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#6-47 Laboratory tests of SNM identifier with respect to ANSI standard reference: technology, test scenarios, and measurements results

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The SNIPER-GN, a special nuclear material (SNM) portable identifier developed by CAEN S.p.A., was tested at ENEA's Nuclear Material Characterization and Radioactive Waste Management Laboratory. This advanced neutron-gamma detection system underwent thorough evaluation with a variety of neutron and gamma sources. The primary goal was to assess the system's performance, particularly its neutron and gamma identification capabilities, in alignment with ANSI standards. The tests included static and dynamic measurements, conducted under challenging conditions, also with moderating and shielding materials interposed between the radioactive sources and the detector. Two plutonium oxide neutron sources with varying neutron emission rates and compositions, along with several gamma sources such as Cs-137, Am-241, and Co-60, were used in the tests. These sources were placed at different distances from the detector to simulate real-world scenarios. The system successfully identified SNM sources even with low neutron count rates and sometimes also in the presence of a masking gamma field. Key results demonstrated the system's ability to maintain accuracy in neutron identification even with a neutron count rate oscillating around 1 CPS (neutron background approximately 0-0.1 CPS) and successfully distinguish between shielded and unshielded configurations. This was possible thanks to the exceptional performance of the unique identification algorithm, which is capable of detecting neutron-emitting nuclides through neutron detection (U.S. Patent No. 11835477). Additionally, the system's performance in angular response tests showed a high degree of sensitivity, with the lowest relative gamma efficiency at 70% in correspondence with the back of the detector. The dynamic tests validated the system's capability to detect radioactive sources in motion, a critical requirement for homeland security applications. Overall, the SNIPER-GN surpassed the performance criteria established by ANSI standards, demonstrating its exceptional reliability for real-time neutron and gamma identification. Notably, the system's capability to detect 5.5 grams of plutonium from a distance of 1 meter in under 1-minute highlights its effectiveness, solidifying its value as a critical tool for accurate and timely SNM detection.

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