HE UNIVERSITY OF WISCONSIN ACCREDITED DOSIMETRY CALIBRATION LABORATORY (UW-ADCL) is now accredited by the American Association of Physicists in Medicine (AAPM) to provide absorbed dose to water ionization chamber calibrations. The absorbed dose to water calibration factor will allow clinical physicists to use the Task Group 51 (TG 51) protocol (to be published in Medical Physics) to simplify the absorbed dose calculation for megavoltage radiation therapy. The ADCL calibration method involves a replacement technique for ionization chambers similar to that previously performed for air kerma calibrations. Measurement proficiency testing between the ADCLs and NIST carried out in the fall of 1998 showed agreement to within 0.2%.

Procedure

THE NIST-CALIBRATED ADCL TRANSFER CHAMBER IS PLACED IN A 50 cm x 50 cm water phantom at a nominal depth of 5 cm to determine the absorbed dose to water rate. The chamber to be calibrated is then placed in the same position as the transfer chamber. With this method, the ADCL determines a calibration factor, \( N_{60\text{Co}} \), for the clinical ionization chamber that is directly traceable to NIST. The relative expanded uncertainty of this calibration has been determined to be +/- 1%, including the NIST uncertainties involved in the calibration of the ADCL transfer standard. This includes a coverage factor of two, which defines an interval having a level of confidence of approximately 95 percent. Chambers that are not inherently waterproof will be inserted in a PMMA sleeve of 1 mm maximum wall thickness, either provided by the ADCL or the physicist. Although a thin latex sheath may be substituted for the PMMA sleeve, rubber sheaths are not permitted for chamber calibrations since they may introduce a 1% attenuation discrepancy. Parallel plate chambers that are not inherently waterproof cannot be calibrated in water at this time.

The calibration factor, \( N_{60\text{Co}} \), is expressed in terms of absorbed dose to water per unit charge (Gy/C). The ionic recombination effect will be measured by the full voltage / half voltage technique and applied to the chamber measurement results. The final calibration factor is therefore corrected for 100% collection efficiency.

Use of the Calibration Factor

THE PHYSICIST SHOULD BE AWARE THAT THE CALIBRATED chamber needs to be used in the same configuration as its calibration. The TG 51 report will include tables of the energy correction factor, \( k_Q \), for high energy photon and electron beams produced by the hospital-based linear accelerators. Since the chambers are calibrated at \(^{60}\text{Co}\) traceable to the NIST water calorimetry results, a correction is necessary for the x-ray beams produced at higher energies. Other corrections necessary for electron beams are also included in the TG 51 protocol. The final equation to calculate the absorbed dose to water is relatively simple; involving only the \(^{60}\text{Co}\) calibration factor, \( N_{60\text{Co}} \) and the usual corrections such as the electrometer calibration factor, air density correction and the energy correction factor, \( k_Q \).

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