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Taking the Nerve Out of Terrorism

Commuters laden with briefcases, purses, and newspapers scurry to get to work on time. Tourists juggling cameras, maps, and strollers try to get their bearings. Students dragging backpacks and books linger as long as possible. For metropolitan transit systems across the Nation, it's a typical morning. But this morning could turn out not to be typical. This could be the morning terrorists plan to strike with a nerve agent.

On just such a morning in 1995, members of the Aum Shinrikyo cult struck against the passengers on the Tokyo subway system. At a predetermined time, cult members used umbrella tips to puncture newspaper-wrapped bags of the liquid nerve agent sarin as they got off their trains. By the time it was all over, 12 people had died and thousands who touched the liquid itself or inhaled its vapors were injured.

Through the efforts of the National Institute of Justice (NIJ), the Technical Support Working Group (TSWG), and TIAX LLC, a collaborative research and development company, the likelihood of a similar attack in the United States should be reduced dramatically in the near future. A prototype personal monitor, small enough to wear on a belt and affordable (about $100 per unit), may be available before the end of 2005. The device will warn law enforcement officers and other first responders of the presence of nerve agents well before their effects can be felt.

Nerve agents, when inhaled, ingested, or brought into contact with the skin or the eyes, interfere with the central nervous system, says David Clopton, a contractor with the National Institute of Justice. They disrupt bodily functions by attacking a class of enzymes called cholinesterases. When there is too little of the enzyme acetylcholinesterase (AChE), known as the body's "off switch," the neurotransmitter acetylcholine builds up and overwhelms receptors with constant stimulation. The muscles quit working and, ultimately, a person stops breathing.

The personal alarm monitor is essentially "a raw nerve ending in a box," Clopton says. The nerve agent detection device constantly measures the activity of an AChE sample immobilized in porous plastic. When the enzyme is active, the reagent turns bright yellow; if it is exposed to a nerve agent, the reagent becomes clear and an alarm sounds. When the wearer hears the alarm, he or she can also check a visual indicator to confirm the presence of a nerve agent. The AChE enzyme used is specific to nerve-type toxins, drastically reducing the possibility of false alarms. Also, the alarm is set at the level of the initial physiological response, not at a lethal level, giving the first responder time to assess and react to the situation.

Laboratories already use similar reagents to test blood samples for possible exposure. TIAX, however, came up with a way to continuously monitor the air for exposure in the field by developing a consumable packet that lasts 12 hours and can easily be replaced at the start of a shift. TIAX tested its innovation against simulated nerve agents and arranged for tests against real sarin and soman at the U.S. Army's Edgewood Chemical and Biological Center. An early prototype of the monitor was also evaluated by several public safety agencies under operational conditions. These included the Washington (D.C.) Area Metropolitan Transit Authority Police, New York City Fire Department, and Los Angeles County Terrorism Early Warning Group. TIAX modified its prototype based on the results of the evaluations. Because Congress transferred the funding and mission for the development of chemical, biological, radiological, and nuclear protective equipment to the Department of Homeland Security, NIJ has forwarded the personal alarm monitor project to the Science and Technology Directorate of DHS for completion. DHS also is developing other technologies to rapidly detect weapons of mass destruction for use in public safety applications.

For more information regarding the personal alarm monitor project, contact Chris Tillery, 202–305–9829 or george.tillery@usdoj.gov. Editor's Note: The Technical Support Working Group (TSWG) is a national forum that identifies, prioritizes, and coordinates interagency and international research and development requirements for combating terrorism. For more information about TSWG, visit www.tswg.gov.

Tabun	Sarin (GB)	Soman GD)	VX

Nerve Agent Quick Reference

Physical Properties	Symptoms	Characteristics	Routes of Exposure	Treatment
Organophosphate compounds.	Salivation.	Attack skeletal muscle receptors.	Inhalation.	Antidotes include atropine, pralidoxime chloride, and diazepam.
Colorless as liquid or vapor.	Constricted pupils.	Attack smooth muscle and central nervous system.	Dermal (eyes and skin).	Decontaminate skin by washing with large amounts of soap and water.
Have no odor or hanve a fruity order.	Watery eyes and runny nose.	Individual susceptibility will differ.	Ingestion.	Secondary exposure can occur from contact with contaminated clothing. (It can also occur when tabun evaporates from contaminated clothing.)
May be aerosolized.	Difficulty breathing.	G agents (tabun, sarin, and soman) semipersistent (minutes to hours).		To protect health care workers and others exposed to a contaminated victim, remove, bag, and seal the victim's clothing and wash the victim's skin with large amounts of soap and water.
Decompose with water.	Vomiting.	V agent (VX) persistent (days to weeks).		
Addition of catalyst (bleach) accelerates decomposition.	Convulsions.			
	Tremors.			
	Paralysis.			
	Respiratory failure.			
	Death.			

Note: Information applies to all above nerve agents unless a particular agent is named.

For indepth information and additional resources regarding the nerve agents listed above, visit the following pages on the Internet site for the Centers for Disease Control and Prevention.

Tabun (GA): www.bt.cdc.gov/agent/tabun/basics/facts.asp
Sarin (GB): www.bt.cdc.gov/agent/sarin/basics/facts.asp
Soman (GD): www.bt.cdc.gov/agent/soman/basics/facts.asp
VX: www.bt.cdc.gov/agent/vx/basics/facts.asp

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