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SERDP and ESTCP Launch Climate Change Efforts

Climate change has the potential to significantly impact the Department of Defense's (DoD) ability to sustain training and testing missions and to maintain military readiness. Maintaining readiness requires a natural and built infrastructure that is sustainable and adaptive in the face of climate change. To assist DoD in this regard, SERDP has moved aggressively to fund research and development (R&D) projects that assess impacts and vulnerabilities and explore approaches to reduce these impacts through adaptation and mitigation. Ongoing and future SERDP and ESTCP projects will equip DoD with the information, analyses, models, and tools needed to meet its mission and stewardship responsibilities now and into the future. Improving scientific understanding and developing models and predictive tools to assess the impacts of climate change are critical tasks—whether the time frame of concern is near-term, 20 years from now, or out to 2100 and beyond.

Sea level rise (SLR) and associated storm surges that may be exacerbated by climate change pose a threat to DoD's coastal installations. To address this threat, SERDP research is focused on developing region-specific models to better understand the physical drivers and processes that determine how sea level change and storm surge will manifest under climate change and how coastal landscapes will respond. A suite of projects is examining scenarios of 0.5, 1.0, 1.5, and 2.0 meter local mean SLR by 2100 to assess the potential impacts of SLR and storm surge to installations on the U.S. Southwest Pacific, Mid-Atlantic, and Gulf Coasts. By combining this knowledge with tools to assess mission critical assets, DoD installations will be better able to predict vulnerabilities and impacts to the natural and built features that protect coastal areas and the effects on critical missions. The results of these projects will also help DoD installations begin to understand their options and need for adaptation.

Understanding impacts and adapting to climate change is of interest in a number of regions in which DoD installations reside. For example, in the Southeast, where DoD natural resource managers are engaged in the long-term management and restoration of ecological systems and threatened, endangered, and at-risk species, such efforts may be limited by the synergistic effects of climate change on already stressed ecological systems. In this context, SERDP researchers have begun to develop recovery objectives for southeastern ecological systems, develop tools for assessing potential options to manage shoreline-dependent bird species, and evaluate assisted colonization as a management tool for coastal transition zone plant species subject to increased levels of storm surge.

In the Southwest, climate change is likely to result in region-specific changes in temperature, precipitation regimes, and extreme weather events that may exacerbate the degradation of southwestern ecological systems of management concern. Three SERDP projects, which include study sites in the Mojave and Sonoran Deserts, are examining the interactions between non-native invasive species (NIS), fire regimes, and climate change. The results will improve understanding of how these interactions, today and into the future, affect the composition, structure, and function of ecological systems in the Southwest. Predictive models developed by these projects also will enable the development of appropriate adaptive management strategies.

Climate change in the Southwest also is likely to exacerbate the degradation of intermittent and ephemeral stream systems, important harbingers of the region's biodiversity, that are already stressed by

See CLIMATE CHANGE, page 8

S•U•C•C•E•S•S STORIES

SERDP research and development and ESTCP demonstration and validation efforts are leading to outstanding technical and environmental advances that are relevant to the Department of Defense (DoD), Department of Energy (DOE), Environmental Protection Agency (EPA), and many other user communities.

SUCCESS STORY

ESTCP Funds First Successful Field Test for the In-Place Management of PCB-Contaminated Sediments

A new in-place method for managing polychlorinated biphenyl (PCB)-contaminated sediment has been successfully demonstrated at a tidal mud flat adjacent to the former Naval Shipyard at Hunters Point in San Francisco. This ESTCP-funded field test demonstrated that mixing activated carbon (AC) into the uppermost biologically active sediment layer would repartition and strongly sorb PCBs and reduce exposures to pore water and biota, thereby reducing ecological and human health risk.

Sediments typically are the final repositories for persistent and bioaccumulative organic contaminants like PCBs. These compounds adhere to fine grain particles and accumulate as deposits in wetlands, estuaries, and other bodies of water. Although banned in the United States from further production in 1979, PCBs are widely distributed in the environment and extremely persistent in sediments. PCBs in sediments pose threats to ecosystems and humans through bioaccumulation in the tissue of aquatic organisms, resulting in nearly 700 fish consumption advisories in the United States.

The typical approach for managing PCBs is to dredge and dispose of sediment, which is costly and increasingly controversial. Experience with sediment cleanup at Superfund sites shows that, while dredging removes contaminant mass, it often does not achieve long-term risk reduction goals. Residual PCBs remaining after dredging pose continuing risk, and a combination of methods should be considered at large or complex sites. Another consideration is that sediment dredging and removal have the potential to resuspend contaminants and adversely affect water quality and biota in the short term.

Prior laboratory studies and a preliminary field trial showed that the addition of AC to sediment contaminated with PCBs significantly reduced the chemical and biological availability of PCBs. Encouraged by those results, the ESTCP project *Field Testing of Activated Carbon Mixing and In Situ Stabilization of PCBs in Sediment (ER-0510)* was designed to demonstrate that AC sorbent mixed with cohesive sediment is a cost-effective, in situ, nonremoval management strategy for reducing risk and the bioavailability of PCBs in sediment. The primary objectives of this field test were to:

- Demonstrate and compare the effectiveness in terms of AC application and ease of use of two available, large-scale mixing technologies.
- Further develop monitoring tools and identify field conditions that affect field-assessment performance.
- Demonstrate that AC treatment reduces PCB release to pore water and bioaccumulation in field tests.

At the former Naval Shipyard at Hunters Point, ESTCP demonstrated an in situ approach for managing PCB-contaminated sediments. Mixing activated carbon into the uppermost sediment layer leads to sorption of PCBs and reduced ecological and human health risk.

- Demonstrate the stability of AC within the sediment and no significant sediment resuspension and PCB release after the large-scale mixing technologies are used.

Using two commercial equipment devices and a one-time mixing event, AC was successfully incorporated into the test plots at Hunters Point to a nominal 1 ft depth at a dose of 2 to 3%, depending on sampling locations. This was verified by the increases in total organic carbon and black carbon contents in AC-amended sediment. Black carbon refers to matter like AC and char that have stronger sorption affinity for PCBs compared to amorphous organic matter.

Field-exposed AC retained a strong stabilization capability to reduce aqueous equilibrium PCB concentrations by as much as 95%, depending on AC dose, for the duration of the 18-month field study. This was demonstrated also in long-term, passive membrane sampler exposure tests lasting more than 7 months that were conducted 1 year after AC addition. The time series test results showed the

See SEDIMENTS, page 8

ESTCP Releases Technical Guide for Monitored Natural Recovery at Contaminated Sediment Sites

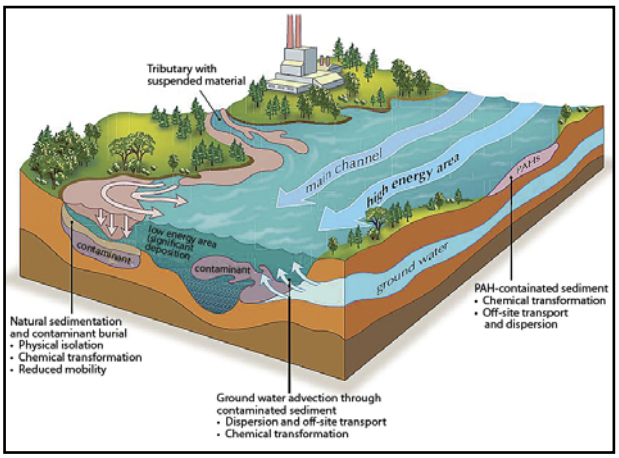
Contaminated sediments are an increasingly significant issue for installations located on or near ecologically sensitive aquatic environments. A range of technology options is needed to improve sediment assessment and remediation. One such option for sediments is monitored natural recovery (MNR), which relies on natural processes—chemical transformation, physical isolation and dispersion of contaminants, and reduction in contaminant mobility and bioavailability to higher level trophic organisms—to reduce ecological and human health risks to acceptable levels, while monitoring recovery over time to verify remedy success.

Dr. Victor Magar and team members from ENVIRON International Corporation, Limno Tech Inc., the U.S. Army Corps of Engineers, the U.S. Navy, and the U.S. Environmental Protection Agency have developed a technical guide for evaluating the site-specific suitability of MNR and applying MNR to sediment sites. Compiled under the ESTCP project *Development of Guidance for Monitored Natural Recovery at Contaminated Sediment Sites (ER-0622)*, this technical guide will promote consistency among practitioners and assist project managers and management teams in evaluating and implementing MNR.

The main objectives of this technical guide are to 1) establish principles and evaluation criteria for the comprehensive and cost-effective evaluation of MNR as a remedial option and 2) provide a framework for properly designing, implementing, and monitoring MNR and for predicting the long-term performance of natural recovery processes in managing or reducing ecological and human health risks. The technical guide provides a framework to consider alternative remedies or, as appropriate, to enhance MNR via thin-layer sediment placement or other actions that might be required to achieve appropriate risk reduction within an acceptable time frame. Included are MNR case studies and examples at representative sites that demonstrate these concepts at work in real-world situations.

The *Technical Guide for Monitored Natural Recovery at Contaminated Sediment Sites* provides a step-by-step conceptual primer for applying MNR and supports DoD's efforts to improve the cost-effectiveness of sediment remediation by advancing the science and engineering of in-place sediment management approaches.

For more information, access the technical guide in the SERDP and ESTCP Online Library at http://docs.serdp-estcp.org using 0622 as the Search Phrase. Technical questions may be directed to Dr. Victor Magar, ENVIRON International Corporation, Chicago, Illinois, at (312) 288-3840 or vmagar@environcorp.com.



A new technical guide developed by ESTCP will assist project managers in evaluating and implementing MNR at contaminated sediment sites. MNR relies on natural processes, as depicted here, to reduce ecological and human health risks, while monitoring recovery over time to verify remedy success.

Webcast Now Available on Geophysical System Verification, a Physics-Based Alternative to GPOs

ESTCP, in collaboration with the Services, state and federal regulators, and the National Association of Ordnance and Explosive Waste Contractors (NAOC), has designed a physics-based alternative to geophysical prove-outs (GPO). The industry has 15 years of experience with the primary geophysical sensors used in munitions response, and the research community has developed a detailed understanding of their operation. Capitalizing on this, geophysical system verification (GSV) moves resources from an upfront evaluation of geophysical systems to ongoing verification of system performance, building confidence that data generated throughout a munitions response project is meeting project objectives.

SERDP and ESTCP are pleased to announce the release of a webcast that provides a tutorial on the physics basis of GSV, outlines key elements of this approach (instrument verification strip and production blind seeding program), and describes its implementation on an example site.

GSV webcast topics include:

- Introduction and Objectives
- Physics Basis for Geophysical System Verification
- Geophysical System Verification Concepts
- Application to an Example Site
- Final Thoughts

Instructors are Mr. Jim Austreng (California Department of Toxic Substance Control), Dr. Tom Bell (SAIC), Mr. Jeff Swanson (Colorado Department of Public Health and Environment), and Mr. Andy Schwartz (U.S. Army Corps of Engineers). To view the webcast, visit www.estcp.org/links/GSV-webcast.cfm.

SPOTLIGHT on SERDP and ESTCP FY 2009

New initiatives in the SERDP and ESTCP focus areas are highlighted throughout

SERDP and ESTCP initiatives for **Weapons Systems and Platforms** (WP) focus on characterizing and reducing the environmental impact of producing, maintaining, and using Department of Defense weapons systems. In 2009, SERDP initiated research to develop advanced methods for removing solids from shipboard waste streams, characterize the emissions from open burn/open detonation operations, develop a dynamic accelerated corrosion test protocol, investigate environmentally acceptable pretreatments for multimaterial systems, develop technologies for environmentally benign aircraft deicing, and improve understanding of how methylene chloride/phenolic paint strippers remove coatings. ESTCP investigators began demonstrating technologies that treat bilge water on ships, reduce hazardous emissions from welding operations, eliminate hexavalent chromium from primers, reduce the biochemical oxygen demand (BOD) of aircraft deicing fluids, eliminate chromates and reduce volatile organic compounds (VOC) from coatings for steel substrates, and reduce emissions from heavy diesel vehicles. Results from these initiatives will provide DoD with several benefits, including a reduction in hazardous waste from certain industrial and maintenance processes, increased performance of targeted weapons systems, cost savings from replacing environmentally harmful substances, and compliance with more stringent environmental regulations.

SERDP Research

Additional information on these efforts can be found at www.serdp.org under the Research Projects *link.*

Magnetically Activated Self-Cleaning Membranes (WP-1670)

Principal Investigator: Sumith Wickramasinghe - Colorado State University

This project will investigate the use of magnetically activated, self-cleaning membranes for removal of solids in military shipboard wastewater. These new membranes are lightweight, robust, and efficient and will not increase the footprint of current filtration systems. The system will be fully automated and may be cleaned in place.

Solids Separation and Concentration of Shipboard Wastewaters and Residuals by a High Shear Rotary Membrane System (WP-1671)

Principal Investigator: John Bendick - Naval Surface Warfare Center Carderock

The objective of this project is to develop a robust shipboard High Shear Rotary Membrane System (HSR-MS) capable of managing multiple solids-bearing wastes. Benefits will include more efficient solids removal prior to existing shipboard treatment processes; direct replacement of problematic treatment systems with the more robust, higher efficiency system; and concentration of sludge, waste oil, and process residuals.

Feasibility of New Technology to Comprehensively Characterize Air Emissions (WP-1672)

Principal Investigator: Byung Kim - U.S. Army Engineer Research and Development Center-Construction Engineering Research Laboratory

The objectives of this project are to develop a new conceptual framework for comprehensive air emission characterization from full-scale open burning (OB) and open detonation (OD) operations, evaluate the feasibility of the new air emission characterization technologies under real field conditions, use the new technology to characterize air emissions from full-scale high explosive OB operations, and develop air emission factors for high explosive OB operations. The results will provide a firm scientific basis for DoD to protect human health and the environment.

Accelerated Dynamic Corrosion Test Method Development (WP-1673)

Principal Investigator: James Dante - Luna Innovations Inc.

The objective of this project is to develop a next-generation accelerated corrosion test methodology that can be used to assess novel corrosion prevention technologies and quantify the performance of material systems. Successful development of this test method will facilitate the rapid transition of material systems and corrosion prevention technologies by quantifying damage mode severity in complex systems and providing a means for comparative product testing and qualification in support of product selection.

Dynamic Multivariate Accelerated Corrosion Test Protocol (WP-1674)

Principal Investigator: Corey Bliss - Air Force Research Laboratory

This project seeks to develop a comprehensive test protocol for accurately predicting the performance lifetime of DoD coatings. The resultant test protocol will be independent of substrate composition and will accurately rank the performance of coating systems equivalent to the results obtained by long-duration field exposure. Such an accelerated test method will advance the development of environmentally compliant coatings for corrosion protection by facilitating rapid performance analysis of new materials.

Wash Primer Replacement Based on the Superprimer Technology (WP-1675)

Principal Investigator: William van Ooij - University of Cincinnati

The objective of this project is to develop one or more wash primers that are chromate-free, have very low VOCs, and are also free of phosphoric acid. These wash primers will consist of mixtures of silanes, water-dispersed resin systems, nanoparticles, and anti-corrosion pigments, which function well in water-borne primers. Development of these wash primers will help DoD reduce its use of hexavalent chromium in compliance with relevant EPA regulations.

Initiatives in Weapons Systems and Platforms

the year. Weapons Systems and Platforms efforts are featured here.

Environmentally Friendly Zirconium Oxide Pretreatment (WP-1676)

Principal Investigator: Shan Cheng - PPG Industries Inc.

This project seeks to develop and optimize a zirconium-based surface treatment compatible with current military coatings and substrates that can be applied with existing equipment and perform as well as or better than hexavalent chromium wash primers. These new pretreatments will reduce environmental hazards and extend the lifetime of DoD assets by providing high-level corrosion and adhesion protection.

Pretreated Starch Suspensions for Low Environmental Impact Aircraft Deicing (WP-1677)

Principal Investigator: Richard Watts - Washington State University

In support of providing effective aircraft deicing with minimal environmental effects, this project will evaluate the freezing point depression of different pretreated starch formulations, determine the biochemical oxygen demand and aquatic toxicity of the most effective freezing point depression formulation, and provide a preliminary evaluation of the compatibility of pretreated starch solutions with aircraft materials. These deicers could be made from waste starch, further promoting sustainability within DoD.

Environmentally Benign Aircraft Anti-Icing and Deicing Fluids Based on Cost-Effective, Bio-Based Ingredients (WP-1678)

Principal Investigator: Satya Chauhan - Battelle Memorial Institute

The objective of this project is to develop and evaluate a bio-based, environmentally friendly, and low-residue Type IV aircraft anti-icing fluid (AAF) that is compatible with the commercially available aircraft deicing fluid (ADF) EcoFlo. A second objective is to further improve the environmental friendliness of EcoFlo based on the results of AAF development. Benefits from use of these fluids include a reduction in BOD and ecotoxicity as compared to propylene glycol-based ADFs.

New Ionic Liquids from Natural Products for Environmentally Benign Aircraft Deicing and Anti-Icing (WP-1679)

Principal Investigator: Matthew Davis - Naval Air Warfare Center Weapons Division

This project seeks to develop new deicing and anti-icing material formulations based on ionic liquids derived from natural products. These ionic liquids are expected to have minimal BOD when released into an aquatic environment. They will also be compatible with many non-toxic deicing formulation additives. Moreover, the very mild character of the ionic species employed will minimize corrosion of metal aircraft parts.

Understanding the Science Behind How Methylene Chloride/Phenolic Chemical Paint Strippers Remove Coatings (WP-1680)

Principal Investigator: John Graham - University of Dayton

The objective of this project is to establish a fundamental understanding of how methylene chloride/phenolic chemical paint strippers remove organic coatings and, by extension, how other potential chemical paint strippers function. Researchers will demonstrate laboratory tools and methods that can be used to evaluate and contrast how potential alternative chemical paint strippers function in comparison to standard solvents.

Science Underlying Methylene Chloride/Phenolic Paint Stripping (WP-1681)

Principal Investigator: David Dean - Naval Air Warfare Center Weapons Division

This project seeks to develop an in-depth, science-based understanding of the factors that contribute to and affect the process of stripping paint using methylene chloride/phenolic chemical paint strippers. The resulting information can be used to develop alternative, less hazardous, high-performance paint-stripping compositions.

Scientific Basis for Paint Stripping Mechanism of Methylene Chloride/Phenol-Based Paint Removers (WP-1682)

Principal Investigator: Young Han - Naval Air Systems Command

The objectives of this project are to gain a fundamental understanding of the chemical interactions between coatings and methylene chloride/phenolic chemical paint removers at the molecular level using modern spectroscopic techniques and to monitor the physical changes in the coatings exposed to the removers using standardized test methods. Results will include a scientific foundation for identification or formulation of a new class of paint removers with advantages such as lower VOCs, less hazardous solid waste disposal, reduced process times, and reduced corrosion-related repair time.

See FY 2009 WP INITIATIVES, page 6

FY 2009 Initiatives in Weapons Systems and Platforms (continued)

ESTCP Demonstrations

Additional information on these efforts can be found at www.estcp.org under the Technologies *link.*

Demonstration of a Centrifugal Separator and Ultra-Filtration Membrane System for the Treatment of Shipboard Bilgewater (WP-0902)

Principal Investigator: Robert Neumann - Naval Surface Warfare Center Carderock

The objectives of this project are to demonstrate the performance of a centrifugal separator and ultra-filtration membrane system for processing shipboard-generated oily waste with measurement of key effluent quality parameters and to validate the system's ability to meet discharge requirements. Additionally, the evaluation will determine system reliability, operation, and maintenance requirements. This system would allow ships to process bilgewater and discharge the effluent overboard without violating discharge restrictions.

Innovative Welding Technologies to Control Hazardous Air Pollutant Emissions (WP-0903)

Principal Investigator: Kathleen Paulson - Naval Facilities Engineering Command Engineering Service Center

This project will demonstrate two technologies for controlling hazardous air pollutants (HAP), particularly hexavalent chromium (Cr^{6+}), generated during certain welding operations. These technologies are the addition of tetramethylsilane (TMS) to the shield gas and new Cr-free welding consumables. Using these technologies, DoD can reduce the fugitive emissions generated during welding repair and maintenance operations at the depot and shipyard level and during limited welding at smaller intermediate operations. Occupational exposures to Cr^{6+} and other metals also will be reduced.

Validation/Demonstration of Anti-Corrosion Inhibitor Primer Formulations as Replacements for Hexavalent Chromium Military Primer Coatings (WP-0904)

Principal Investigator: Peter Zarras - Naval Air Warfare Center Weapons Division

The objective of this project is to demonstrate a new primer formulation that can be incorporated into either a Cr^{6+}-free epoxy or a conductive polymer formulation. The expected benefits of a completely Cr^{6+}-free military coating include a significant reduction in the costs of disposing of hazardous Cr^{6+} waste, improved worker safety, compliance with existing and future environmental regulations, and maintaining mission readiness through military equipment sustainability.

Demonstrate a Low Biochemical Oxygen Demand Aircraft Deicing Fluid (WP-0905)

Principal Investigator: Mary Wyderski - Wright-Patterson Air Force Base

This project will demonstrate an environmentally advantaged aircraft deicing fluid. Successful demonstration of this ADF will provide DoD the option to use a fluid utilizing the waste products of biofuel production as opposed to propylene glycol fluids that are derived from petroleum and will lead to a reduction in the BOD of runoff discharged at DoD facilities that de-ice aircraft.

Non-Chromate, ZVOC Coatings for Steel Substrates on Army and Navy Aircraft and Ground Vehicles (WP-0906)

Principal Investigator: Brian Placzankis - U.S. Army Research Laboratory

The objective of this project is to demonstrate and validate the performance of non-chromate, low- or zero-VOC coatings on steel processed at Army and Navy repair facilities. These technologies include 1) phosphated steel that is "rinsed" or post-treated with trivalent chromium or non-chromium solution, primed with non-chromated primer, and topcoated with low- or zero-VOC topcoat and 2) steel that is pretreated directly with trivalent chromium or non-chromium solution, primed with non-chromated primer, and topcoated with low- or zero-VOC topcoat. Implementation of these new processes will assist DoD in attaining anticipated environmental compliance objectives while simultaneously reducing costs through elimination or reduction of hazardous waste streams and risk reduction for the laborers on the production lines.

Demonstration of Heavy Diesel Hybrid Fleet Vehicles (WP-0907)

Principal Investigator: David Cook - Naval Facilities Engineering Command Engineering Service Center

This project will evaluate the benefits and readiness of existing early-commercial hybrid platforms and establish a military link to the hybrid vehicle manufacturing industry by demonstrating and validating two commercial hybrid power train technologies—an aerial lift truck and refuse hauler—that feature a supplemental power system (either electric or hydraulic) for the diesel internal combustion engine. The project will further identify platforms that would benefit most from the hybrid technology. Hybrid vehicles reduce fuel use, air pollution, noise, and engine wear and also extend vehicle range. In tactical settings, hybrid vehicles can reduce logistical support requirements (e.g., fuel delivery) and may provide other operational advantages. Hybrid vehicles also permit electrification of control systems for enhanced safety and performance.

ASETSDefense Workshop Features Hexavalent Chromium Alternatives to Assist Organizations Responding to DoD Policy Memorandum

The second ASETSDefense workshop on sustainable surface engineering for aerospace and defense was held in Westminster, Colorado, August 31-September 3, 2009, with an attendance of 225 engineers representing DoD, prime contractors, and suppliers. Sponsored by SERDP and ESTCP, the workshop focused on engineering alternatives to chromates (Cr^{6+}) to help organizations meet the requirements of the policy memorandum, Minimizing the Use of Hexavalent Chromium, issued by the Under Secretary of Defense for Acquisition, Technology and Logistics on April 8, 2009. Other sessions in this workshop assessed alternatives to beryllium (Be), cadmium (Cd), and volatile organic compounds (VOC). More than 50 briefings were presented.

Chromate is a ubiquitous corrosion inhibitor for treating aluminum (Al), magnesium (Mg), and steels used in components such as fasteners, electronics, and aircraft skins. It is also used in primers, sealers, fuel tank coatings, and gap fillers, as well as in processes for anodizing and hard chrome plating. The primary Cr^{6+} alternatives are Cr^{3+} (trivalent chromium) and chromium-free corrosion inhibitors. Chromate finishes are more widely used in aircraft than in vehicles and ships, although all weapons systems use chromated Cd plating on bolts and electrical plugs. The two main alternatives for chromated Cd plating are electroplated Al and ZnNi with Cr^{3+} finishes, neither of which is a perfect drop-in replacement.

The latest ASETSDefense Workshop emphasized hexavalent chromium alternatives to help those responsible for responding to the requirements of the recent DoD policy memorandum. Many Cr^{6+} alternatives have been implemented on the F-35 Joint Strike Fighter shown here.

Mr. Dan Dunmire, Director of DoD Corrosion Policy and Oversight, reviewed efforts to establish a Cr^{6+} elimination task force team that will identify alternatives and develop mitigation strategies. He stressed that, in addition to being benign, alternatives must meet or exceed all current corrosion protection performance specifications. Increased corrosion on military equipment is an unacceptable risk.

Other presenters highlighted the significant progress on Cr^{6+} elimination across DoD. For example, NAVAIR has developed a Cr^{3+} treatment for Al alloys and a chromate-free primer. NAVAIR's overall approach is to reduce Cr^{6+} by developing experience with low-risk items in relatively benign environments as a step toward addressing more challenging applications. The U.S. Air Force is implementing High Velocity Oxy-Fuel (HVOF) thermal spray in place of hard chrome plating for landing gear repair at Hill Air Force Base in Utah, with 160 parts converted to HVOF already and more than twice that number in the pipeline.

Despite these efforts, DoD still has a significant amount of work to completely replace Cr^{6+} materials and processes. No entirely Cr^{6+}-free paint system has yet been implemented. SERDP and ESTCP continue to make significant investments in the development and demonstration of Cr^{6+} alternatives for components and systems, with efforts spanning chromated primers and hard chrome plating alternatives. An important focus is developing better test methods, including accelerated corrosion tests, to facilitate the timely and effective implementation of alternatives.

In the long run, eliminating Cr^{6+} from weapons systems depends on removing it at the beginning of the supply chain. Lockheed-Martin has implemented a policy that forbids Cr^{6+} use on its platforms without Vice President-level approval. This includes the F-35 Joint Strike Fighter, which has replaced Cr^{6+}-containing materials with alternatives in most applications. Boeing has developed a chromium-free treatment for aircraft skins that works better than chromate to eliminate "rivet rash," where paint comes off the rivets. The company recently has gone further with the delivery in August 2009 of the first commercial airliner with a completely chromate-free finish—a Boeing 777-300ER for KLM.

For the full workshop report and briefings, visit www.asetsdefense.org. A database of engineering data and reports, authorizations, and implementations related to alternative technologies is also available on the ASETSDefense web site. New information is continually being added to this database.

ASETSDefense—Advanced Surface Engineering Technologies for a Sustainable Defense—is a SERDP and ESTCP initiative that aims to facilitate the implementation of new, environmentally friendly technologies for surface engineering by providing ready access to information and data from RDT&E efforts supported by DoD organizations and the private sector.

CLIMATE CHANGE, from front page

human population pressures and associated land-use activities, altered hydrologic regimes, and NIS. Four SERDP projects will address these issues at differing spatial scales at sites across the Southwest. These projects will ultimately provide installations in the Southwest with the fundamental knowledge, strategies, and tools needed to adaptively manage southwestern intermittent and ephemeral stream systems facing current and future stressors such as climate change.

Efforts to mitigate DoD's contributions to climate change are ongoing in SERDP and ESTCP. The focus is on improving DoD's energy conservation and efficiency, increasing its use of renewable energy, and improving land management practices. Advances in these areas will directly reduce our carbon footprint and enable DoD to achieve balance between carbon sequestration and other ecosystem services.

ESTCP's partnership with DoD's Energy Conservation Investment Program (ECIP) has facilitated demonstrations of innovative technologies that improve building energy efficiency, expand distributed energy generation capabilities, and enhance control and management of energy resources and loads. In response to the American Recovery and Reinvestment Act (ARRA) of 2009, SERDP and ESTCP received funds for research and demonstrations of renewable energy and energy efficiency technologies (refer to page 9 for more information). As the performance and costs of these technologies are validated and the technologies implemented across the Services, they have the potential to reduce DoD's carbon footprint.

SERDP continues to make climate change R&D a top priority in the Sustainable Infrastructure focus area. The FY 2011 SERDP solicitation Statement of Need (SON), Impacts of Climate Change on Alaskan Ecological Systems, expands SERDP's coverage of climate change research to cold regions. Climate change in these regions has the potential to significantly alter ecological systems of management concern to DoD. Changes in the freeze-thaw cycles associated with permafrost, for example, could result in a diminished capacity to support mission requirements. The FY 2011 SERDP solicitation SON, Ecological Forestry and Carbon Management, sets the stage for additional SERDP R&D in climate change mitigation. Understanding the carbon cycle for DoD forested ecosystems is critical to identify how ecologically based forest management versus other land uses contributes to an installation's carbon footprint.

To promote dialogue on climate change issues, this year's Partners Symposium features two technical sessions—*Challenges Associated with Regional Predictions of Climate Change Impacts* and *DoD Greenhouse Gas Emissions: Land Use and the Installation Carbon Footprint*—that are sure to uncover new research and data gaps for DoD related to climate change. ◆

SEDIMENTS, from page 2

AC continually reduced uptake of PCBs from pore water, achieving reductions ranging from 76% for tetra-chloro PCBs to 42% for hepta-chloro PCBs. A strong AC-dose response effect was observed for both aqueous equilibrium PCB concentrations and *Macoma nasuta* PCB bioaccumulations. Neither PCB resuspension from the test plots nor adverse impacts to indigenous amphipods and benthic community was observed during the entire assessment period. Overall, the AC treatment did not impact macro-invertebrate benthic community composition, richness, or diversity.

Cost analyses of the demonstration showed that scaling up the AC treatment method at Hunters Point would result in total costs that may be 75% less than for dredging and disposal. In comparison to laboratory studies with well-mixed sediment, limited contact between AC and sediment under field conditions slows mass transfer and the stabilization of PCBs. Slow PCB mass transfer under field conditions calls for predictive models to assess long-term trends in concentrations of PCBs in pore water.

In situ AC amendment of contaminated sediments may provide a suitable method for reducing exposures to the water column and biota where the source of the PCB is from within the sediment. AC addition may be appropriate for in situ stabilization of low-level PCB contamination, including remedies with dredging to manage residuals or capping to form an active barrier.

This innovative in situ approach for managing PCB-contaminated sediments has the potential to lead to significant cost savings and risk reduction for DoD. To learn more about this technique, access the Final Report for ER-0510 in the SERDP and ESTCP Online Library at http://docs.serdp-estcp.org. Technical questions may be directed to Dr. Richard Luthy, Stanford University, Stanford, California, at (650) 721-2615 or luthy@stanford.edu. Collaborators on this project were Dr. Upal Ghosh from the University of Maryland Baltimore County and Dr. Todd Bridges and Mr. Alan Kennedy from the U.S. Army Engineer Research and Development Center. ◆

SERDP and ESTCP Expand Installation Energy Technology Efforts with Stimulus Funds

OVERVIEW

Installations account for 25% of DoD's total energy usage. In FY 2008, DoD spent more than $4 billion on installation energy. The energy required to operate DoD's 570,000 buildings and structures, with a total footprint of approximately 2 billion square feet, is a major source of greenhouse gases. With emerging state and federal policies and regulations, carbon constraints will add to the cost of installation energy. Recent price increases and volatility also have put a significant strain on military installations. Improved energy conservation and efficiency and increased use of renewable and other distributed energy technologies are a clear pressing need for DoD.

In responding to these challenges, DoD can use its facilities as test beds for innovative energy technologies, reach out directly for innovative technologies to the private sector, and partner with other Federal agencies. Advanced development and demonstration of new energy technologies can be performed at military installations to validate performance, cost, and environmental impacts. Once these efforts are completed, SERDP and ESTCP can transfer the research and technology performance results and provide design and procurement information across all Services and installations.

The recent American Recovery and Reinvestment Act (ARRA) of 2009 provided a unique opportunity for SERDP and ESTCP to expand their investment in energy technologies. SERDP and ESTCP received more than $15 million in funding for advanced development and demonstration of energy technologies. Innovative technologies in the areas of landfill gas energy capture, waste-to-energy (through gasification and anaerobic digestion), continuous building commissioning, and microgrids are being supported. At right are brief descriptions of seven of the projects competitively selected to receive ARRA funds. Other projects selected for funding either have already been described or will be described in a future Information Bulletin. Additional project information can be found at www.serdp.org under the *Research Projects* link and www.estcp.org under the *Technologies* link.

A Systems Approach to High Performance Buildings—A Computational Systems Engineering R&D Program to Increase DoD Energy Efficiency (SI-1709)

Principal Investigator: Satish Narayanan - United Technologies Research Center

Retrofitting existing building stocks represents the largest and fastest way to reduce DoD's energy consumption; however, existing modeling and simulation tools cannot accurately capture the dynamic coupling among building subsystems. This project will develop the required systems methodology and building physics and dynamics-based analysis tool set for delivering significantly higher energy performance for building retrofits.

Feasibility and Guidelines for the Development of Microgrids in Campus-Type Facilities (SI-1710)

Principal Investigator: Saifur Rahman - Virginia Tech

Microgrids can improve operating efficiency, enhance use of renewables, and increase the reliability of electric power delivery systems, making any mission-critical load more resilient and secure. This project will develop a methodology that encompasses technology assessment, modeling, and simulation to explore the feasibility of and provide guidelines for the development of microgrids. Results will enable DoD to better plan, analyze, and evaluate the operational benefits and risks of deploying microgrids on its installations.

Renewable Energy Production from DoD Installation Solid Wastes by Anaerobic Digestion (ER-0933)

Principal Investigator: David Parry - CDM Federal Programs Corporation

This project will demonstrate and validate the ability to digest wastes common to DoD installations—pre- and post-consumer food waste, waste cooking oil, and grease trap waste—and generate biogas that subsequently can be converted to a natural gas quality product. The treated gas product can then be substituted for natural gas in numerous end-use applications to help DoD meet the daily energy needs of installations while limiting environmental impacts, reducing demand on stressed energy systems, minimizing overall operations and maintenance costs, and increasing the reliability of the site-specific power systems.

Microgrid Energy Management Controls for Improved Energy Efficiency and Renewable Energy Integration at DoD Installations (SI-0937)

Principal Investigator: Michael Krok - GE Global Research

The current state-of-the-art power grid includes minimal renewable or clean energy, no intelligent distribution, minimal or no energy storage, ad hoc dispatch, uncontrolled load demands, and excessive distribution losses. This project will demonstrate advanced microgrid control technologies capable of improving energy efficiency, expanding use of renewables, and increasing energy security. The advanced control and optimization functions include optimal dispatch of distributed generation power resources, load shedding, islanded operation, and energy efficiency optimization by controlling the major electrical loads.

Wireless Platform for Energy-Efficient Building Control Retrofits (SI-0938)

Principal Investigator: Subbarao Varigonda - United Technologies Research Center

Whole-building optimal control can potentially reduce building energy consumption by 3 to 10%; however, the high first cost of HVAC control systems is a barrier to broad deployment to the existing building stock. This project will develop a scalable, robust building control platform consisting of sensing, computation, and actuation suitable for retrofit applications and demonstrate first cost and operational cost benefits.

Distributed Power Systems for Sustainable Energy Resources (SI-0939)

Principal Investigator: Stella Oggianu - United Technologies Research Center

The objective of this project is to demonstrate the key technologies that would enable the scalable deployment of distributed power sources and energy storage in such a way that these sources would appear as a single entity to the electrical grid. This capability would facilitate the introduction of dynamically stable, modular, and cost-effective energy microgrids that will seamlessly operate in grid-parallel and off-grid modes and lead to significant reductions in DoD energy costs and carbon dioxide output.

Modular Biopower System Providing Combined Heat and Power for DoD Installations (SI-0940)

Principal Investigator: King Brown - Community Power Corporation

This project will demonstrate a modular, renewable energy technology for distributed generation application by on-site conversion of biomass residues for displacement of conventional, nonrenewable heat and power in DoD buildings. The modular biopower system uses thermochemical conversion technology to gasify biomass residues in a downdraft gasifier into three combustible fuel gases that can be consumed in a standard engine genset to produce grid-quality AC power.

Program Update

SERDP

Proposals selected in response to the FY 2010 SERDP solicitations were presented to the SERDP Scientific Advisory Board (SAB) for review at its September and October 2009 meetings. The SAB review will continue at the upcoming March 2010 meeting. Forty-six projects were recommended for funding from the Core Solicitation and nine projects from the **S**ERDP **E**xploratory **D**evelopment (SEED) Solicitation.

On October 29, SERDP released the FY 2011 Core Broad Agency Announcement (BAA) and Federal Call for Proposals and the SEED Solicitation. The box below lists the Statements of Need (SON) for the FY 2011 solicitations. Private sector pre-proposals responding to the FY 2011 BAA for the Core Solicitation are due January 7, 2010. Full proposals responding to the Federal Call for Proposals and requested full proposals responding to the BAA are due March 11, 2010. Full proposals responding to the FY 2011 SEED Solicitation also are due on March 11.

Visit www.serdp.org under the *Funding Opportunities* link for details regarding the FY 2011 solicitation instructions and schedule for proposal submission.

ESTCP

In September, as part of the FY 2010 Solicitation, full proposal submitters presented their proposed work to the ESTCP Technical Committees (ETC). The ETCs made recommendations to the ESTCP Director, who selected projects to be funded in FY 2010.

Proposal acceptance letters have been disseminated, and Principal Investigators are requested to enter their initial project plan information in the online reporting system. These plans must be submitted before the release of FY 2010 funding. Project initiation kickoff conference calls then will be scheduled with the ESTCP Program Managers.

A solicitation for the FY 2011 Program is planned for release on or about January 7, 2010. Watch www.estcp.org under the *Opportunities* link for details.

FY 2011 SERDP Statements of Need

For more information, visit www.serdp.org/funding.

Environmental Restoration

- Determination of the Environmental Impacts of Munitions Compounds in the Marine Environment
- In Situ Remediation of Perfluoroalkyl Contaminated Groundwater
- Improved Understanding of Impacts to Groundwater Quality Post-Remediation
- Improved Assessment of Munitions Constituent Source Terms on Operational Ranges
- (SEED) In Situ Remediation of Contaminated Aquatic Sediments

Munitions Management

- Advanced Technologies for Detection, Discrimination, and Remediation of Military Munitions on Land
- Improvements in the Detection and Remediation of Military Munitions Underwater
- Tools to Support Informed Decisions on Munitions Response Sites
- (SEED) Advanced Technologies for Detection, Discrimination, and Remediation of Military Munitions on Land and Underwater

Sustainable Infrastructure

- Impacts of Climate Change on Alaskan Ecological Systems
- Behavioral Ecology of Cetaceans
- Ecological Forestry and Carbon Management
- Ecology and Management of Source-Sink Populations

Weapons Systems and Platforms

- Development of Alternatives to Copper-Beryllium and Aluminum-Beryllium Alloys for Military Applications
- Environmentally Benign, Insensitive, Castable, High-Performance, Minimum-Smoke Rocket Propellant
- Understanding the Corrosion Protection Requirements for Adhesive Bond Primers
- Combustion Science to Predict Emissions from Military Platforms Burning Alternative Fuels
- Environmentally Benign Removal Process for Low Observable Weapon Systems (restricted to U.S. government organizations only)
- (SEED) Replacement of Hexachloroethane in Handheld Obscurants

Recent Additions to the Online Library

The following are samples of new publications now available in the SERDP and ESTCP Online Library (http://docs.serdp-estcp.org). Access them by entering the project number noted after the report title (e.g., 0125) under Search Phrase. Other documents may be accessed by entering an appropriate keyword or selecting relevant search filters.

Environmental Restoration

- Cost & Performance Report: Demonstration and Certification of Amphibian Ecological Risk Assessment Protocol (ESTCP ER-0514)
- Cost & Performance Report: Direct Fixed-Bed Biological Perchlorate Destruction Demonstration (ESTCP ER-0544)
- Cost & Performance Report: Validation of Sampling Protocol and Promulgation of Method Modifications for the Characterization of Energetic Residues on Military Training Ranges (ESTCP ER-0628)
- Final Report: Treatment of RDX & HMX Plumes Using Mulch Biowalls (ESTCP ER-0426)
- Final Report: Demonstration of a Full-Scale Fluidized Bed Bioreactor for the Treatment of Perchlorate at Low Concentrations in Groundwater (ESTCP ER-0543)
- Final Report: Adaptive Long-Term Monitoring at Environmental Restoration Sites (ESTCP ER-0629)
- Final Report: Development of Assessment Tools for Evaluation of the Benefits of DNAPL Source Zone Treatment (SERDP ER-1293)
- Final Report: Characterization of Contaminant Migration Potential through In-Place Sediment Caps (SERDP ER-1370)

Munitions Management

- Cost & Performance Report: Feature-Based UXO Detection and Discrimination (ESTCP MM-0210)
- Cost & Performance Report: Remote Excavation of Heavily Contaminated UXO Sites (ESTCP MM-0327)
- Cost & Performance Report: Man-Portable Simultaneous Magnetometer and Electromagnetic System (ESTCP MM-0414)
- Cost & Performance Report: Wide Area UXO Screening with the Multi-Sensor Fixed Wing Airborne System MARS, Former Kirtland Precision Bombing Range, New Mexico (ESTCP MM-0607)
- Final Report: Transportable Manned and Robotic Digital Geophysical Mapping Tow Vehicle (ESTCP MM-0608)

Sustainable Infrastructure

- Cost & Performance Report: Optical Remote Sensing Method to Determine Strength of Non-Point Sources (ESTCP SI-0214)
- Final Report: Impacts of Military Training and Land Management on Threatened and Endangered Species in the Southeastern Fall Line/Sandhills Community (SERDP SI-1302)
- Final Report: Regenerating Longleaf Pine on Hydric Soils: Short- and Long-Term Effects on Native Ground-Layer Vegetation (SERDP SI-1303)
- Final Report: Maximizing Sampling Efficiency and Minimizing Uncertainty in Presence/Absence Classification of Rare Salamander Populations (SI-1393)
- Final Report: Airborne Weapons Noise Prediction Model (SERDP SI-1397)
- Technical Report: Intermountain West Military Training Lands Planting Guide: Selecting Seed Mixtures for Actively Used Military Lands (ESTCP SI-0401)

Weapons Systems and Platforms

- Cost & Performance Report: Demonstration/Validation of an Environmentally Compliant Low Observable Coating that Facilitates Rapid Application (ESTCP WP-0408)
- Final Report: Investigation of Chemically Vapor Deposited Tantalum for Medium Caliber Gun Barrel Protection (SERDP WP-1425)

PARTNERS IN ENVIRONMENTAL TECHNOLOGY

STRATEGIC ENVIRONMENTAL RESEARCH AND DEVELOPMENT PROGRAM (SERDP)
&
ENVIRONMENTAL SECURITY TECHNOLOGY CERTIFICATION PROGRAM (ESTCP)

INFORMATION BULLETIN

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FOR SERDP AND ESTCP

JANUARY 2010

January 7
Pre-proposals due in response to the SERDP FY 2011 Core Solicitation Broad Agency Announcement

January 7
A Federal Call for Proposals and a Broad Agency Announcement for ESTCP FY 2011 project funding to be released on or about this date

January 15
SERDP and ESTCP quarterly progress reports due for the first quarter of government FY 2010

FEBRUARY 2010

February 3-5
Munitions Management (MM) In-Progress Review (IPR) meeting

February 4
Full proposal requests sent to qualified proposers responding to the SERDP FY 2011 Core Solicitation Broad Agency Announcement

February 8-12
Environmental Restoration (ER) IPR meeting

February 17-18
Weapons Systems and Platforms (WP) IPR meeting

February 22-26
Sustainable Infrastructure (SI) IPR meeting

MARCH 2010

March 2-4
SERDP Scientific Advisory Board (SAB) meeting
San Diego, California

March 4
Pre-proposals due in response to the ESTCP FY 2011 Solicitation Federal Call for Proposals and Broad Agency Announcement

March 11
Full proposals due in response to the SERDP FY 2011 Core Solicitation Federal Call for Proposals and Broad Agency Announcement

Full proposals due in response to the SERDP FY 2011 **SE**RDP **E**xploratory **D**evelopment (SEED) Solicitation

RELATED CONFERENCES & EVENTS

December 14-18, 2009
2009 American Geophysical Union (AGU) Fall Meeting
San Francisco, California
For more information, visit www.agu.org/meetings/fm09.

March 22-26, 2010
National Military Fish & Wildlife Association (NMFWA) Meeting
Milwaukee, Wisconsin
For more information, visit www.nmfwa.org/2010_Meeting.

April 6-9, 2010
2010 AFCEE Technology Transfer Workshop
San Antonio, Texas
For more information, visit www.afcee.af.mil/resources/technologytransfer/technologytransferworkshop.

April 11-15, 2010
Symposium on the Application of Geophysics to Environmental and Engineering Problems (SAGEEP)
Keystone, Colorado
For more information, visit www.eegs.org/sageep.

May 24-27, 2010
Seventh International Conference on Remediation of Chlorinated and Recalcitrant Compounds
Monterey, California
For more information, visit www.battelle.org/conferences/chlorinated.

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