AbstractID: 14108 Title: Status of the NIST primary standard water calorimeter for 60Co beams

Purpose: Validation of a second-generation primary standard water calorimeter for use in ^{60}Co radiation beams. **Method and Materials:** Work on a second-generation water calorimeter at NIST has progressed to a stage in which extensive comparison tests are being conducted with a transfer chamber connecting the historical value determined by Steve Domen. The present water calorimeter, based upon Domen's original design, consists of a thin-walled cylindrical glass vessel of ~2 cm radius and ~12 cm length, with two thermistor probes mounted along the axis. The response of the thermistors, which are wired into opposite arms of a Wheatstone bridge, is measured with a lock-in amplifier (LIA). The calorimeter, situated at 5 cm depth in a water phantom at various SDD (77.4 cm and 100.0 cm), is subject to periodic 70s radiation exposures from a vertical ^{60}Co radiation beam, and its steady-state response is obtained both by Fourier analysis and midpoint extrapolation of the time waveform obtained from the LIA. A separate vessel of similar, but not identical, dimensions containing a calibrated Farmer chamber then replaces the thermistor system to obtain a dose rate under identical conditions. **Results:** Agreement between chamber and calorimeter estimates of dose is within 0.4% for SDD of 77.4 cm, and 0.13% at 100 cm. At 77.4 cm, dependence on spatial variations due to possible nonuniformities in the beam were faithfully replicated by the thermistor system, however, the latter estimates of dose rate were lower in all cases. At 100 cm, there is no spatial dependence and no evidence of systematic error. **Conclusion:** The differences between calorimeter and transfer standard were within the 1 sigma statistical uncertainty of +/- 0.13% at 1 m; consistency of the new calorimeter with the historical value is obtained. Reproducibility and possible corrections are needed before the primary standard can be reestablished.