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## GOOD STORY

### Chemical Detection and Response Enhancement for Transit Systems

#### SUMMARY

Argonne National Laboratory, in conjunction with the Department of Homeland Security (DHS), the Federal Transit Administration (FTA), the Office for Domestic Preparedness (ODP) and with support from other national labs and private industry partners, has developed and implemented a chemical warning and response enhancement system to assist transit security officials and emergency responders in the event of a chemical release in a subway system. The system is called PROTECT (Program for Response Options and Technology Enhancements for Chemical/Biological Terrorism), and it combines detectors, cameras, and software to alert security officials quickly of a chemical release and provide emergency responders with tools to speed and improve their response.

#### BACKGROUND

On the morning of March 20, 1995, members of a Japanese religious cult boarded a number of trains inside Tokyo's subway system and punctured bags containing deadly sarin nerve agent. The sarin immediately began making passengers ill, but authorities did not begin receiving emergency calls until a half hour after the sarin had been released, and trains carrying the gas continued to operate and carry passengers for as long as one and a half hours after the release. The attack killed twelve people, caused thousands more to seek medical attention, and revealed the vulnerability of public transit systems to acts of terrorism.

The attack also demonstrated the need for advanced, coordinated detection systems for chemical agents. By 1998, Argonne and Sandia National Laboratories, in collaboration with the Department of Energy's (DOE's) Chemical/Biological National Security Program (now DHS' Science and Technology Directorate), had begun development and testing of PROTECT, a comprehensive chemical detection and response enhancement system. In 2001, PROTECT was successfully tested in one major US metropolitan subway, and in 2003, it became fully operational.

#### GOALS

PROTECT's objective is to provide transit security officials with notification of a chemical release. The system also enables outside emergency responders to coordinate an effective, rapid response through its advanced command and control software showing hazard zones in conjunction with its networking and information sharing capability.

## **DESCRIPTION**

### ***Chemical Detectors in Stations***

The PROTECT system is composed of three essential components. The first of these are the chemical detectors that are placed in rail stations. Hidden within a station, these detectors detect and identify the chemical attack. If the sensors detect a chemical plume, they then immediately trigger a silent alarm to facility managers.

### ***Surveillance Cameras***

The second critical component of PROTECT are the high-resolution surveillance cameras that are installed throughout a subway system. Existing camera systems can be used, but some cameras may need to be upgraded, as necessary, to be able to zoom and focus on suspicious objects or persons at high resolution. When a detector indicates the presence of particular chemicals, facility managers use the cameras to scan the station and look for any gas plumes, spilled liquids or powders, passengers becoming ill, or suspicious persons or packages.

If, by using their surveillance cameras, the transit authorities confirm that a dangerous chemical release has occurred, they can immediately halt train traffic as necessary, contact emergency response providers, and begin to coordinate the safe evacuation of the rail system. During the response phase, the CCTV cameras can provide police, fire, and EMS with valuable imagery to further direct their emergency response.

### ***Software and Modeling Tools***

The third critical component of the PROTECT system are the computer software and networking capabilities that it provides to emergency managers and responders. PROTECT's computer software produces plume maps which display the changing area of contamination (i.e. below and above-ground "hot zones"). These maps, as well as the CCTV images from inside the subway system, can be viewed by emergency managers at an emergency operations center (EOC) to help them coordinate their response. Responders in the field can also access the same information by plugging portable computers into specially "wired jacks" located at points above-ground that provide a connection to the secure network. By having the ability to monitor the changing flow of the chemical plume from the EOC and from above-ground, police, fire, and EMS officials can more safely manage and direct the evacuation and medical treatment of afflicted passengers.

### ***Corollary Benefits***

In addition to its ability to speed and strengthen the response to a chemical event, PROTECT offers emergency responders other benefits. The sophisticated camera system can assist law enforcement officials when dealing with a terrorism-related incident such as a suspicious package or bomb threat within a rail system by providing police above-ground with real-time, detailed surveillance of the situation. The command and control software tools can also assist firefighters when determining their response to a fire and smoke condition in the rail system by giving them an instantaneous monitoring capability of train locations and the fire from above-ground.

## **REQUIREMENTS**

### ***Key to Success***

- **Integrated System.** The principal source of PROTECT's effectiveness is its integrated systems approach to the interior infrastructure emergency management problem. Sensitive detection devices backed by advanced camera surveillance

enable facility managers to confirm quickly and accurately whether or not a chemical release has occurred. Tracking software allows emergency responders to monitor the release and rapidly tailor their response in accordance with the changing situation. Information from inside the rail system can be sent in real-time to responders in the field or at surrounding EOCs.

- In a major exercise conducted in the tested subway system, the rapid detection capability, linked with networked information sharing, combined to reduce response time from an estimated thirty-one minutes **to only five minutes**. During a chemical-agent incident, this lower response time is essential in the effort to limit human casualties.

### **Resources**

The costs of implementing the PROTECT system vary widely depending on the relative size and technological needs of a particular rail system. CCTV cameras may need to be upgraded so as to provide detailed images to facility managers and be networked to transmit those images to emergency responders. The number of stations needing detectors and the network and computing capabilities of local emergency responders also greatly effect the cost of implementing PROTECT.

### **Technology Transfer and Training**

The FTA is overseeing the transfer of PROTECT technology to interested jurisdictions. The FTA conducts workshops for transit authorities and offers training seminars in the use of the detectors and command and control software. The PROTECT system can be used with other facilities such as airports and intermodal transportation facilities, and the FTA is facilitating its transfer to those types of building complexes as well.

### **Links**

- PROTECT Infosheet from Argonne National Laboratory:  
[http://transit-safety.volpe.dot.gov/security/pdf/protect\\_factsheet.pdf](http://transit-safety.volpe.dot.gov/security/pdf/protect_factsheet.pdf)
- Federal Transit Administration, Research & Technical Assistance:  
[http://www.fta.dot.gov/26\\_ENG\\_HTML.htm](http://www.fta.dot.gov/26_ENG_HTML.htm)

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