CBARR NEWS

A RECOGNIZED LEADER IN CB SOLUTIONS

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Laboratory Services

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DIRECTOR'S NOTE

Solid Foundations, Uncharted Territory

TIM BLADES, CBARR DIRECTOR OF OPERATIONS

Welcome to the brand-new newsletter of the Chemical Biological Application and Risk Reduction (CBARR) Business Unit! We've given ourselves a fresh look we felt was appropriate for some of the new things we've set out to accomplish in 2014, including destroying Syria's stockpile of chemical agent. This newsletter will be published on a quarterly basis, and we hope you find the content engaging and relevant to the world of chemical and biological (CB) defense. The work we do at the U.S. Army Edgewood Chemical Biological Center (ECBC) is special, and continues to be recognized internationally.

This edition of the CBARR News focuses on our laboratory services, the bread and butter of how we analyze samples for clients across the globe. With a fleet of facilities and vehicles, we offer both fixed and mobile laboratories capable of accurately identifying and detecting a variety of threat agents. All of our services are customizable, with equipment and technology configured to perform on land or at sea. Our "anytime, anywhere" capability is what enables large scale missions to occur, but it is the specificity and precision of our day-to-day operations that keep us grounded.

I am proud of the dedication and teamwork we have demonstrated throughout the past year with the development of the Field Deployable Hydrolysis System (FDHS), a new WMD-elimination technology that will be used overseas to destroy Syria's chemical agents. The operations will be monitored and verified by a mobile laboratory installed on the MV Cape Ray, a vessel that was retrofitted specially for the mission supporting the Organisation for the Prohibition of Chemical Weapons (OPCW) and the United Nations.

Because of our strong foundation, built upon decades of technical expertise and operational excellence, ECBC is able to continue executing traditional client missions while also navigating new challenges like the FDHS operation safely and strategically. We continue to make a difference working with others to rid the world from the threat of chemical weapons.

ECBC Laboratory Analysis Meets CASARM Quality Assurance Requirements

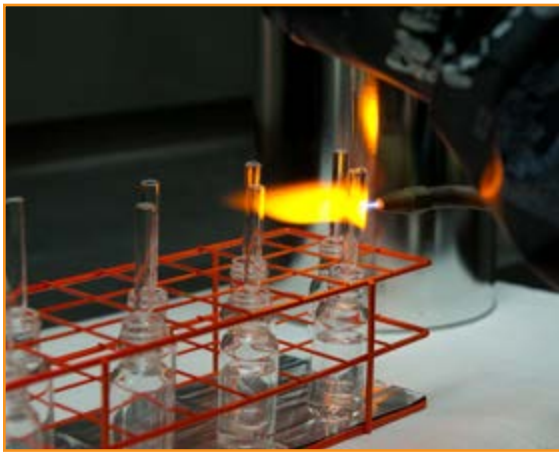
Chemical agent monitoring requires numerous checks and balances to ensure safety and quality support to customers. The quality system for chemical agent air monitoring operations of the Environmental Monitoring Laboratory (EML) at ECBC is registered by the U.S. Army Research, Development and Engineering Command's (RDECOM) Chemical Agent Standard Analytical Reference Material (CASARM) Quality Assurance Team (CQAT) and meets a set of quality assurance requirements designed to protect personnel and the environment during air monitoring activities.

"We have a quality assurance plan for chemical agent air monitoring, and sites like ECBC that fall under our program are required to write a quality control plan that meets the requirements listed in that CASARM QA plan," said Elaina Taylor of the CASARM Quality Assurance Team. "All of these requirements are based off of ISO-9001, an international standard for quality management systems."

The EML at ECBC encompasses a wide range of facilities and vehicles that offer unique laboratory applications and solutions at locations in the Edgewood Area of Aberdeen Proving Ground, Md., and Pine Bluff Arsenal, Ark. ECBC has nine fixed laboratories used for research, development, test and evaluation of agent operations as well as general chemistry and biological work. Six fixed laboratories can be used for surety-level work and 12 mobile labs are equipped with fume hoods and glove boxes to provide customizable services. Additionally, ECBC has more than 40 multi-purpose mobile platforms used for air monitoring.

CASARM conducts yearly audits that assess the procedures used and data collected for chemical agent air monitoring. Each year the audit includes a review of the following areas: management review; reference materials; certification, competence, and training; quality control; external and internal audits; and corrective and preventive action. CASARM conducts a surveillance audit for two years, which assess the areas listed above, plus additional areas such as customer satisfaction, calibration, sample collection and purchasing. A conformance audit is conducted every three years, which assesses every area of the quality system. Semi-annual proficiency tests also occur.

"Depending on the agents requested and their availability, each site in our program receives a calibration standard, a quality check standard, and a proficiency test standard that we have analyzed at the time of preparation and approximately eight months later. Performing our analyses around the same time that our sites



analyze the proficiency test samples, helps us to see the methods being used by each site and validate whether or not they are getting the same results. If we find a site has failed a proficiency test, then the laboratory will go back and perform corrective action to determine the cause of the failure and re-evaluate the data to determine if there has been any impact," Taylor said.

According to Taylor, calibration standards are used to calibrate the instrument while the quality checks are used to verify the control of the instrument and the calibration standard itself. CASARM evolved out of a U.S. Army need to standardize the processes used at different laboratories when conducting air monitoring across demilitarization sites and depots working to eliminate the nation's stockpile of chemical agent.

CBARR is also certified by the DoD Quality Systems Manual and adheres to standards in the ACWA QA plan and CMA QA plan. They are currently seeking accreditation from the DoD Environmental Laboratory Accreditation Program.

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Ahead of the Bio Threat Curve: Laboratory Expertise Driven by Technological Advancements

Chemical Biological (CB) Operations Division excels in ricin sample analysis

The Internet Age has changed the way people access information, enabling them to share and exchange content in a new form of currency. While this has provided many benefits to society, it has also increased the mishandling of knowledge for ill-intended purposes, such as the recent incident with a Georgetown University student who was arrested for possessing a lethal amount of ricin.

According to a USA Today report, the student admitted to making the toxin in his dorm room after he learned how to make the substance on his iPhone and then bought the ingredients at retail stores.

"The bio threat has become more widely known in the Internet Age because the instructions are out there," said Andrew Bailey, biologist for CBARR. "One of the things we do at ECBC is lead the way in defending against what's next."

The Environmental Bio Monitoring Laboratory (EBML) within CBARR's CB Operations Division is a high-throughput lab responsible for accurately assessing a variety of air, liquid and soil samples, including unknowns. The advancement of technology has been an integral part of ECBC's ability to identify and detect a number of targets such as ricin.

Ricin is a highly toxic, naturally occurring protein found in the seeds of the castor oil plant. There is currently no antidote for the substance, which could be lethal if an average adult inhaled a dose the size of a few grains of salt. In April 2013, an envelope laced with ricin intended for President Barack Obama was intercepted by law enforcement officials when protocols established for mail screening revealed the threat of a biological weapon. Preventing the transport of materials laced with ricin is a priority for the national defense community, and ECBC has the technical expertise and trained personnel to work with some of the most advanced detection technologies.

"The method we use to detect ricin is electrochemiluminescence (ECL). It's a proven method that can be used for antibody based immunoassays for detection," said Lindsey Lyman, CBARR biologist. "ECLs use electrical excitation of a tagged ion to measure specific protein molecules in targets like ricin."

The ECL method is a highly sensitive assay for detection and enables personnel to accurate detect toxins using only a fraction of a target molecule. "We know our assay will detect the whole molecule but we can get comparable results using just detection of the 'A-chain.' We use that as a positive control rather than using live active toxin on a daily basis in order to cut down on risk and improve safety," Lyman said.

Andrew Bailey preps samples in a bio safety cabinet.

A second method used for bio threat detection is the polymerase chain reaction (PCR) technology, an assay that looks at the DNA, rather than the proteins of an organism. However, the current PCR platform is nearly a decade old. According to Bailey, advancing this system will be the eye to what the future could be. "I've also seen some equipment that is fluidics-driven, which would lead to analyzing more targets in less time and cost. That's something we're always trying to focus on: minimizing the time it takes from when ECBC receives the samples to when the client receives the results," Bailey said.

The CB Operations Division began to develop its biological detection capability in 2004, first conducting basic microbiology testing and then creating a mobile laboratory with an automated sampling system. Now, the use of robotics and high-speed analytical instrumentation allow the EBML the capacity to analyze 96 samples in an eight-hour time frame for seven targets across the ECL and PCR platforms. These technologies enable ECBC to test a large number of samples and provide advantageous confirmation on certain targets, with the ECL assay identifying proteins and the PCR assay analyzing DNA.

"One of the unique things about the Division is just the sheer number of targets we can test for. From the bio perspective, we have the capability and assays for over a dozen targets. That's a large number compared to some other bio capabilities because while many organizations focus on threats that are on the top of the list, we also focus on more of the rare ones," Lyman said.

CBARR uses the latest technology to enhance its bio threat detection capability.

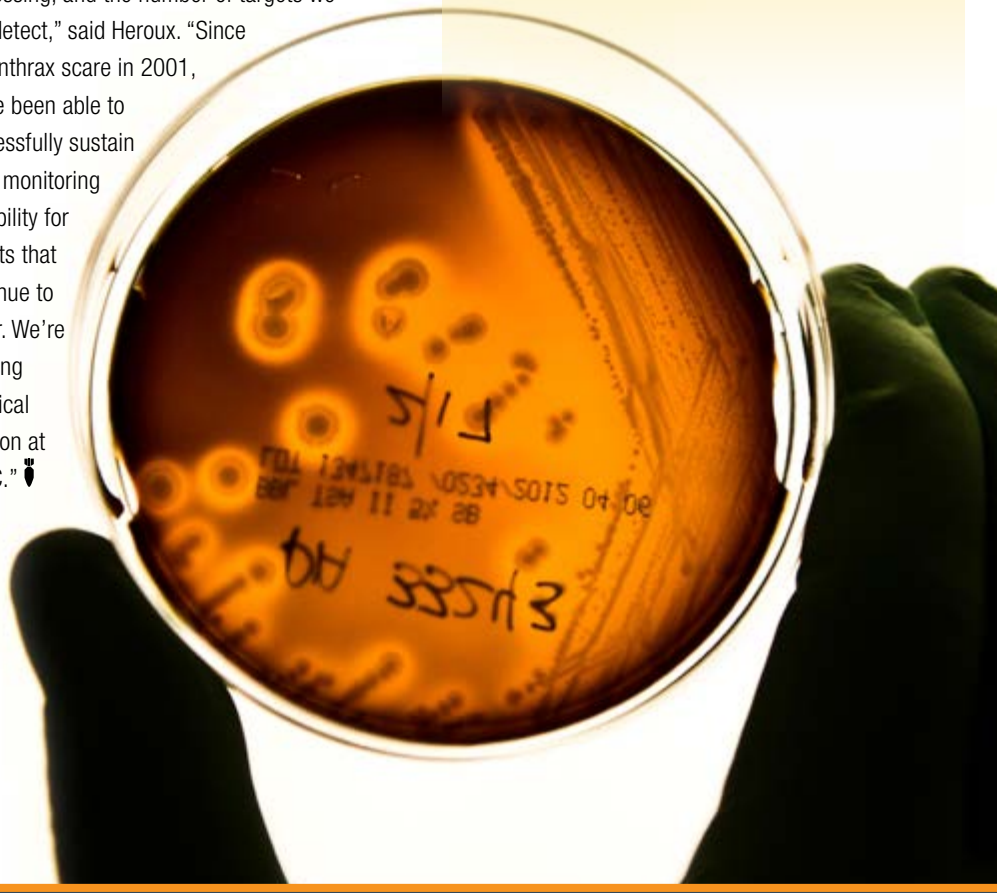
In May 2013, the EBML provided air monitoring and sample analysis support in a characterization effort of the E3200 block located on the Edgewood Area of Aberdeen Proving Ground. The buildings located at this site were suspected of being contaminated with chemical and biological warfare materials used throughout the course of base history. The project was led by the U.S. Army Engineering and Support Center, Huntsville (USAESCH), and resulted in the analysis of more than 150 surface samples of buildings, as well as soil and liquid samples that helped determine the future of the buildings.

Biological threats have typically not been as well known as other agents, especially when compared to the presence of chemical weapons in the world since World War I, and the resulting depth of knowledge that has come with the storage and handling of those weapons. With more stockpile sites in numerous locations and more countries adhering to standards set by the Organisation for the Prohibition of Chemical Weapons (OPCW), chemical weapons have taken the forefront of CB defense. Global events like the sarin attack in Syria last August continue to keep those weapons in the headlines, while the most recent biological warfare events have been ricin-related.

"Traditional bio threat agents are those that are backed by historical data on weaponization. The new bio threat agents are those that have been identified by careful research by the intelligence community," said Karen Heroux, CBARR biologist. "We are constantly branching out to expand the target list in order to properly defend against an evolving threat."

ECBC works with the Joint Program Executive Office for Chemical and Biological Defense (JPEO-CBD)'s Critical Reagents Program (CRP) to acquire many of the raw materials necessary to advance their bio detection capability. The CRP is the principle resource of high-quality, validated and standardized biological detection assays and reagents. This partnership enables ECBC to continuously achieve process improvements.

"I feel that we are ahead in terms of technology, including the speed and amount of sample processing, and the number of targets we can detect," said Heroux. "Since the anthrax scare in 2001, we've been able to successfully sustain a bio monitoring capability for threats that continue to occur. We're fulfilling a critical mission at ECBC."



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CBARR Laboratory Evaluates Decontaminability and Compatability of Universal Munition Storage Container (UMSC) for Chemical Materials Agency (CMA)

CBARR replicates EDS process in small scale to study UMSC

Safely destroying chemical munitions requires a special team of operators, technicians and chemists qualified to operate state-of-the-art equipment. Many times, however, stockpiled and recovered chemical warfare materiel has undergone extensive degradation, leaving the integrity of the munition in question and suspect of leaking. A team of CBARR chemists at ECBC designed a study that evaluates the prototype packaging material used to wrap leaker munitions to see if the high density polyethylene (HDPE) absorbs the chemical agent and if it can be successfully decontaminated in the Explosive Destruction System (EDS).

The U.S. Army Chemical Materials Activity's (CMA) EDS is a transportable chamber system used to destroy chemical warfare materiel. Unlike open detonation, which uses explosives to destroy the chemical agent, the EDS seals the item in a steel chamber, uses explosives to access the contents of the munition and destroy the burster, and chemicals to neutralize the chemical agent.

"This study was meant to evaluate if chemical munitions stored in the Universal Munition Storage Container (UMSC) can be destroyed directly in the EDS without unpackaging the item," said Brandon Dusick, CBARR chemist. "The UMSC would eliminate hazards associated with operator handling and eliminate risks of leakers in storage. Currently, leaking munitions must be stored in metal overpacks. Opening the overpacks and preparing the munition for insertion into the EDS is the most hazardous part of the operation."

A mission at Dover Air Force Base in September 2012 included a munition that was suspect of leaking. This munition, among two other 75-mm munitions filled with mustard, was safely destroyed by CBARR personnel using the EDS. Beginning in October 2014, the EDS will support destruction of overpacked and reject chemical munitions at Pueblo Chemical Depot, Colo.

To evaluate the durability of the packaging material for these kinds of munitions, Dusick and his team first analyzed the EDS process to determine if the HDPE would interfere with destruction of the agent or the waste stream. By replicating what happens in the EDS on a laboratory bench scale, they achieved the cavitation effect of the spinning chamber by fully encapsulating the packaging samples in a sand bath that was fitted with stir bars and heated to a constant temperature of 60 degrees Celsius.

The design enabled the team to conduct an effective decontamination study. Using a piece of blank metal as a baseline comparison, coupons of packaging material were spiked with mustard agent. After sitting for 30 minutes, the samples went through the replicated EDS process of heating and stirring. The coupons were extracted and placed into the bags for one hour.

"Under normal EDS operations, a vapor sample from inside the chamber is pulled through valving in the EDS door into a 10 liter plastic bag, called a Tedlar bag. The Tedlar bag is then brought to the onsite laboratory where the air is desorbed on a DAAMS (Depot Area Air Monitoring System) tube

An ECBC CBARR technician operates the EDS at Dover Airforce Base in September 2012. The remediation project resulted in the successful destruction of recovered chemical warfare items.

and then analyzed via GC/MS. Operators are not allowed to open the door to the EDS if the agent vapor level inside the chamber is above a safe limit," explained Dusick.

The team replicated the Tedlar bag sample by placing the sample coupons inside similar bags that were hooked up to DAAMS equipment. Follow-on analysis of these samples detected traces of mustard agent in the vapor for a majority of the samples. After treatment levels were met, the coupons were extracted and decontaminated with a hexane rinse.

This process was repeated daily over four weeks, and the results showed minimal detections of mustard agent after decontamination. The second part of the study, however, increased the amount of time the coupons sat with spiked agent prior to the replicated EDS process. Every two weeks the coupons were taken out of storage and weighed to see if there were significant changes.

"Is the coupon doubling in mass? If it was absorbing the mustard, the weight would increase. While the agent did adhere to the coupon, we found that there were no dramatic changes in weight, which tells us the mustard agent is not greatly being absorbed by the material," Dusick said.

According to Dusick, the bench scale study demonstrated that residual mustard will be present on the packaging material after the EDS process is complete, but that the agent was not greatly absorbed by the plastic. The design of the study was paramount in collecting data that contributed to how leaker munitions can be safely packed, handled and transported during future EDS operations.

"We have standard procedures that rarely change when we conduct all of our air, water and soil sample analysis, but for something like this that is more investigative, we really had to figure out how to design the study," said Dusick. "Trying to get the laboratory bench scale to mimic the EDS, and to maintain a consistent temperature within the sand bath was a challenge. But we were able to problem solve in order to get results that could translate to the system."

The work took place in ECBC's Chemical Transfer Facility (CTF), designated as the nation's only declared Single Small Scale Facility under the Chemical Weapons Convention. It the single repository for the Army's research and development stocks of toxic chemical agents used to conduct defensive research and development throughout the Department of Defense. All chemical agent used in these studies are prepared and shipped from the CTF, including bench scale and large volume neutralization experiments like those conducted by Dusick's team.

A LOOK BACK IN HISTORY

More than 13 years ago, the first EDS prototype was under operational testing when the call came to deploy the equipment to the former Rocky Mountain Arsenal in Colorado. There, on Jan. 28, 2001, the EDS conducted its first mission, safely destroying recovered GB bomblets that were considered unsafe for transport. Since then, the partnership between CMA and ECBC has resulted in many EDS deployments and the safe destruction of nearly 1,800 munitions at numerous project sites across the country, including Washington, D.C., Delaware, Arkansas, Alabama, Utah and Colorado.

Employee Spotlight: Frank Zydel

From academia to business, an expert in analytical instrumentation

All Frank Zydel had to do to graduate with a Ph.D. from the University of Sciences in Philadelphia was to identify a new compound that had never been discovered before in some kind of living organism. That, and he had to prove the biosynthetic pathway of how the compound was naturally made.

"I said, really? You can do that? Well great, I'm in," Zydel, Ph.D., recalled of his conversation with the college recruiter. "I was there for seven years. It was the kind of place you scratch and claw your way to get out of. It's only when you convince the school that you are an expert in a given study during a particular moment of time in the world that they finally let you graduate."

In short, Zydel discovered two novel compounds from barley (Hordeum vulgare) seed husk, proved their natural biosynthetic route, designed a synthesis route for their production and use as laboratory standards and assayed the compounds against colon cancer cells to show their cytotoxicity."

Zydel's Ph.D. research included intensive study of a fungus that grew within a plant known for producing large amounts of anti-cancer compounds that are currently used to treat breast cancer and colon cancer. These compounds are difficult to synthesize, however, and man-made extraction puts the plant at risk of extinction. With limited quantities available, the drug was incredibly expensive.

To understand how to improve extraction methods, Zydel had to discover the source of the compound: was it the fungus or the plant that the fungus grew in?

"We found that it was the fungus that was actually the organism making the compound, so we were able to isolate the fungus. But we knew that for thousands of years, this fungus and this plant have grown together in a symbiotic relationship. We couldn't expect the fungus to act the same way once separated from the plant, which had been its supply source for food and water," explained Zydel.

As a result, the fungus stopped producing the anti-cancer compound at levels which were economically feasible. This was a turning point for Zydel, who ended up moving to a new project when he was introduced to lead chemists at the U.S. Department of Agriculture-Eastern Regional Research Center (USDA-ERRC) in Wyndmoor, Pa. With a bachelor's degree in horticulture, Zydel was naturally interested in the research being conducted on industrial agricultural byproducts. Industrial agricultural byproducts are predominantly plant-based byproducts that are produced by the agricultural, food, distilled spirits and cosmetic industries, to name a few. Typically, barely and hops grains discarded from breweries, referred to as distillers spent grains, are used for cattle feed and/or bakery products, but scientists at the USDA-ERRC were extracting the oils from the spent grains, which were still rich in oils even after the beer making malting and fermentation process. These kinds of oils, such as vitamin-E, tocopherols, tocotrieneols are used as nutraceuticals in foods like margarine and cosmetic products like makeup and skin lotions. Zydel wasn't interested in the oils, however. He was interested in the raw fibrous matter that remained once the oils had been extracted.

"We have all been hearing for a long time that a diet high in fruits, vegetables, nuts and plant fiber, while also low in red meat, is healthier for us. But why? I always questioned why. What really is or are the major compounds that are providing the benefits?" Zydel recalled. "Epidemiological studies have shown that societies following a diet high in fruits, vegetables, nuts and plant fiber have much lower instance of high blood pressure, gastrointestinal disease, obesity and cancer. So I decided to investigate the one thing all plant material has in common: the fiber. I wanted to know if the compounds in the fiber contributed to a healthier life."

Zydel took extracts from barley seed husks and assayed the extracts and extract fractions against colon cancer cells. He found that two extract fractions killed the colon cancer cells. One fraction of the extracts was known to contain a high level of simple compounds. The other fraction contained a class of compounds that were cross linkers of plant fiber constituents. According to Zydel, the second fraction was more interesting because nobody had tested the cross linkers against colon cancer before.

"It was great to discover that this specific fraction contained a class of compounds that killed colon cancer cells. When tested against the colon cancer cells, it showed cytotoxicity that I was able to prove existed from nature and wasn't just a byproduct of the extraction process," he said.

In order to extract, synthesize, isolate and purify the compounds of interest, Dr. Zydel became proficient in various extraction methods and analytical instrumentation such as mass spectrometry, chromatography and nuclear magnetic resonance.These analytical techniques and extraction processes were necessary to not only identify the compounds, but to develop a standard for the synthesis that proves it exists. Because the compounds of interest were never discovered before, they were not commercially available and Zydel had to create his own standards. Now, others use it as a reference.

"You have to use all of these instruments together to prove your data, to prove your experiments work, and it's never just one piece of data. It's a combination of information. Everything has to come together to support your thesis," he said.

In the end Zydel can summarize his research and findings in one statement: "The absolute reality is to eat a diet high in plant fiber. Ferulic acid is a major constituent and building block of plant fiber which is found in almost all plant material. Ferulic acid acts as an irritant to the lining of your intestinal tract. This promotes the intestinal lining to refresh and regrow itself a lot quicker so existing damaged or cancerous cells don't live long enough to really affect the overall health of your digestive system, and that's just one of the advantages of plant fiber as a whole."

An Expertise in Analytical Instrumentation

Zydel is CBARR's first employee with a Ph.D. He works in the organization's Environmental Monitoring Laboratory (EML), where various air, water and soil samples are brought in for testing from the field or incident area. The EML is a broad-service bio-analytical laboratory outfitted with modern facilities and equipment used for a wide range of environmental analytical testing and validation services.

"I needed to use these analytical instruments to prove my theory. For two years, I ran the mass spectrometry lab at the university," Zydel said. "Now, my expertise in analytical instrumentation is helping me identify process efficiencies. CBARR has a quick turnaround time for customers, usually within 48 hours. But we're always trying to streamline our operating procedures in order to become more efficient and reduce operating costs."

The EML processes a high volume of samples, including air, wipes, biological tissues and food, for chemical or biological warfare material. It is accredited by A2LA for technical competence in the field of biological testing using qualitative real time polymerase chain reaction (PCR) and qualitative electrochemiluminescence (ECL) detection in potentially contaminated samples. The EML also supports environmental remediation investigations, health and safety monitoring, and demilitarization and testing operations for chemical agents and industrial compounds.

"With a Ph.D in Pharmacognosy, drug discovery and development, from natural products, you're pretty much expected to stay in academia," Zydel said. "But ECBC was appealing to me because it operates under a business model where you have to be efficient and effective in order to bring in more customers. It's more service based, which is very appealing to me."

Building these relationships and working collaboratively with customers is a payoff Zydel wouldn't have been able to pursue within an academic institution. ECBC has given him the opportunity to utilize his background and knowledge in a team setting that pursues quality customer service through the use of fixed or mobile laboratories

"It's a nice feeling knowing that you are not just part of a team, but are a part of an organization. You have to do your part in order for other people to do theirs."

More than 50 CBARR personnel support EML operations, including biologists, chemists, quality control specialists, scientists and technicians who have experience working both nationally and internationally.

RESEARCHING VACCINE DELIVERY SYSTEMS

Zydel had an early interest for how living organisms could be a source of medicine, be it snake venom or extracts from a plant. For example, indigenous tribes used to chew on willow shrub to ease a toothache. With a background in horticulture and chemistry, Zydel had a passion for plant biotechnology. His undergraduate studies at Delaware Valley College afforded him an internship at the Hepatitis B Foundation where he studied the expression of anthrax vaccine in lettuce, carrots and tobacco. The research contributed to improved vaccine delivery systems in which a food source could be modified for a population to grow and consume in the form of a plant or seeds. According to Zydel, this would eliminate the concern of isolating the vaccine, purifying it and preserving it during delivery to a medical staff to distribute. "What if you could just send a plant seed for a population to grow and eat?" Zydel asked. This research is ongoing.

CBARR at Sea | Project Briefs

Leave it to CBARR to think outside the laboratory. The organization's mobile analysis capability is second to none, as demonstrated by its commitment to go wherever is needed—even if it means on a boat in the middle of the ocean. Take two of CBARR's most recent at-sea operations, the HUMMA Project and the joint mission to destroy Syria's chemical agent stockpile in accordance with the United Nations (UN) and the Organisation for the Prohibition of Chemical Weapons (OPCW).

The HUMMA Project

ECBC has supported the University of Hawaii in a multi-phase research effort to investigate the environmental impact of sea-disposed military munitions along the Hawaiian coast. Since 2009, a team of CBARR scientists have conducted sample analysis onboard a research vessel for the project, called the Hawaii Underwater Military Munitions Assessment (HUMMA). This year, the team is now entering the fifth and final field mission, where tests will be conducted by a remotely operated vehicle (ROV) owned by the University. These tests will be compared against past results completed by human-occupied submersibles used in past field operations.

According to the HUMMA project website, both conventional and chemical munitions were discarded south of Pearl Harbor following World War II, including 16,000 M47A2 100-pound mustard-filled bombs. CBARR was first brought onto the research team as chemical experts in 2009 when the University of Hawaii began to map the ocean floor of munition locations and used the PISCES submersible to collect samples within 10 feet of munitions. In November 2012, CBARR supported its second mission for HUMMA and provided chemical analysis for nearly 300 samples collected by the submersible, including 165 sediment samples, five water samples and 36 samples of shrimp tissue.

"Our job on the dive was to provide chemical warfare material sampling expertise and to help locate items on the bottom of the ocean," said Mike Knudsen after returning from the 2012 mission. Knudsen is a field remediation air monitoring manager for CBARR who made a total of six dives in the submersible, with each trip lasting roughly nine hours.

Now in the final phase of the HUMMA project, the team will use the ROV to collect environmental samples near the munitions. The process for analyzing the samples remains the same, however. Once samples are retrieved from the ocean, CBARR personnel use chemical agent detectors and fixed instruments to monitor the ROV, collected samples and air for various agents, like mustard, that may be present. To do that, CBARR replicates a traditional mobile analytic platform and retrofits it to operate on a boat. A glove box is used for sample preparation and MINICAMS accurately monitors the air inside the designated laboratory space. All equipment, including computer monitors, are tied down and secured to accommodate the ship's movement on the ocean surface.

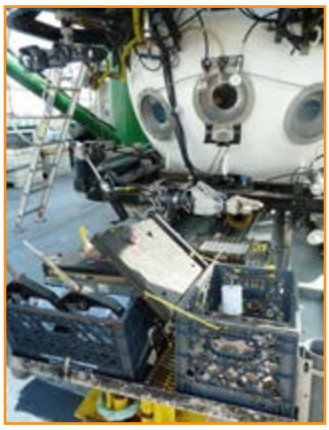
After completing the 2012 mission, John Schwarz, CBARR analytical chemistry laboratory manager and project lead said, "One the ship we were able to successfully execute the quality of analytical procedures and protocols for samples as we would in our fixed laboratory back at our headquarters. To me, that's why it was a big achievement. We did it on a boat in the ocean."

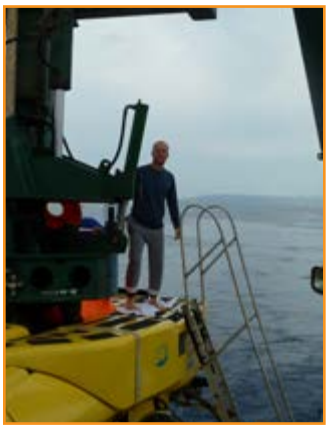
More Information on the HUMMA Project

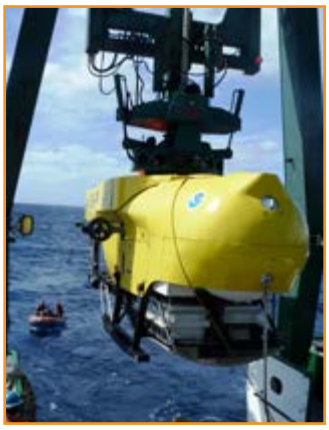
HUMMA Project website

The latest media coverage:

- **KITV4:** UH Scientists to Assess Pearl Harbor Military Munitions
- **Hawaii News Now:** UH Team to Study Mustard Agent Dumpsite Near Pearl Harbor
- **Hawaii Stream:** University of Hawaii Scientists to Investigate Munitions at Sea







The FDHS Aboard the MV Cape Ray

CBARR is ECBC's team of experts that specializes in chemical demilitarization and field operations. Though the destruction of chemical agent stockpiles traditionally takes place at fixed U.S. site locations and in countries around the world, CBARR is able to replicate all the necessary components to execute its mission in the most unconventional places.

On Jan. 27, 2014, the MV Cape Ray set sail from Portsmouth, Va., and headed for international waters on an unprecedented WMD-elimination mission for the OPCW and UN. Onboard the vessel are two Field Deployable Hydrolysis Systems (FDHS), a new technology that will destroy about 700 metric tons of Syria's chemical agent stockpile.

The high-throughput system meets the 99.9 percent destruction efficiency standard set by the OPCW in the Chemical Weapons Convention in 1997. It neutralizes bulk amounts of chemical warfare agents and their precursors through chemical reactions involving reagents that are mixed and heated. The system was specifically designed to be transportable, with all 12 components of a given FDHS project site able to fit in 20-foot storage containers for transportation, including an onsite laboratory.

The onsite laboratory includes an environmental control unit, sample handling and storage capability, analytical systems suite and data management. The mobile lab is equipped with a ventilated glove box and fume hood for sample handling and preparation, as well as analytical instruments such as gas chromatograph/mass spectrometers and infrared spectrometers that are used to analyze liquid samples. This suite of equipment was specifically selected and developed to provide identification and confirmation of the agent material prior to processing, and verification of effluent destruction.

Some 64 specialists from ECBC and partnering organization, the Joint Project Manager for Elimination (JPM-E) are conducting the operation aboard the MV Cape Ray.

More Information on the FDHS

- Special Edition of the CBARR News
- Hydrolysis Animation on YouTube

Media Coverage of ECBC's Support to the OPCW/UN Mission

- **The Baltimore Sun | April 2, 2014:** Aberdeen Scientists Waiting to Destroy Syrian Chemical Weapons
- **BBC | Feb. 27, 2014:** Destroying Syria's Chemical Weapons
- **Fox News | Feb. 13, 2014:** US Ship Tasked with Destroying Syrian Chemical Arms Arrives in Spain En Route to Italy
- **CBS 13 WJZ Baltimore | Jan. 30, 2014:** Experts at Aberdeen Proving Ground to Neutralize Syria's Chemical Weapons
- **Stars and Stripes | Jan. 28, 2014:** MV Cape Ray on its Way to Neutralize Syria's Chemical Weapons
- **Bloomberg | Jan.3, 2014:** Shipping Out to Destroy Syria's Chemical Weapons
- **Reuters | Jan. 2, 2014:** U.S. Ship to Depart Soon on Chemical Weapons Mission to Mediterranean

CBARR Director of Operations Tim Blades (second from right wearing high vis gear) speaks with Undersecretary of Defense for Acquisition, Technology and Logistics Frank Kendall (third from left) and Joseph Westphal, Under Secretary of the Army (second from left) on Jan. 2 during a tour of the FDHS units installed on the MV Cape Ray.

The MV Cape Ray departed from Norfolk, Va., on Jan. 27 to support a joint mission for the OPCW and UN to destroy Syria's chemical agent stockpiles. ECBC specialists will operat etwo FDHS units to neutralize the stockpile using proven hydrolysis technology.

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