THE ENGINEERING EDGE

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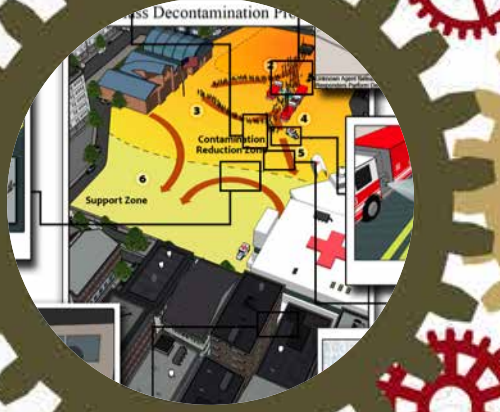
DESIGN

Designing Better Protective Gear **pg. 4**

BUILD

Cross-Directorate Effort to Improve Packaging for M18A1 Filters **pg. 5**



SUPPORT

Key Contributions to New National Guidance on Mass Patient Decontamination **pg. 7**

TEST

Testing Fabric for New Warfighter Uniforms **pg. 6**

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http://www.ecbc.army.mil/news/ENG/

INSIDE THIS MONTH'S ISSUE:

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For article suggestions, questions or comments, contact **Ed Bowen** at **edward.c.bowen8.civ@mail.mil.**

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ECBC Packaging Specialist Deploys with Navy Reserves

Mary K. Peck (right) is presented a memento by Deborah Motz from the Joint Project Manager for Protection. *Photo courtesy of the ECBC Packaging Branch*

On Mar. 12, the Engineering Directorate hosted a farewell gathering for Packaging Branch employee Mary K. Peck, who is deploying in support of Operations Noble Eagle and Enduring Freedom. Peck is a Gunner's Mate First Class with 15 years of service in the Navy Reserves. Representatives from the Joint Program Executive Office for Chemical and Biological Defense, U.S. Army Public Health Command and ECBC were in attendance to thank Peck for her packaging and logistics expertise on a variety of CBRNE projects, and to wish her well as she departs for her year-long deployment.

Ask a Tech Tip: Glow Sticks Spark Your Child's Interest in Science

Mike Kauzlarich**, of the Pyrotechnics and Explosives Branch, reveals how the techniques and lessons learned in labs can help you solve your household problems. Submit a question to him at **usarmy.APG.ecbc.mbx.engineering-directorate@mail.mil.

A cool way to spark your child's interest in science is to explain everyday chemical reactions. Glow sticks (or light sticks) make for a great lesson. Kids love to play with glow sticks, especially around holidays such as Halloween and Independence Day, or on camping trips and at concerts. Glow sticks have an outer casing made of plastic and an inner vial made of glass. The glass vial contains a chemical known as phenyl oxalate ester, and it floats in a chemical solution of hydrogen peroxide and fluorescent dye that is contained within the plastic tube. The fluorescent dye is available in many different colors. The chemical reaction occurs when you bend the plastic tube and break the capsule. The two chemicals combine, become "excited" and glow! You can further demonstrate the effect of temperature on the reaction by putting the glow stick in the freezer—the light will dim as the stick gets cold. Take it out of the freezer and it will glow brightly again as it warms. Take advantage of simple and fun opportunities like this one to get your child interested in chemistry!

Expert Working Group Advises Simulant Selection for Testing Chem-Bio Programs of Record

Scientists from the Army's Aberdeen and Dugway Proving Grounds are collaborating to advise DoD program managers of the most effective simulants to use during the critical testing phase for new chemical-biological detection equipment.

The West Desert Test Center – Edgewood Chemical Biological Center Simulant Working Group (WESWG) serves as a universal source for subject-matter experts (SMEs) in science and technology to provide support and recommendations to programs of record (PORs) for chem-bio defense systems.

The group is charged specifically with selecting chemical agent simulants for testing based on program requirements, technology constraints, and how alike the simulant is to an actual threat. Their goal is to deliver the chem-bio defense test and evaluation (T&E) community a standardized capability to select simulants through a scientific and methodical examination of options. Historically, many PORs have chosen simulants simply based on what was used in the past. This has led to operational test (OT) failures, confounding OT results, and program delays—all of which can be prevented by WESWG's process.

WESWG is comprised of SMEs from ECBC and West Desert Test Center (WDTC) with backgrounds in detection and analytical expertise pertinent to simulant selection for various detectors. The group is led by Brian MacIver, chief of the ECBC Permeation and Analytical Solutions Branch; Matt McCarty, WDTC Chemical Test Branch program manager; and Adam Rogers, chief of WDTC's Chemical Branch.

WDTC and ECBC bring to the group very different and complementary expertise in T&E. WDTC conducts full database searches and evaluation of initial simulant lists, which relies heavily on their knowledge of physical chemistry, testing and compound detection. ECBC serves as the programmatic lead for WESWG, and provides expertise in chemistry, detection, testing and analysis.

"The WESWG has been an effective and efficient collaboration, providing a technical edge to chem-bio programs by supporting T&E needs and driving successful developmental and operational testing," said MacIver.

The working group's primary objective is to coordinate between the PORs and operational test agencies (OTAs) to ensure that simulants are operationally relevant and will work during the OT period. They are currently focused on simulant selection for the Next Generation Chemical Detector (NGCD). At a recent WESWG meeting, candidate simulants were evaluated based on physicochemical factors (i.e., how similar the simulant is to agent chemically) and usability (i.e., how similar the simulant is to agent in terms of performance during test). During the meeting, usability factors were ranked and weighted by WESWG members, with input from OTAs and NGCD program representatives, to ensure the most relevant simulants were identified.

Following the down-select of chemical simulants to a final list, the remaining candidates will be evaluated for each technology type and states of matter required for NGCD OT. The working group's final output will be a list of recommended simulants for the NGCD program and details about why they were chosen.

The simulant selection for NGCD is expected to run through FY15.

Designing Better Protective Gear

Chemical-biological protective gear worn by Army pilots and aircrews has evolved to improve survivability in flight. ECBC engineers are putting design at the forefront of new Mission-Oriented Protective Posture gear, known as MOPP, in order to carefully tailor a suit that addresses specific pilot needs during a given air mission. They are working on a chemical-biological protective mask that mitigates thermal burden and hydration issues for flight crews that can also fully integrate with specific current and future aircraft.

The JSAM-JSF will provide combined chemical-biological and anti-gravity protection. *Credit: JSAM-JSF program team*

An Apache crew member dons the JSAM during an operations test conducted at Ft. Hood, Texas. *Credit: JSAM Apache program team*

"With more than 130 different platforms, five different helmets and a variety of aircrew equipment, focusing on one mask design became difficult," said Don Kilduff, an ECBC engineer who has supported JSAM since its inception. "Over time, the program split into different systems to meet the specific needs across the DOD aviation community."

The Joint Service Aircrew Mask (JSAM) was initiated in 1999 by the Joint Program Executive Office for Chemical and Biological Defense and the Joint Project Manager for Protection (JPM P). The goal of the program is to provide individual respiratory, ocular and percutaneous protection from chem-bio warfare agents and radiological particulates for pilots and aircrew. The Services use different platforms and different configurations of support equipment, which presented an integration challenge.

ECBC engineers lead the program management of two JSAM programs: JSAM Apache, used by the Army on the AH-64 helicopter, and JSAM-JSF, for the multi-service, multi-country Joint Strike Fighter program. Support includes testing, analysis, logistics and systems engineering, as well as program management and lifecycle management.

As the product manager for the JSAM Apache, Kilduff is responsible for the lifecycle management of the JSAM Apache masks—development, test and evaluation, procurement and sustainment. His team supported test and evaluation through ground evaluation of the mask with cockpit components, ingress, egress, emergency egress, aircraft controls, field of view and night vision compatibility.

The current version of the JSAM Apache has an additional design feature to allow crew members to quickly don and doff the mask in-flight without removing their helmets.

ECBC engineers are using an integrated approach to design advanced chemical-biological protection for Apache and Joint Strike Fighter pilots.

ECBC engineers designed a removable face plate that attaches and detaches from the MOPP hood. The Army is fielding this version to more than 19,000 Soldiers worldwide.

The JSAM-JSF system has faced a similar challenge, but with the added complication of integrating with the Joint Strike Fighter (also known as the F-35 Lightning II), the world's foremost stealthy, survivable and lethal multi-role fighter jet that is still in development.

The mask will be a lightweight, protective respirator, worn as above-the-shoulder chem-bio protection by F-35 pilots. When integrated with the F-35 life support system and pilot flight equipment, it will provide combined chem-bio and anti-gravity protection.

"One of JSAM-JSF's unique challenges is developing the system while the rest of the platform is in different stages of development, including key interfaces, such as pilot flight equipment, helmets, spectacles, laser eye protection, communication systems, ejection seats and life support systems," said Ryan Adams, the JSAM-JSF Product Manager with the ECBC Protection Engineering Division. "Working closely with the JSF Program Office has been critical in maintaining awareness of potential changes that may impact JSAM-JSF."

The system is in developmental testing. Adams said testing the first F-35 flights with JSAM-JSF chemical-biological ensemble is projected for late 2015.

"The aircraft requirements and capabilities are constantly evolving," Kilduff said. "Our work must keep pace with other equipment changes and be fully integrated with the aircraft to keep Soldiers both safe and comfortable."

To read the full article from the March/April issue of RDECOM's *Army Technology* magazine, go to *http://armytechnology.armylive.dodlive.mil/*

In-House, Cross-Directorate Effort to Improve Packaging for M18A1 Filters

The M18A1 is a gas filter that removes toxic chemical agent vapors and gasses from a number of Army armored vehicles. Using a specialized tool, the metal filter containers are opened much like an aluminum can. The container's sharp edges have reportedly caused cuts to Warfighters' gloves and hands.

Recognizing this safety hazard, the ECBC Packaging Branch contacted U.S. Army TACOM, the item manager, to propose alternative designs to the container packaging that would improve safety and reliability, reduce possibility of damage during shipping and storing, and reduce overall packaging costs.

"For this in-house effort, and as part of the Directorate's business development strategy, we pooled expertise and support from across the Engineering Directorate—design and prototyping expertise from the Advanced Design and Manufacturing (ADM) Division; vibration, drop and accelerated aging testing capabilities from the Environmental and Field Testing Branch (EFTB); and filter performance testing from the Test Reliability and Evaluation Branch (TREB)," said Packaging Branch Chief David Vincitore.

Designing the Prototypes

The effort began with ADM and the Packaging Branch researching and developing packaging alternatives. The designs had to meet level A (international shipping) and level B (shipping to storage warehouse) military packaging standards, "but also be easier to open and have at least the same shelf life as the original package, if not better," said Karyn Merson, packaging specialist.

When considering design alternatives, it occurred to the team: Rather than put the filters in a metal canister, why not use a bag? "A bag meets military specifications, is vacuum-sealed to protect the filter's integrity, and would alleviate potential damage to the filters during shipping and storage," said Vincitore.

Taking this concept a step further, the team developed three prototype packages for the bagged filters: 1) a polyethylene foam box per filter, with two foam boxes secured inside a fiberboard box; 2) a PVC container to hold each filter, with two containers per fiberboard box; and 3) a polybox with waterproof coating that eliminated the need for a separate fiberboard box.

Testing for Damage

After thoroughly inspecting all filters, each package prototype went through a series of tests to gauge how the package would withstand typical shipping, storage and environmental conditions. Vibration tests were conducted to simulate two shipping scenarios: loose cargo (when the package may be transported in a military vehicle traveling over rough terrain) and secured cargo (when the package may be tied down in the back of a truck, driving on a smooth road). Each prototype was dropped on its side, corners and edges; then the package and filters were examined for damage. Tests were also done to see how each prototype would hold up to a certain weight when several packages were stacked together.

Accelerated Aging Storage Tests

The current configuration for the M18A1 has a shelf life of five years, so it was essential for the prototypes to meet or exceed that requirement. Accelerated aging tests simulate time passing to represent an item's shelf life. "We collected information about the typical storage conditions of the item—for example, sitting outside in desert conditions versus stored in a temperature-controlled warehouse or depot," explained Mark Hull, EFTB electronics technician. "Then we used a temperature chamber to simulate the aging process. We also exposed the prototypes to various elements, such as rain, all within our test chambers."

When you anticipate your customer's needs, then provide a solution that not only meets but exceeds their expectations for innovation, quality and performance, that is excellent customer service—and exactly what the ECBC Engineering Directorate is demonstrating with the M18A1 packaging redesign effort.

Next Steps

Following the accelerated aging storage tests and inspection of each filter, TREB will test the filters to see if the vibration, drop and accelerated aging tests led to any degradation in filter performance. Those tests are expected to be completed in May. A final recommendation will be submitted to TACOM for consideration. The report will also be shared with engineers at ECBC-Rock Island, who support the sustainment of the filters.

Three Custom Packaging Prototypes


Polyethylene foam box


PVC container


Polybox

Photos courtesy of ECBC Packaging Branch

Scientists Use Both Standard and New Methods to Test Fabric for New Warfighter Uniforms

The Defense Threat Reduction Agency is leading an effort to design a new Warfighter uniform—with added protection against chemical warfare agents encountered in the field—and ECBC scientists are using both standard and new methods to test fabrics that will be used in the new suit.

The effort is part of a joint U.S. Army and Air Force program called the Integrated Protective Fabric System (IPFS) program. It is led by the U.S. Army Natick Soldier Research Development and Engineering Center (NSRDEC) and the U.S. Air Force Civil Engineering Center, and supported by ECBC. Other organizations involved in the program include Calgon/Chemviron, Emory University, Enropics and Phasex.

The new uniform is designed to decrease thermal burden to the Warfighter, while maintaining the same or better protection against chemical agents. Different fabrics may be used in the uniform based on where heat is more common, like the chest and groin area; but a greater protection factor is needed for places where the Warfighter is likely to come in contact with agent, such as on the shoulders, elbows or knees.

In collaboration with NSRDEC, the ECBC Permeation and Analytical Solutions Branch (PASB) was recently involved in testing agent absorption on different fabrics that could be used in the IPFS, now in the Milestone B phase of development. All testing needed to meet the chemical and biological defense program test and evaluation standards, as well as the requirements of the IPFS program.

"Natick brought us on board based on our previous work with them, as well as our unique ability to test using live agents and our understanding of transport phenomenon," said Brian MacIver, PASB chief. "The quality of our labs and test methods, and our reach-back support from subject-matter experts in toxicology and decontamination from across the Center make us an ideal partner for this type of program."

To test the fabrics, branch scientists used innovative and effective test methods to identify reactions between CWAs and the material. Three test methods were used—low-volatility agent permeation (LVAP), air liquid vapor aerosol group (AVLAG) and advanced super-shedding efficacy test (ASSET)—the latter being a brand-new capability developed specifically for this program.

The LVAP method was recently developed by ECBC researchers and and will soon become an official test and evaluation method with the U.S. Department of Defense for VX permeation through protective equipment. The method has been validated through the Deputy Under Secretary of the Army-Test and Evaluation, and permits the experimental evaluation of protective materials against contaminants that were traditionally difficult to analyze.

Following standard test operations procedures, scientists used the AVLAG test cell to evaluate multiple layers of experimental carbon and shell fabrics to measure quantitative permeation of specific agents through the material. From past development efforts, the PASB has been able to well-characterize the AVLAG system, reducing variability in the data through more accurate control over testing variables that are inherent to AVLAG or any other test cell or device.

The branch supported the development of "super-shedding" coating capability specifically for this program. A modification of the AVLAG method, the ASSET method uses a different application of agent to the material. "With this method, we aided NSRDEC in their development of fabric that sheds (repels) liquid contamination," explained Christopher Steinbach, a chemist supporting the PASB. "The coating reduces agent permeation by allowing agent to run off the fabric."

To perform the ASSET tests, scientists used the same AVLAG cells, but placed on a tilt table custom built by the ECBC Advanced Design and Manufacturing Division. The table was tilted at a range of 45 to 75 degrees so the agent could run off the fabric swatches. "The tilting represents a Warfighter's movements, as well as the how the uniform will naturally conform to their body," said Steinbach.

Scientists from the ECBC Permeation and Analytical Solutions Branch and U.S. Army Natick Soldier Research and Development Center worked together to create new test methods for novel fabrics being developed for a new military uniform.

Then samples of air were pulled from the cells every few minutes to develop a curve for the growth of the concentration of agent on the fabric. The cells were monitored in real time for 24 hours, with 13 to 26 cells being used at a time. "The higher throughput allows for better statistics for evaluation," said Steinbach.

ASSET testing will continue through FY15. Any necessary follow-on testing will be conducted at the request of NSRDEC.

Related Articles

"Suited Up: ECBC Researchers Help Develop Self-Detoxifying Suit for Joint Forces," *http://www.ecbc.army.mil/news/2015/suited-up-ecbc-researchers-develop-self-detoxifying-suit-joint-forces.html*

"Army researching uniforms that automatically decontaminate," *http://science.dodlive.mil/2015/04/03/army-researching-uniforms-that-automatically-decontaminate/*

ECBC Experts Key Contributors to New National Guidance on Mass Patient Decontamination

ECBC Engineering Support Division Chief Bill Lake and Chief Systems Engineer Dr. Stephen Divarco were asked to serve on the Federal working group that advised and developed new national guidance on mass patient decontamination as requested by the White House National Security Council. Lake and Divarco are not only regarded as experts in chemical and biological defense, but they have also contributed to previous guidelines for first responders, and have more than 60 years of combined experience in private industry and government.

Two ECBC experts were key contributors to recently published U.S. Department of Homeland Security (DHS) and U.S. Department of Health and Human Services (HHS) guidance on patient decontamination in a mass chemical exposure incident that will be used by cities across the country.

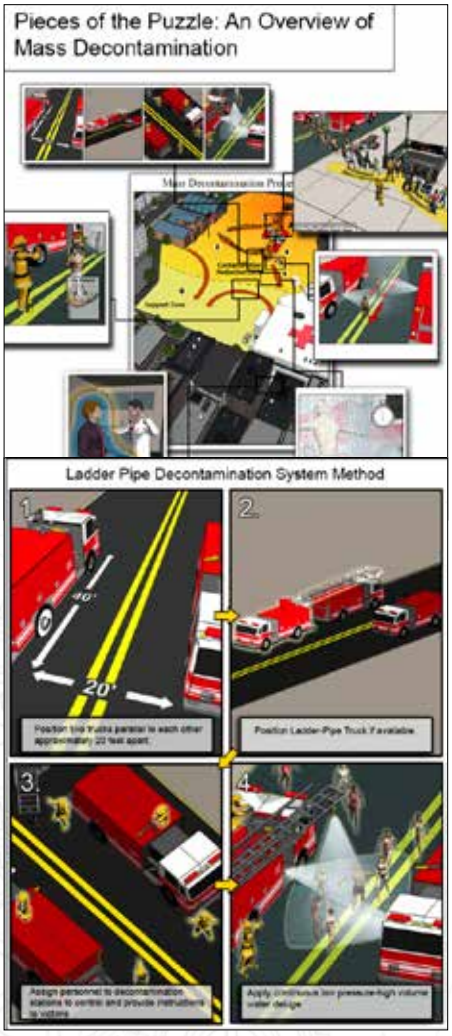
"Prior to September 11, preparedness focused on industrial chemical accidents," said Lake. "Following September 11, federal and municipal leaders and first responders considered the possibilities of planned chemical attacks. What if 10 people are exposed? Or 100 or 5,000? How do you treat people who are exposed, while protecting and aiding those who are not? This new document provides decontamination methodologies to give practical guidance that covers those types of scenarios for city planners and first responders."

The document, titled "Patient Decontamination in a Mass Chemical Exposure Incident: National Planning Guidance for Communities," contains strategic-level, evidence-based best practices for use when planning and conducting patient decontamination in a mass chemical casualty incident, and is intended for senior leaders, planners, incident commanders, emergency managers and trainers of local response organizations and health care facilities. The focus is on external decontamination of living people exposed to toxic industrial chemicals, toxic industrial materials, or chemical warfare agents resulting from either an intentional or accidental release.

To shape and substantiate the recommendations, a working group of Federal technical experts and local first responders was formed to seek out and apply all of the evidence available. Lake was asked to join the working group in 2011. He was a co-author on the original ECBC Special Report, "Guidelines for Mass Casualty Decontamination during a HAZMAT/Weapon of Mass Destruction Incident, Volumes I and II" (ECBC-SP-024).

Divarco was instrumental in the development of next-generation civilian first responder protocols (ECBC-SP-36) for decontamination during hazardous materials/weapons of mass destruction mass casualty incidents, as well as in providing key information to military personnel who support civil authorities. He was asked to join the working group in 2013 to assist in the final subject review as a subject-matter expert.

"Our involvement in the development of this guidance has given ECBC more credibility based on the new empirical data and technical information presented by the report, supports the the foundation for first responder mass casualty decontamination presented by ECBC in previous reports, and, very importantly, has increased awareness on the subject with city administrators and civilian first responders," said Divarco.



A typical civilian first responder setup for a mass casualty decontamination scenario. *Credit: ECBC Advanced Design and Manufacturing Division*

To read the full article, go to *www.ecbc.army.mil/news.* To download the guidance, go to *www.phe.gov/Preparedness/responders/Documents/patient-decon-natl-plng-guide.pdf.*

AWARD

ECBC Detection Engineering Team Earns Silver Quill Award for "Stryker Detectors Rescued"

Congratulations to a group of ECBC engineers that recently received the Silver Quill Award from the U.S. Army Chemical, Biological, Radiological and Nuclear School for their article titled, "Stryker Detectors Rescued."

The article was published in the winter 2014 edition of *Army Chemical Review*. The award recognizes the group's knowledge and expertise in chemical and biological defense, as well as their writing ability and dedication to the protection of the Warfighter.

Authors William Argiropoulos, Gerald Dietz, Dr. John Kennedy and Kyle Phillips work together in the Detection Engineering Branch (DEB) of the Detection and Decontamination Engineering Division. The Branch provides comprehensive engineering and program support for chem-bio detection systems, as well as fielding, training and program management services for special projects.

The article details the team's long-time support of a TACOM-led reset program to inspect and repair chemical defense equipment, such as the M88 detector, a component of the M22 Automatic Chemical Agent Detector Alarm (ACADA) used on the Army's Stryker family of vehicles. The M88 detector protects the Stryker's crew and passengers from chemical agent hazards. A damaged or inoperable detector puts Warfighter lives at risk. The reset program allowed the opportunity for the equipment to be inspected, assessed and repaired by highly skilled ECBC and TACOM personnel upon return from deployments and before being redeployed to the field—increasing equipment availability, unit readiness and combat effectiveness.

During the reset missions, DEB personnel observed a variety of detector failures which were ascribed to developing failure trends and improper handing of the M88 units in the field. This included damaging water leakage and physical damage beyond the expected wear and tear. The team coordinated an investigation with Stryker unit personnel, the Project Manager-Stryker, and the ACADA manufacturer to identify the causes and possible solutions. The DEB subsequently published an article in *PS Magazine* which provided guidance on the installation, preventative maintenance, handling and storage of the M88 detectors to assist the user in keeping the equipment in good working order.

ECBC personnel have published several articles in recent issues of *Army Chemical Review* and other science and engineering journals in order to inform the chem-bio community of ECBC's capabilities and expertise and the critical role they play in completing the Warfighter's mission. Publishing articles such as this one not only communicates vital equipment information to the Army Chemical School and the Soldier, but it also documents experiences and lessons learned that the chem-bio defense industry can reference for years to come.

To read "Stryker Detectors Rescued," download the winter 2014 edition of *Army Chemical Review* at *http://www.wood.army.mil/chmdsd/.*

THE ENGINEERING EDGE

Telling the Engineering Story to Your Customers

Let *The Engineering Edge* newsletter help you tell the Engineering story to your customers and contacts in the chemical-biological defense community!

Story topics include:

- **Design-Build-Test-Support capabilities**
- **Project updates**
- **Collaboration and partnership success stories**
- **Warfighter support**
- **Leadership and innovation**
- **Workforce development**
- **Employee spotlights and achievements**

Just let us know your story idea – we'll take it from there! Submit your story ideas and article requests to Ed Bowen at edward.c.bowen.civ@mail.mil.