AbstractID: 4895 Title: Air-kerma strength determination of a ¹⁶⁹Ytterbium high dose rate brachytherapy source.

Purpose: To provide an accurate determination of the new ^{169}Yb high dose rate (HDR) bracytherapy source in terms of air kerma strength, based on an adaptation of the current, NIST traceable, in air measurement standard in use for ^{192}Ir HDR sources.

Methods and Materials: Several modifications to the seven distance technique, which is the current standard for HDR source strength measurement, were required to adapt it to the ^{169}Yb spectrum. An Exradin A4 spherical chamber was employed, which has a relatively flat chamber response to the range of energies in the ^{169}Yb spectrum, and has been verified to accurately measure the air kerma strength of ^{192}Ir to within the reported uncertainty of the current standard measurement technique.

To convert the electrometer readings to source strength, a chamber coefficient, N_k, was determined by using the NIST calibrated chamber coefficients from several NIST H-Beams, whose energy spectrums fall strategically within the ^{169}Yb spectrum. Several correction factors must be applied to these electrometer readings, including corrections for temperature and pressure, air attenuation, air scatter, ion recombination, and corrections for the finite size of the chamber.

Results: The decay corrected average of fourteen measurement iterations was 8.063×10^{-3} Gy-m^2/hr. Analysis of uncertainty was performed on these experimental ^{169}Yb air kerma measurements using the standard NIST method for evaluating uncertainty. This analysis established an overall k = 2 expanded uncertainty of 2.10%.

Conclusion: It is shown that, with a few modifications, the current standard for high dose rate brachytherapy source calibration could be employed to accurately calibrate the new ^{169}Yb HDR brachytherapy source in terms of air kerma strength. The uncertainties as analyzed fall within those currently used for ^{192}Ir calibration.

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