Domestic Nuclear Threat Security

DoNuTS Technical Meeting

Time: 1600 Wednesday, 13 May 2009

Place: NE Conference Room, 1106 Etcheverry

Speaker: James McFarland, UC Berkeley Nuclear Engineering

Subject: Another Technological Step Towards Threat Reduction: Nuclear Resonance Fluorescence

Nuclear resonance fluorescence (NRF) is a promising technique for identification of special nuclear material (SNM) in nonproliferation, safeguards, and arms control applications. An experiment exploring the NRF properties of ^{239}Pu was conducted at the University of California Santa Barbara Center for Terahertz Science and Technology. A 4.0 MeV bremsstrahlung photon source was used to irradiate ~ 4 g Pu which was 93% enriched in ^{239}Pu. The limit of detection was calculated to be 2 ± 1 eV barn, and two ^{239}Pu NRF peaks were identified at 2143 keV [4 ± 2 eV barn] and 2423 keV [10 ± 3 eV barn]. A high background is attributed to the interaction of neutrons and is supported by the identification of seven neutron capture peaks, five neutron scattering peaks, and two beta delayed gamma-decay peaks in the spectrum. Despite the high background, some NRF lines in ^{239}Pu could be seen, and NRF remains a viable technique for SNM identification requiring further study.