AbstractID: 13241 Title: Comparison of characteristics of two liquid-filled ionization chambers

Purpose: To characterize two liquid-filled ionization chambers for reference dosimetry of nonstandard fields.

Methods and Materials: Two chambers used in this work, an in-house developed guarded liquid-filled ionization chamber (GLIC-03) and a commercial PTW microLion chamber 31018, were filled with anhydrous 2,2,4-Trimethylpentane liquid. The stability and reproducibility of each chamber was evaluated by delivering a series of certain dose to each chamber and repeating the same process with polarizing voltages of +500 V (GLIC-03) and +800 V (microLion). The polarity effect was measured for each chamber. The directional dependence of each chamber's response was measured by irradiating the chamber at different radial directions by either chamber rotation or gantry rotation. The relative ion recombination effect in the liquid was determined theoretically and experimentally for each chamber.

Results: During a single measurement set both chambers' responses were stable within 0.13 % after pre-irradiation to 130 Gy and 65 Gy for the GLIC-03 and the microLion, respectively. The reproducibility of the chamber's response was 1 % (GLIC-03) and 0.20 % (microLion). The measured polarity correction factor P_{pol} was 1.005-1.006 and 1.001-1.002 for the GLIC-03 and the microLion, respectively. When rotating each chamber, its response was not different more than 0.18 %. When irradiating it from different directions, the GLIC-03 showed anisotropic response due to the filling tubes, while the microLion's response was the same to within 0.18 %. The theoretical and experimental relative ion recombination effect for the GLIC-03 agreed to within 0.7 %, which is due to incomplete charge collection in the time period between pulses. The microLion showed a better agreement, within 0.25 %, between the calculated and measured relative ion recombination effect.

Conclusions: We have evaluated two liquid-filled ionization chambers' characteristics in various aspects. These characterized chambers can be used to accurately measure reference dose in nonstandard fields.