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**Physical Limitations of Neutron-Based Explosives Detection Systems** PHILLIP WOMBLE, ALEXANDER BARZILOV, JON PASCHAL, LINDSAY HOPPER, RYAN MOORE, JEREMY BOARD, ERIC HOUCHINS, IAN RICE, JOSEPH HOWARD, Western Kentucky University — Recent events in Madrid and London have once again focused attention on the problem of threat detection using elemental analysis. Neutron-based systems are utilized to perform bulk chemical analysis due to their high chemical specificity and their fairly rapid response time. While there are many acronyms for these systems, their working principle is typically to interrogate the sample with a beam of neutrons and to identify and quantify secondary particle emissions (e.g. photons) and relate these emissions back to number of atoms present of a given element. These systems perform optimally when their designers and operators are aware of the physical limitations inherent in these devices. For example, minimum detection limits are strongly constrained by the signal-to-noise ratio in a given system. The purpose of this paper is not to denigrate any of these systems but to discuss the strengths and limitations of various approaches.

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