AbstractID: 10273 Title: Accuracy of quality control measurements with solid-state detectors in diagnostic radiology

Purpose: Recently, solid-state detectors have been increasingly adopted as diagnostic physics survey equipment due to their compact size and convenience. A single piece of equipment can be used to measure many quantities, including “exposure”, kVp, and half-value layer (HVL), with only a single irradiation. While these detectors perform well in certain beam qualities, they can deliver inaccurate results in others.

Materials and methods: Diagnostic physics measurements including exposure, HVL, and entrance exposure rate were made on several types of equipment, including mammographic, standard radiographic, fluoroscopic, and angiographic systems. Measurements on the angiographic system were made with various amounts of added filtration, ranging from 0.1 to 0.9 mm Cu. Exposure and exposure rate were measured using both a 6 cc ionization chamber and a solid state dosimeter, and HVL was measured using both a 6 cc ionization chamber with Al 1100 and a solid-state dosimeter.

Results: While measurements made on mammographic (0.35 mm Al HVL) and standard radiographic systems (3.1 mm Al HVL) were in good agreement between traditional survey equipment and the solid-state dosimeter, measurements made in X-ray beams of other qualities differed between the two types of survey equipment. The solid-state dosimeter reported a lower HVL than measured with the ionization chamber for beam qualities ranging from 3.8 mm Al HVL to 6.8 mm Al HVL, including measurements performed on commonly-used fluoroscopic systems. For X-ray beams with HVL greater than 6.8 mm Al, results were again in agreement between the two types of survey equipment. Also, entrance exposure rate measurements can be inaccurate if the device is used improperly.

Conclusions: Caution should be used when making diagnostic physics measurements using solid-state dosimeters. Proper positioning of the device is critical for accurate entrance exposure rate measurements, and accurate measurements may not be possible in certain X-ray beam qualities.