A Novel Approach to Gross Alpha and Beta Determinations by Liquid Scintillation Counting on Savannah River Site Waste Samples

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As a consequence of waste vitrification efforts underway at the Savannah River Site, a need has arisen to obtain gross alpha and gross beta values in samples with high salt contents, and high beta activities. Traditional methods for determining gross alpha activities at SRS were based primarily on gas flow proportional counters. Plate mounting losses from volatile solids, as well as varying self-attenuation factors, made quantification difficult. Rough beta values were obtained from liquid scintillation analyses or were identified by more time consuming radionuclide-specific methods. Other sample mounting methods were investigated for the alpha determinations, as well as more involved radionuclide speciations. A less time consuming method was desired to analyze large numbers of these samples, as well as other various contaminated samples which routinely flow through our lab.

Liquid scintillation counting is a well established technique for screening samples for radioactivity. Relatively recent advances in liquid scintillation counters have made it possible to use pulse shape discrimination to simultaneously discern alpha and beta components for large quantities of samples. For samples of similar composition and radionuclide distributions, these instruments can be adjusted to give excellent gross alpha and beta results. However, in SRS waste samples, which span a number of combinations of materials and radionuclide distributions, a constant discriminator setting, with fixed alpha and beta efficiencies, invariably leads to erroneous results.

A Packard Instruments Model 2550/AB Tri-Carb Liquid Scintillation Analyzer has been used to investigate the potential for a high turn-around low cost method of obtaining quantitative gross alpha and gross beta values from samples of varying matrices. The spill-over, or "cross talk", between alpha and beta activities for various sample conditions using Canberra Ultima-Gold AB liquid scintillation cocktail has been examined.

A method has been developed to measure the alpha activity using the standard addition method in conjunction with liquid scintillation counting. Spill-over rates can be compensated for in the final results using the measured alpha efficiency. Results of these experiments will be discussed.