Argonne NATIONAL LABORATORY

Homeland Security

Millimeter-Wave Radar Detection of Chemicals, Gases, and Radiation

APPLICATIONS

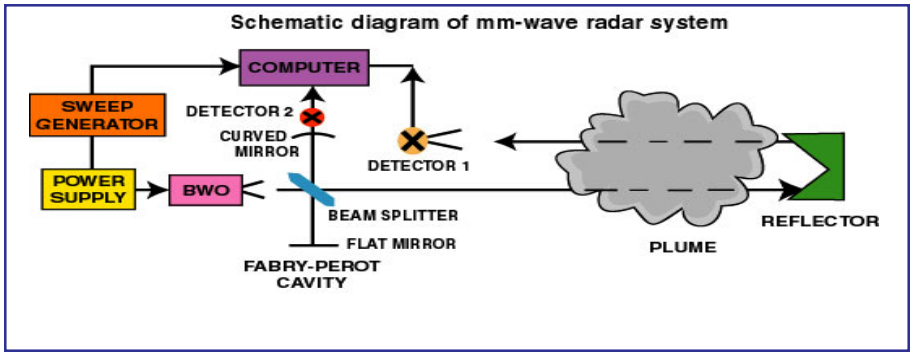
- Mobile detection of chemical or nuclear proliferation for treaty verification or national defense
- Detecting radiation leaks from nuclear power plants at long distances
- Stationary leak detection around chemical plants
- Flyby monitoring of gas pipeline infrastructure
- Monitoring stack emissions in industrial plants
- Detecting leaks in pressurized components
- Trace explosives detection for cargo and personnel screening at portals.
- Standoff monitoring of radiological and nuclear materials transport at choke points.

BENEFITS

- Nearly 100% specific for gas-phase molecules at low pressures
- Continuous, real-time monitoring of gas samples
- Better penetration of materials than optical methods
- All-weather, day and night capability
- Allows standoff/remote detection

Fast, remote detection of airborne chemicals, gas leaks, and radioactive substances at low concentrations

A millimeter-wave (mmW) radar detection system developed by Argonne National Laboratory locates gas leaks, airborne chemicals, and radioactive substances with impressive speed and accuracy from long distances. While the principle of chemical and explosives detection is based on molecular spectroscopy using a swept-frequency radar, detection of gas leaks and radiation is based on measuring changes in scattering properties of the leak or radiation plume with a pulsed radar. Because of unique absorption and scattering properties of these substances in the mmW frequencies,



Argonne's system can determine both narrow and broad spectral features of airborne materials at pressures ranging from millitorr to atmospheric and at temperatures from ambient to 300°C. The ability to detect so many substances in such a wide range of conditions makes this mmW radar detection system useful for many types of applications.

Argonne's mmW radar has been successfully field-tested for chemical detection at a Nevada test site, identifying chemicals such as methyl chloride to a concentration of 12 parts per million (ppm) at a standoff distance of 60 meters. Argonne has tested and identified unique explosives spectra for common and plastic explosives at low pressures using a heat cell spectrometer. Overseas field testing for gas leaks demonstrated successful detection of a propane leak at 720 meters. Field testing of radiation detection demonstrated the ability to detect a weak radioactive cloud emanating from a nuclear power plant's ventilation stacks during

LINKS TO ONLINE INFORMATION

http://www.et.anl.gov/sections/sinde/highlights/homeland_security.html

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ABOUT ARGONNE TECHNOLOGY TRANSFER

Argonne National Laboratory is committed to developing and transferring new technologies that meet industry's goals of improving energy efficiency, reducing wastes and pollution, lowering production costs, and improving productivity. Argonne's industrial research program, comprised of leading-edge materials research, cost-saving modeling, and unique testing and analysis facilities, is providing solutions to the challenges that face U.S. manufacturing and processing industries.

normal operation at a distance of 9 kilometers. Further evaluation of the radar images showed a clear difference in radiation levels detected when the nuclear plant was operating and when it was idle.

The sensor can measure a suite of airborne chemicals at 1–100 ppm-m levels in real time with minimal interference from common atmospheric chemicals. Argonne's mmW radar sensors can be mounted in a wide variety of places, from fences and buildings to vehicles and aircraft, for long-range, all-weather, day and night detection capability. When paired with a sensitive, fast-scan gas analyzer, the mmW radar detection system can immediately identify environmental pollutants with near 100% specificity.

A network of mmW radar detection systems can be coordinated and monitored using computer-based information management systems that record and respond to information as it is received. When used in an integrated hardware/software surveillance network, Argonne's millimeter-wave radar system adds a highly effective layer of protection against chemical, gas, and radiological threats.