Modifying ultrafiltration membranes to capture radionuclides for nuclear forensics analysis

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This presentation will describe new membrane materials and sample collection and concentration methods, combined with state-of-the-art analysis techniques, for the identification and accurate quantification of the isotopic composition of special nuclear material. Ultrafiltration (UF) membrane surfaces were modified with radionuclide-selective ligands and used to concentrate alpha emitting radionuclides for determination of isotopic composition and quantification of activity. Membranes were prepared by grafting uranium- and plutonium-selective polymer ligands from the surface of polyethersulfone and polyacrylonitrile UF supports. Radioactive samples were filtered through the membranes, after which the loaded membranes were used as a substrate for alpha spectroscopic analysis to determine isotopic compositions. Percent recovery and peak resolution were analyzed for membranes prepared using supports with different molecular weight cutoffs. The effect of residence time on recovery was investigated by adjusting transmembrane pressure. Determination of activity was achieved by developing a rapid quantification technique using scintillating quantum dot coatings on the UF membranes. The results of this research are laying the foundation for the development of a rapid, field portable method for the separation and isotopic identification of waterborne SNM, which would be a powerful nuclear forensics tool.