VALIDATION AND CORRECTION FOR \(^{208}\)Tl ACTIVITY TO ASSAY \(^{232}\)Th IN EQUILIBRIUM WITH ITS DAUGHTERS

O. Abo-Bakr Omar\(^a\), M. A. E. Abdel-Rahman\(^a\), S. A. El-Mongy\(^b\)

\(^a\) Military Technical College, Kobry El-kobbah, Cairo

\(^b\) Nuclear and Radiological Regulatory Authority of Egypt, Egypt

The natural radioactivity measurements and analysis of \(^{232}\)Th have been studied using \(\gamma\)-ray spectroscopy depending on its decay daughters in equilibrium: \(^{208}\)Tl of 583.19 keV, \(^{228}\)Ac of 911.2 and 968.97 keV, and \(^{212}\)Pb of 238.63 keV. When using these gamma transitions to calculate the \(^{232}\)Th specific activity, the \(^{208}\)Tl daughter of 583.19 keV gamma line with its 0.845 branching ratio gives activity of approximately 33.94% less than the other gamma transitions. This article is trying to explain and validate this difference and discrepancy that analysts may encounter during calculation of \(^{232}\)Th activity based on \(^{208}\)Tl (583.19 keV) gamma line. Very efficient HPGe detector was used to carry out this work. The MDA and figure of merit as functions of HPGe and energy sensitivity were calculated and tabulated. This issue was verified and validated using black sand and natural environmental samples. A correction factor was proposed and applied on the 583 keV line of these samples that contain \(^{232}\)Th in equilibrium with its daughters to minimize and eliminate the above-mentioned difference in the calculated \(^{232}\)Th specific activity.

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\(^1\)E-mail: omar805805805@gmail.com