

Which levels of alpha- and beta contamination are possible to detect with manual search?

Measurement of alpha-beta activity on surfaces can be a cumbersome task. The value of a measurement will vary depending on the speed with which the probe is moved over the surface, distance to the surface and characteristics and flatness of the surface.

Contamination limits and recommended values are given in levels of Bq/cm² while the instrumental response is given in counts per second (cps), therefore a relationship between contamination and instrumental response needs to be developed. This relationship will be different for each type of instrument.

Goal:
These measurements will form the basis for the methodology of measuring alpha and beta contamination.



Sources used
Alpha and beta sources of low, medium and high energies (maximum energies showed):

Am-241	5400-5500 keV
Ni-63	66 keV
Tc-99	294 keV
Sr/Y-90	546, 2284 keV

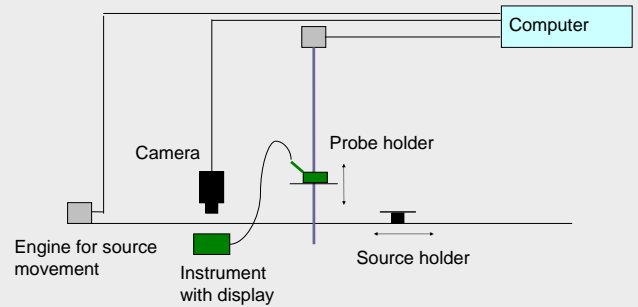
Glass slides are coated with activity between 0.4 - 26 Bq/cm² for alpha and 4 - 400 Bq/cm² for beta. The active area is 200 cm² (10 cm × 20 cm).

Results

Enhanced speed gives an increasing delay for the displayed values but no delay in the audible signal.

The conversion factor ((Bq/cm²)/cps) is, for example, 0.48 for Tc-99 and 0.27 for Sr/Y-90 at the reference distance of 30 mm and increases with increasing distance, while beta energies equivalent to Ni-63 with a contamination of 400 Bq/cm² are impossible to register in practice.

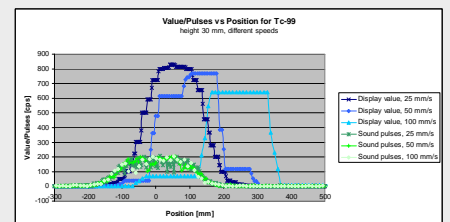
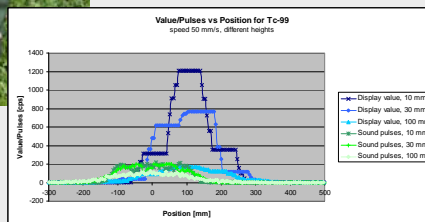
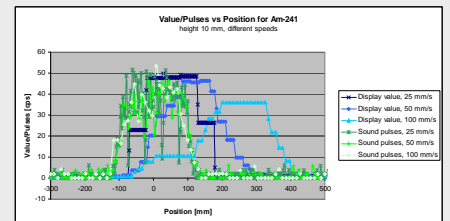
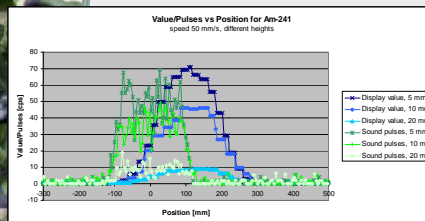
Engine for elevating the probe holder



Experimental setup

Measurements are made with custom made equipment and computer program created for this purpose. All parameters are monitored and modified. The first instrument tested is "Intensimeter 28" with its hand-held combination probe (alpha and beta), used by the Swedish Armed Forces.

The scanning speed and distance to the source are varied and different nuclides are used.



The graphs shows, for 26 Bq/cm² Am-241 and 400 Bq/cm² Tc-99, how display values and sound pulses changes with position for a selected speed and height.

Nuclide	Conversion factors * (Bq/cm ²)/cps	
Ni-63	-	-
Tc-99	0.48	0.92
Sr/Y-90	0.27	0.43

* Values at heights of 30 mm and 60 mm



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