the National Institute of Standards and Technology (NIST). Two different FAC aperture sizes were used for each of the air kerma rate measurements at NIST. Additional measurements for each source were performed using a well-type ionization chamber with a custom-built aluminum source holder. The ratio of air kerma rate at 100 cm to well chamber current was used to determine a well chamber calibration coefficient for each source.

Results: The air kerma rates for the smaller aperture were generally within 2% of the rates measured with the larger aperture, indicating that the sources were aligned properly. The well chamber calibration coefficients demonstrated some source to source variation, with an overall standard deviation of 5.3%. The results suggest that most of this variation can be attributed to azimuthal anisotropy around the long axes of the sources, and not differences in the photon spectrum emitted from each source.

Conclusion: Both the Attix and Ritz FACs are appropriate for measuring air kerma rates from the miniature x-ray sources, but further work will be necessary to develop methods suitable for traceability to national measurements standards.

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