

RSSI AT-101 MINIMUM DETECTABLE EXPOSURE

When counting α -tracks, which are discrete events, the limit of detection (L_d) can be quantified. L_d is the minimum track count necessary to be certain of detecting counts above background. L_d is translated to the minimum integrated exposure that can be detected on a routine basis, frequently expressed as the minimum detectable activity (MDA), or more appropriately as the minimum detectable exposure (MDE), in picocurie-days per liter pCi-days/L or as pCi/L for a specified exposure period in days.

The value for L_d is expressed as:

$$L_d = \frac{k^2}{T} + 2k \left[2 \frac{R_b}{T} \right]^{1/2} \quad (1)$$

where

L_d = the limit of detection,

k = the one-sided confidence factor ,

T = the counted area for background and detector foils, and

R_b = the background track count per counted area

If k is 1.65, 95% of the measurements of a true track count L_d are detected, L_d is a practical detection limit with a 95% probability of detecting. T is 1 for a counting area defined as a foil. The equation above reduces to:

$$L_d = 2.72 + 3.30[2R_b]^{1/2}$$

For the AT-101, $R_b = 33$, yielding $L_d = 29.5$ tracks. Multiplying by the exposure conversion factor, 0.16 pCi-days/L-track yields an MDE of 4.7 pCi-days-L or 0.05 pCi/L for a 90 day exposure. The lowest value reported by RSSI under USEPA guidance is 0.1 pCi/L. Measured concentrations below 0.1 pCi/L are reported as 0.1 pCi/L. Calculated concentrations where the track count is below the L_d are reported as <0.1 pCi/L or as <4.7 pCi-days/L divided by the exposure period, whichever is greater.

(1) NBS SPECIAL PUBLICATION 456, Measurements for the Safe Use Of Radiation