AbstractID: 4866 Title: Design of a Small Radiation Facility for Radiobiology Studies

Purpose: To design a small radiation facility for the partial- and fully -body irradiation of zebrafish embryos, cell cultures or any other small specimen used for radiobiology studies.

Method and Materials: Zebrafish embryos larger than 1mm are the main animal to be irradiated in this micro-irradiator. Radiation is provided by a 50 kV photon beam from a miniature x-ray source, Xoft Inc., CA. Radiation field is delimited by a pinhole collimator. Diameter of the pinhole ranges from 0.5mm. A movable table and a video camera connected to a computer are used to position the specimen under the beam. Radiochromic film has been irradiated to test positional accuracy and dose distribution.

Results: Coordinates of the position of the zebrafish with respect to the collimator are calculated from the image provided by the video camera and sent to the computer-controlled movable table to position the specimen under the beam. The micro-irradiator is totally portable and it can fit on the desktop. Positioning can be acquired with uncertainties of 50 μm in X and Y axis. Collimator design and portable shielding reduce both primary beam and scattering at safe radiation levels. Dose distribution is good enough for zebrafish irradiation and penumbra is in the order of 150μm ± 50μm.

Conclusion: The designed micro-irradiator has attractive characteristics to facilitate zebrafish irradiation. Its portability and shielding simplicity make it adequate for any radiobiology laboratory. Its uncertainty in positioning is significantly smaller than zebrafish embryo size and radiation penumbra is acceptable for specimen larger than 1mm. This novel micro-irradiator design is appropriate for irradiation of partial-and fully- body zebrafish, cell cultures and any other small specimen used in radiobiology.