

GROSS ALPHA / BETA PROPORTIONAL COUNTING FOR SAMPLES HAVING HIGH RESIDUE MASS

Hewitt W. Jeter

Teledyne Environmental Services
Westwood, New Jersey

Gross alpha and beta measurements are commonly performed by direct counting with gas-flow proportional detectors (although alternative methods are being introduced using liquid scintillation counting, extraction or precipitation methods). In the traditional approach, solid samples such as air particulate filters and smear samples are mounted on shallow metal planchets and are positioned close to the detector. Aqueous samples are evaporated and the residue is transferred to a planchet for counting in the same way.

The self-absorption characteristics of the residue in the planchet must be considered in the calculation of gross alpha / beta results. Increasing the thickness of the residue causes greater self-absorption of alpha and beta particles, such that fewer particles are able to reach the detector. In practice, empirical self-absorption curves are used to calculate results, based on experiments using varying residue masses.

Most gross alpha / beta analytical procedures specify an upper limit of 0.1 gram residue mass for gross alpha analysis and 0.2 gram residue mass for gross beta analysis, for aqueous samples evaporated and transferred to 2 inch diameter metal planchets (20 cm² surface area). These limits are based on the "infinite thickness layer" concept, which reasons that thicker deposits would be intractable because of total absorption of particles from the deeper layers of the residue.

Limiting the residue mass in this way causes practical problems for many water samples which have significant dissolved matter. Often a trial-and-error approach must be used to find a sample aliquot which yields a residue mass within the allowable limits.

Gross alpha and beta analyses can be performed for samples having heavier residue masses if the appropriate calibrations are performed. The method involves assumptions which can be justified by experimentation. Test samples show good results beyond the traditional mass limits, leading to improved productivity for gross alpha / beta analyses.