Minimum Detectable Activity (MDA) calculations:

Gamma Spectroscopy: At a 5% probability of making type 1 and type 2 errors,

$$MDA = \frac{\left(2.71 + 4.65 \times \sqrt{B}\right) \times Decay}{\varepsilon \times b \times LT \times k \times q}$$

Where:

B = Background Sum
Decay = decay factor
ε = efficiency
b = abundance
LT = elapsed live time
k = 3700 dps/μCi
q = sample quantity

Liquid Scintillation: Considered "Figure-of-Merit" (FOM or E^2/B) by Packard Instrument Company.

$$FOM = \frac{\left(Efficiency\right)^2}{Background} = E^2 / B$$

Gas-Flow Proportional Alpha/Beta Analysis:

$$MDA = \frac{0.67^2}{TEA\mu} + 2Lc$$

Where:

0.67 = Standard deviation multiple (k) to obtain 75% confidence level
T = Count time of sample acquisition
E = Efficiency of the counting channel
A = Attenuation factor
μ = Correction factors to convert Lc to desired activity per unit
and:

$$Lc = \frac{0.67\sqrt{\left(\frac{R_b\left(1 + R_b T_s z^2\right)}{T_s}\right) + \left(\sigma_{r_b}\right)^2}}{EA\mu}$$

LL/38v

Where:

R_b = Background count rate
T_s = Sample count time
σ_{rb} = Error of the background rate
z = systemic error (1% max, therefore 0.01 used)
E = Efficiency of the counting channel
A = Attenuation factor
μ = Correction factors to convert Lc to desired activity per unit
0.67 = Standard deviation multiple (k) to obtain 75% confidence level