Purpose: To determine the dosimetric characteristics of an orthovoltage x-ray beam that will be used in a porcine animal model for the study of radiation-induced skin injury (cutaneous radiation injury, or CRI). CRI can be expected in the event of a radiological accident or terrorist action. Dose to the porcine skin surface is most accurately estimated when the surface dosimetry for various x-ray energies and qualities is well understood. This study will correlate surface dosimetry and grades of CRI response (skin dose-response), for the investigation of a novel CRI topical treatment.

Methods: X-ray dose will be administered to porcine skin to induce Grades II and III CRI. HVL, percent depth dose (PDD), and surface dose are determined in phantom for circularly collimated filtered and unfiltered 300 kV orthovoltage x-ray beams. The cutaneous dose distribution and dose response to skin will be described for this beam, including the appropriateness of in vivo use of optically stimulated luminescent (OSL) dosimeters.

Results: Narrow beam HVL measurements at 300 kVp, unfiltered, demonstrate a soft x-ray spectrum with rapid beam hardening: HVL1=0.48 mm Al and HVL2=5.5 mm Al. Addition of the secondary collimator provides inherent filtration that yields an HVL1=8.8 mm Al and HVL2=13.5 mm Al. Radiochromic film dosimetry is useful for PDD measurement, provided care is taken for film calibration and positioning.

Conclusions: Characterization of a 300 kV orthovoltage x-ray beam is required to enable accurate surface dosimetry for a porcine model. For this particular study, removal of the secondary collimator provides both a much softer beam for the deposition of surface dose, as well as an increase in dose rate. Custom-designed collimators provide x-ray beam definition, with suitable flatness and symmetry for the irradiation of a 10 cm^2 area of porcine skin, as required for induction of CRI.