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Application of 10B Lined Proportional Counters to Traditional Neutron Counting Applications in International Safeguards

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Many neutron detection techniques are under consideration as replacement for ^3He proportional tube in international safeguards applications. The traditional ^{10}B -lined proportional tube is a commercial off the shelf (COTS) technology for neutron detection that pre-dates the development of ^3He detectors. This long history of use of these detectors in neutron counting facilitates modeling, design and testing of assay systems based this alternative detection technique. In comparison to the ^3He tube, the ^{10}B -lined detector meets or exceeds all relevant criteria (e.g., stability, resistance to gamma-ray exposure, etc.) with the exception of neutron detection efficiency per unit volume. Boron coating thickness and the active detection area per unit volume limit the measurement performance ultimately achievable with these detectors, however, assay systems based on the ^{10}B -lined proportional detector can be constructed with sufficient measurement performance to achieve the International Target Values for a subset of traditional safeguards counting applications. Additionally, these detectors are well suited to a number of active neutron interrogation applications such as the differential die-away and ^{252}Cf Shuffler techniques. We have examined the performance of a set of commercially manufactured neutron slab counting assemblies configured as a neutron coincidence collar, a passive neutron coincidence well counter, and as the detector assembly within a large cavity ^{252}Cf Shuffler. Measurement performances are presented and compared with that of the standard ^3He based counting systems. These performance levels present a baseline of what can be achieved using COTS neutron counting with no significant development required against which the anticipated performance of a potential alternative technology and the additional portion of the safeguards application space it could address.

Country or International Organization

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