PARTNERS IN ENVIRONMENTAL TECHNOLOGY

WINTER 2003
NUMBER 15

SERDP Strategic Environmental Research and Development Program
ESTCP

INFORMATION BULLETIN

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More than 800 attendees participated in the 2002 *Partners in Environmental Technology* Technical Symposium and Workshop.

For event highlights, see pp. 4–5 of this issue.

SYMPOSIUM & WORKSHOP DRAWS RECORD CROWD

Attendance at the Partners in Environmental Technology Technical Symposium & Workshop broke all records as more than 800 environmental professionals converged on the Marriott Wardman Park Hotel in Washington, D.C., December 3-5, 2002. The annual technical exposition hosted by SERDP and ESTCP is a nationally recognized technical symposium and workshop focusing on important and timely environmental issues.

Under the theme "Meeting DoD's Environmental Challenges," the event highlighted a number of issues associated with the sustainability of military testing and training ranges. The two and one-half day event opened with a Plenary Session featuring distinguished speakers from the Bush Administration, the Armed Forces, and an environmental advocacy group. As the first of the speakers, Assistant Deputy Under Secretary of Defense for Environment Mr. John Paul Woodley, Jr., offered the Administration's assessment of DoD's future environmental challenges. Following Mr. Woodley, Lieutenant General John D. Hopper, Jr., USAF, the Vice Commander of the Air Education and Training Command for the U.S. Air Force, shared his thoughts on the requirements and challenges at training and testing ranges and persistent environmental issues that impact military readiness. Dr. John A. Wiens, the Chief Conservation Scientist of the Mid-Americas Region for the Nature Conservancy, discussed the science of conservation in human-impacted environments as well as collaborative efforts between DoD and the Nature Conservancy. At the conclusion of the Plenary Session, the Chair of SERDP's Scientific Advisory Board, Dr. Herb Ward, presented the SERDP Project of the Year Awards and the first ESTCP Project of the Year Award. Recipients of these prestigious awards and a description of their award-winning research or demonstrations follow.

Cleanup. Dr. Pedro Alvarez, University of Iowa, was selected for his fundamental research on the synergistic biogeochemical interactions between zero-valent iron and microorganisms for the remediation of RDX-contaminated groundwater. In addition to developing a cost-effective and sustainable remediation approach, this project has enhanced the understanding of biogeochemical interactions in contaminated aquifers and the role of mineral surfaces in natural attenuation.

Compliance. Dr. Judith Pennington of the U.S. Army Engineer Research and Development Center's Environmental Laboratory and Dr. Thomas Jenkins of the U.S. Army Engineer Research and Development Center's Cold Regions Research and Engineering Laboratory were selected for their cutting-edge work to provide sound and scientific data concerning the distribution and fate of surface soil contamination from explosive compounds on military training ranges. Drs. Pennington and Jenkins collaborated with an impressive international team of leading experts and researchers from industry, academia, and government to achieve their research objectives to promote environmentally responsible management of military ranges.

Conservation. Conservation's Project of the Year was awarded to Mr. Alan Anderson from the U.S. Army Corps of Engineers Engineer Research and Development Center's Construction Engineering Research Laboratory (CERL). Mr. Anderson and his team collaborated on a project to significantly improve the Army Training and Testing Area Carrying Capacity, or ATTACC methodology, by developing scientifically based units of measure for estimating training and testing area carrying capacity. ATTACC now can be used

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S•U•C•C•E•S•S STORIES

SERDP-funded research and development efforts and ESTCP-funded demonstration and validation activities continue to provide a rapidly increasing number of outstanding technical and environmental advances. These developments are highly important and relevant to the Department of Defense (DoD), Department of Energy (DOE), Environmental Protection Agency (EPA), and many other user communities.

SERDP
Strategic Environmental Research and Development Program

SUCCESS STORY

Dr. Hawari, SERDP PI, Honored with Golden Jubilee Medal

In recognition of his world-renowned research on the fate, transport, and remediation of explosive compounds, Dr. Jalal Abed Al-Hawari recently received the Queen's Golden Jubilee Medal, commemorating the 50th anniversary of Her Majesty Queen Elizabeth II's accession to the throne. The medal is awarded to those persons who have made a significant contribution to Canada, to their community, or to their fellow Canadians. Dr. Hawari of the National Research Council (NRC) Biotechnology Research Institute in Montreal is the lead Principal Investigator (PI) on two ongoing SERDP-funded projects, *Microbial Degradation of RDX and HMX (CU-1213)* and *Environmental Fate and Transport of a New Energetic Material, CL-20* (CP-1256), that are described below.

Explosives are highly energetic chemicals that rapidly release large amounts of energy and gaseous products upon detonation. Some of the most frequently manufactured and used explosives include hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX) and octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX). Past and present practices such as manufacturing, waste discharge, testing and training, demilitarization, and open burning/open detonation have led to severe soil and groundwater contamination worldwide. Furthermore, it has been shown that both RDX and HMX are modestly toxic to aquatic organisms, earthworms, and indigenous soil microorganisms. Their toxicity necessitates removal from affected areas.

Prior to SERDP project CU-1213, few microbial-based mineralization technologies existed for explosives. Composting and soil bioslurry were known to remove contaminants effectively, but the actual fate often remained unclear. The lack of knowledge about the degradation products and pathways of explosives such as RDX and HMX hampered efforts to achieve effective mineralization and gain understanding of the environmental fate and transport of these chemicals and their biotransformation products.

Through the efforts of Dr. Hawari and his research team composed of Dr. Jim Spain of the U.S. Air Force Research Laboratory and Dr. Sonia Thiboutot of Defence Research and Development Canada, RDX and HMX were successfully degraded under both anaerobic and aerobic conditions. Degradation of these cyclic nitramines via initial denitration led to ring cleavage, spontaneous decomposition, and mineralization in water to the benign compounds of nitrous oxide and carbon dioxide. Anaerobic and aerobic bacteria initiated the complete destruction of RDX and HMX. In addition, key metabolites were identified that provided new insights into the degradation pathways of RDX and HMX. Future experiments will determine how these processes function in natural and model soil systems. This increased fundamental understanding of the microbial and enzymatic degradation of RDX and HMX provides a foundation for future pilot-scale demonstrations and the development of cost-effective bioremediation technologies that will be suitable for the cleanup of contaminated sites.

Recently, it has been discovered that high density polynitropolyaza-caged molecules also contain high energy. A typical energetic chemical of this family is hexanitrohexaazaisowurtzitane (commonly known as CL-20), which is being considered as a potential replacement for existing propellant and explosive materials. However, it has been recognized that the environmental fate and transport of this compound must be understood prior to its adoption. Like RDX and HMX, CL-20 is a heterocyclic nitramine, which contains the functional groups responsible for the thermal and chemical properties of these explosives. It is thus expected to show some similarities with RDX and HMX in its chemical and enzymatic reactivity. Future wide-scale military practices with CL-20 also may result in contamination of soil and groundwater and thus in adverse effects to the environment.

Under SERDP project CP-1256, it was hypothesized that the chemical and microbial knowledge obtained during work with RDX and HMX would be helpful in the study of the transport (soil/CL-20 interactions) and transformation (chemical, microbial, and enzymatic degradation) mechanisms of CL-20. Consequently, analytical methods for the determination of

See HAWARI HONORED, page 8

SUCCESS STORY

Firefighters Warm Up to NoFoam

To ensure that Aircraft Rescue and Firefighting (ARFF) vehicles operate properly in an emergency, they are required to undergo Aqueous Film Foaming Foam (AFFF) discharge tests on a quarterly basis. The discharge test verifies that the on-board AFFF delivery system is functioning correctly. To date, the most common method of determining acceptable ARFF vehicle performance in the field is to discharge AFFF through each of the vehicle's nozzles and then collect foam samples in accordance with National Fire Protection Association (NFPA) 412 Standard. In addition to the mandated testing requirements, local authorities and fire chiefs also conduct additional routine discharge testing. This routine testing is a visual check of foam being emitted through the various nozzles of the vehicle. Each vehicle is equipped with at least two and up to as many as five different types of nozzles. Depending on the type of vehicle, this discharge procedure generates large amounts of AFFF wastewater ranging from 850 gallons to more than 2600 gallons per vehicle for each 30-second nozzle test.

The wastewater generated from all of these tests results in damage to the environment. Despite its wide use and effectiveness for firefighting, AFFF poses an environmental risk because of its resistance to biodegradation, its toxicity from constituent butyl carbitol (a glycol ether) and perfluorooctyl sulfonates (PFOS), and its high biochemical oxygen demand (BOD) and chemical oxygen demand (COD). Besides these environmental concerns about AFFF wastewater discharges into the environment, the extreme foaming capacity of AFFF makes the recovery and treatment of spent AFFF difficult. In some regions, the Navy is no longer allowed to discharge AFFF wastewater to industrial waste treatment plant facilities because of subsequent treatment plant fouling. As a result, when disposing of the AFFF wastewater, activities must address additional costs associated with hazardous waste handling, collection, and disposal and issues of liability.

To maintain mission readiness while minimizing the release of AFFF to the environment, the Naval Facilities Engineering Service Center (NFESC) under the sponsorship of ESTCP [through the project *Universal Stationary NoFoam Unit for Aircraft Rescue and Firefighting Vehicles (PP-0026)*] has developed, demonstrated, and validated a NoFoam Unit that is universal to all models of ARFF vehicles to test the AFFF delivery system. This mobile/stationary unit has been designated the Universal Stationary/mobile NoFoam Unit (USNOFU). The primary component of the conversion is external to the vehicle and does not alter the function of the ARFF vehicle's fire fighting capabilities.

In order to test, the firefighter drives the ARFF vehicle to the mobile NoFoam Unit and connects to the unit's surrogate test fluid supply line. At this point the firefighter continues through the firefighting discharge procedures. A flow meter installed in the unit senses the flow rate of the surrogate fluid, and the reading is displayed on the monitor. The firefighter simply reads the monitor and quickly determines the vehicle's AFFF delivery system performance. The flow that is monitored represents the flow rate of the AFFF concentrate into the vehicle AFFF delivery system. The firefighter also has the option to employ a dye water surrogate solution for visual confirmation of performance. However, the firefighter must read the NoFoam Unit's rate meter to determine vehicle performance accurately. The dye concentrate selected is environmentally benign, biodegradable, and certified by the National Sanitation

ARFF vehicle discharge testing with the NoFoam Unit.

Foundation International. The NoFoam Unit will accommodate any number and model of ARFF vehicle with minimal vehicle airfield duty down time.

Following successful completion of the demonstration and validation process, NFESC transferred ownership of three NoFoam Units to the respective demonstration sites at Marine Corps Air Station (MCAS) Quantico, VA; Tyndall Air Force Base (AFB), FL; and Naval Air Station (NAS) Fallon, NV. Shortly thereafter, MCAS Futenma, Okinawa, took delivery of a NoFoam Unit. Under purchase agreement, NFESC also has delivered NoFoam Units to Hanscom AFB, MA, and MCAS Yuma, AZ, with a third unit scheduled for delivery to MCAS New River, Jacksonville, NC. Through the Pollution Prevention Equipment Program (PPEP), three additional NoFoam Units have been delivered, and another five units are scheduled for delivery. Currently, as many as 10 additional DoD firefighting activities are expressing interest or are actively pursuing acquisition of their own NoFoam Units.

The expected DoD benefit from field application of the NoFoam Unit is the elimination of AFFF wastewater into natural or domestic water systems. Additional benefits include reducing or eliminating the need for hazardous waste handling, collection, and disposal. By using the NoFoam Unit, environmental concerns, such as AFFF wastewater liability, are no longer an issue. In summary, the NoFoam Unit

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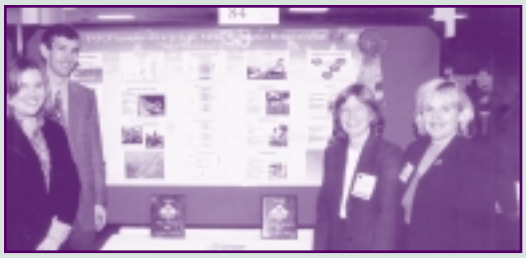
Partners in Environmental Technology Technical Symposium & Workshop

December 3–5, 2002
Marriott Wardman Park Hotel
Washington, D.C.



Clockwise from top left: Ms. Karen Miller (second from right) and Dr. Paul Johnson are the recipients of ESTCP's First Project of the Year Award. Dr. Pedro Alvarez is selected for SERDP's Cleanup Project of the Year Award. Project of the Year Awards are announced during the Plenary Session. Dr. Herb Ward (right), Chair of SERDP's Scientific Advisory Board, presents the SERDP Pollution Prevention Project of the Year Award to Dr. Charles Kuehmann. Dr. Judith Pennington (second from left, back row) and Dr. Tom Jenkins (second from right, back row) share the SERDP Compliance Project of the Year Award with members of their research team. Mr. Alan Anderson (far left) and his research team are recognized with the SERDP Conservation Project of the Year Award.

Lieutenant General Hopper explains the issues and limitations facing the Air Force's training bases.

During the Plenary Session, Mr. Woodley presents the policy aspects of DoD's environmental challenges.

SERDP's Executive Director Mr. Brad Smith outlines the technical program agenda.

Dr. Wiens describes collaborative efforts between DoD and the Nature Conservancy.

PHOTOS BY CRAIG KELLSTROM

2002 H•I•G•H•L•I•G•H•T•S

Expanded networking sessions provide greater opportunities for participants to interact with technical presenters and exchange ideas with other attendees.

Dr. Jeffrey Marqusee (far right), ESTCP Director and SERDP Technical Director, discusses recent UXO developments with researchers.

Attendees enjoy valuable networking and technology transfer opportunities at the largest poster and booth session to date.

Right and below: The Symposium & Workshop's technical program highlighting 12 topical areas is a forum for information exchange between acknowledged experts and the research and technology user communities.

Program Development Update

SERDP

The FY 2004 solicitation has been initiated, and the preproposal response from industry has been overwhelming. By the January 9 deadline, the Program Office received 272 preproposals in response to the Broad Agency Announcement. This was over 100 more responses than that received during the previous year. Preproposals were requested against 23 Statements of Need. These preproposals underwent Staff review, and requests for full proposals were extended to those that showed promise and met the relevance criterion. On March 6, the Program Office received 91 full proposals from industrial firms and the academic community. On that same day, 146 full proposals were logged in from federal agencies in response to a Call for Proposals. Together, these proposals now are undergoing an independent peer review evaluation and then will be reviewed by the Technology Thrust Area Working Groups (TTAWG) during the summer.

For further details on the requirements and schedule for any of the solicitations listed above, please refer to the SERDP web site www.serdp.org.

ESTCP

A Call for Proposals to non-DoD federal organizations and a Broad Agency Announcement for private sector bidders was released on January 9 requesting preproposals. The Call solicited preproposals under four topics within the UXO and Cleanup Pillars. All preproposals were due at the Program Office no later than March 13. Based upon a technical review, qualified proposers will be asked to submit a full proposal for review later in the summer.

Similarly On January 9, a Call for ESTCP Phase I Proposals was sent to DoD organizations soliciting demonstration proposals in Cleanup, UXO, Compliance, and Pollution Prevention technology Pillars. These proposals were due April 10 and will be reviewed by a DoD Review Committee in the late June timeframe. Successful proposers will be asked to submit enhanced full proposals for review by Multi-Agency Review Committees later in the summer.

For details on all ESTCP solicitations and these new full proposal requirements, please refer to the ESTCP web site www.estcp.org. ◆

RECORD CROWD, from page 1

not only to better estimate installation capacity and training schedules but also to project and defend training budgets.

Pollution Prevention. The final SERDP award was presented to Dr. Charles Kuehmann and Dr. Gregory Olson of QuesTek Innovations for developing a new superior stainless structural steel (Ferrium S53) that combines mechanical properties equivalent to current ultra-high strength steels with the anti-corrosive properties that virtually eliminate the need for toxic metal plating. Their computational design methodology reduced the development time from over a decade to just a few years at roughly five percent of the normal development cost. Ferrium S53 was developed with only five prototypes over a two-year period resulting in a development cost savings of approximately $50 million. Under ESTCP sponsorship, QuesTek is slated to begin work to fully qualify Ferrium S53 for DoD aircraft landing gear components.

ESTCP Project of the Year. Ms. Karen Miller of the Naval Facilities Engineering Service Center and Dr. Paul Johnson of the Arizona State University were chosen as the first ESTCP Project of the Year Award recipients for their demonstration of an innovative in-situ MTBE bioremediation technology. Using a unique bacterial culture, the researchers created a biological barrier across the width of an MTBE plume. In as little as 180 days, the oxygen system successfully created a well-oxygenated zone along the length of the biobarrier removing 99.9 percent of the MTBE and other petroleum hydrocarbons from the groundwater. This demonstration provides clear proof that the biobarrier technology is a cost-effective tool to cleanup MTBE plumes.

A technical program on 12 topical areas, the true substance of the Symposium & Workshop, began after the Plenary Session and provided both stimulating presentations from acknowledged experts, as well as presentations of examples of cutting-edge technological solutions for environmental matters of concern. In between technical sessions and during lunch and evening receptions, participants interacted with technical presenters and other attendees as well as with the more than 220 poster presenters and 20 exhibitors from various departments and agencies. The number of poster presenters this year also surpassed previous events as did the number of international attendees, particularly from Canada, the Netherlands, Sweden, Great Britain, and Australia as well as NATO representation.

Planning is well under way for the next Symposium & Workshop. Be sure to mark your calendar for December 2-4, 2003. The event once again will be held at the Marriott Wardman Park Hotel in Washington, D.C. Topics for the technical sessions will be chosen this summer. Given that attendance has grown roughly 20 percent for the past several years, the upcoming Symposium could provide networking and information exchange opportunities for nearly 1000 attendees. Watch our web sites for additional details. ◆

PROGRAM NOTES

- **OUR THANKS TO ALL WHO PARTICIPATED IN THE PARTNERS IN ENVIRONMENTAL TECHNOLOGY TECHNICAL SYMPOSIUM & WORKSHOP IN DECEMBER**. The event attracted a record number of attendees and was a tremendous success thanks to all of your efforts. Be sure to mark your calendar for the next Symposium & Workshop which is scheduled for December 2-4, 2003, at the Marriott Wardman Park Hotel, Washington, D.C.
- **THE COMBINED SERDP AND ESTCP IN-PROGRESS REVIEWS (IPR)** are being held in Arlington, Virginia, during April and May. The schedule calls for the IPRs to be held on the following dates: Conservation IPR (April 2-4); Cleanup IPR (April 7-11 and April 22-25); Pollution Prevention IPR (April 28-May 2); Compliance IPR (May 5-8); and UXO IPR (May 12-15 and May 20-21).

S◆E◆R◆D◆P

- **PROGRESS REPORT DATA** (i.e., a written summary of the quarter's technical accomplishments, updated completion dates for milestones, and any concerns regarding technical/financial progress) for the second quarter of Government FY 2003 were due by April 15, 2003.
- **THE SERDP SCIENTIFIC ADVISORY BOARD (SAB) IS SCHEDULED TO MEET JUNE 11-12** in Arlington, Virginia. Contact Veronica Rice at (703) 696-2119 or via e-mail at Veronica.Rice@osd.mil for additional information.

E◆S◆T◆C◆P

- **DOD PHASE I PROPOSALS WERE DUE** to the ESTCP Program Office on April 10, 2003.
- **QUARTERLY REPORTS** for the Second Quarter of Government FY 2003 were due April 15, 2003.

E◆S◆T◆C◆P *(Continued)*

- **NEW PUBLICATIONS NOW AVAILABLE ON THE ESTCP HOME PAGE** www.estcp.org

Cost and Performance Reports:

Cleanup

Site Characterization and Analysis Penetrometer System (SCAPS) Heavy Metal Sensors Demonstration/Validation

Compliance

Advanced Leak Location and Detection Verification System for Underground Fuel Pipelines

Mineralization of TNT, RDX, and By-Products in an Anaerobic Granular Activated Carbon-Fluidized Bed Reactor

UXO

Evaluation of Footprint Reduction Methodology at the Cuny Table in the Former Badlands Bombing Range

NOFOAM, from page 3

enables firefighters to routinely perform AFFF discharge tests and thereby meet their firefighting missions with a higher level of confidence.

For further information about the NoFoam Unit, please contact Mr. Rance Kudo, NFESC, Port Hueneme, CA, at (805) 982-4976 or via e-mail at kudort@nfesc.navy.mil or Mr. Kurt Buehler, NFESC, Port Hueneme, CA, at (805) 982-4886 or via e-mail at buehlerkd@nfesc.navy.mil. ◆

PARTNERS IN ENVIRONMENTAL TECHNOLOGY

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

INFORMATION BULLETIN

WINTER 2003 NUMBER 15

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C◆A◆L◆E◆N◆D◆A◆R

FOR SERDP AND ESTCP

APRIL 2003

April 2-4
Conservation In-Progress Review (IPR) meetings

April 7-11
Cleanup In-Progress Review (IPR) meetings (week 1 of 2)

April 10
ESTCP DoD Phase I proposals due

April 22-25
Cleanup In-Progress Review (IPR) meetings (week 2 of 2)

April 28-May 2
Pollution Prevention In-Progress Review (IPR) meetings

MAY 2003

May 5-8
Compliance In-Progress Review (IPR) meetings

May 12-15
UXO In-Progress Review (IPR) meetings (week 1 of 2)

May 20-21
UXO In-Progress Review (IPR) meetings (week 2 of 2)

JUNE 2003

June 11-12
SERDP Scientific Advisory Board (SAB) meeting

RELATED CONFERENCES & EVENTS

June 2-5
The Seventh International Symposium on In Situ and On-Site Bioremediation
Orlando, Florida
Sponsored by Battelle.

For more information, visit http://www.battelle.org/environment/er/conferences/biosymp/default.stm.

HAWARI HONORED, from page 2

CL-20 and its degradation products in soil and water were developed. Dr. Hawari with assistance from Co-PI Dr. Geoffrey Sunahara identified physicochemical, biochemical, and toxicological parameters that can be used by site managers to sustain the military training of their personnel without causing adverse effects to the environment. Together, the collaborative partnership between SERDP, NRC, U.S. Army Soldier and Biological Chemical Command, and Pacific Northwest National Laboratory is expected to produce scientifically sound data that will provide military personnel and other site managers with a base of knowledge to understand and predict the fate and environmental impact of this powerful energetic compound.

Energetics contamination represents a considerable portion of contamination at DoD sites. The research findings from these two projects led by Dr. Hawari demonstrate a holistic approach for addressing energetic chemicals. Understanding the microbial and enzymatic degradation of RDX and HMX will facilitate future remediation technologies for these toxic explosives that have been and continue to be used extensively. Before widespread use of CL-20 is implemented, its fate and transport will be understood, enabling pollution prevention measures.

Congratulations go to Dr. Hawari on his receipt of this well-deserved honor. For further information about this research, please contact Dr. Hawari at (514) 496-6267 or via e-mail at jalal.hawari@nrc.ca. ◆

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INFORMATION

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