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Decontamination Technology Still Outdated

The Defense Department proposes $52 million for research and development efforts

by Roxana Tiron

The Pentagon plans to accelerate, during the next five years, research and development efforts in chemical and biological decontamination technology.

Current and future programs aim to reduce the logistical burden of transporting decontamination equipment and to develop safer decontamination agents. The equipment used today is not only hazardous to military hardware, but also to operators and the environment.

Decontamination is still "a huge technological challenge," said Maj. Gen. John Doesburg, head of the Soldier Biological and Chemical Command. He has also been named to lead the Army's Research, Development and Engineering Command. According to Mark Brickhouse, a researcher at the Army's Edgewood Chemical Biological Center, there is no easy answer to developing decontamination material that won't damage military equipment.

The Army, he said, still uses the same technology introduced 40 years ago. Decontamination agents in use today, such as high test hypochlorite (HTH), super tropical bleach (STB) and decontamination solution 2 (DS-2) are caustic. Potentially, they can damage equipment, pollute the environment and cause personal injury, according to experts. Many of them also are flammable and, therefore, can't be used on ships, new high-performance aircraft and non-hardened equipment.

Brickhouse said that DS2 is effective, but "it is very aggressive and can be very destructive to surfaces." As a matter of fact, it can't be used anymore, he noted. "It is sitting in stockpile."

Bleach, on the other hand, is available in many forms both for chemical and biological decontamination. But there is concern about the corrosive nature of bleach, so Edgewood is looking into developing other agents.

Some of the research focuses on activated hydrogen peroxide, which is generally more compatible with the wider range of materials than bleach-based products, and also enzyme decontamination, which is looking at producing more innocuous chemicals, according to Brickhouse.

Researchers are seeking decontamination materials that can be used with both chemical and biological agents at the same time.

Advanced Catalytic Enzyme

The Edgewood Center is working to develop an enzyme-based decontaminant. The advanced catalytic enzyme system (ACES) will contain enzymes for the detoxification of nerve agents and related pesticides, sulfur mustard, bacterial cells and anthrax spores. According to a paper published by the Edgewood Center, "catalytic enzymes are highly efficient, detoxifying many times their own weight of agent in seconds or minutes." Additionally, ACES is supposed to be non-corrosive, non-flammable and environmentally safe.

The enzyme-based decontaminant is environmentally friendly just like a laundry detergent containing enzymes would be. The enzyme would be provided in the form of dried powder that can be added to whatever water-based spray or foam systems are available to the services at the time.

Edgewood researchers estimated that to provide 2 million gallons of decontaminant for a major military

engagement would require 11,000 tons of DS2. “On the other hand, the equivalent amount of dry enzyme-based decontaminant would weigh approximately 56 tons and have no special storage and transportation requirements. This reduction is especially important for ships at sea,” said the Army publication.

While the enzyme system is aqueous, it requires less water and simplifies decontamination operations. The goal is to use whatever water is available on location.

Long-Term Development

Despite ongoing research and development, Brickhouse admitted that there is no impending breakthrough in any decontamination technology at this point, “because these things tend to be incremental. We are constantly working towards better efficacy.”

“We are engaged in a fairly long-term research and development effort, because the challenges keep evolving and as more types of materials are considered [for equipment building] we have to improve our capability,” he added.

He said that no single technology meets all the Defense Department requirements, and new decontamination agents need to be validated against rigorous chemical and biological challenges.

“There are many decontamination solutions out there. This is essentially an embarrassment and also a problem,” said Joseph Zarzycki, technology director at the Edgewood Center. He spoke at the Advanced Planning Briefing for Industry, in Hunt Valley, Md. “We can’t afford to have multiple decontaminants. That is the bottom line. We have to have one decontaminant that can do all chemical agents, all the biological agents.”

Contractors have been outdoing themselves trying to come up with decontaminants that do not need as much liquid, that can be sprayed on equipment, that come in powder form, are easy to transport, and moreover are environmentally friendly.

“Everybody claims to do decontamination,” said Brickhouse. “Lots of people are out there with a lot of claims.” He said that the center often tests products against actual chemical and biological agents “to determine whether these technologies are as efficacious as they claim,” Brickhouse said. “We have good potential opportunities to take their technology and really challenge it.”

Logistics Burden

Bringing current decontamination equipment to the battlefield can create a significant logistical burden. “The major problem with decontamination right now is that it requires a liquid base which means water, or some other liquid, which has to be transported,” Doesburg told National Defense.

“Whether it is water that you mix with the decontaminant to use it on a application, or whether it is a cleaning formula, it needs to be transported around. It has got to be moved which means that other things [that soldiers] may need, like food and drinking water are not transported, because you transport decontamination solution.”

David Siegrist, an analyst with the Potomac Institute, said that the U.S. military has a pretty good set-up for individual decontamination. However, large-scale decontamination poses a big problem, he said. “If you have an area hit with a Scud missile, large scale decontamination is a big problem.

“Decontamination kills living things,” he said. “How can you get to kill the living things that you want it to kill and preserve the things that you do not want to kill?”

The Defense Department is planning to allocate approximately $52 million for decontamination in 2004, said Anna Johnson Winegar, the deputy assistant to the secretary of defense for chemical and biological defense. That is part of a $1.1 billion package requested for chemical and biological defense. Winegar also spoke at the APBI.

Winegar said that the Defense Department plans to procure four key systems by 2009. These are the Modular Decontamination System, the Joint Service Family of Decontamination System, the Joint Service Sensitive Equipment Decontamination System and the Sorbent Decontamination System.

Modular Decontamination System

The Modular Decontamination System would provide high-pressure water for the primary wash process of equipment on the battlefield. The Army wants a more deployable system that makes more efficient use of water, which is a scarce resource in an arid environment such as Iraq.

To decontaminate their equipment, soldiers currently use the aging M12A1 Power Driven Decontamination device, with mops and brooms or with other small portable devices. However, these methods are time consuming and labor intensive, according to the Army.

The MDS includes a decontaminant pumper and a high-pressure/hot water module. Both modules use significantly less water and work faster. Both the pumper and the high-pressure devices are diesel-powered and have an electrical-start capability.

The decontaminant pumper dispenses DS2 or liquid field expedient decontaminants, formalin, household bleach and diesel fuel through two spray wands. Mounted on a trailer, the pumper draws the decontaminant from a container on the ground.

The washer delivers hot pressurized water at high speed. This washer can also dispense a high-volume (40 gallons per minute) flow of cold water and, through an injector, liquid detergents. The device can draw water from natural water sources and dispense it at various pressures, temperatures and flow rates.

The MDS, made up of one pumper and two washer modules, has two 3,000-gallon self-supporting collapsible water tanks, a 125-gpm diesel-powered water pump and 3/4-ton trailers.

The MDS will replace the M12A1 Skid Mounted Decontamination Apparatus and the M17 Lightweight Decontamination System. Initial operational capability has been projected for this year.

Joint Decontamination Systems

For the decontamination of large fixed sites, the Pentagon is developing the Joint Service Family of Decontamination Systems, which could be used by all the services. JSFDS would tackle chemical, biological agents and toxic industrial materials. The Block I acquisition will identify and field a family of commercial decontaminants, including enzymatic products.

Edgewood Center officials said that advanced catalytic enzyme decontamination could eventually be used as an improvement for the JSFDS. Block II will look at equipment, applications and dispensers, and Block III will evaluate medical/personal decontamination. The requirements that cannot be met by commercial items will be addressed in Block IV.

The Joint Service Sensitive Equipment Decontamination System will help remove chemical and biological agents from sensitive equipment, such as avionics, electronics, electrical and environmental systems and equipment, aircraft and vehicle interiors. The decontamination will have to be done “on-the-move” without disrupting operations. JSSED has to be “compatible with all other aircraft/vehicle/ship servicing tasks, including refueling, rearming, and other decontamination operations,” according to the Army’s Chemical and Biological Command.

The Edgewood Chemical Biological Center is the lead acquisition agency for this program. Edgewood also assessed technologies proposed by commercial suppliers.

The Edgewood Center already has determined that a transportable re-circulating solvent wash sonicated bath system would be the most appropriate for JSSED Block I, according to Army documents.

Block II will look into the capability of decontaminating the interiors of aircraft or vehicles requiring “unique volumetric processing.” The proposed Block II system solution would use high-output air heaters to produce the necessary heat and air-flow for long-duration interior decontamination.

In Block III, the Edgewood Center will test JSSED’s ability to decontaminate aircraft and vehicle interiors during operations, or “on the move.” This decontamination process is not supposed to have any adverse effects on crew, mission or platform performance. Based on the technology assessment performed, the most feasible solution for Block III systems is using spot decontamination kits for sensitive equipment and

interiors.

The fourth technology that the Defense Department wants—the Sorbent Decontamination System—would act as a reactive sorbent for immediate wipe-down of equipment. The sorbent powder would remove and neutralize the chemical agents from surfaces. The SDS is supposed to decrease decontamination time and eliminate the need for water, unlike the systems the soldiers currently use. The SDS is designed to operate in temperatures between -25 and 120 degrees.

It can decontaminate a 12.5 square meter surface. The SDS consists of two 0.7 pounds packs of reactive sorbent powder, which is non-toxic and non-corrosive, two-wash-mitt-type sorbent applicators, case straps and detailed instructions. One important feature of the SDS is the fact that the reactive sorbent powder does not interfere with operation of NBC detectors and monitors.

Asked which decontamination technology he would like to see in the field, Doesburg said it would be a system that can self-decontaminate. Doesburg said that the Army would like a decontamination solution that “you can spray in a very thin spray and that you do not need as much of, or does not require a liquid base.”

Even though he admitted that it is “a far stretch for everybody to think about now,” he would like to see equipment with “a chemical agent absorbent coating that you put onto a vehicle that would absorb whatever contaminant you come into contact with and self-decontaminate.”

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