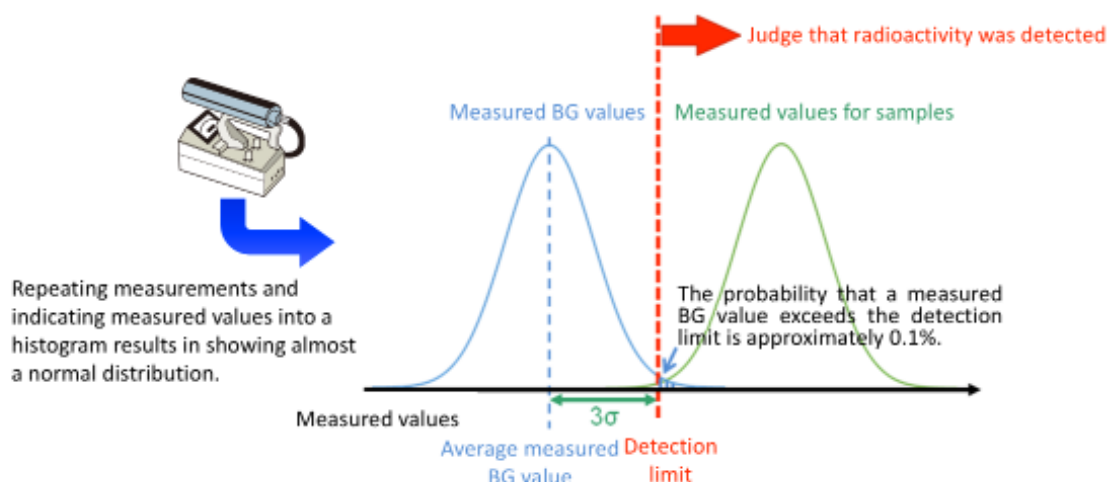


Ideas on Detection Limits (3σ Method)

- Even a minor change in measurement conditions can influence measurement results and there is also background (BG) radioactivity derived not from samples themselves. Therefore, due consideration is required when setting a detection limit in order to assure statistical reliability.
- One of the representative ideas on detection limits is the 3σ method. Under the 3σ method, a detection limit is defined as a value obtained by adding three times sigma of the measured background values to their average. When a measurement result exceeds this value, it is judged that signals (radioactivity, a dose rate, etc.) from a sample are detected.



When measuring background radioactivity or dose rates using a survey meter or other equipment, even a minor change in measurement conditions can influence measurement results. Therefore, it is necessary to repeat measurements in order to obtain reliable measurement results.

Indicating values obtained through repeated measurements into a histogram results in showing a normal distribution. The minimum amount of radioactivity that can be detected as a statistically significant value under the condition of fluctuating background dose rates is referred to as a detection limit (or lower limit).

Under the 3σ method, one of the representative ideas on detection limits, a detection limit is defined as a value obtained by adding three times sigma to the average of the measured background values. This is because when the measured value is larger than 3σ , the probability of BG measurements that exceed the detection limit by fluctuation is approximately 0.1%.

In addition to the 3σ method, there is the Currie method. Under this method, a lower detection limit is set in consideration of the fluctuation of sample measurements so as to reduce the probability of a “false negative,” where measurements close to but above the detection limit are judged as Not Detected (ND).

Reference

- “Practical handbook for γ -ray measurement,” authored by Gordon Gilmore and John D. Hemingway, translated into Japanese by Yonezawa Nakashiro, et al., NIKKAN KOGYO SHIMBUN, LTD. (2002)
- “Ideas on detection limits and minimum limits of determination,” by Uemoto Michihisa, Bunseki 2010 5, 216-221 (2010)

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