Gross Alpha Measurements Using Extraction Chromatography in Conjunction with Pulse Shape Discrimination Liquid Scintillation Analysis on Savannah River Site High Activity Waste Solutions

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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 values in samples with high salt contents and high beta activities. Current waste treatment processes are resulting in sample matrices with 6 to 7 orders of magnitude more beta than alpha. Traditional methods for determining gross alpha activities at SRS were based primarily on gas flow proportional counter analyses of samples flame mounted on planchets. Sample pre-treatment either by extracting the actinides, or stripping out the beta emitters was necessary before an alpha analysis could be carried out. Plate mounting losses from volatile solids, as well as varying self-attenuation factors, made quantification difficult. A less time consuming method was desired to analyze these samples to provide a more rapid turn-around to the customer.

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. 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. It was found spill-over from the beta to alpha channels could be reduced to levels of approximately 0.1%

A method has been explored to measure the alpha activity in this sample type using Eichrome's Actinide resin in conjuction with liquid scintillation analysis with pulse shape discrimination. As has been previously demonstrated by Eichrom, the DIPEX extractant will disperse in liquid scintillation cocktail, allowing for a quantitative liquid scintillation analysis of environmental samples. Results of these experiments to extend the method to analyses of higher activity samples will be discussed.