

Gamma-Ray Spectrometry Users Forum

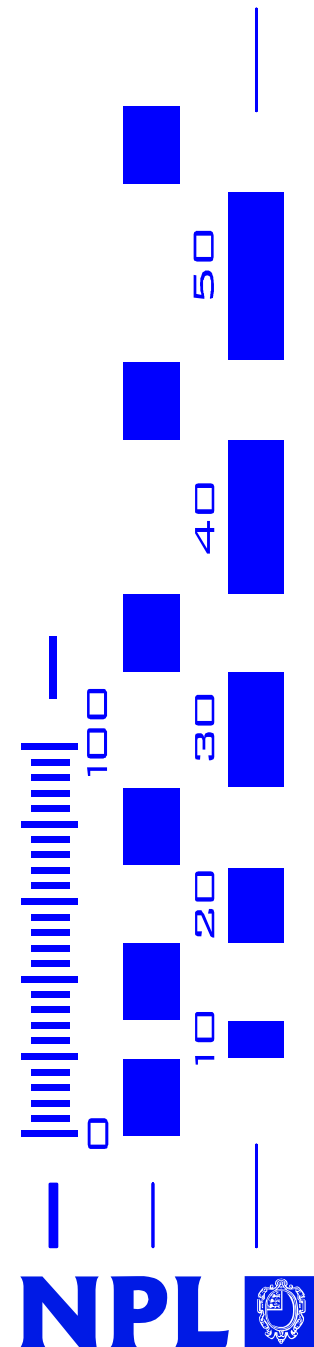
SUMMARY NOTES

GSUF SUBGROUP ON MINIMUM DETECTABLE ACTIVITIES

14 SEPTEMBER 1999

Simon Woods

October 1999



BACKGROUND

- u What is meant by MDA?
- u Which formalism do I use?
- u When do I use it?
- u Are others reporting the same as me?
- u
- u GSUF subgroup set up to address the problem

DISCUSSIONS

- u Consensus as to the reporting of results
- u Recommendations based on equations of Currie
- u Clarification on estimation of background uncertainties (*single counts, peak integration, low count rates*)
- u Confidence limits of 95% adopted

DEFINITIONS

L_U Upper limit in counts

L_D Limit of detection in counts

σ_0 Standard deviation of background counts

σ_N Standard deviation of net counts or peak area

B Background count

N Net count

A Net peak area (counts)

m Number of channels within peak region

n Number of channels within background regions

RECOMMENDATION 1 - PEAK DETECTED

u Quote result and uncertainty

CRITICAL LIMIT

u General Case:

$$L_c = 1.645 \sigma_0$$

u Single Count Case:

$$L_c = 1.645 \sqrt{2B}$$

u Peak Integration Case:

$$L_c = 1.645 \sqrt{B(1 + n / 2m)}$$

RECOMMENDATION 2 - PEAK NOT DETECTED

u Upper limit to the count or peak area

Represents what has been achieved

I am 95% certain that the actual activity in the sample will be less than this amount

UPPER LIMIT (MAXIMUM ACTIVITY)

u General Case:

$$L_U = N + 1.645\sigma_N$$

u Single Count Case:

$$L_U = N + 1.645\sqrt{(N + 2B)}$$

u Peak Integration Case:

$$L_U = A + 1.645\sqrt{(A + B[1 + n / 2m])}$$

RECOMMENDATION 3 - DETECTION LIMITS

- u **Limit of detection and MDA**

Represents what might be achieved

What count could I be 95% certain of detecting?

- u **MDA is not the minimum activity detectable**

- u **Peak not detected: MDA will always be greater than the Maximum Activity**

LIMIT OF DETECTION (MDA)

u General Case:

$$L_D = 2.71 + 3.29\sigma_0$$

u Single Count Case:

$$L_D = 2.71 + 3.29\sqrt{2B}$$

u Peak Integration Case:

$$L_D = 2.71 + 3.29\sqrt{B(1 + n / 2m)}$$

SUMMARY

- u Peak detected (above critical limit) - give result

Reporting of results

- u Peak not detected (below critical limit) - give maximum activity

Reporting of results

- u Characterise system - give MDA

Figure of merit for tender documents

