

## Article Extract

|               |  |
|---------------|--|
| Extract from: | Journal of Radiological Protection, Volume 33, No. 2 (2013)  |
| Author(s):    | S A Mitchell and C J Martin  |
| Title         | Comparison of ionisation chamber and semiconductor detector devices for measurement of the dose-width product for panoramic dental units |

### Abstract

Doses for panoramic dental radiography are assessed in terms of the dose-width product (DWP) or dose-area product, which gives a measure of the radiation through a whole exposure. The DWP can be measured using a pencil ionisation chamber (IC) similar to that used for computed tomography dose assessment.

However, ICs are sensitive to radiation incident from all directions and so backscatter from the image receptor may increase the recorded dose. This study compares measurements performed using four options: a pencil IC mounted straight on the image receptor, the IC mounted with a steel plate to the rear to standardise scatter conditions, the IC mounted with a steel plate and lead collimators in front to minimise the effect of extra-focal radiation, and a QUART dido [2000K] employing a one square centimetre semiconductor detector (SD) designed for panoramic measurements.

The results indicate that modification of the current method by incorporating a steel plate reduced the measurement dose by 7% on average, but the reduction was greater for units with semiconductor imaging plates. The measurements with the SD agree more closely with the IC with the steel plate to the rear. An IC with a backing plate to standardise scatter or a suitable SD is recommended for measurement on panoramic dental units.

[...]

### Introduction

[...] Originally the DWP was measured by a small detector, an Unfors 511 Mult-O-Meter (Unfors Instruments AB, Billdal, Sweden) (Doyle et al 2006), placed in the x-ray beam and the result multiplied by the width of the beam. However, because of the variation in air kerma across the beam, this method was subject to large inaccuracies. An alternative technique is to use a computed tomography dose index (CTDI) pencil ionisation chamber placed perpendicular to the beam at the image receptor in a similar manner to the measurement of dose across a CT beam (Isoardi and Ropolo 2003, Perisinakis et al 2004, Doyle et al 2006). A disadvantage of this method is that radiation scattered from the image receptor housing to the rear of the chamber will also be recorded, as pencil ionisation chambers are sensitive to radiation incident from all directions (Martin 2007) and the scatter air kerma may vary with the structure and composition of the image receptor. [...]

### Conclusions

The results of this study suggest that if a pencil IC is used to measure DWP then a steel or lead plate should be used to standardise scatter conditions. A 10 mm wide SD such as the QUART dido [2000K] provides an alternative method for assessment of panoramic radiography DWPs. Since the SD is smaller it is more straightforward to use and has the additional benefit of enabling the tube potential and exposure time to be measured, so that it is possible to carry out a full radiation protection survey using a single detector. In addition, the SD may provide a more suitable instrument for measurement of DWPs for the lower exposure factors employed with DR panoramic units.