



MINDS

PPPL Researchers Develop MINDS Anti-terrorism Device

Anti-terrorism efforts are getting a boost from the U.S. Department of Energy's Princeton Plasma Physics Laboratory (PPPL). A team led by PPPL engineer Charles Gentile has developed a Miniature Integrated Nuclear Detection System, called MINDS, which can be used to scan moving vehicles, luggage, cargo vessels, and the like for specific nuclear signatures associated with materials employed in radiological weapons. MINDS could be employed at workplace entrances, post offices, tollbooths, airports, commercial shipping ports, as well as in police cruisers, to detect the transportation of unauthorized nuclear materials.

A cost-effective compact system which combines many off-the-shelf components with specific nuclear detection software, MINDS is capable of detecting X-rays, soft gammas, gammas, and neutrons. Radionuclides can be recognized and differentiated from one another since each has a distinctive energy signature or fingerprint. The system compares the energy spectrum of the detected radionuclide with the spectra of particular radiological materials that might be used in weapons.

Three U.S. patents have been issued on the device, which is licensed to InSitech, a not-for-profit organization that brings government-developed technology to market. The system is also sub-licensed to VeriTainer Corporation, a California company providing nuclear radiation detection services to the global container industry.

MINDS is currently undergoing testing in Singapore. It also is in operation at a U.S. military base and at a major rail and bus commuter center in the northeastern United States.

Unique Capabilities

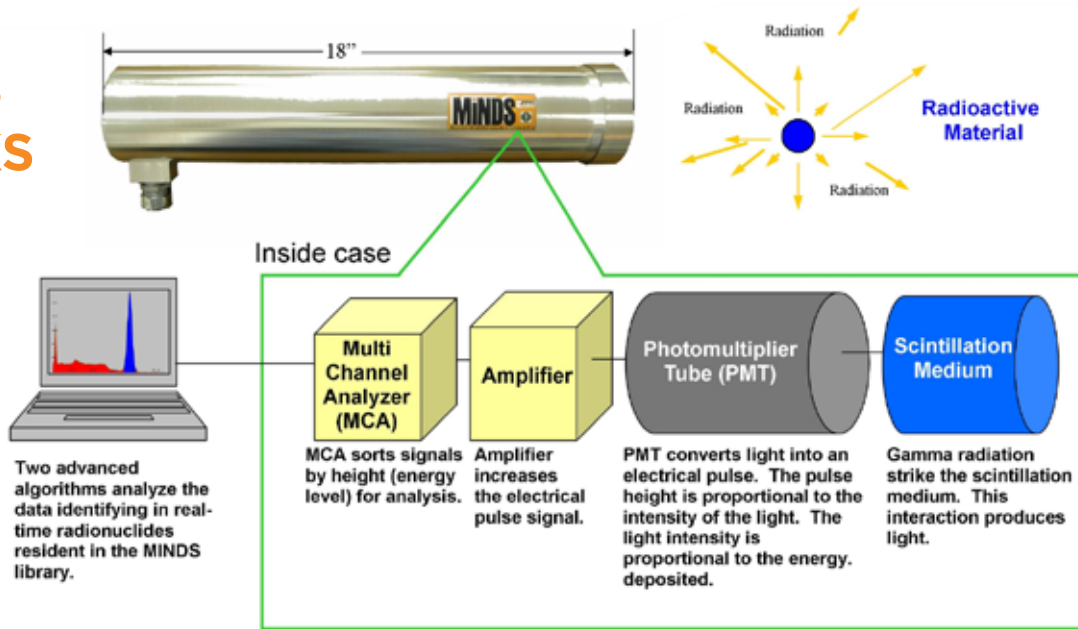
MINDS can detect one-billionth of the material deemed plausible to create a radiological dispersion device — a "dirty bomb." The system can be deployed in a variety of applications, because it is capable of differentiating among naturally occurring radioactive elements, authorized medical and acceptable industrial nuclear substances, and threat materials. By identifying the specific radioactive material present, MINDS eliminates the "car alarm" syndrome, where the operator is accustomed to so many false alarms that future warnings could be ignored. MINDS can be con-



MINDS tollbooth application.



HOW MINDS WORKS

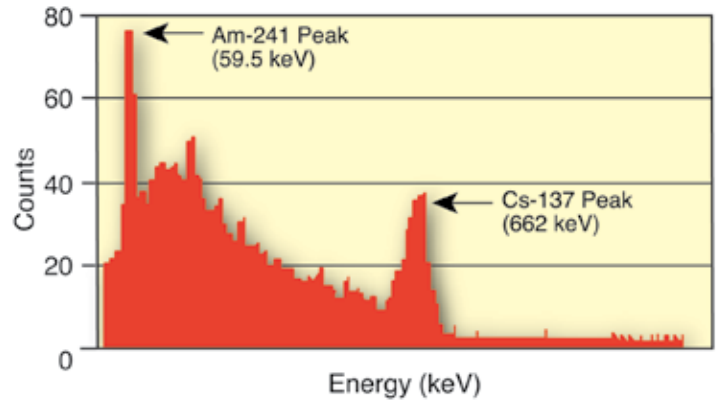


figured to “filter out” natural radiation, or any acceptable radiation in the background environment. It is sophisticated to the degree that it will identify radioactive materials even when they are intentionally concealed or masked. As MINDS scans a target, in approximately one second the system senses, identifies, and transmits the presence of radioactive materials at levels slightly above background. Also, MINDS is a passive system and does not need to emit a radiation signal to excite the target source. In addition, unlike other devices, MINDS does not require active cooling.

MINDS can be fitted with up to three different radiation detectors, or heads, to cover a whole gamut of nuclear radiation. The detector heads can include, for example, a boron trifluoride or helium tube to detect neutrons; a PIN diode or a cadmium zinc telluride detector to detect X-rays and low-energy gamma rays; and a sodium iodide crystal to detect higher energy gamma rays.

The nuclei of radioactive elements emit energy at distinct levels that can serve as footprints, or signatures to determine the presence of these elements in the environment. MINDS is typically configured to work with a lap-top, but can also employ desk tops and main frames to store a library of the nuclear spectra or nuclear “signatures” of radioactive elements in conjunction with advanced artificial intelligent algorithms. In its current configuration, MINDS stores the specific energy signatures of sixteen individual radionuclides.

MINDS employs two sets of powerful algorithms in a synergistic fashion to resolve nuclear spectra in a real-time hyper-accurate manner. This unique feature differentiates it from other commercially available radionuclide identifying devices. The first of these algorithms employs classical peak fitting curves to isolate specific areas of the spectra for radionuclide identification. The other algorithm employs artificial intelligence logic to resolve and identify the nuclear spectra, which are unique to the different radionuclides of interest.



The MINDS detector employed at a guard station.



The MINDS detection head is 18 inches in length and 5 inches in diameter.



The Princeton Plasma Physics Laboratory is operated by Princeton University under contract to the U.S. Department of Energy. For additional information, please contact: Office of Communications, Princeton Plasma Physics Laboratory, P.O. Box 451, Princeton, NJ 08543; Tel. (609) 243-2750; e-mail: pppl_info@pppl.gov or visit our web site at: www.pppl.gov.