

# PROTECT

## Defending subways against chemical attack

### Context

As highlighted by the 1995 sarin nerve gas attack on the Tokyo subway system, underground transit is especially vulnerable to chemical weapons. The trains and stations offer confined spaces filled with potential victims, and the trains themselves quickly spread contamination from station to station. In the event of an attack, rapid response is crucial: in the Tokyo incident, it took less than 10 minutes for several stations to be affected.



The PROTECT system will give early warning of a chemical attack in a subway, potentially saving lives.

### Solution

In collaboration with Argonne and Lawrence Livermore national laboratories, Sandia National Laboratories developed PROTECT, the Program for Response Options and Technology Enhancements for Chemical/biological Terrorism.

First demonstrated in the Washington, D.C. Metro system, this automated network of chemical sniffers, TV cameras, and computers provides reliable early warning of chemical attack, as well as intelligent emergency response management.

Chemical sensors in the subways link to emergency response computers in the command center. If an alarm is triggered, computer screens guide transit operators through optimized response protocols; typically, trains are halted and the software maps out safe evacuation routes.

The same software has been demonstrated on the wireless laptops of first responders, enabling rich and rapid information transfer (e.g., photos, facility maps, technical updates) to and from the command computers. Closed-circuit cameras in the subway send streaming video to the local fire department as well as the transit agency, so emergency personnel know what to expect before they arrive.

### Benefits

- Saves lives: In a chemical attack, every minute counts, as the health risk increases with exposure time. Drills have shown that PROTECT cuts response time—which could translate into thousands of lives saved, as well as thousands of debilitating injuries prevented.



Cities across the country have expressed interest in PROTECT, which can be easily tailored to suit the needs of different subway systems.

- Adapts to any subway: The system can be easily modified for different transit agencies.
- Easily expanded: The modular system can incorporate new capabilities—such as sensors to detect bio-weapons, radiation, or explosives—and can be readily extended to new subway stations. This approach allows transit agencies to acquire anti-terrorism capability on a priority basis, equipping individual stations as budgets allow.

### Approach

This federally funded project entailed close collaboration among the national labs and local transit agency, police,

and fire jurisdictions. Sandia designed the sensor network; Argonne developed the emergency response software and managed the integration of the video camera data; and Lawrence Livermore contributed plume modeling to predict street-level hazard zones during an event.

Initially focusing on a DC Metro station that was deemed a high-risk target, Sandia installed the first chemical sensors and began testing in 2000. Harmless smoke was used to model chemical plumes, enabling strategic sensor placement and development of optimum evacuation routes for different attack scenarios. By 2003, the DC system was judged robust and reliable enough to serve in permanent, automated operation.

A later phase of the project focused on Boston, where Sandia tested more sophisticated detection and networking capabilities, using wireless sensors to speed design.

Sandia's advanced Sensor Management Architecture (SMA) enables synergism among nodes, yielding more useful information than if each sensor merely relayed its own data to a central alarm station. This smart networking capability improves data processing efficiency and security, optimizes bandwidth usage (in some cases reducing it), and permits reliable, two-way communication. Moreover, it allows networks to self-configure, thereby enabling rapid setup of a sensor network for temporary applications, such as monitoring high-risk special events.



In this multi-lab project, Sandia was responsible for designing the advanced sensor network, which enhances data processing efficiency and security.

## Status

In March 2003, PROTECT became the nation's first permanently installed detection system for chemical attacks in a public place. DC Metro has equipped more than a dozen stations; Boston also has PROTECT in permanent operation. Chicago, San Francisco, and other cities have expressed interest.

Although Sandia's official role in PROTECT ended in September 2003, we continue to develop solutions for protecting subways and other public facilities from chemical and biological attack.

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