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THE NORWEGIAN SYSTEM FOR IMPLEMENTING THE IAEA CODE OF PRACTICE BASED ON ABSORBED DOSE TO WATER

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The Norwegian Radiation Protection Authority (NRPA) SSDL recommended in 2000 the use of absorbed dose to water as the quality for calibration and code of practice in radiotherapy. The absorbed dose to water standard traceable to BIPM was established in Norway in 1995 [1]. The international code of practice, IAEA TRS 398 [2] was under preparation.

As a part of the implementation of the new dosimetry system the SSDL went to radiotherapy departments in Norway in 2001. The aim of the visit was to:

- Prepare and support the users in the implementation of TRS 398 by teaching, discussions and measurements on-site.
- Gain experience for NRPA in the practical implementation of TRS 398 and perform comparisons between TRS 277 [3] and TRS 398 for different beam qualities.
- Report experience from implementation of TRS 398 to IAEA.

The NRPA 30x30x30 cm^3 water phantom is equal to the BIPM calibration phantom. This was used for the photon measurements in 16 different beams. NRPA used three chambers: NE 2571, NE 2611 and PR06C for the photon measurements. As a quality control the set-up was compared with the Finnish site-visit equipment at University Hospital of Helsinki, and the measured absorbed dose to water agreed within 0.6 %. The Finnish SSDL calibrated the Norwegian chambers and the absorbed dose to water calibration factors given by the two SSDLs for the three chambers agreed within 0.3%.

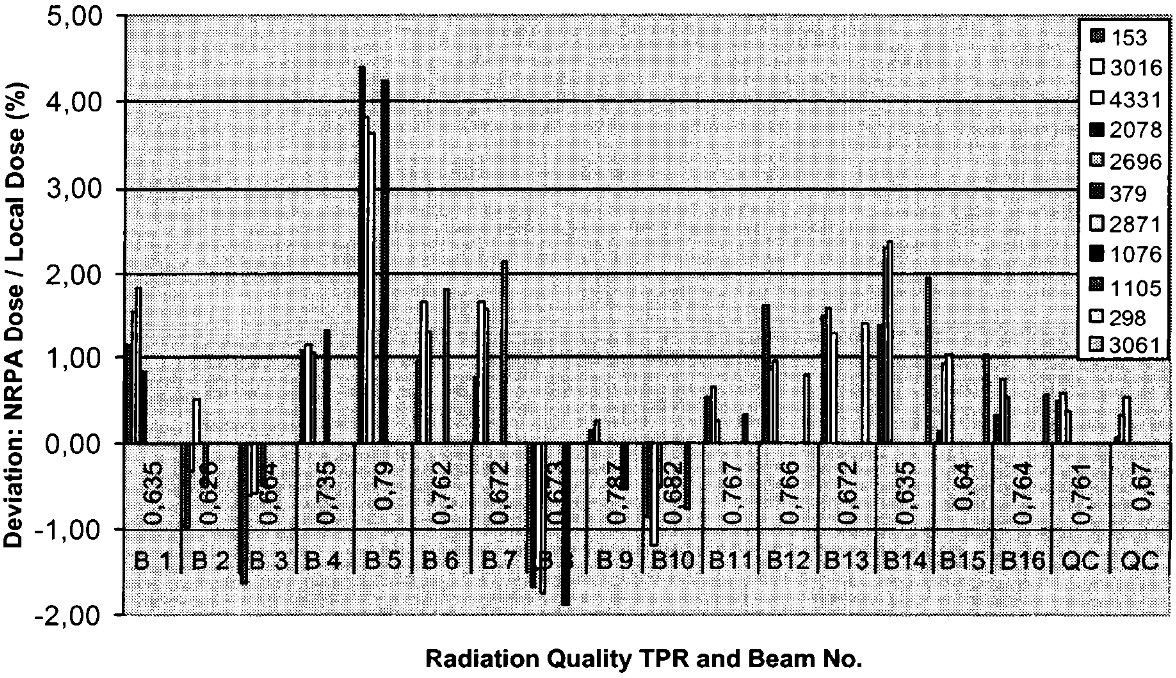

Figure 1 The NRPA dose determination (TRS 277) of absorbed dose. Deviation (%) from local determined dose for different beam qualities $TPR_{20,10}$. Base line is local dose. Each pillar represents one chamber.

The local clinical dosimetry in Norway was based on TRS 277. For the site-visit the absorbed dose to water was determined by NRPA using own equipment including the three chambers and the hospitals reference chamber. The hospital determined the dose the same evening using their local equipment. For the 16 photon beams the deviations between the two absorbed dose to water determinations for TRS 277 were in the range –1,7 % to +4.0 %, see figure 1. The uncertainty in the measurements was

1% (k=1). The deviation was explained in local implementation of TRS 277, the use of plastic phantoms, no resent calibration of thermometers, barometers and electrometers.

A new roundtrip was done for electron beams. The aim of this visit was to cross-calibrate the hospital plan-parallel chambers in a high energy electron beam and measure absorbed dose to water in different high energy electron beams. The measurements were performed in the local water tank for beam data measurements. The absorbed dose was this time compared to the treatment units monitor calibration. Results from absorbed dose to water measurements for high energy electron beams showed that compared to TRS 398 the electron beams was off in the range –2,3 to + 4,6 %. The uncertainty of the electron measurements was 1.5 % (k=1).

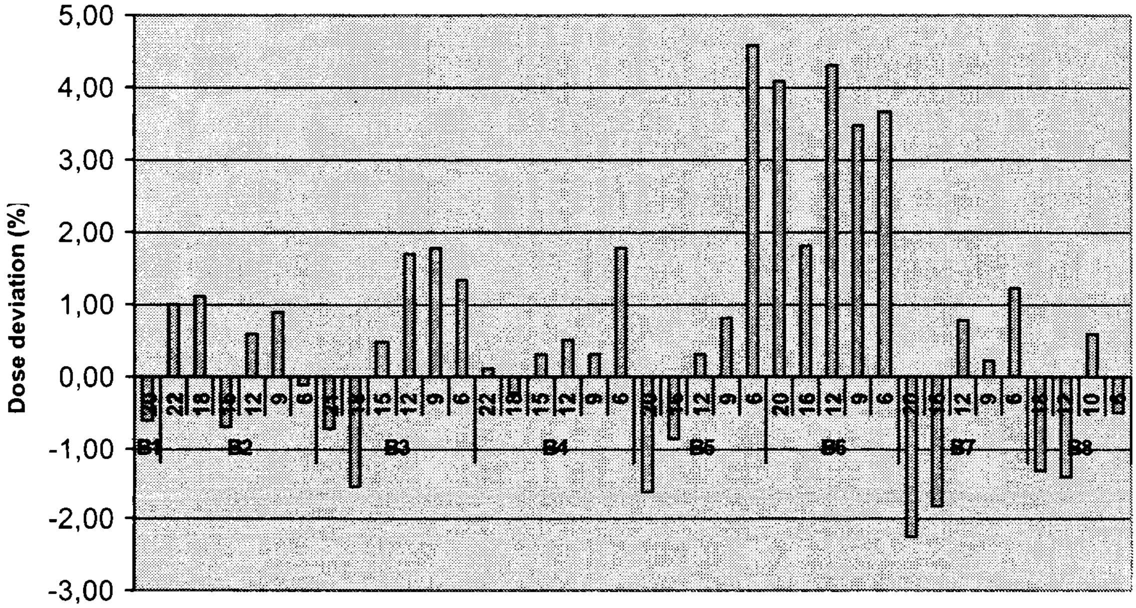

Figure 2 The NRPA dose determination (TRS 398) of absorbed dose. Deviation (%) from local determined dose (TRS 381) for different beams and nominal electron energies. The base line is 1 Gy or 100 MU.

The absorbed dose to water calculated from the former air kerma ^{60}Co standard is at the Norwegian SSDL 0.5% lower than absorbed dose to water ^{60}Co standard. From calculation one can see that the CoP TRS 277 give 0.5% to 1.0% higher dose than CoP TRS 398 in high energy photon beams depending on beam quality. For electrons this deviation is in the range – 0.3 % to + 0.1 %.

The air kerma standard and TRS 277 CoP give in Norway 1.0 % to 1.5 % too high doses for high energy photons, while the dose change for electron beams is smaller than the uncertainty. On site measurements show higher deviations because of local implementation of a code of practice. The medical physicists welcomed the visit and requested more visits. This research was done in cooperation with IAEA, Agreement No. 11627.

REFERENCES

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