



Nuclear Materials Identification System

Overview

The Nuclear Science and Technology Division and the Oak Ridge Y-12 Plant have been developing the Nuclear Materials Identification System (NMIS) since 1984. NMIS has application to many areas involving fissile materials. Applications include identification and quantification of fissile materials for nuclear materials control and accountability. Other uses include process plant monitoring and control, nuclear criticality safety applications, nuclear warhead dismantlement, and as a technology for verification of nuclear arms control treaty compliance. The system utilizes active and/or passive neutron and gamma interrogation to determine the characteristics of containers or devices containing fissile material.

Methodology

In the active interrogation mode, NMIS uses a Californium-252 source to excite the subject fissile material (uranium or plutonium) with neutrons. This activation initiates fission chain-reactions in the material under inspection. Two or more detectors placed in the vicinity of the item under inspection acquire neutron and/or gamma radiation emerging from the item. Time-domain signatures characterize the time distribution of neutrons and gamma rays resulting from direct transmission, scattering, and induced fission. For passive interrogation, NMIS uses the detectors, but omits the Californium-252 source. NMIS relies upon the spontaneous emission of neutron and/or gamma radiation from the item being examined and thus is useful for plutonium. Real-time processing of the source and detector signals, which can be sampled at up to 1 billion samples per second rates, produces a set of signatures that depend on the particular fissile material configuration.



Capabilities

- NMIS provides a proven, fully integrated, compact method for the characterization, identification, and verification of systems and components containing fissile material.
- Future improvements include fast pulse shape discrimination, a deuterium-tritium neutron interrogation source, and incorporation of gamma spectroscopy measurements for detection and characterization of high explosives, chemical agents, and illicit drugs.

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