particles. This is seen in the narrowing of the elastic and excited state peaks in a plot of momentum versus counts. In the majority of the Hall A experiments, the VDCs are used, so as the experiments become more precise, it is necessary to achieve the best possible database in order to study the collision.

Fingerprint Analysis a the Infrared Beam Line. *JORGE SERVIN (West Hills College, Lemoore, CA 93245) MIKE MARTIN (Lawrence Berkeley National Laboratory, Berkley, CA 94720).* Fingerprint Analysis has been around for thousands of years. Samaritans were the first that we know of to use fingerprints as a way to sign a contract. Samaritans were not the only one's to use fingerprints as a way to do business, in the late 1800 century, Francis Galton used fingerprints in India because the majority of people there were illiterate. The most famous case in the history of fingerprinting occurred in the late 19th century when a man was spotted in the incoming prisoner line at the U.S. Penitentiary in Leavenworth, Kansas by a guard who 'knew' him and had just seen him already in the prison population. Upon examination, the incoming prisoner claimed to be named Will West, while the (not escaped) existing prisoner was named William West. According to their Bertillon Measurement they were essentially indistinguishable. As they were not twins, the Bertillon system came into some question. However, their fingerprints were different, and fingerprint identification received a significant boost in credibility. In our research at Lawrence Berkeley National Laboratory this summer, the Intensive Research Group did fingerprint analysis at the Infrared Beam line. Our project consisted of finding out what kind of chemical components were present in fingerprints. We put our fingerprints on a gold plated slide. Then, we used the FTIR (Fourier Transformation Infrared Red) Spectrometer to analyze the sample. The machine measures the absorbance of infrared radiation by the sample and records a spectrum. Then we search the computer library or known spectra and find the best match to the sample. This tells us the different types of molecules that are presented in the sample fingerprint. Now the boundaries of infrared forensics are being pushed into uncharted territories by researchers at Berkeley Lab, and the results are promising for criminal and antiterrorism investigations as well as for historians and archaeologists.

Initial Studies of $^{238}UO_2^{2+}$ and $^{248}Cm^{3+}$ Complexation by Potentiometry and Time Resolved Laser Fluorescence Spectroscopy (TRLFS). *KRISTINA SVENSSON (College of Marin, Kentfield, CA 94904) HEINO NITSCHE (Lawrence Berkeley National Laboratory, Berkley, CA 94720).* Understanding the chemical behavior of actinides' aqueous chemistry is necessary for designing cleanup and containment methods, predicting transport rates and preventing further contamination of areas to which actinides have been introduced. The determination of stability constants via potentiometric titrations or TRLFS provides fundamental chemical information which supplements data used for modeling actinide behavior in the environment. TRLFS was used to analyze micromolar concentrations of UO_2^{2+} and Cm^{3+} complexed with simple carboxylic acids of varying carbon chain lengths as well as with phosphoenol pyruvate (PEP) to attain fluorescence lifetime information. The modeling software Hyperquad 2000 aided in the determination of the stability constants of PEP, but additional experimentation is needed. The results show no correlation between carbon chain length and fluorescence lifetime. A blue shift is evident from that of free uranyl at pH 3.9 in the presence of 0.05M propionic acid. These shifts are evidence of a second fluorescent species in solution, but further characterization is required for identification. At pH 3, both UO_2^{2+} and Cm^{3+} show a red shift in the presence of 0.045M PEP. These shifts are evidence of a second fluorescent species in solution, but further characterization is required for identification.

Size and Weight Reduction Through the Use of Depleted Uranium Dioxide (DUO_2)-Steel Cermet Materials for Spent Nuclear Fuel Rail Transport and Storage System. *PAUL SWANEY (North Carolina State University, Raleigh, NC 27607) M. JONATHAN HAIRE (Oak Ridge National Laboratory, Oak Ridge, TN 37831).* Currently the US Department of Energy (DOE) has an inventory of ~500,000 MT of depleted uranium as a result of enrichment processes. The cost of disposing of this material has been estimated from $240million to 1.5 billion. Finding a practical use for the depleted uranium would save hundreds of millions if not billions of dollars. One possibility is using depleted uranium to make depleted uranium dioxide-steel cermet storage casks for spent nuclear fuel (SNF). Shielding analyses were conducted using the SAS1 Module of the SCALE4.4a code developed at Oak Ridge National Laboratory. The spent nuclear fuel radiation source term was obtained from Origen-ARP in the SCALE4.4a code package. The gamma shielding efficiency of the cermet material is compared to Holtec International's HI-STAR 100 cask system that uses conventional steel for radiation shielding. The HI-STAR 100 cask was modeled using information obtained from Holtec's Final Safety Analysis Report (FSAR). After modeling the HI-STAR 100 cask, the steel layers of the cask were replaced with a layer of cermet material. The thickness of the cermet shielding was adjusted to give the same radiation doses as the HI-STAR cask. The objective of this work is to reduce cask weight and size by using the cermet material to replace conventional steel. If no credit is taken for cermet mechanical properties during licensing, calculations show the cask weight reduced by 13.7% and the overall diameter of the cask reduced by 4.8%. However if the cermet can be relied upon for structural strength and more depleted uranium is used in the cermet material, then the effectiveness of the cermet is better utilized. When the cermet material is fully utilized the cask weight can be reduced up to 17.6% with a reduction in the cask diameter of 6.3%. A small study was performed to analyze the characteristics of a cask using cermet with embedded B4C neutron absorber. When this neutron absorber is embedded in the cermet, the cask diameter is reduced by over 10%. Smaller cask size will facilitate handling during SNF loading operations. If the cask size and weight become small enough, the cask can be put directly into the SNF storage pool for loading for transport, thereby eliminating the need for a separate pool transfer cask.

A Superabsorbing Hydrogel for Radiological Dispersal Device ("Dirty Bomb") Cleanup. *NADIA VASQUEZ (Richard J. Daley College, Chicago, IL 60652) MICHAEL KAMINSKI (Argonne National Laboratory, Argonne, IL 60439).* Radiological decontamination technologies are needed for non-destructive removal of radioactivity from porous surfaces such as concrete and marble. We are configuring a novel process for post-restoration of an RDD from porous materials in the event of a terrorist attack. The optimized process would involve three steps: (1) remove surface bound species and penetrate the pore structure to free radionuclide ions from the surface and into the pore water; (2) pull water from the pore structure with a superabsorbing hydrogel, and; (3) remove the radioactivity-loaded gel by wet vacuum. We studied decontamination properties in designing an optimal polymer gel formulation. We report performance parameters of polymer candidates for aqueous solution absorbency with a gravimetric analysis of swelling capacity of gel formulations ("tea bag test"). We found the polymer water absorbency is dependent on the effect of ions or chelators in the following wash solutions: NH_4Cl, $CaCl_2$, and deionized H_2O. We observed increased absorption capacity using smaller grain sized polymer than commercially distributed polymer. The resulting superabsorbent retention capacity calculations suggest that the critical absorption time of polymer formulations is within ten minutes of immersion. The absorbency of polymer candidates is affected by cross-linked and linear formulation ratios. Furthermore, double immersion did not affect subsequent retention of the polymer.

Nitrogen Solubility in Water. *WENDY WAGSTER (Texas A&M University-Kingsville, Kingsville, TX 78363) GRAYDON YODER (Oak Ridge National Laboratory, Oak Ridge, TN 37831).* Integral reactor concepts for new nuclear reactor designs with safety features that incorporate the pressurizer component as an integral part of the reactor core are being developed. Some of these designs use nitrogen to maintain the pressure within the reactor core. However, nitrogen dissolves in water and upon a pressure drop nitrogen pockets will develop in the primary system. Therefore, in order to analyze the integral reactors that use nitrogen pressurization it is important to understand how much nitrogen will dissolve into the water. The purpose of this research is to understand and determine the amount of nitrogen that dissolves in the water at various temperatures and pressures. Knowing the amount of dissolved nitrogen the second part of research is to determine the nitrogen concentration in the primary system as a function of time by establishing a nitrogen diffusion rate. The amount of nitrogen that dissolves in the water is calculated based on the partial pressure of nitrogen and the total pressure of the reactor core. It is well known that the amount of nitrogen that will dissolve is more dependent on temperature than pressure. Also, it is known that as water reaches its saturation point (at a specific pressure) the amount of nitrogen that dissolves will decrease and eventually reach zero. For the specified partial pressure of 24.673 atm (2.5 MPa) and 601 K the nitrogen concentration is 2.43 $g^{N2}/Kg\ H_2O$. For a total pressure of 148.038 atm (15 MPa) and a temperature of 601 K the nitrogen concentration is 2.564 $g^{N2}/Kg\ H_2O$. Transient diffusion calculations through the pressurizer/primary system interface will be used to determine the nitrogen concentration in the primary system. This information can then be used to determine the effect of dissolved nitrogen on the transient response of the reactor.

Studying the $^{11}C + d \rightarrow n + {}^{12}N$ Reaction for its Astrophysical Significance. *THAZIN WIN (University of Illinois at Chicago, Chicago, IL 60607) JOSEPH CERNY (Lawrence Berkeley National Laboratory, Berkley, CA 94720).* After the Big Bang there were only light nuclei up to boron in the early stages of development. For stars about the size