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### **Evaluation of the influence of wall material and thickness in well-type ionization chambers using PENELOPE Monte Carlo code**

**Purpose:** Study the influence of wall materials and thicknesses in the response of two well-type ionization chambers using PENELOPE Monte Carlo code. **Methods and Materials:** A multi-parallel electrodes chamber has original steel walls with 0.2mm thickness. The chamber with coaxial electrodes has aluminum walls and 2.5mm thickness. The response of the two chambers with original and exchanged inner wall materials and thicknesses was studied with PENELOPE. The spectra of radiopharmaceuticals used in Nuclear Medicine ( $^{131}\text{I}$ ,  $^{99\text{m}}\text{Tc}$ ,  $^{67}\text{Ga}$  and  $^{201}\text{Tl}$ ) were simulated and the total and the distribution of energy deposited in the gas were obtained. **Results:** For the multi-electrode chamber it was found a decrease of 39% and 28% in sensitivity for the wall thickness and material changes, respectively, when the lower energy was simulated ( $^{99\text{m}}\text{Tc}$ ). For the other radiopharmaceuticals simulated the differences found were always inferior than those found for  $^{99\text{m}}\text{Tc}$ . For the coaxial electrode chamber the change in wall material (aluminum to steel) resulted in a decrease in sensitivity of 48% and 24% for  $^{99\text{m}}\text{Tc}$  and  $^{131}\text{I}$ , respectively. For all cases studied, the spatial dose distribution in the gas is substantially changed when the wall materials and thicknesses are changed, for example an increase of 56% in the dose contribution to the gas near to the wall (within 1cm) for one study. **Conclusion:** The results obtained by simulation show that there is a wide range of variation in the response of both chambers when the wall material and thicknesses are changed. While some configurations show no difference in the relative response, the change in the dose deposition pattern inside the sensitive volume can be further studied to lead to the possibility of optimizing its configuration for a given application.