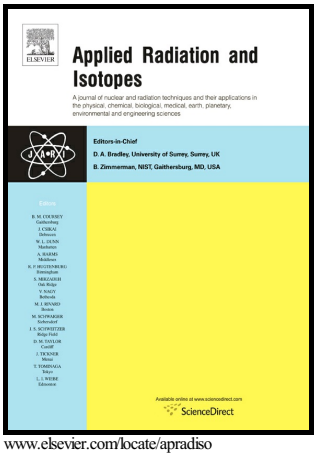

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DECISION THRESHOLD AND RELATIVE UNCERTAINTY OF THE MEASURED NET SIGNAL IN RADIATION MEASUREMENT

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Abstract: This work proposes a simple way to assess whether a physical effect due to the sample is present, via the relative uncertainty of the measured net signal. A possibility for evaluation of the respective relative limit for any particular (already measured) positive net signal is shown. This relative limit ('*relative decision threshold*') is strictly related to the basic definition of the decision threshold. The full agreement between the conclusions via the decision threshold and via the relative decision threshold, is experimentally demonstrated.

Keywords: Critical level-Decision threshold; Relative Uncertainty; Net signal; Detection limit

1. Introduction

In general, the analysis of the sample radioactivity includes an estimation of the activity and its uncertainty only when the measured net signal is statistically significant, i.e. when the sample count rate is statistically different from (higher than) the background count rate.

Consequently, when low level activity samples are measured one has first to estimate the statistical significance of the net signal (where the net signal is the background corrected result from a sample measurement).

It is well known that the critical level (Currie, 1968) ('*decision threshold*' (ISO 11929, 2010)) is used in order to test (within a given probability) whether the measured net signal is statistically significant, i.e. whether a physical effect due to the sample measurement is present. Currie (1968) defines the critical level L_c as:

$$L_c = k_\alpha \cdot \sigma_0 \quad (1)$$

and ISO 11929 (2010) defines the decision threshold y^* as:

$$y^* = k_\alpha \cdot u(0) \quad (1a)$$

where k_α is the quantity for the standardized normal distribution for probability 1-α (α is probability of the error of the first kind); σ_0 is the absolute uncertainty of the net signal the true