Title

An optmized NaI(Tl) multi-detector method for the determination of spatial contamination in urban areas.

Abstract

It has been proposed a four NaI(Tl) three inches detectors arranged in a cross-shaped layout combined with Monte Carlo method and Artificial Neural Networks (ANN) to assess the multi-directional contamination activity of urban surfaces following a radioactive release and/or to search of radioactive sources. This methodology has been optimized to a three NaI(Tl) detectors T-shaped shielded setup providing easier handling and reducing costs, weight and analysis time. The detectors´ responses to the contaminated surfaces were simulated using the Monte Carlo Method. A very simple model of a street with a wall on either side was used to simulate the urban environment. Training and production data sets for the three-detector and for the four-detector arrangements with lead shielding of varying thicknesses from 1 to 10 cm were obtained with the Monte Carlo method. These data-sets were used to train and test two different ANN topologies which were chosen in a previous work. This approach can be used to indicate highly contamination surfaces in a given area or even the direction where a radioactive source might be found, saving extra dose to the survey team. The results showed that trained ANNs can accurately predict the contamination on urban surfaces. The proposed setup, its calibration and the calculations methodologies are a powerful tool to be used in field surveys.

Keywords: n-situ radiation measurements; NaI(Tl) detectors calibration, Monte Carlo Simulations, neural networks, surface contamination assay