AbstractID: 13953 Title: Development of a wall-less Fricke dosimetry system for megavoltage photon and electron beams

Purpose:
To develop a dosimetry system based on the Fricke (ferrous sulphate) dosimeter that can be used to determine absolute dose in regions of large dose gradients in megavoltage photon and electron beams.

Method and Materials:
Building on the techniques first used at the Swiss national standards laboratory, METAS, we have developed a system where Fricke solution can be irradiated in polyethylene bags rather than the usual glass vials. This approach means that there is no wall correction and the dosimeter size and shape can be tailored to each application. As a first test the Fricke system was used to determine the absorbed dose absolutely in low energy electron beams. The Fricke response was compared with the NRC primary standard water calorimeter and calibrated ionization chambers using the TG-51 protocol. Measurements were made in 4, 8, 12, 18 and 22 MeV beams and the delivered dose was in the range of 7 Gy to 50 Gy.

Results:
The accuracy and precision of the Fricke dosimetry is very dependent on solution preparation and contaminants, which affect the readout. It was found that the contaminating effect of the polyethylene bag on the readout signal was small and could be accurately corrected by using unirradiated controls. The standard uncertainty in the sensitivity coefficient of the Fricke system was found to be 0.2 % and the standard uncertainty in the determination of absorbed dose to water was estimated to be 0.6 %.

Conclusion:
The Fricke dosimeter system remains relevant to megavoltage dosimetry, offering accuracy comparable with, or better than, other integrating systems. The dosimeter is insensitive to dose homogeneities and can be used to determine mean dose to arbitrary volumes. It therefore has applications in reference dosimetry for (TG-51) non-compliant beams as well as dose verification in IMRT.

Conflict of Interest (only if applicable):