

Comparative Performance of Standing Whole Body Monitor and Shielded Chair Counter for In-vivo Measurements

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Abstract : In-vivo monitoring facility at Indira Gandhi Centre for Atomic Research (IGCAR), Kalpakkam, caters to the monitoring of internal exposure of occupational radiation workers from various radioactive facilities of IGCAR. Internal exposure measurement is done using Na(Tl) based Scintillation detectors. Two types of whole-body counters, namely Shielded Chair Counter (SC) and Standing Whole-Body Monitor (SWBM), are being used. The shielded Chair is based on a NaI detector of 20.3 cm diameter and 10.15 cm thick. The chair of the system is shielded using lead shots of 10 cm lead equivalent and the detector with 8 cm lead bricks. Counting geometry is sitting geometry. Calibration is done using 95 percentile BOMAB phantom. The minimum Detectable Activity (MDA) for ^{137}Cs for the 60s is 1150 Bq. Standing Wholebody monitor (SWBM) has two NaI(Tl) detectors of size 10.16 x 10.16 x 40.64 cm³ positioned serially, one over the other. It has a shielding thickness of 5cm lead equivalent. Counting is done in standup geometry. Calibration is done with the help of Ortec Phantom, having a uniform distribution of mixed radionuclides for the thyroid, thorax and pelvis. The efficiency of SWBM is 2.4 to 3.5 times higher than that of the shielded chair in the energy range of 279 to 1332 keV. MDA of 250 Bq for ^{137}Cs can be achieved with a counting time of 60s. MDA for ^{131}I in the thyroid was estimated as 100 Bq from the MDA of whole-body for one-day post intake. Standing whole body monitor is better in terms of efficiency, MDA and ease of positioning. In case of emergency situations, the optimal MDAs for in-vivo monitoring service are 1000 Bq for ^{137}Cs and 100 Bq for ^{131}I . Hence, SWBM is more suitable for the rapid screening of workers as well as the public in the case of an emergency. While a person reports for counting, there is a potential for external contamination. In SWBM, there is a feasibility to discriminate them as the subject can be counted in anterior or posterior geometry which is not possible in SC.

Keywords : minimum detectable activity, shielded chair, shielding thickness, standing whole body monitor

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