CERL's 2011 Annual Summary

by Dr. Ilker Adiguzel, Director

"Very busy and productive" summarize the past year for the U.S. Army Engineer Research and Development Center's Construction Engineering Research Laboratory. With a mission to conduct research and development for sustainable military installations, the lab's capabilities and expertise touch virtually all facets of facility acquisition, energy, water and waste reduction, land conservation, and facility life-cycle management. Here are some highlights of CERL's fiscal year 2011 activities.

R&D to help achieve net zero

Energy security and independence remain top priorities for the Department of Defense. With the Assistant Secretary of the Army for Installations, Energy, and Environment's announcement of the first "net zero installations," CERL has been engaged in partnerships with many stakeholders to help reach goals for energy, water and waste. Researchers participated in the ASA(IE&E) selection process and is actively involved in multiple initiatives to support installation directorates of public works as they organize to reach net zero.

A growing concern in DoD is the potential for cyber attack to vulnerable electric grids that could cause major mission disruptions at military bases. CERL's energy researchers are serving as technical manager for a Joint Capability Technology Demonstration led by the U.S. Pacific Command and U.S. Northern Command. Called Smart Power Infrastructure for Energy Reliability and Security, or SPIDERS, the project will integrate cyber-secure smart grids with renewable energy at three sites: Joint Base Pearl Harbor Hickam, Hawaii, Fort Carson, Colo., and Camp Smith, Hawaii. Operating experience from each of three phases will build toward the first DoD installation with a smart, "islandable" and cyber-secure microgrid at Camp Smith consisting of task-critical assets, office buildings, housing units, wind and solar energy, energy storage, and emergency generators, all protected by a layered defense.

Adiguzel

The lab also completed a study for the Combined Security Transition Command – Afghanistan, which sought recommendations for installing renewable energy technologies at the new Afghanistan National Security University. CERL evaluated possible options and then provided a recommended list to CSTC-A, including information from a reality check by two researchers who completed a "boots-on-the-ground" visit to Kabul.

CERL's net-zero support includes a project to evaluate waste-to-energy options, such as this conceptual graphic of a rotary kiln waste gasification system under construction at the State University of New York. Graphic courtesy of W2E Ventures, Inc.

Advanced science for facility security

CERL is leading a multi-institutional effort to develop and integrate ultra-efficient air purification systems and self-decontaminating-surface materials for the protection of DoD buildings from airborne biological threats. Current building air security systems, which are based on sensors and energy-intensive High-Efficiency Particulate Air filters, are too costly and high-maintenance for the most DoD buildings. This research will result in integrated air security systems that are more affordable, consume less energy, and require minimal maintenance. In this multi-year effort, state-of-the-art technologies, including acoustic air purification and biocidal enzyme-based nanocomposite paints, are being transitioned from lab to pilot scale.

The lab also is leading a major effort to develop a "greener" decontaminant for rapid remediation of large DoD infrastructure, such as an airbase, in the wake of

an anthrax attack. Conventional decontaminants are difficult to deploy in large quantities at forward operating bases due to their high storage footprint, corrosivity, and toxicity. With a bio-inspired enzyme-based approach, CERL and its collaborators are leveraging recent breakthroughs in molecular biology and materials science to inactivate Bacillus anthracis spores in a highly efficient, targeted manner. The goal of this project is to reduce FOB decontamination response times from several months to 2 weeks. The Defense Threat Reduction Agency is funding the research.

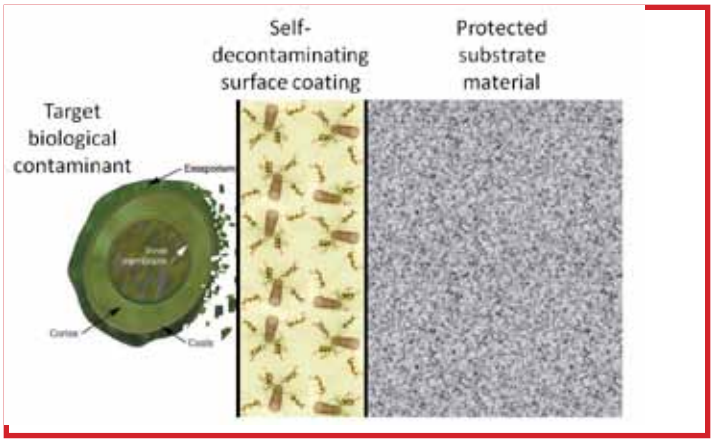
Tiny sensors to check water safety onsite

Rapid, portable, onsite detection of water contaminants versus sending samples to fixed laboratories will provide Soldiers with a major advantage to test water sources in their areas of operation. Recent technological advances have allowed for the creation of tiny microfluidic chips that reproduce the performance of large analytical instrumentation in a miniaturized package with faster results and much reduced costs. However, until now, these devices have been

Dr. Travis King displays CERL's patented SafePort along with a sensor.

confined to laboratory use. The SafePort™ portable water analysis system will now bring rapid chemical analysis to the field -- minimizing down time while awaiting results and substantially reducing analytical costs.

The SafePort™ system consists of a portable, user-friendly hardware unit that accepts various user-selected, interchangeable microfluidic chips for rapid detection and quantitation of chemical species in water and for toxicity screening. The ultimate goal of SafePort™ is to bring microfluidics-based analysis of water samples to the field with "push button" operating simplicity, providing accurate, actionable answers to Army personnel in minutes.



An innovative technology, biocidal enzyme-based nanocomposite coating, creates a self-decontaminating surface.

Improved facility delivery through Building Information Modeling

During a facility's design using BIM, manufacturers often provide information of little use to the designers, such as fan belt size and pump base plate configuration. However, this information is critical to improving efficiency within the DPW operations and maintenance community. A project launched this year seeks to ensure that when a facility with BIM is delivered to an installation, O&M personnel will find it useful for their work and embrace it. The approach is to identify and extract information generated by the Construction-Operations Building information exchange standard that can facilitate maintenance and repair over the building life cycle. The project is funded by the Assistant Chief of Staff for Installation Management's Installation Technology Transition Program. It will result in a new standard called Operator's Property information exchange, or OPie.

COBie, which is currently being balloted as part of the National BIM Standard, is also being piloted at the U.S. Army Corps of Engineers New York District. The pilot will demonstrate the use of fully electronic construction submittals, provided through ProjNet-eSubmittal, directly linked to the Resident Management System and Contractor's Quality Control Module. USACE is developing a strategy to implement COBie Corps-wide.

Another ITTP project that just started will identify the points of intersection among the BUILDER Sustainment Management System, requirements of the High Performance and Sustainable Buildings Guidance, and Installation Status Report, and how they feed into

ACSIM's Headquarters Installation Information System. The ultimate goal is to provide a central location with all information needed to comply with Executive Order 13514, which requires each agency to "implement high performance sustainable Federal building design, construction, operation, and management, maintenance, and deconstruction."

Technology and support to fight corrosion

CERL continues to serve as the Army lead in the DoD Corrosion Prevention and Control program, which is funded by the Deputy Undersecretary of Defense for Acquisition, Logistics, and Technology. Two technologies developed under this program – thermoplastic composite bridges installed at Fort Bragg, N.C., and a carbon nanocoating – received R&D 100 awards this year from R&D Magazine. The award recognizes the top 100 innovations worldwide. In addition, the composite bridge was selected as one of the Top Three Editor's Choice awards.

The lab's corrosion experts also provide critical field support to its customers. In one project for the Department of Transportation Office of the Inspector General, they examined how corrosion may have occurred in 30-year-old steel piles in the Dulles Corridor Metrorail after decades of exposure to electrical current from the Metro Orange
Line tracks. This phenomenon— "stray current corrosion"—can occur when the direct current used in electrified railways strays from its intended path and follows a buried structure like a pipeline or steel pilings. The stray current will flow back to its intended path but corrosion occurs at the point where it leaves the buried pile. Estimating the steel lost over time due to corrosion is important in projecting how many years of service may be expected from the piles in question.

Visit CERL's website at http://www.cecer.army.mil

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