CBARR NEWS

A RECOGNIZED LEADER IN CB SOLUTIONS

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Sustainability

INSIDE THE ISSUE

Director's Column | PAGE 2

Packing the Essentials for Schofield Operations | PAGE 3

Safety: The Cornerstone of Sustainability | PAGE 4

ECBC Investigates Sea-Dumped Munitions in the Pacific | PAGE 6

Munitions Recovered from East Coast Locations Assessed at MAPS Facility | PAGE 10

Staying Connected in the Field | PAGE 11

Applying Experience: ECBC Supports Stockpile Disposal Efforts in Pueblo | PAGE 12

Finding Agent in the Air | PAGE 14

ECBC operators demonstrate the process to safely access, drain, neutralize and decontaminate recovered chemical munitions at ECBC's Munitions Assessment and Processing System facility

Securing Sustainable Futures One Mission at a Time

There is always something new on the horizon. New technology, emerging threats and a next generation science community are all realities that continue to shape the geopolitical terrain of chemical demilitarization. Some may call it a setting sun, but our vision for a world free of weapons of mass destruction is a future we work toward every day at the U.S. Army Edgewood Chemical Biological Center (ECBC).

Our shared resources and a network of partners continue to strengthen with each new mission. It's what fuels our Chemical Biological Application and Risk Reduction (CBARR) Business Unit and drives us to invest in our personnel and their safety. In this issue of the CBARR News, we shed light on the critical steps we've taken to sustain our future in order to secure yours.

Our portfolio of project work continues to diversify across the chemical demilitarization lifecycle. Our sample gathering and analysis work with the University of Hawaii furthers our ability to perform shipboard operations while the decontamination work conducted on the MV Cape Ray verifies our standard of safety. Field operations at Schofield Barracks in Hawaii and Pueblo Chemical Agent-Destruction Pilot Plant in Colorado demonstrate the logistics and infrastructure strength needed to transport personnel and equipment wherever they are needed.

Whether it is remediation, assessment and evaluation, operations, decontamination or disposal work, CBARR is a "one stop shop" for handling the most hazardous materials known to man while helping to restore the environment in a socially responsible manner.

Tim Blades
CBARR Director of Operations

On the Cover:
ECBC scientists prepare to monitor samples collected near munitions at bottom of the sea.

Packing the Essentials for Schofield Operations

ECBC completes EDS mission in Hawaii

Taking a trip to Hawaii can be exciting. Packing for such a trip can be overwhelming. Instead of bathing suits and flip flops, however, ECBC's CBARR operators took only the essentials with them when they deployed for another chemical demilitarization mission at Schofield Barracks.

"When I thought about what we needed to sustain operations for this mission, I thought about how we typically work together to transport the personnel and equipment we need to be successful at any location," said Ray Diberardo, ECBC project manager.

Schofield Barracks is located on Oahu, the third largest island in Hawaii. It is home to the 25th Infantry Division and is a strategic post for supporting Pearl Harbor. It also offers chemical and biological defense training. ECBC deployed about 16 CBARR technical operators to safely destroy 10 recovered chemical munitions using the Chemical Materials Activity's Explosive Destruction System (EDS). These munitions have been stored at Schofield Barracks for nearly three years.

The multi-week project included site set-up and tear-down, along with days of consistent destruction operations. According to Diberardo, ECBC operated the EDS Phase 2 Unit 2 (P2U2) model, along with supporting equipment such as generators, air compressors, a personnel decontamination station, treaty and command trailers, change rooms, filter units, mobile laboratories and engineering control structures.

"We needed this equipment to sustain operations given the travel, location and circumstances," said Diberardo. "We needed to be able to anticipate any problems we may encounter and pack accordingly. If we're down due to a broken part and don't have a replacement, that could take 3-4 days to get back up and running if we can't find a local solution."

An aerial view of the Hawaii operations site where ECBC safely destroyed recovered chemical munitions using the Explosive Destruction System

Hiccups like that could impact the time, cost and schedule for customers. To avoid any deviance from the operational plan, ECBC has to think about how equipment is transported to and from Edgewood Area of Aberdeen Proving Ground, Md. According to Diberardo, everything had to be shipped by rail or truck to the West Coast before it was then sea-shipped to Hawaii.

"Normally when you have an operation that is within the continental United States, you get 90 percent ready and allow for the remaining 10 percent to solidify once you get on site," Diberardo said. "That's not the case here for Hawaii, which is outside the continental United States. Everything, 100 percent, has to be ready for shipment because if you miss the boat there is added cost, schedule and resources to make up for lost time."

If equipment does not get used for the mission, it gets used in some other capacity by a partner organization or is returned to Edgewood. Nothing is left behind as trash, either. The munition fragments and chemicals are stored in containers and disposed as hazardous waste.

This isn't the first time ECBC has done munition disposal operations at Schofield Barracks. A few years ago, ECBC operated the Transportable Detonation Chamber, (TC-25) which is a transportable system designed to contain repeated detonations of up to 25 pounds of TNT. The system included a detonation chamber, expansion chamber and an air pollution control system, and was used to destroy 72 items. This time, the EDS was chosen because of its low impact on the environment and the fact that there were fewer items destined for destruction.

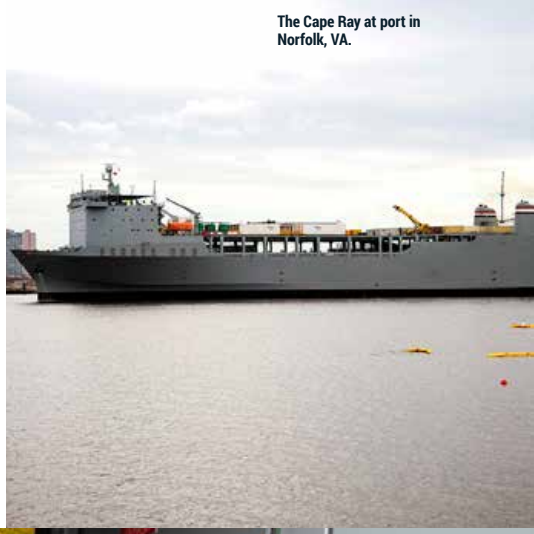
Safety: The Cornerstone of Sustainability

How CBARR Secures On-Site Operations

Site locations may change and destruction technologies may evolve, but there is one thing that always remains the same: safety. ECBC adheres to and incorporates toxic chemical agent safety standards issued by the Department of the Army, as well as regulations set forth by the Occupational Safety and Health Administration (OSHA). Following these guidelines not only keeps employees safe during field operations, but provides a framework to problemsolve responsibly.

"A lot of our field operations include the remediation or demilitarization of chemical agent so there's always an element of danger we have to account for and manage," said Jarad Tucker, safety and health manager with ECBC's Safety and Health Office (SHO).

Safety principles are woven into everything from site design, agent handling, laboratory monitoring, personnel protective equipment, decontamination and disposal, storage and shipping, and pre-operational training. Integrating core policies into everyday actions helps ingrain safety into routine actions, and over time, it has simply become a part of CBARR's culture.



The Cape Ray at port in Norfolk, VA.

"Safety is everybody's responsibility, not just the responsibility of the safety representative or the manager," Tucker said. "If we're going out to a site, we want to make sure everything is compliant with OSHA and Army regulations, which can be split into two categories: chemical agent safety regulations and general industry regulations."

These policies are documented in detailed standing operating procedures (SOPs) that all personnel follow for a given mission, in conjunction with a Health and Safety Plan, and an Emergency Response Plan. But in order to execute successfully, site challenges must be identified and addressed in customized scopes of work that oftentimes integrate with the mission of other organizations, whether it is ECBC's partners or customers. Safety is the common denominator.

Will Rowell, a chemical engineering technician with ECBC, checks the electrical system connected to the Field Deployable Hydrolysis System

"One of the main challenges is keeping safety fresh, especially on long-term field site projects where daily operations can become repetitive," Tucker said. "Whether approaching it from a human emotion or changing regulatory requirements perspective we, as a Safety and Health Office, are constantly trying to approach daily safety from a fresh perspective."

According to Tucker, asking questions is one of the best ways to do that. He actively seeks feedback from the technical operators and scientists on-site, and tries to pick a different topic each day to focus on, in order to co-develop safety solutions. Personnel are typically on multi-week rotations, and after a while, safety becomes part of culture that is sustained through effective communications among the ranks, Tucker said.

"We are the chemical agent experts, and we bring that expertise to the table, but the FDHS was so much more than just that."

CBARR's international field operations mission has expanded over the past four years, especially in Australia. Working with other countries to integrate two sets of safety requirements can be challenging and complex, but from a safety perspective, it's about bringing the best of both practices together for an even safer and more secure environment.

The most recent example has been the consolidation of multi-agency strengths to complete the historic mission to destroy 600 metric tons of Syria's declared chemical agent stockpile aboard the MV Cape Ray—something that had never been done before. But it was ECBC's ability to provide integrated chemical and biological solutions that made the Field Deployable Hydrolysis System (FDHS) functional and safe to operate.

Above: Chris Druyor, an ECBC chemical engineering technician, turns a valve aboard the MV Cape Ray while supporting FDHS operations.

"One of the cool things with the FDHS mission, was that there was never a system like that built before. We are the chemical agent experts, and we bring that expertise to the table, but the FDHS was so much more than just that. It involved safety from all aspects and levels of the project, it was truly a unique mission," Tucker said.

Whatever the territory, safety has always been the cornerstone for CBARR's sustainability, and in turn, has helped rid the world of some of the most dangerous chemicals known to man. ECBC is currently supporting the Program Executive Office, Assembled Chemical Weapons Alternatives (PEO ACWA) to destroy a small portion of the final 10 percent of the U.S. chemical weapons stockpile using the U.S. Chemical Materials Activity's Explosive Destruction System at the Pueblo Chemical Agent-Destruction Pilot Plant in Colorado.

"For the EDS operation, we'll have safety personnel in the command post watching everything on a closed-circuit television," Tucker said. "If there's an incident that occurs, we have to make decisions pretty quickly in order to instruct our operators, who are already wearing PPE, to safety. It's about being able to pull the information you need from all the training and experience acquired over the years, and remain calm enough to make critical decisions in that moment."

ECBC recently received the Director of Army Safety Risk Management Award on March 19. This award recognizes an outstanding performance by an organization or individual in the field of risk management, which is defined as the Army's principal decision-making process used to identify and assess hazards, determine and control risks and ultimately, prevent both accidental and tactical losses. This is the first time anyone at Aberdeen Proving Ground, Md. has received this award.

ECBC Investigates Sea-Dumped Munitions in the Pacific

Research partnership with the University of Hawaii explores environmental impact

It's no secret that chemical munitions from World Wars I and II are still around today. Though their use is prohibited by the Organisation for the Prohibition of Chemical Weapons (OPCW), they can be still found in stockpiles or recovered from land, and are waiting to be destroyed. They are also found at the bottom of the ocean, where they have corroded for nearly a century and can disintegrate upon touch.

The robotic arm of a remotely operated vehicle collects sediment and water samples where chemical munitions are found 500-600 meters underwater off the coast of Hawaii.
(Photo courtesy of University of Hawaii)

Sea-dumping munitions was not an uncommon practice during the 20th century, and in 1972 the United States formally banned sea disposal when Congress passed the Marine Protection, Research and Sanctuaries Act. Understanding the resulting environmental impact has led to critical research being conducted by the U.S. Army and Margo Edwards, principal investigator for the University of Hawaii at Manoa: the Hawaii Undersea Military Munitions Assessment (HUMMA) project.

"This project is definitely near and dear to my heart," Edwards said. "We are really trying to understand something important to the planet, to the people, to the environment. We're trying to document the legacy of the things we've dumped dozens of years ago, and it's compelling because there's not much information from that time, so it's like a mystery novel."

According to Edwards, trace amounts (parts per billion) of mustard agent, along with several degradation products, have been detected in the sediment where chemical munitions are known to be found 500-600 meters underwater. In October 2014, ECBC supported a one-week UH research effort where remotely operated vehicles (ROVs) collected 442 sediment scoops, 35 water samples, 84 shrimp samples, 11 starfish and 2 anemones, and 28 box cores, which is similar to a piston that is pushed into the sediment to maintain consistent layering when it recovers the sample. Throughout the course of the multi-year research effort, other data has been collected, including more than 100,000 still images plus high resolution video data that was captured from multiple cameras.

"We analyzed double the amount of samples we did in 2012 and in half the time," said John Schwarz, project lead and ECBC Environmental Monitoring Laboratory (EML) manager. "This time we went closer to the munition and collected 8-16 samples at each location using an ROV that could submerge for 36-48 hours at a time. This significantly improved productivity and eliminated the safety risk of having people onboard an underwater vehicle for extended periods of time."

According to Schwarz, mustard agent freezes at a temperature of 58 degrees Fahrenheit, so there is little to no environmental risk to the ocean at these depths, where the average temperature is 45 degrees Fahrenheit. Samples from the research have been sent back to the EML located at Aberdeen Proving Ground, Md., where further studies are investigating what kind of bacteria lives in the sediment found at that depth in order to determine other things like oxygen content, metals analysis and toxic industrial compound levels.

But the mystery remains: at what point did the munitions start leaking mustard?

"We analyzed double the amount of samples we did in 2012 and in half the time"

"I think our data point to an answer that is consistent across the biology and sediment samples as well as the level of collapse we see in the munitions," Edwards explained. "We weren't there at the time of the sea dumping so we can't prove this definitively, but we're building a compendium of evidence that suggests that the leakage from these munitions mostly occurred 70 years ago when they were first dumped into the ocean."

Sea water is a natural catalyst for corrosion and has accelerated the rate of disintegration for the munitions. According to Edwards, it's a relatively slow process to investigate the current condition of the munitions when the atmospheric pressure at that depth is 65 times the atmospheric pressure at sea level; all the more reason to use ROVs when collecting samples. After years of research, Edwards and her team have sampled around 50 munitions site locations—a small, yet multi-faceted data set that indicates neither the munitions nor their chemical contents have impacted sea life significantly.

For example, the team discovered that one species of starfish often selects munitions as a natural habitat. Edwards and her team worked with scientists at the Smithsonian Institution to study the lesions on the arms of starfish that were collected living on munitions. These lesions were hypothesized to be a result of contact with mustard agent. After extensive investigation, the Smithsonian Institution not only realized that this was a new species of starfish, but concluded that the lesions were the result of a parasitic barnacle invading the arms of the starfish. The parasitic barnacle itself may also be an undiscovered species.

"Every aspect of this project has taken us in new directions where we discover amazing things that we just didn't know," Edwards said.

Agent Onboard: ECBC Handles Contaminated Samples Aboard Ship

From a room onboard the research vessel, scientists from the Woods Hole Oceanographic Institution controlled the ROV, including the robotic arms that scooped and sealed samples around the munitions. The samples were loaded onto an "elevator" near the ROV, a large platform with weights that anchored it to the sea floor. Once enough samples were collected, the weights were cut loose and the platform floated up toward the water's surface where a crane from the research vessel would lift it onto the ship.

"There were two hazards we were facing," said Lou Alvano, ECBC chemist. "There was the potential chemical hazard with the samples being brought up from the sea floor, and there was also that hazard of working on the deck, which was slippery. We constantly weighed those two risks to decide the best way to proceed and safely assess what's recovered."

The ECBC team would then wash the samples with fresh water and use a hand-held monitoring assay to screen for any gross level contamination. Once cleared, the samples were double bagged and transferred to the onsite laboratory glove box where they were opened within engineering controls.

"We tried to get as much sediment into the bags in order to transfer it to the fume hood where we could perform a solvent extraction and analyze the liquid," said Mike Glorioso, ECBC chemical engineering technician who has more than a dozen years of air monitoring laboratory experience. "At that point, the agent is safe to handle."

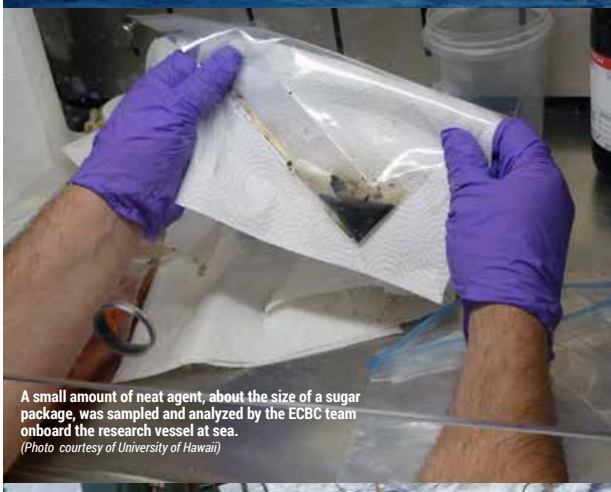
During the mission, one of the samples pulled up from the bottom of the ocean floor was suspected of containing a small amount of neat mustard agent. Glorioso recalled working in the glove box and seeing some discoloration when tested with M8 paper, which immediately indicated the presence of mustard agent. Once confirmed, the mission shifted from air monitoring and laboratory analysis to agent decontamination, Glorioso said.

"The coolest thing about working with ECBC is they are very easy-going guys until things go in an unexpected direction, and then they kick into another gear," Edwards said. "It was a very small amount of neat agent, about the size of a sugar packet, but the ECBC team wasted no time notifying the captain, isolating the deck and laboratories, and implementing emergency protocols to keep everyone safe."

This worst-case scenario is what ECBC prepares for, and Edwards called their response professional and impressive. The unexpected twist was safely handled but it also meant extending the mission in order to completely decontaminate the ship for a few days.

"It's not the first time we had to adjust on the fly and it's not going to be the last," said Glorioso. "We're cross-trained in a lot of different skill sets so our individual roles on any given mission may change depending on the need. It's a testament to our experience and the missions we've been on. We know how to safely handle everything."

Since 2009, ECBC has supported the Hawaii Undersea Military Munitions Assessment (HUMMA) project.
(Photo courtesy of University of Hawaii)



A small amount of neat agent, about the size of a sugar package, was sampled and analyzed by the ECBC team onboard the research vessel at sea.
(Photo courtesy of University of Hawaii)

A new species of starfish was discovered to have made a habitat out of the munitions.
(Photo courtesy of University of Hawaii)

Project Timeline: Discovering the Unknown

Since 2007, Edwards has led the HUMMA project, a five-phase $7.5 million research effort for the Office of the Deputy Assistant Secretary of the Army for Environment Safety and Occupational Health.

"When we started in 2007, we really didn't know where to look or what we were going to find. It was a real unknown," Edwards said, who recalled framing the project with a number of questions:

- Are we going to be able to detect the munitions with sonar technology?
- Are we going to be able to visit the munitions if we locate them?
- Are we going to be able to collect the samples that we need to?

"We were pretty sure the answer to all of those questions was going to be 'yes' but in those water depths and with that technology, what we were talking about at the time had never been attempted before. Now, here we are eight years later and we're asking some very sophisticated yet fundamental questions about how these munitions are deteriorating."

ECBC has supported the research effort as chemical experts since 2009 when a team of CBARR scientists first conducted sample analysis onboard a research vessel off the coast of Oahu. More than 50 hours of video data and 3,500 images of munitions were collected as the university and prime contractor Environet investigated parts of a 500 square-kilometer region of ocean floor using the three-person PISCES submersibles.

In 2012, ECBC supported the second phase of the HUMMA project, which included using the same submersibles to descend to the bottom of the ocean and collect samples within 10 feet of the munitions. Nearly 300 samples were collected, including 165 sediment samples, five water samples and 36 samples of shrimp tissue. This was also the first time the Hawaiian Brisingid starfish were discovered among the deteriorating chemical munitions.

The lessons learned in 2012 enabled ECBC to return in 2014 with proven analytical methods for monitoring as well as overall laboratory design onboard the ship. Now, with the final phase of the HUMMA project complete, the U.S. Army and the University of Hawaii can evaluate performance differences between human-occupied submersibles and the ROVs used during the last mission.

For more information, check out www.hummaproject.com

Munitions Recovered from East Coast Locations Assessed at MAPS Facility

Chemical munitions recovered from Maryland, Florida and Washington, D.C. were recently drilled and sampled at the Munitions Assessment and Processing System (MAPS) facility located downrange at Edgewood Area of Aberdeen Proving Ground (APG), Md.

The MAPS facility is an 11,500 square-foot single-story masonry and steel structure used to safely access, drain and sample chemical munitions, as well as detonate the remnants of explosively configured munitions under engineering controls.

On March 30, two swab samples and a 60mL liquid sample were extracted from a chemical EK-4 bomblet recovered from Withlacoochee State Forest in Florida that was suspected of containing mustard fill and thickened mustard.

Two other recovered munitions—a 75mm artillery projectile from the Spring Valley remediation site in Washington, D.C., and a 4.2-inch mortar projectile recovered from APG—were also drilled and sampled on Feb. 12. The 75mm artillery projectile was suspected of being filled with magnesium arsenide. Four holes were drilled into the munition at 90 degree angles and an 8-gram sample was taken and submitted to ECBC's Environmental Monitoring Laboratory for characterization. The holes were then plugged with a wax plug and wrapped with duct tape.

The 4.2-inch mortar projectile was unfuzed and suspected to have a fill of FS smoke. A hole was remotely drilled in the munition in the explosion containment chamber (ECC) and a 5mL liquid sample was extracted. The remaining fill was extracted and transferred to a Department of Transportation bottle, which was then transported to ECBC's Chemical Transfer Facility for storage. The munition was then flushed with water, dried and repacked.

All three munitions were first assessed at their found site locations with the Portable Isotopic Neutron Spectrometer (PINS) Chemical Assay System before being packaged, transported and stored at the N-Field bunker in Edgewood prior to being drilled and sampled. One of these munitions was flushed with water and dried post-operation. All of the recovered munitions were repackaged in their original multiple round container (MRC), and are currently stored in the N-Field bunker until they can be destroyed.

Processing a munition at the MAPS facility takes about one full day to complete, and two additional days are needed for the EML to analyze and characterize a report for customers. MAPS is a significant improvement in protecting human health and the environment. In an area where chemical agents and industrial chemicals are managed, the MAPS facility is equipped with a ventilation system that established negative air pressure and discharges air through carbon filters. Near real-time air monitors provide additional workspace surveillance.

ECBC operators demonstrate the process to safely access, drain, neutralize and decontaminate recovered chemical munitions at ECBC's Munitions Assessment and Processing System facility

Ray Diberado (left), control room operator, communicates with chemical engineering technicians operating the FDHS aboard MV Cape Ray while Rob Malone (right), records data on the current operation.
(U.S. Navy photo by Mass Communication Specialist Seaman Desmond Parks/Released)

Staying Connected in the Field

ECBC CIO provides secure mobile computing capability

The rapid pace of technology continues to be a catalyst for the way people live, work and play. Network connections have promoted mobile computing applications that have increased access to information and knowledge sharing, and as a result, empowered communication on an individual and organizational level. For CBARR, staying connecting during field operations is critical for mission success.

The Corporate Information Office (CIO) at ECBC is the backbone for the Center's operations. Its secure network facilitates how scientists and engineers are able to get the right information to the right people at the right time, in order to fulfill their mission to advance chemical and biological defense. One way to do that is using secure servers to secure data and minimize risk should something happen to a given device. Protecting critical information goes hand-in-hand with how knowledge is managed, whether it is inside the lab or out in the field.

In August 2014, ECBC safely destroyed more than 600 metric tons of Syria's declared chemical agent stockpile onboard the MV Cape Ray. The historic mission raised awareness for ECBC's technical expertise in deployable chemical demilitarization services like the Field Deployable Hydrolysis System (FDHS). Lesser known, is the secure IT infrastructure that enabled crucial information to be communicated from the Cape Ray in the middle of the Mediterranean Sea to ECBC headquarters at Edgewood Area of Aberdeen Proving Ground, Md.

"We provided them with laptops and because they were using ship-controlled satellite internet service, we worked with them to reconfigure both the classified and unclassified networks so information was not being shared with the general population onboard the ship," said Ron Ward, chief technology officer for ECBC.

"Originally, it was kind of like the Wild West for everyone. People were trying to send emails and videos back home to loved ones while others needed the bandwidth to send mission-related information to their colleagues. We were able to help them redesign that network to prioritize accordingly," he said.

This isn't the first time CIO has provided network access to deployed personnel. Many organizations like ECBC and the U.S. Chemical Material Activity that are in the chemical, biological, radiological, nuclear and explosives (CBRNE) space share aspects of a common chemical demilitarization mission to clean up sites located across the country. According to Ward, CIO provides IT support for personnel on temporary duty (TDY) travel to remote locations and rely on reach-back capabilities here at Edgewood.

"We came up with a solution to used encrypted mifi devices," Ward said. "It has wifi on one side and cellular service on the other, so it allows you to take a network with you wherever you're going. The low bandwidth network service also allows you to emulate a desktop so you can do a lot of work over a small amount of bandwidth."

This kind of mobile computing capability helps personnel continue to deliver quality customer solutions without interruption in time or schedule, and as a result, keeps costs to a minimum. Facilitating connections with partners and customers has always been at the heart of the CIO. In addition to a secure network, the CIO has also leveraged information sharing tools, like SharePoint, to develop custom ways for project teams to collaborate across their organization, as well as with external partners in academia and industry.

The EDS is placed under engineering controls within environmental enclosures at the Pueblo Chemical Agent-Destruction
Photo courtesy of PEO-ACWA

Applying Experience: ECBC Supports Stockpile Disposal Efforts in Pueblo

ECBC takes steps to maintain operational readiness for EDS mission

When an organization envisions a world free of weapons of mass destruction (WMD), it's easy to become farsighted–blind to the realities of today–in the pursuit of a better tomorrow. The details make the difference, and those are what ECBC pays particular attention to when preparing to destroy chemical weapons at locations like the U.S. Army Pueblo Chemical Depot (PCD) in Colorado.

"There are several unique aspects associated with this project," said Dennis Bolt, an ECBC project manager for CBARR. "First, it's a surety operation, which means we're handling munitions that are stored at a U.S. Army Chemical Depot instead of recovered munitions found in the ground. Second, we're operating a new Explosive Destruction System (EDS), called the P2R, and third it's an extended project that may last 10-12 months, which would require extended logistical support. All of these things require a great deal of planning, organizing, preparation and training."

Details like worker and public safety, environmental protection, and regulatory compliance at local, state, federal and Department of Army levels, are necessary components, carefully crafted to meet the needs of all stakeholders. Collectively, these details are the lens through which the mission is focused: in this case, safely and securely destroying a portion of the final 10 percent of the U.S. chemical weapons stockpile stored at PCD.

Currently 22 ECBC personnel work at PCD to operate and support the P2R EDS unit, which began operations on March 18, 2015. This includes chemical engineering technicians, chemical plant operators, chemists, safety and environmental specialists, an EDS crew chief and project manager. The EDS is expected to operate 12 hours a day, five days a week, to safely destroy an estimated 1,300 munitions—including 560 overpacked munitions and Department of Transportation (DOT) bottles that have either been drilled and sampled, or suspected of leaking; and 740 anticipated reject munitions that cannot be processed easily in the main plant.

"Since we began 'hot' operations, we'll be out there for about 40-52 weeks. That's a fairly lengthy deployment," said Bolt, who led efforts to develop a logistics management plan. "Our ability to sustain this kind of operation is heavily dependent on how we manage the logistics of supplies, spare parts, consumables and personnel."

Bolt said personnel will be on approximately 28-day rotations, while operational supplies like personnel protective equipment (PPE), reagents and replacement parts for the EDS will be maintained in a warehouse on a 45-day, long-term storage schedule. Day-to-day operational supplies will be kept in a secondary warehouse on a five-day storage schedule, and will be restocked every week from the long-term storage warehouse.

"Working on a military installation also makes some aspects of the operation a little easier. We have security and medical support measures in place, as well as resident resources that are available to support us. It's been really great to work with the many different organizations associated with this project," Bolt said.

The destruction of these munitions support a larger effort spearheaded by the Program Executive Office, Assembled Chemical Weapons Alternatives (PEO ACWA) to meet the U.S. commitment to achieve 100 percent destruction of its chemical weapons as outlined by the Chemical Weapons Convention (CWC). PEO ACWA ensures the operation adheres to the CWC's imperatives of public safety, environmental protection, and international transparency and oversight.

"We're always looking at ways to improve upon the process"

"The first priority is safety," said Scott Susman, PEO ACWA team lead for systems engineering operations. "As we get ready for operations, we make sure the workforce is prepared and proficient in the job they are about to do. We're always looking at ways to improve upon the process so that efficiencies can be realized during operations."

One way to do that is by capturing lessons learned from previous EDS operations. ECBC has operated the technology since it was first developed by the U.S. Chemical Materials Activity (CMA) Non-Stockpile Chemical Materiel Project, now known as the Recovered Chemical Materiel Directorate, in 2001. CMA has deployed the EDS to support projects around the country at sites in Maryland, Washington, D.C., Delaware, Arkansas, Alabama, Utah and Colorado. Each After-Action Review (AAR) is a reflection of what worked well during the operation and is a forum for feedback directly from CBARR operators and technicians. The results speak for themselves: an upgraded EDS model with a higher throughput and safety protocols that reduce time spent during the most laborious steps in the operation.

Conducting a pre-operational survey that looks at different aspects of the process, from safety and surety to security and basic operations, is another way to ensure proficiency. This continuous improvement mentality not only better prepares a multitude of organizations for achieving a long-term common mission, it emphasizes the technical value details have in sustaining the necessary short-term operations along the way.

"We are continuously looking at our standing operating procedures," Susman said. "ECBC brings a lot of experience and perspective to the table—not only with chemical material destruction but specific operations using the EDS. Each organization has their niche and excels at what they do, which is why it's such an advantage to have all these folks involved in this project.

ECBC operators place a Department of Transportation bottle containing mustard agent inside the Munitions Holder for destruction. Start of agent operations began March 18 in Colorado.
Photo courtesy of PEO ACWA

The EDS Process

PCAPP was built onsite at the depot to safely destroy the chemical weapons stockpile that has been stored there since the 1950s and contains more than 2,600 tons of mustard agent. Processes such as neutralization followed by biotreatment, and destruction technologies like the EDS, have been chosen as safe and effective methods used to eliminate the stockpile.

Unlike open detonation, which uses explosives to destroy chemical agent, the EDS seals munitions inside a steel vessel, then uses explosives to access the contents of the munition, expose the chemical agent and destroy the burster.

Chemicals are then added to the chamber to neutralize the munition's fill of chemical agent. The blast, vapor and fragments are all contained inside the stainless steel vessel. Destruction of chemical agent is confirmed by CBARR operators who provide on-site sampling and analysis of the residual liquid and air inside.

Finding Agent in the Air

ECBC Monitoring Team Proves Cape Ray Decontamination with Sample Analysis

Brandon Granger, an oiler, prepares a steel plate for use in the fitness area aboard the container ship MV Cape Ray. *(U.S. Navy photo by Mass Communication Specialist Seaman Desmond Parks/Released)*

Finding target agents like mustard and DF in a given sample of air can sometimes be like finding a needle in a haystack. Chemical compounds litter the air waves, making it hard to distinguish hazardous agents from pollutants typically found in the air. When working on an operational ship like the MV Cape Ray, the degree of difficulty becomes magnified.

Everything from grease and dirt, to cleaning products and paint were in the atmosphere due to the ship's crew constantly performing maintenance work. Not to mention, the engine room was located directly below the main trailer deck where two Field Deployable Hydrolysis System (FDHS) units were performing neutralization.

"Every one of those activities is collected on the DAAMS (depot area air monitoring systems) tubes," said Brandon Bruey, ECBC chemist. "That has the ability to mask the signal of mustard and impact what gets picks by our monitoring equipment."

It's a tedious process that ECBC environmental monitoring personnel have mastered over the decades, and with new technology, they have improved the time, accuracy and safety of chemical demilitarization missions. Two near real-time systems--miniature continuous air monitors (MINICAMS) and a total phosphorous analyzer (TPA)--were used during the mission to destroy more than 600 metric tons of Syria's declared stockpile on board the Cape Ray in the summer of 2014. In order to accurately monitor mustard and DF during operations, Bruey first had to prove the equipment could detect the desired agent in that kind of environment.

Monitoring equipment was set up at every exit of the main trailer deck and at key points along the chemical agent transport path throughout the ship. Hundreds of air and wipe samples were taken when the crew was in Rota, Spain this past spring, making final preparations, as they awaited the shipment of Syrian chemical agent.

"I don't think we realized how dirty the environment was until it showed up analytically on our instruments," Bruey said. "To prove we could detect agent in those conditions, we used a standard of dilute mustard to spike a clean DAAMS tube. We then pulled air from the environment through the tube and analyzed it to see if we could detect mustard. We knew it was present because we had purposefully put it on there, but could we see it?"

Not at first.

While this might have given some teams a bit of anxiety, ECBC's CBARR team did what they do best: adapted to unanticipated conditions and rose to the challenge. The time docked in Rota, Spain allowed them to fine tune equipment to achieve more conservative monitoring requirements, and detect chemical agent at lower levels and more locations on the Cape Ray. Modifications included special filter cartridges and working with the maritime crew members to accommodate their maintenance schedules in order to limit its impact on neutralization operation hours.

"The first time we actually saw the system work and we saw what we were expecting to see, we could all exhale. By the time the operation was given the green light, we were ready," Bruey said.

There were two different monitoring campaigns for mustard and DF during the FDHS operation, each of which required different instrumentation. According to Bruey, DAAMS and MINICAMS were used for mustard but since MINICAMS cannot detect DF, the TPA was used to clear the ship for the toxic agent precursor. TPA

was used at Pine Bluff Arsenal in Arkansas at the binary destruction facility and had been successful in monitoring DF. An ECBC operator who had been involved in that operation was familiar with the instrument and had experience developing methods for accurate detection. That knowledge was used to calibrate the TPA and ended up detecting a pin-point leak that had occurred under engineering controls, and might not have otherwise been noticed.

By the time the Syrian stockpile was safely destroyed, hundreds of air and wipe samples had been collected during the 24/7 real-time monitoring of the operation. The next step was to decontaminate the Cape Ray to the worker population limit (WPL), so that non-chemical workers at port could work safely around the main trailer deck. Air and wipe samples were analyzed and confirmed to WPL levels, which are extremely low exposure levels that are safe and not expected to produce any adverse health effect. Once the ship returned to port in Virginia, the Cape Ray had to be cleaned to the general population limit (GPL) for sulfur mustard, which is 0.00002 mg/m3, or 20 times lower than WPL. This monitoring is extremely low for mustard and required ECBC to use exceptionally sensitive equipment to verify decontamination.

"CBARR has always been able to adapt and get done what needs to get done"

"CBARR has always been able to adapt and get done what needs to get done," said Wyatt McNutt. "The monitoring requirements grew increasingly more conservative as the mission went on, and we've been able to meet all of those decontamination levels."

In December 2014, Bruey and McNutt traveled to Norfolk, Virginia, where the Cape Ray was docked, and conducted final sample collection to confirm the ship had been certified free of HD to the GPL. They also collected wipe samples for HD and methylphosphonic acid (MPA), a DF breakdown product. According to McNutt, MPA was used as a clearance indicator at roughly 25 locations on the main trailer deck and more than a dozen other high traffic areas around the ship's engine rooms, galley, cargo and berthing areas. ECBC had the historical knowledge of working with this method and clearance level at other U.S. chemical demilitarization facilities.

This was the last step before DoD could provide certification to the U.S. Maritime Administration so the Cape Ray could be returned to Reduced Operating Status (ROS-5). The Cape Ray is one of 46 Ready Reserve Force vessels in the Department of Transportation's fleet that are maintained to meet the nation's sealift needs for national and homeland security.

"CBARR pulled off this seemingly impossible mission and made it look easy. From a sustainability standpoint, it puts us at the forefront if there is ever the need to complete a mission like this in the future," Bruey said.

ECBC does more than just eliminate harmful chemicals by executing demilitarization missions; it cleans up the environment and makes it safe for people to live in the wake of their destruction. From beginning to end, ECBC provides sustainable lifecycle solutions.

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