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PORTABLE SHORT PULSE NEUTRON SOURCE FOR IDENTIFCATION AND LOCALIZATION OF CLANDESTINE NUCLEAR MATERIALS

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The reliable detection of special nuclear materials continues to be a primary goal of national security programs conducted by the NNSA Defense Nuclear Nonproliferation organization. While these programs are diverse, many share a core need for a small, robust pulsed neutron generator. This project addresses this need by deploying a recently developed portable dense plasma focus (DPF) neutron source to identify and localize special nuclear material objects. The portable DPF system was presented at ICOPS 2018; it weighs approximately 100 lbs and uses 750 W of utility electrical power. The DPF produces 30 nanosecond-wide neutron pulses with a total yield of 6E7 neutrons per pulse at the DD fusion energy of 2.45 MeV. The system has a repetition rate of 0.2 Hz., resulting in a time-average yield of approximately 1.2E7 neutrons per second. The portable DPF was deployed at the Device Assembly Facility (DAF), located at the Nevada National Security Site (NNSS), to measure the active interrogation response products of highly enriched uranium (HEU) objects. Two primary diagnostic systems were implemented to measure the response products of the HEU objects: 1. Sandia National Laboratories'(SNL) Mobile Imager of Neutrons for Emergency Responders (MINER) detector array to determine the spatial localization of the neutron-stimulated HEU object; and 2. Lawrence Livermore National Laboratory's (LLNL) recently developed short-pulse fast fission diagnostic to obtain signature fast-fission neutron spectra of the fissioning HEU object. These two compact diagnostics solutions, combined with the portable DPF system, provide safe, mobile, and effective integrated platform for sensing and locating clandestine nuclear materials.

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