Evaluation of Uncertainties in the Calibration of Radiation Survey Meters

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Body of Abstract: At the Calibration Laboratory of IPEN about two thousand radiation meters are calibrated each year, including radiation therapy, diagnostic radiology and radiation protection instruments. In order to meet the requirements of ISO 17025, the quantification of the expanded uncertainties of experimental data must be carried out using well defined concepts, like those expressed in the "Guide to the Expression of Uncertainty in Measurement" (ISO-1998). The calibration procedure of gamma ray survey meters involves two values that have to get their uncertainties clearly known: measurements of the instrument under calibration and the true values (air kerma rates). Considering the continuos improvement of the calibration methods and set-ups, it is necessary to evaluate periodically the involved uncertainties in the procedures. Uncertainties of measurements are expressed as relative standard uncertainties, and the evaluation of standard uncertainties is classified into type A and type B. The uncertainty in the instrument under calibration is normally of type A, and it is obtained by a series of measurements, at least ten, and then its standard deviation is multiplied by the t-factor to express the confidence level of the instrument. For the physical quantity of air kerma rate, the true value is obtained through the indirect measurements performed with a 1.0 m3 spherical ionization chamber, Physikalisch-Technische Werkstätten, model LS01, traceable to the Brazilian Ionizing Radiation Metrology Laboratory. In this case, the integral of the electrical current during a time interval is measured : the charge (Q±DQ) formed in the chamber active volume when it is submitted to radiation at a defined distance (x±Dx) and instant (t±Dt). The measurement of the instrument under calibration (and its uncertainty) is compared with the true value (and its uncertainty). In this work it is shown how the measurement uncertainty of a individual calibration can be estimated and how it can be generalized to be valid for any radiation survey meters.