A System for Rapid Water Sampling and Analysis Based on Empore™ Membranes and Solid Scintillation Spectrometry

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We are developing a system for rapid water sampling and analysis based on Empore™ membrane technology and a novel solid scintillation beta spectrometer. We have demonstrated the system under field conditions for technetium and strontium at environmental levels with a variety of sample types (groundwater, surface water, fuel pool water, etc.). We found the system simple to operate and able to withstand rough handling during shipment and field use. Typical laboratory procedures using Empore™ membranes employ nominal flow rates of 50 mL/min. Although convenient for laboratory analyses, these flow rates would be inefficient for field collection. We evaluated several designs for membrane holders during testing at Department of Energy sites. Six groundwater monitoring wells and two surface water sites were sampled, with a total of 67 samples collected on Empore™ Technetium Rad Disks. The ^{99}Tc concentrations in these water samples were 2-4000 pCi/L. Sample volumes of 1.0-14.0 L were collected at flow rates of 150-440 mL/min, the latter an increase of more than eightfold over results for the conventional laboratory method for these disks. Off-site analyses of the membranes for ^{99}Tc were performed by liquid scintillation (LSC) and solid scintillation counting. Water samples were also analyzed for ^{99}Tc by standard methods, and general agreement with results for the Empore™ membrane was demonstrated among three laboratories. Several sample prefilters and effluents were also selected for analysis; only trace amounts of residual ^{99}Tc were detected. The system was also evaluated for on-site analysis of the Empore™ membrane samples. Results will be presented for the determination of ^{99}Tc and ^{90}Sr in process matrices with a new solid scintillation spectrometer. This portable spectrometer requires no gas or liquid scintillator, yields counting efficiencies comparable to gas proportional counters, and provides both quantitative and qualitative information.

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