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Active Interrogation with Proton Beams

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Abstract:

Heavy shielding complicates active interrogation of cargo because shielding attenuates both the probe and product particles. The product of these two attenuation factors can make detection very difficult. Intermediate energy protons produce fissions as effectively as neutrons or high energy gamma rays but are much more penetrating than either of these conventional probes. We will present measurements of cross sections for proton-induced delayed neutron production from a variety of materials, including actinides, using 0.8 and 4. Gev protons; we will show the time spectrum for delayed neutrons measured using 20 kg samples of depleted uranium, and we will show data that demonstrated the production of fission neutrons by delayed neutrons in an enriched (10%) 60-kg uranium sample.

This work was supported by Defense Threat Reduction Agency (DTRA) under contract IACRO-09-4559I.

This abstract was approved by DTRA for public release and was presented & published in the Proceedings of the 51st Institute of Nuclear Materials Management (INMM) Annual Meeting, Baltimore, MD, July 2010. RRL 2 Nov 2010

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1. TITLE: Active Interrogation Using Energetic Protons CONTRACT NUMBER N/A

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4. MATERIAL TO BE: Presented Published Date Required: 17 Nov 2010

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Remarks: Abstract was reviewed at LANL for sensitive information and OPSEC and found to be unclassified and acceptable for presentation

OPSEC REVIEW/DATE

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Remarks Cont:

/publication at a meeting with international participants.

A very similar abstract (attached) was approved by DTRA for public release and presented at the 51st Institute of Nuclear Materials Management (INMM), Baltimore, MD, July 2010.

Authors have been cautioned that both paper and presentation materials must also be reviewed and that experimental data for uranium targets is particularly sensitive, will be scrutinized carefully in the review process and may not be approved for public release.

Abstract: "Active Interrogation Using Energetic Protons"

LANL P-25 Threat Reduction Team:

Christopher L. Morris, Kiwhan Chung, Steven Greene, Gary Hogan, Mark Makela, Fesseha Mariam, Matthew Murray, Edward C. Milner, Alexander Saunders, Randy Spaulding, Zhehui Wang, Laurie Waters, and Frederick Wysocki

Paper to be presented at the "Tenth International Topical Meeting on Nuclear Applications of Accelerators", April 3-7, 2011, Knoxville, TN., and subsequently published in the IAEA Proceedings Series.

Co-sponsored by the American Nuclear Society and the UN IAEA.

Technical Session: "Interrogation Systems", sub-topic: "contraband detection"

Text of the abstract:

Energetic proton beams provide an attractive alternative when compared to electromagnetic and neutron beams for active interrogation of nuclear materials because they have large fission cross sections, long mean free paths and high penetration, and they can be manipulated with magnetic optics. We have measured time-dependent cross sections and neutron yields for delayed neutrons and gamma rays using 800 MeV and 4 GeV proton beams with a set of bare and shielded targets. The results show significant signals from both unshielded and shielded nuclear materials. ~~Measurements of neutron energies suggest a signature unique to fissile material.~~ Results are presented in this paper.

(abstract is 102 words; we are allowed 250 words).

delete this sentence.

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