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Chem Bio

DHS Program Gives Hazardous Materials Teams Networked Sensors

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When hazardous materials teams respond to a possible terrorist attack or chemical accident, they must carry sensors with them to find out exactly what they are dealing with.

The protective masks they wear make it hard to see the readings, and then they must radio the findings back to a command-and-control center. But it may be dark, and hard to read the meters. Communications may be garbled and a "13" may sound like a "30." Ambient noise may further complicate matters.

The Department of Homeland Security's science and technology directorate recently completed a multi-year effort to solve some of these problems.

The integrated chemical, biological, radiological, nuclear and explosive program developed a set of standards that allows these sensors to transmit data directly back to a higher headquarters where others can sort through the findings on a common operating picture.

That allows first responders in hot zones to concentrate on the tasks at hand. The data collected can also be seen through secure Internet connections and studied in real-time by experts anywhere in the world.

If a dirty bomb comprising radiological material were to detonate in a U.S. city, for example, an expert sitting in a national laboratory could analyze that data and immediately tell first responders on the scene what they were up against.

The directorate originally had the goal of integrating all the chemical, biological and radiological sensors that hazmat teams use into one device, said Teresa Lustig, the S&T division's ICBRNE program director.

"It became very obvious … that if we were not using their existing equipment with their existing emergency management systems that we were setting ourselves up for failure," she said during a webcast the directorate sponsored to promote the program.

The problem with that was that these teams were using sensors from dozens of different vendors. The trick was to set up standards and convince the manufacturers that it was in their best interest to adopt them, she added.

DHS worked with the Pacific Northwest National Labs in Richland, Wash., the Space and Naval Warfare Systems Center in San Diego and a vendor, Safe Environment Engineering, to come up with the wireless communication system and common operating picture.

When DHS was looking for a potential partner to run a pilot program, it settled on Los Angeles County. It has 88 cities, 9.8 million residents, a population density of 2,500 people per square mile and some 250,000 businesses. It also hosts major sporting events, award ceremonies, VIP visits that involve Secret Service protection, and one of the most active ports on the West Coast.

The problem of communicating in hazardous material scenarios was already well known there, said Bob Cramer, a retired Los Angeles city fire department chief.

Those trying to radio reports had "a very difficult time … just understanding information, numbers and everything else that can be difficult to transmit," he said.

Cramer described an incident in 1998 involving possible radiation on the cargo tarmac at LAX. It was dark. Plane engines were noisy and the team sent back incorrect readings.

"In retrospect, looking at that, how could they not? We put them in impossible conditions," Cramer said. It was after that incident when he first began pondering the problem of how to take the pressure off the hazmat teams, and send the readings back to where an expert could read them in more ideal conditions.

"I was surprised that none of the manufacturers of the instrumentation that was available at the time offered that capability," he added. Passive sensors at fixed sites were beginning to offer that feature. Why not handheld devices? It took almost a decade of work, the eventual involvement of DHS and federal grant money to make it happen.

Cramer said the main obstacles were vendors, who were reluctant to open up their proprietary software to the add-ons that allow the transmissions. Firefighters are also conservative about adding new technologies to their toolkits, and resisted the new system at first, he said.

The program had to tie together three elements: the wireless system, the remote display that allows incident commanders or others to see what is happening inside a hazardous area, and lastly, the "lifeline gateway," that allows the data to be shared over the Internet.

This last capability can potentially be a powerful tool, said, retired Los Angeles fire department battalion chief, Robert Rose. The number of subject matter experts who can interpret such data are limited. Through the Internet, a specialist in radiological emissions, for example, could be examining the data in real time at a national laboratory and sharing his or her conclusions with an incident commander.

"It's truly an asset for the local teams to be able to have that," said Rose.

Along with the sensors, the communication backbone the data travels over can also support video and infrared cameras.

Capt. James Lesinski, captain of the Los Angeles Fire Department, and a former hazmat task force commander, said standardization of the sensors so they can adapt to the system was key.

"We did not want to get painted into one corner with just certain equipment," he said. The program came up with the common alerting protocols, which can be added on to the sensors so they can transmit data.

Lustig said that was one of the challenges. The directorate had to convince sensor manufacturers to standardize the protocols.

Today, about 40 instruments made by a variety of makers can connect to the ICBRNE system.
Mick Kehler, a hazardous material specialist with the Los Angeles County Sherriff's Department, said the system is now with every hazmat agency in the county. It has also been installed in several fixed radiological sensors that can transmit readings back to the county's Emergency Operations Center where they can track plumes. At one recent sporting event, radiological material detectors picked up a strong reading on a man who was approaching a gate. They were able to track him on the monitor until he reached their position. In that case, it turned out to be a recently hospitalized patient who had undergone radiation treatments. But the anecdote shows how the system performs, he said.

It "was able to give me a full minute to minute-and-a-half warning that radiation was coming towards my gate," he said.

Along with being employed at the Oscars and Grammy Awards, it was also tested during a large-scale exercise in the summer of 2010, operation Golden Phoenix.

This training event involved 800 participants from more than 130 different agencies, and supposed that a 10-kiloton nuclear device was detonated in Los Angeles, which DHS considers a worst-case scenario as far as terrorism incidents. The science and technology directorate sponsored the exercise. The Center for Asymmetric Warfare at the Naval Postgraduate School in Monterey, Calif., set it up.

During a one-day test of the communication systems, data was collected from 61 locations using 40 sensors. The idea was to send the data back to a command center where leaders could make decisions about evacuations, emergency shelters and other actions. The readings were also sent through the Internet to Federal Emergency Management personnel in Washington, D.C., said Brendan Applegate, one of the organizers of the event.

"Those subject matter experts, especially in the radiological fields, they are going to be in limited supply," Applegate said. "Now, you can beam that data instantly to a subject matter expert in an unaffected part of the country, or even the world, and have them weigh in on the decision making and the courses of action they should take in reaction to that environment."

Cass Kaufman, the former director of radiation management at the L.A. County Department of Public Health, said radiological detectors were also used in the aftermath of the Japanese nuclear disaster in Fukushima, Japan, to see if any of the isotopes were reaching California.

Lustig said the science and technology directorate's work on the program is done. Now that it has proven the

concept, and it has been tested, it can only encourage other cities or organizations to adapt the technology. In hopes that the concept catches on, it hosted the webcast that attracted about 500 viewers.

The problem is that municipalities and other local governments are struggling financially.
Kaufman said: "Clearly funding is an issue … but I would hope that at least the urban areas would consider this type of system. I can testify to the fact that it is very enabling for the agencies that participate."

Several large municipalities have taken an interest in the program, as well as the National Guard's Civil Support Teams, which are spread throughout the country and offer advice to local authorities in the event of a weapon of mass destruction catastrophe.

Lesinski would also like to see more real-time data collected by biological sensors. That is a separate issue that the developers of that technology must tackle, he noted. Samples of bio-hazardous material generally must be taken to a lab to be investigated, a process that can take several
days.