Comparison of the LLNL and JAERI Phantoms using Four 80-mm Diameter Germanium Detectors

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The calibration phantom is an important consideration when determining counting efficiency. Historically, a realistic torso phantom developed by Lawrence Livermore National Laboratory, USA (LLNL) has been employed as the *de facto* standard for the calibration of lung counting systems. However, the Japanese Atomic Energy Research Institute (JAERI) has developed an alternative realistic torso phantom that would be more representative of an Asian man. One feature of the JAERI phantom is that it more closely represents the lung dimensions given in Reference Man (ICRP 23) than does the LLNL phantom, so it can be argued that calibration factor determined from the JAERI will be more accurate for real people. The lungs of the JAERI phantom are considerably longer than that of the LLNL phantom, so it was hypothesized that larger diameter detectors may provide improved counting efficiency, relative to the LLNL phantom, due to greater lung coverage with the larger diameter detectors. It is important to note that the efficiency determined from the JAERI phantom, has been experimentally shown to be 2 - 45 %, depending on chest wall thickness, photon energy and detection system (size / type). In this study, all efficiency measurements were performed using a single broad energy germanium (BEGe) detector manufactured by Canberra Industries[a] (80 mm diameter by 20 mm thick). This detector was positioned at four locations over each phantom, and efficiency data were collected for lungs containing ^{241}Am / ^{152}Eu and ^{235}U. Efficiency determined from each phantom is compared as a function of energy and muscle equivalent chest wall thickness.

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