

Science and Technology for National Security

Nuclear Nonproliferation, Treaty Verification, Arms Control, and Counter-Terrorism

As the U.S. Department of Energy's (DOE's) lead laboratory for civilian nuclear fuel cycle research, Argonne is a national center of excellence for the detection, management, decontamination, and disposal of nuclear materials, radioisotopes, and other sources of radiation. For that same reason, the Laboratory has developed a significant base of expertise to address the health and environmental impacts of exposure to these hazards, and the staff is knowledgeable about techniques for minimizing their effects. Therefore, the Laboratory is well positioned to provide effective technical support for the processes of detecting, communicating, reacting, responding, mitigating, preventing, and neutralizing the threat of domestic nuclear or radiological terrorist attacks.



Figure 1. DOE's Radiological Assistance Program deploys staff and equipment for incidents involving radiological materials. Response equipment includes alpha, beta, gamma, and neutron radiation monitoring devices and a full range of personal protective equipment.

The international component of the program aims to reduce the threat to U.S. national security by limiting the spread of nuclear, chemical, and biological weapons of mass destruction. Among the more pressing problems that face the United States is assuring the integrity of systems for controlling nuclear materials in the independent states that resulted from the dissolution of the former Soviet Union and in the nuclear-capable nations of south and southeast Asia. Argonne supports the U.S. effort to provide technical assistance to these nations to help

improve their systems for monitoring, control, and export of nuclear materials; for decontamination and decommissioning; and for assuring the security and safe disposal of reactor fuels and other materials that might be used in the manufacture of weapons.

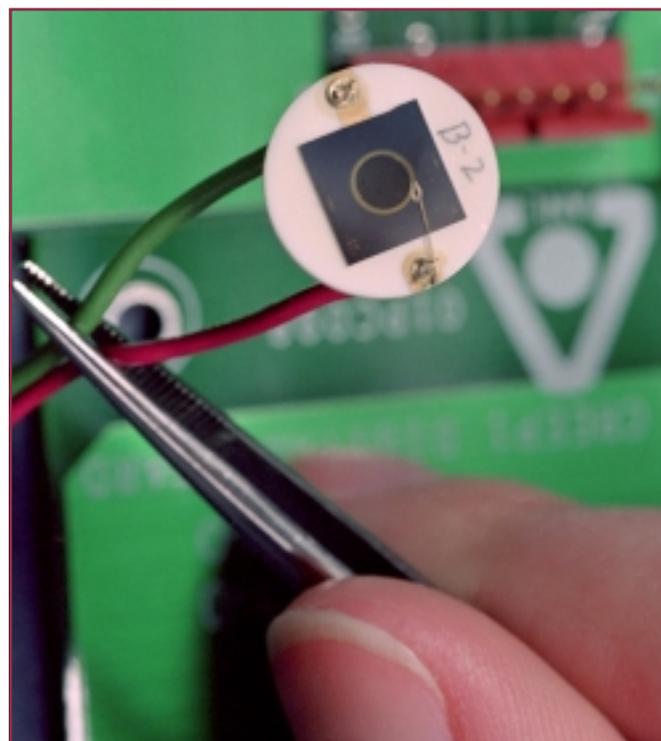


Figure 2. Gallium arsenide (GaAs) neutron detector will be useful in the field and may be tailored for specific applications.

The capabilities that the Laboratory brings to this international program are equally applicable to homeland nuclear security. Thus, for example, Argonne is equipped to develop and apply sensitive detectors for identifying facilities, equipment, and containers used to make, handle, or conceal nuclear materials. As a participant in the DOE Region V Radiological Assistance Program (RAP), Argonne currently collaborates with local and federal authorities, providing technical advice, training, expert personnel and equipment, and monitoring and assessment support for the mitigation of immediate radiation hazards and risks to workers, the public, and the environment due to radiation emergencies and incidents (Figure 1).

The Laboratory also maintains substantial capabilities for nuclear-related field and laboratory measurements (Figure 2), radiation dose estimation, decontamination, emergency construction, radioactive materials handling, nuclear risk management, and domestic nuclear threat attribution.

Argonne Facilities and Equipment to Support Nuclear and Radiological Security

A very substantial inventory of facilities and equipment is available to support public agency efforts to detect, analyze, attribute, prevent, and remediate nuclear and radiological attacks. These include the following:

- *The Large-Scale Test Facility* is a 1000-m³, nuclear-qualified, explosion-rated test cell used for conducting tests involving significant (and concurrent) safety hazards, including steam explosion, radioactive materials, chemical hazards, and combustible gas hazards.
- The staff at *The Engineering Development Laboratory* work closely with engineering groups in the design and development of new equipment and systems and have the ability and facilities to construct mockups and test prototypes.
- *The Fuel Assembly and Storage Building* is a multipurpose radiological facility used to house various research and development operations involving radiological materials. This facility can be used for radioactive materials analyses, system mockup, materials development, and testing.
- *The Fuel Conditioning Facility* at the Argonne-West site in Idaho can be used for testing nuclear process monitoring and counter-proliferation technologies.
- *The Fuel Manufacturing Facility* is a secure, Hazard Category 2 facility that may be suitable for performing tests necessary to benchmark nontraditional nuclear phenomenology models and for testing monitoring systems.
- *The Hot Fuels Examination Facility* is a large hot cell used to remotely characterize radioactive materials, including spent nuclear fuel, radioactive hardware, and waste drums.
- *The Neutron Radiography Facility* is a 250-kW Training Research and Isotope Production, General Atomics (TRIGA) reactor. It provides the capability to neutron-radiograph highly irradiated fuels, waste forms, and components. The facility also houses neutron generators and shielded cells for nondestructive assays, activation analyses, and radiation effects testing.
- *The Radioactive Scrap and Waste Facility* is a four-acre dry storage facility at the Argonne-West site. It consists of approximately 1,350 carbon steel below-grade silos, which provide containment for all types of radioactive and mixed hazardous waste and spent fuel. It can be used to test monitoring and surveillance technologies.
- *The Transient Reactor Test Facility* is a graphite-moderated, air-cooled reactor designed to produce short, controlled bursts of nuclear energy for transient testing of fuels and materials. The reactor is suitable for radiation effects testing.
- *The Zero Power Physics Reactor* is a large, low-power, critical assembly used for studies and measurements involving subcritical and critical mockups of reactor cores or fissile material systems. Fissile materials can be assembled in a configuration closely resembling that of a particular reactor core or process under consideration.
- *The Alpha-Gamma Hot Cell Facility* is a series of shielded cells capable of handling and analyzing irradiated nuclear fuel and other radioactive materials.
- *Two shield cell facilities* are capable of handling irradiated nuclear fuel and other radioactive materials. One facility can handle very high radiation fields; the other can handle up to 10,000 Ci of 1-MeV gamma-emitting material.
- *The Robotics Laboratory* is a complex for development of manipulator systems for remote work in unstructured hazardous environments. Capabilities include single- and dual-arm remote systems, remote control room with 2-D and 3-D video, open architecture control hardware, imaging and sensor capabilities, and a complete software development environment.
- *The Actinide Facility* is specifically designed to receive and encapsulate actinides for their subsequent safe characterization at a normal, open Advanced Photon Source beamline. Such a capability bears directly on potential terrorist acts involving nuclear materials.

Contacts

Harvey Drucker
Associate Laboratory Director
Energy and Environmental
Science and Technology
Phone: 630/252-3804
Fax: 630/252-3847
drucker@anl.gov

John Sackett
Associate Laboratory Director
Engineering Research
Phone: 630/252-4485
Fax: 630/252-5318
john.sackett@anl.gov



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