AbstractID: 8072 Title: Evaluated phantom material for ¹²⁵I and ¹⁰³Pd dosimetry

The evaluation of the dosimetry of low energy brachytherapy sources is often carried out in solid phantoms of water equivalent material. AAPM Task Group 43 specifies liquid water as the standard reference standard [1]. Historically, measurements were made in various materials selected by availability, solid phase machinability, and water quasi-equivalence. These have been evaluated by empirical, theoretical, and simulation (Monte Carlo) methods producing factors to convert dose in phantom to dose in water. A new Plastic Water^{TM} material, PW-LR, has been formulated for liquid water equivalency at photon energies 20 to 30 KeV, and replaces PW2030 material. This new material was evaluated using (MCNP4b) Monte Carlo simulation and by ratios of build-up factors to convert TG-43 dosimetric parameters among different materials [2]. Current NIST XCOM v3.51 interaction data was used throughout. Estimated (analytical model) correction factors for ^{125}I and ^{103}Pd spectra are presented for the radial dose function, g(r), and for the dose-rate constant, Λ. In PW-LR, correction in g(r) ranges from 0.99 to 1.0 and from 0.985 to 1.019 for Λ. This compares to a range of [0.93, 1.9] for g(r) in PMMA and [0.99, 1.06] in RW-1 and of [0.71, 0.74] for Λ in PMMA and [1.05-1.07] in RW-1. The work shows the new material to be an excellent water substitute at low energy. The material is solid and easily machined to accommodate sources and dosimeters.

(1) R. Nath, et al., Medical Physics **22**, 209-234 (1995). (2) R.E. Wallace, Med. Phys. **25(7)**, A172 (1998).