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Alternative Fuel cycle Materials Verification and Monitoring Using Advanced High-Dose Neutron Detectors

The development of advanced sustainable nuclear fuel cycles relying on used nuclear fuel is one of the key programs pursued by the United States Department of Energy to minimize waste generation, limit proliferation risk and maximize energy production using nuclear energy. Safeguarding of advanced nuclear fuel cycles is essential to ensure the safety and security of the nuclear material yet it introduces new challenges associated with novel methods of its handling and processing, and variety of nuclear material forms. Development of technologies tailored specifically for such applications is therefore needed.

Non-destructive assay (NDA) systems currently in use to safeguard used fuel typically employ fission chambers or 3He-based tubes for neutron detection. The purpose of this work is to develop and evaluate technology adequate for the unique challenges of advanced nuclear fuel cycle materials that, in addition, offers potential to exceed performance parameters of the standard NDA systems. The novel technology is based on boron-lined parallel-plate proportional counters and features inherent capability to operate in high neutron count rates and high gamma-ray backgrounds encountered in used fuel and pyro-processing applications. Its design characteristics can be used to minimize gamma-ray sensitivity and to extract average neutron energy information from the multi-plate design.

This high-dose neutron detector (HDND) is currently under development at Los Alamos National Laboratory and was evaluated with range of process materials at Idaho National Laboratory. A versatile, miniature version of HDND for process monitoring is also currently under development. The HDND demonstrated capability to operate over a range of six orders of magnitude of gamma dose rate with good neutron detection performance. This paper will describe the detector design optimization for advanced fuel cycle applications and the performance results.

Which ”Key Question” does your Abstract address?

NEW1.2

Which alternative ”Key Question” does your Abstract address? (if any)

NEW1.1

Topics

NEW1

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