Abstract

In this thesis project, a convex windowless extrapolation chamber was developed as a primary measurement device to determine surface dose rate from curved $^{106}Ru/^{106}Rh$ episcleral plaques. The efficacy of an extrapolation chamber design without an entrance window was verified through dose rate measurements with a planar windowless extrapolation chamber and a NIST-calibrated $^{90}Sr/^{90}Y$ ophthalmic applicator. The planar windowless extrapolation chamber was modified to accommodate a flat $^{106}Ru/^{106}Rh$ plaque. Extrapolation chamber results were compared with on-contact un-laminated EBT3 film measurements as well as the manufacturer source calibration using a scintillation detector. The average surface dose rate was found to be 1.2% lower than the corresponding film measurement result and 7.7% lower than the value reported by BEBIG. The flat source was then stamped into a curved CCB plaque, and measurements were carried out with the convex windowless extrapolation chamber. The average surface dose rate was found to be 1.8% higher than the corresponding value from curved un-laminated EBT3 film measurements and 5.3% lower than the manufacturer value. Similar measurements were performed for an additional curved $^{106}Ru/^{106}Rh$ source, and the measured surface dose rate was 2.8% higher than the result from un-laminated EBT3 film, 4.2% lower than the manufacturer result, and 4.2% higher compared to alanine measurements made at NPL. To transfer the extrapolation chamber result for surface dose rate to clinics, measurements were performed with conventional ionization chambers in a fixture. The surface dose rate from the conventional chamber calibration agreed within 3.8% with the expected convex extrapolation chamber result. From this work, the accuracy of surface dose rate measurements from current dosimetry techniques was analyzed through comparison with the convex windowless extrapolation chamber.