PARTNERS IN ENVIRONMENTAL TECHNOLOGY

EARLY FALL 2009
NUMBER 39

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PARTNERS IN ENVIRONMENTAL TECHNOLOGY

TECHNICAL SYMPOSIUM & WORKSHOP

Meeting DoD's Environmental Challenges

December 1–3, 2009
Washington, D.C.

See page 5 for information on this year's Plenary Session and details about the 11 technical sessions and five short courses, for which PDHs will be available.

Register now at www.serdp-estcp.org/symposium.

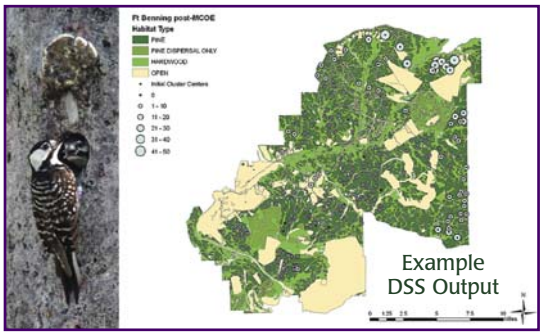
DoD EPA DOE SERDP ESTCP

INFORMATION B•U•L•L•E•T•I•N

Decision Support Tool Minimizes Impacts of Range Construction on Endangered Red-Cockaded Woodpeckers at Fort Benning

SERDP researchers have developed a management tool that simulates the potential impacts of land use and habitat changes on endangered red-cockaded woodpecker (RCW) populations. The tool is already proving invaluable at Fort Benning and is expected to be instrumental at other military installations across the southeastern United States where force realignment decisions, the introduction of new weapons systems, and continued urbanization in surrounding areas threaten successes achieved in RCW recovery.

The decision support system (DSS) identifies and ranks habitats for RCW populations and allows base managers to assess the potential impacts of land use changes on RCWs and compare alternative management scenarios. SERDP researchers Dr. Jeff Walters, Ms. Paige Baldassaro, and Mr. Ken Convery from Virginia Tech and Dr. Ross McGregor, Dr. Larry Crowder, and Mr. Jeff Priddy from Duke University's Marine Laboratory developed the interactive DSS under the SERDP project *A Decision Support System for Identifying and Ranking Critical Habitat Parcels on and in the Vicinity of Department of Defense Installations (SI-1472)*. The DSS captures the spatial patterns of the growth (or decline) of RCW populations and predicts how changes in the landscape and habitat at particular locations will affect them.



RCW photo courtesy of Kevin Rose.

A decision support system developed with SERDP support simulates the interaction of red-cockaded woodpecker (RCW) populations with current and potential future landscapes. In a pilot test of this new tool, Fort Benning land managers were able to evaluate various new range construction scenarios to minimize impacts on RCW populations and, in so doing, integrate training and conservation objectives.

It allows the user to assess alternative scenarios and identify the one that best meets training and conservation needs. Possible uses of the DSS include evaluating the clearing of land for new range construction, cantonment expansion, or acquisition of additional habitat for RCWs off installation. The DSS incorporates knowledge of how RCW populations function and interact with habitat and enables users to apply that knowledge to real landscapes.

Through efforts to manage this high-priority threatened and endangered species, the Department of Defense (DoD) has achieved great success to date in recovering populations of the RCW while sustaining military testing and training on its installations in the southeastern United States. Four of the seven largest remaining RCW populations occur on military installations, and DoD has led the way in efforts to recover the species. The population on Fort Bragg in North Carolina has increased sufficiently in size for the U.S. Fish and Wildlife Service (USFWS) to designate it as recovered, and the population on Eglin Air Force Base (AFB) in Florida also recently exceeded the recovery goal. Both Fort Bragg and Eglin AFB are heavily used for training, as are the two other bases with large populations, Fort Benning and Fort Stewart, both in Georgia. A fifth

See DSS, page 2

installation with a significant population, Marine Corps Base (MCB) Camp Lejeune in North Carolina, has tripled the size of its RCW population over the last 18 years. The populations on Fort Benning and Fort Stewart have increased considerably as well. However, RCW recovery successes at all of these installations are being threatened by increasing demands on the land.

The unique biology of RCWs, *Picoides borealis*, makes their conservation especially difficult and DoD's success in increasing their numbers all the more impressive. RCWs are the only woodpecker that constructs its nesting and roosting cavities in live pine trees, a process that takes several years. Once completed, a cavity can be used for years or even decades. RCWs live in family groups of up to seven adults, and each family member has its own private roost cavity. Groups, therefore, are tied to a set of cavity trees, making them extremely sedentary. The birds also need mature pine habitat and lots of it: each group requires 120 to 150 acres of pine at least 60 years old. Tens of thousands of acres are needed to support a viable population of RCWs, and this habitat cannot readily be shifted to accommodate new training needs. It is often impossible to devote some acres to training and others to conserving RCWs; the two activities must be integrated and accomplished on the same acreage. Further compounding the challenge, isolated groups of RCWs do not fare well. For these reasons, groups cannot be scattered across the landscape but must be connected by corridors of habitat and have close-by neighbors with which to interact.

Recent developments at Fort Benning provided an opportunity to test the DSS prior to its release and demonstrate its utility for assessing and minimizing impacts to RCW populations. The recent BRAC process brought several new units to Fort Benning, necessitating major changes to the landscape to accommodate new training needs, including construction of new ranges. With an existing RCW population of more than 300 groups occupying nearly 50,000 acres, locating new training in areas not managed for RCWs was impossible. The DSS proved invaluable in designing an arrangement of new ranges on the landscape that would minimize adverse impacts to the RCW population. Fort Benning relied heavily on the DSS in formulating a plan to accommodate new training while providing for continued recovery of RCWs. The plan was described in a Biological Opinion submitted to the USFWS for consultation under the Endangered Species Act.

Before applying the DSS, the projection was that 25% of Fort Benning's RCW population would have to be sacrificed to meet new training needs, a heavy blow to what had been a highly successful RCW management program. The SERDP research team worked with biologist Dr. Don Imm and managers at Fort Benning, Ms. Alicia Jackson from JCA, Inc., and Dr. Michele Elmore from The Nature Conservancy to address this dilemma. The DSS was applied to various BRAC and "grow the Army" base expansion scenarios, simulating "what if" possibilities such as project "footprint" adjustments, relocations, additions, and removals. These modifications were assessed in concert with existing and approved projects already on the landscape. The possible consequences of declining forest health and the combined effects of forest health and expanded training were assessed by simulating loss of forest stands considered "unhealthy" based on field inventory data. Five health scenarios were developed, ranging from typical mortality patterns to potentially catastrophic forecasts. The DSS was employed to compare and assess the collective impacts of each proposed project plan with the baseline condition, with and without potential forest health concerns. More than 40 scenarios were compared in a stepwise fashion during a two-week period, using projected RCW population size over the next 50 years as the key output. Variability between individual model runs of the same scenario was invaluable in assessing the likelihood of impacts of proposed projects, and GIS-based spatial representations also proved useful in assessing impacts.

Managers were able to use the results of this analysis to alter range configurations in a way that minimized impacts on the RCW population while still enabling range construction and operation. For example, initial runs of the DSS projected the RCW subpopulation in the southeastern part of the installation would become unstable and thus subject to decline following new range construction. A close examination suggested that the initial configuration of the ranges resulted in poor connectivity between this subpopulation and the rest of the RCWs on the installation. When the ranges were realigned to allow for connecting corridors, the southeastern subpopulation was projected to remain stable.

In its initial test, the DSS proved useful to DoD as a planning tool for integrating training and conservation objectives. In return, Fort Benning staff provided valuable feedback that enabled further improvements of the DSS. In a subsequent test, the DSS was used successfully at MCB Camp Lejeune to evaluate habitat for RCWs off installation for possible acquisition. Most recently, the DSS was publicly released, which will enable it to be widely used not only on DoD installations but also across all land management entities in the Southeast that harbor RCWs.

For more information on the DSS and how it might be utilized on your installation, visit www.cmiweb.org/projectpage.aspx?projectid=36 (under the Related Documents and Links section) or contact Dr. Jeff Walters, Virginia Tech, Blacksburg, Virginia, at (540) 231-3847 or jrwalt@vt.edu. ◆

DoD Workshop Advances Strategy for Environmentally Sustainable Energetics

Workshop Held March 24-25, 2009 in Rockaway, New Jersey

Sponsors

SERDP; ESTCP; U.S. Army Research, Development, and Engineering Command (RDECOM); Program Executive Office (PEO) Ammunition; and PEO Missiles and Space

Participants

More than 70 representatives from the acquisition, research, training, and environmental communities of the Office of the Secretary of Defense, U.S. Army, U.S. Navy, and Department of Energy

DoD Need

Energetic materials are used in mission-critical applications across DoD. Environmental, safety, and occupational health (ESOH) laws and regulations have directly impacted training with and the production of energetic materials at U.S. military installations. Examples include the complete shut-down of live-fire training at the Massachusetts Military Reservation because of munitions constituents (perchlorate, RDX, etc.) in groundwater, the inability to use perchlorate-containing simulators at many installations, and cessation of TNT production in the 1980s at Radford Army Ammunition Plant in Virginia. Potential future issues may include the revised National Ambient Air Quality Standard for lead, which may affect the way that soldiers train with small arms, rockets, and missiles through training restrictions.

Objective

The objective of this workshop was to establish a strategy for the development and implementation of new, environmentally sustainable energetic materials for use in DoD weapons systems. This strategy should consider the entire life cycle of weapons systems that contain energetic materials and include contributions from the acquisition, research, training, and environmental communities.

Format

The workshop included presentations from the energetics acquisition community, DoD research organizations working in the area of energetic materials, and the energetics demilitarization and insensitive munitions community. Presenters were asked to provide an overview of the current energetics programs and focus on the known ESOH issues. Participants then broke into smaller working groups to focus on identifying ESOH issues associated with energetic materials in the following areas: explosives and ordnance, rocket and missile propulsion, and ammunition/gun propellants and pyrotechnics.

Results

Workshop participants identified the following as some of the key ESOH issues associated with all phases of the life cycle of energetic materials.

Replacement for RDX. RDX is one of the most powerful energetics available to DoD and is widely used in high explosive formulations, rocket/missile propellants, and gun propellants. RDX is acutely toxic to humans, can be transported in the environment, and is a groundwater contaminant.

Alternatives to lead compounds. Lead compounds are used in primary explosives, rocket propellants, and gun propellants. Exposure to lead is associated with a number of acute and chronic health effects even at very low levels.

Alternatives to perchlorates. Perchlorates are used as oxidizers in rocket/missile propellants and pyrotechnic formulations. Perchlorate is highly mobile in the environment and impacts thyroid activity in humans.

New synthesis routes to TATB. TATB is commonly used in fuses and nuclear weapons because it is more resistant to shock and heat than any other material of comparable energy. The current production process for TATB requires trichlorobenzene (TCB) as a feedstock. TCB is regulated by multiple federal workplace and clean water regulations.

Alternative smoke formulations. Pyrotechnic smoke formulations are used for signaling and obscuration in training and on the battlefield. Some of the current smoke formulations use potentially hazardous fuels and dyes.

Alternative production processes for nitrate esters. Nitrate esters are critical components of rocket, missile, and gun propellant formulations. Nitrate esters themselves are not very toxic to humans, but the production processes used to nitrate the materials produce a number of potentially hazardous waste streams.

Unknown risks of new materials. DoD is developing the next generation of energetic materials and formulations to meet performance, insensitive munitions, and environmental requirements. The ESOH risks of these new materials must be understood fully before they can be implemented in the field as environmentally sustainable energetics.

Outcomes

In collaboration with the acquisition, training, and environmental communities, SERDP and ESTCP can play a key role in addressing the concerns highlighted at this workshop by funding research and development efforts and technology demonstrations. SERDP, in particular, plans to release several Statements of Need in this area over the next few years. ◆

Technical Report and Animation Introduce Geophysical System Verification as a Physics-Based Alternative to GPOs

Short Course Offered at Partners Symposium

ESTCP, in collaboration with the Services, state and federal regulators, and the National Association of Ordnance and Explosive Waste Contractors (NAOC), has designed a new approach as a physics-based alternative to geophysical prove-outs (GPO). 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.

The evaluation and cleanup of current and former military sites contaminated with buried munitions relies on two well-understood geophysical technologies to detect the munitions: magnetometry and electromagnetic induction. As these technologies were introduced in munitions response projects, the geophysical prove-out was developed to determine whether the geophysical data collected would meet project objectives. In the GPO process, one or several geophysical systems under consideration for a project are deployed over an area representative of the project site conditions that has been seeded with inert military munitions or their surrogates. Performance on the GPO is taken as a good predictor of performance throughout the project.

Over the last 15 years, numerous GPOs have been performed on a variety of site conditions, and a significant body of knowledge has accumulated documenting the performance of these technologies. This accumulated understanding, along with the recognition that magnetic and electromagnetic responses of munitions may be predicted reliably using physical models, presents the opportunity to streamline and enhance the GPO with a more rigorous, physics-based approach.

Using the GSV process, the resources traditionally devoted to a GPO are reallocated to support simplified but more rigorous verification that a geophysical system is operating properly and to support ongoing monitoring of production work. The two main elements of GSV are:

- *Instrument Verification Strip.* An instrument verification strip (IVS) containing a handful of targets replaces the traditional GPO, which consists of several tens to a hundred or more targets. The objective of the IVS is to verify that the geophysical survey system is operating properly.
- *Production Blind Seeding Program.* In the blind seeding program, the production site is seeded with targets at surveyed locations that are blind to the data collection and processing teams. The objective is to provide ongoing monitoring of the quality of the geophysical data collection and target selection process as it is performed in the production survey throughout the project.

Similarities exist between the GSV approach and common environmental sampling quality procedures. Using the IVS is comparable to running a known concentration sample for daily instrument checks, and the blind seeds are comparable to blanks and matrix spikes.

In moving resources from an upfront evaluation of geophysical systems to ongoing verification of system performance, the physics-based GSV approach reduces the logistical burden of the current process, allows use of a smaller plot, and results in greater confidence in the performance of the production geophysics and the success of the overall project.

A document and animation presenting the physics basis of GSV, outlining key elements of this approach, and describing its implementation on an example site are available in the SERDP and ESTCP Online Library at http://docs.serdp-estcp.org by searching on the keyword GSV. A short course highlighting the GSV approach will be presented on Tuesday, December 1, at the Partners in Environmental Technology Technical Symposium & Workshop. For more information and to register for this course, visit www.serdp-estcp.org/symposium.

Webcast Now Available on Classification Methods

Distinguishing intact munitions from nonhazardous metal and geology, a process referred to as classification, is critical to the Department of Defense's efforts to cost-effectively remediate munitions-impacted sites. SERDP and ESTCP are pleased to announce the release of a webcast that provides a tutorial on the sensors, methods, and status of the classification of military munitions using geophysical methods at field sites under operational conditions.

The webcast covers advanced processing of data collected with existing commercial instruments, as well as the promising results from emerging optimized systems. Module topics include:

- *Introduction and Objectives*
- *Terminology and Concepts*
- *Magnetics: Fundamentals and Parameter Extraction*
- *Electromagnetics (EM): Fundamentals and Parameter Extraction*
- *Classification Methods for Magnetic and EM Data*
- *Example Classification Results*
- *Future Sensors: System Design and Classification Implications*
- *Final Thoughts: Current Technology Status, Future Research and Demonstration Efforts, Cost, and Implementation*

Instructors are Dr. Thomas Bell (SAIC), Dr. Stephen Billings (Sky Research, Inc.), Dr. Dean Keiswetter (SAIC), and Dr. Herb Nelson (SERDP/ESTCP).

To view the webcast, visit www.estcp.org/links/classification-webcast.cfm.

Partners in Environmental Technology Technical Symposium & Workshop

Meeting DoD's Environmental Challenges

Register Now! Advance Registration Deadline is November 18.

This year's Symposium & Workshop, sponsored by SERDP and ESTCP, will offer a dynamic opening Plenary Session, a comprehensive technical program that includes 11 technical sessions and five short courses, and an Exhibit Hall showcasing innovative environmental research and technology demonstrations through more than 450 poster presentations. A special session describing SERDP and ESTCP funding opportunities also will be offered. Throughout the event, attendees will have many opportunities to network with more than 1,000 environmental professionals from the government, academic, and private sectors.

PLENARY SESSION

The opening Plenary Session will feature three distinguished speakers—Dr. Dorothy Robyn, the Deputy Under Secretary of Defense for Installations and Environment; Lieutenant General Robert Van Antwerp, U.S. Army Chief of Engineers and Commanding General of the U.S. Army Corps of Engineers; and Dr. Peter Kareiva, Chief Scientist for The Nature Conservancy—who will discuss emerging environmental challenges facing DoD. Also as part of the Plenary Session, SERDP and ESTCP Principal Investigators who have helped DoD achieve its mission while improving its environmental performance will be honored as the SERDP and ESTCP Project-of-the-Year Awards are announced.

TECHNICAL SESSIONS

Concurrent technical sessions will cover a variety of scientific and technical subjects.

- Amendments for Contaminated Sediments
- Field Applications of Advanced Diagnostic Tools
- Risk-Based Contaminant Management on Active Training Ranges
- Classification Methods for Military Munitions Response *(Two-Part Session)*
- Ecology and Management of DoD Coastal and Estuarine Ecosystems
- Challenges Associated with Regional Predictions of Climate Change Impacts
- DoD Greenhouse Gas Emissions: Land Use and the Installation Carbon Footprint
- Aircraft Emissions: Future Impacts and Alternative Fuels
- Emerging Contaminants – From Assessment to Action
- Environmentally Sustainable Energetics

SHORT COURSES

Short courses on select technologies and alternative approaches in environmental restoration and munitions management will offer unique training opportunities on recent advancements in science and technology.

- Geophysical System Verification – Alternative to Geophysical Prove-Outs (GPO)
- Visual Sample Plan – Unexploded Ordnance Module
- Long-Term Monitoring Optimization
- Tools for Management of Chlorinated Solvent-Contaminated Sites
- Multi-Increment Sampling (MIS) Applications for Environmental Remediation

Professional Development Hours (PDH) will be available for short course attendance.

PARTNERS IN ENVIRONMENTAL TECHNOLOGY

Marriott Wardman Park Hotel
Washington, D.C.
December 1–3, 2009

For the most up-to-date information on the technical program or to register, visit www.serdp-estcp.org/symposium.

SPOTLIGHT on SERDP and ESTCP FY 2009

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

SERDP and ESTCP initiatives in **Environmental Restoration** (ER) focus on the technologies and strategies required to characterize, clean, and manage contaminated sites, both to ensure that the lands can continue to be used for military training and to protect the health of the people who live and work on and near these sites. In 2009, SERDP initiated research and development efforts to improve understanding of the fate and transport of munitions constituents on operational ranges, the management of large dilute groundwater plumes, the vapor intrusion pathway from chlorinated solvent-contaminated groundwater plumes, and the accuracy of groundwater contamination measurements based on environmental parameters and sampling methods. ESTCP investigators began demonstrating state-of-the-art technologies and approaches for characterizing, remediating, managing, containing, and monitoring contaminants of concern in groundwater, soil, and sediments. Results from these initiatives will help DoD implement efficient and cost-effective approaches to remedy the effects of past practices.

SERDP Research

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

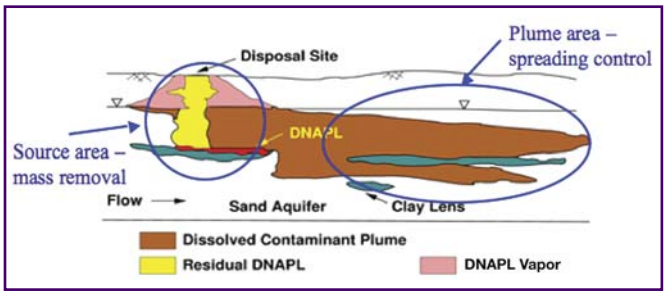
Chlorinated Solvents: Dissolved Phase Characterization and Remediation

Quantifying the Presence and Activity of Aerobic, Vinyl Chloride-Degrading Microorganisms in Dilute Groundwater Plumes by Using Real-Time PCR (ER-1683)
Principal Investigator: Timothy Mattes/The University of Iowa

The objective of this project is to develop and validate real-time polymerase chain reaction (PCR) techniques with the ability to quantify the presence and activity of aerobic vinyl chloride (VC)- and ethene-assimilating bacteria in environmental samples from dilute groundwater plumes. These molecular biology tools will provide direct lines of evidence for natural attenuation of VC and support anaerobic bioremediation technologies that generate VC as a metabolic intermediate.

Semi-Passive Oxidation-Based Approaches for Control of Large, Dilute Groundwater Plumes of Chlorinated Ethylenes (ER-1684)
Principal Investigator: Franklin Schwartz/The Ohio State University

This project will examine the feasibility of employing an advanced-oxidation approach, based on potassium permanganate, for controlling the spread of dissolved chlorinated solvents at low concentrations in groundwater. Because the approach is semi-passive and relies on wells for emplacement, it has great potential for application to contamination in deep aquifers. Researchers also will investigate possibilities of improving efficiency by creating slow release forms in situ using biopolymers containing potassium permanganate.

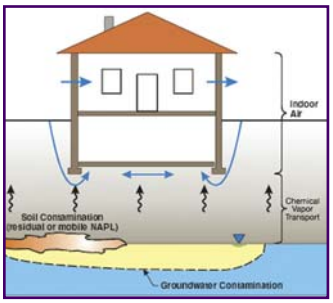


Coupled Diffusion and Reaction Processes in Rock Matrices: Impact on Dilute Groundwater Plumes (ER-1685)
Principal Investigator: Charles Schaefer/Shaw Environmental & Infrastructure, Inc.

The objective of this project is to measure and evaluate the impacts of bedrock structure and mineralogy on the persistence and diffusive flux of trichloroethene (TCE) from rock matrices to groundwater. The impact of oxidation fronts (generated naturally or via in situ chemical oxidation) between the fracture and matrix on these processes will be investigated, and TCE dechlorination kinetics via ferrous iron minerals within the rock also will be assessed. The findings will enhance DoD's ability to predict the long-term rate of dissolved contaminant flux from rock matrices, improving estimates of groundwater plume contaminant concentrations and natural attenuation time frames.

Chlorinated Solvents: Vapor Intrusion Pathway

Integrated Field-Scale, Lab-Scale, and Modeling Studies for Improving the Ability to Assess the Groundwater to Indoor Air Pathway at Chlorinated Solvent-Impacted Groundwater Sites (ER-1686)
Principal Investigator: Paul Johnson/Arizona State University



This project will conduct integrated field-scale, lab-scale, and modeling studies focused on topics critical to the evolution toward more confident and cost-effective guidance for assessing the groundwater to indoor air pathway at chlorinated solvent-impacted groundwater plume sites. At a fundamental level, this research focuses on the processes associated with the emission of chemical vapors from dissolved chemical groundwater plumes, their transport through the subsurface, and their entry to indoor air. Researchers also will examine how vadose zone and indoor sources can confound pathway assessment. At the applied level, this research will improve pathway assessment (i.e., data collection, data interpretation, modeling) and determine ways to identify indoor and outdoor chemical sources that can confound the assessment.

Initiatives in Environmental Restoration

the year. Environmental Restoration efforts are featured here.

Vapor Intrusion from Entrapped NAPL Sources and Groundwater Plumes: Process Understanding and Improved Modeling Tools for Pathway Assessment (ER-1687)

Principal Investigator: Tissa Illangasekare/Colorado School of Mines

The objective of this project is to improve the understanding of the processes and mechanisms controlling vapor generation from entrapped nonaqueous phase liquid (NAPL) sources and groundwater plumes, their subsequent migration through the subsurface, and their attenuation in naturally heterogeneous vadose zones under various natural physical, climatic, and geochemical conditions. Benefits to DoD include improved management guidance for vapor intrusion sites, ultimately leading to the reduction in risk to subsurface structures and homes, and more informed regulatory decision making on contaminant cleanup levels.

Range Characterization and Assessment

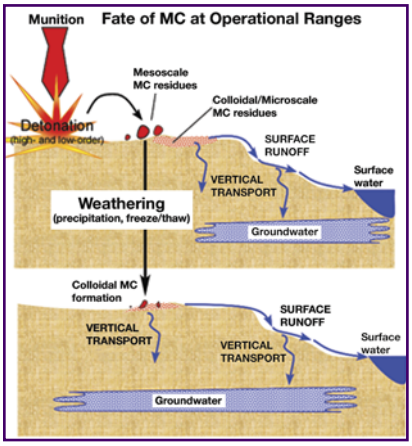
Improving Understanding of the Fate and Transport of Munitions Constituents to Enhance Sustainability of Operational Ranges (ER-1688)

Principal Investigator: Herbert Allen/University of Delaware

This project will develop models supported by appropriate data that can predict the dissolution and release rate of nitroglycerin (NG), 2,4-dinitrotoluene (2,4-DNT), and nitroguanadine (NQ) from nitrocellulose (NC) matrix propellant residue as well as the partitioning of military grade RDX, HMX, TNT, NG, DNT, NQ, and mixtures of these munitions constituents to soils of varying physical and chemical characteristics. The resulting information can be used to develop fate and transport models at contaminated sites for use in risk assessments. Use of scientifically sound risk assessments will help ensure the sustainability of operational ranges.

Fate and Transport of Colloidal Energetic Residues (ER-1689)

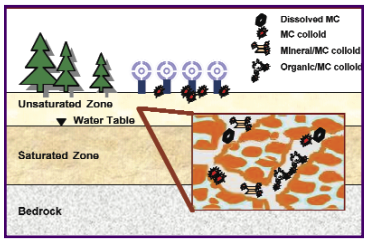
Principal Investigator: Mark Fuller/Shaw Environmental & Infrastructure, Inc.



This project will assess the formation of small-sized munitions constituent (MC) residues during controlled detonations and during weathering of larger residue particles and will measure and model the transport (infiltration and surface runoff) and dissolution of these particles. The results will provide data that allow the mass loading of explosive residues at active training ranges to be more accurately estimated, as the impact of colloidal MC migration and dissolution will be quantified. The modeling effort will enable an improved assessment of the on- and off-range migration of detonation residues into the vadose zone, groundwater, and surface water.

Mobility of Particulate and Dissolved Munitions Constituents in the Vadose Zone at Operational Ranges (ER-1690)

Principal Investigator: Melanie Mayes/Oak Ridge National Laboratory



This project seeks to understand, quantify, and predict the transport of particulate and dissolved MC in realistic vadose-zone conditions. Researchers will determine the potential for preferential transport, which might occur through natural fractures, root traces, and macropores, using laboratory-scale undisturbed soil samples. Transport parameters will be quantified for dissolved- and particle-phase MC under both normal vadose-zone conditions and under stormflow scenarios. These parameters will be applied to site-specific subsurface models of operational ranges to predict the potential for mobility through the vadose zone into underlying aquifers.

Dissolution Rate of Propellant Energetics from Nitrocellulose Matrices (ER-1691)

Principal Investigator: Susan Taylor/U.S. Army Corps of Engineers, Engineer Research and Development Center-Cold Regions Research and Engineering Laboratory

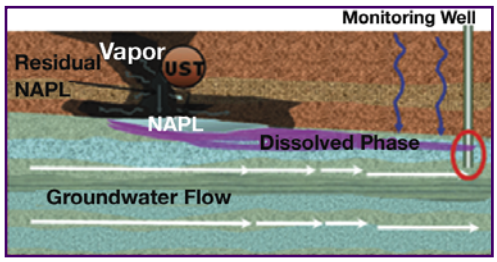
This project will characterize nitrocellulose-based propellant residues that result from firing commonly used military munitions and quantify how quickly 2,4-DNT in single-base propellants, NG in double-base propellants, and NQ in triple-base propellants leach from their NC matrices. Controlled laboratory experiments that mimic field conditions on training ranges where rainfall dissolves spatially isolated propellant residues on the soil surface will be used, and based on this data, a dissolution model for these unique materials will be developed and tested. This research will fill a critical data gap needed to understand the fate and transport of propellant energetics.

Long-Term Monitoring

An Assessment of Aquifer/Well Flow Dynamics: Identification of Parameters Key to Passive Sampling and Application of Downhole Sensor Technologies (ER-1704)

Principal Investigator: Sanford Britt/ProHydro, Inc.

A substantial portion of long-term monitoring costs is associated with groundwater sampling and analysis. The objective of this project is to develop a comprehensive understanding and description of how contaminant concentrations measured in a well using either passive sampling devices or in situ sensors relate to contaminant concentrations in the surrounding formation. Elucidating the relationship between solute concentrations in wells and in the surrounding formation will provide the understanding and documentation necessary to support the efficient and cost-effective application of alternative sampling and monitoring strategies.



See FY 2009 ER INITIATIVES, page 8

Improved Understanding of Sources of Variability in Groundwater Sampling for Long-Term Monitoring Programs (ER-1705)

Principal Investigator: Charles Newell/GSI Environmental, Inc.

This project will identify key sources of variability that influence volatile organic compound (VOC) concentration measurements in water samples collected from groundwater monitoring wells using current sampling and analysis techniques. If sources of monitoring variability can be identified and quantified, this variability then can be controlled either through modified monitoring approaches or improved data analysis techniques. This, in turn, will reduce the amount of monitoring data required to achieve monitoring goals and improve the ability to identify spatial and temporal trends in the monitoring data.

Lab-on-a-Chip Sensor for Monitoring Perchlorate in Groundwater and Surface Water (ER-1706)

Principal Investigator: Donald Cropek/U.S. Army Corps of Engineers, Engineer Research and Development Center-Construction Engineering Research Laboratory

This project will use zwitterionic surfactant chemistry to create a miniaturized sorption zone that selectively and controllably binds and releases perchlorate in the presence of excess common environmental anions such as nitrate and chloride. This novel concentration zone will be embedded onto a microfluidic sensor platform that will test its ability for perchlorate extraction and concentration to provide rapid, sub-part-per-billion analysis of perchlorate in surface water and groundwater samples. Lab-on-a-chip devices offer the potential to integrate all steps of a chemical analysis method into a single inexpensive package that works autonomously.

ESTCP Demonstrations

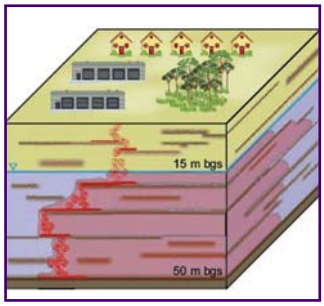
Additional information on these efforts can be found at www.estcp.org under the Technologies *link.*

Chlorinated Solvents: DNAPL Source Zone Remediation

Cooperative Technology Demonstration: Polymer-Enhanced Subsurface Delivery and Distribution of Permanganate (ER-0912)

Principal Investigator: Michelle Crimi/Clarkson University

This project will validate the use of a water-soluble polymer with permanganate for in situ chemical oxidation (ISCO) of organic contaminants. The primary objectives are to improve the sweep efficiency of permanganate through heterogeneous media containing lower permeability media and to control manganese dioxide particles to improve oxidant delivery and flow, thus enhancing contaminant destruction.



Enhanced Amendment Delivery to Low Permeability Zones for Chlorinated Solvent Source Area Bioremediation (ER-0913)

Principal Investigator: Charles Newell/GSI Environmental Inc.

The objective of this project is to demonstrate and validate the use of shear-thinning fluid to enhance the delivery of bioremediation amendments at a DoD site where chlorinated solvents are present. Shear-thinning fluid can create a more stable displacement front than what is created through standard amendment injection, and as a result, the injected shear thinning fluid will have a greater ability to penetrate lower permeability zones and to deliver amendments directly to hard-to-treat areas. This approach has the potential to increase the efficiency of source zone bioremediation in heterogeneous settings.

Range Sustainability

Demonstration of the Attributes of Multi-Increment Sampling and Proper Sample Processing Protocols for the Characterization of Metals on DoD Facilities (ER-0918)

Principal Investigator: Alan Hewitt/U.S. Army Corps of Engineers, Engineer Research and Development Center-Cold Regions Research and Engineering Laboratory

Environmental studies of military training ranges have shown that energetic residues are heterogeneously distributed, and as such, multi-increment sampling methods have been recommended for site characterization. This project will employ a multi-increment sampling technique coupled with adequate sample processing to demonstrate superior data quality and address the data gap that exists with the characterization of metals on training ranges. This technique will be similar to EPA Method 8330B for the characterization of energetic residues.

Modified Biopolymers as an Alternative to Petroleum-Based Polymers for Soil Modification (ER-0920)

Principal Investigator: Steven Larson/U.S. Army Corps of Engineers, Engineer Research and Development Center-Environmental Laboratory

This project will examine the use of a nontraditional soil additive, a biopolymer, as a substitute for petrochemical-based synthetic polymers to produce soils with high strength, reduced erosion, and decreased dust production. The biopolymer offers an additional advantage in that it can be modified to a form that also stabilizes heavy metals in the soil and prevents their transport in leachate and surface water runoff.

Initiatives in Environmental Restoration

the year. Environmental Restoration efforts are featured here.

Sediments: Physicochemical Characterization

Passive Polyethylene Sampling in Support of In Situ Remediation of Contaminated Sediments (ER-0915)

Principal Investigator: Philip Gschwend/Massachusetts Institute of Technology

Hydrophobic organic compounds (HOC) such as polychlorinated biphenyls contaminate sediments at many DoD sites. The objective of this project is to demonstrate that the polyethylene (PE) passive sampling methodology is a commercially viable in situ technology for determining horizontal and vertical distributions of HOCs in sediments and that PE passive sampling is well suited to long-term monitoring programs.

Demonstration of an In Situ Friction-Sound Probe for Mapping Particle Size at Contaminated Sediment Sites (ER-0919)

Principal Investigator: Bart Chadwick/SPAWAR Systems Center Pacific

Potential zones of contamination in sediments and at groundwater-surface water interface (GSI) sites are readily identified by grain-size analysis, and there is a need for a rapid, in situ, cost-effective screening method for grain-size characterization at these sites. This project will demonstrate a sediment friction-sound probe (SED-FSP) that can accomplish this characterization to promote adaptive assessment and management strategies and reduce the time and cost of site characterization.

Risk Assessment and Bioavailability Issues

Validation of an In Vitro Bioaccessibility Test Method for Estimation of Bioavailability of Arsenic from Soil and Sediment (ER-0916)

Principal Investigator: Susan Griffin/U.S. Environmental Protection Agency, Region 8

Animal research has established that the relative oral bioavailability (RBA) of arsenic in soils can vary significantly (5-60%) based on site-specific factors. This project will develop an in vitro bioaccessibility assay for arsenic in soils and sediments and validate it against 41 different arsenic-containing test materials in an attempt to generate formal agency guidance and training on in vitro methods for assessing the RBA of arsenic on a site-specific basis.

Improvement, Verification, and Refinement of Spatially Explicit Exposure Models in Risk Assessment (ER-0917)

Principal Investigator: Mark Johnson/U.S. Army Center for Health Promotion and Preventive Medicine

To estimate exposure and risk to valued receptor species, current environmental risk assessments for wildlife use a simplified method that produces a single, deterministic species-specific estimate of hazard for each substance of concern. Chemical concentrations and wildlife interactions within the environment, however, are heterogeneous so these ecological assessments may not be applicable to all species. The objective of this project is to test and verify risk estimates for terrestrial wildlife and fish using Spatially Explicit Exposure Models (SEEM).

Long-Term Monitoring and Process Optimization

Demonstration of the Gore Module for Passive Groundwater Sampling (ER-0921)

Principal Investigator: Louise Parker/U.S. Army Corps of Engineers, Engineer Research and Development Center-Cold Regions Research and Engineering Laboratory

Long-term groundwater sampling programs, which are required to assess contaminant trends in groundwater and risk to human health, are becoming exceedingly costly. The Gore Module, developed by W. L. Gore & Associates, Inc., can be used to sample a wide variety of volatile and semi-volatile organic compounds. The objective of this project is to demonstrate the utility, sensitivity, comparability, and potential cost savings of passive groundwater sampling using the Gore Module at DoD and DOE sites.

Field Portable GC-MS Unit for Semi-Volatile Compound Analysis in Groundwater (ER-0922)

Principal Investigator: Anthony Bednar/U.S. Army Corps of Engineers, Engineer Research and Development Center-Environmental Laboratory

Traditional methods for monitoring groundwater concentrations of munitions constituents involve sending large amounts of sample from the field to a laboratory for analysis, which is costly and time-consuming. This project will utilize a field-portable Gas Chromatograph-Mass Spectrometer (GC-MS) for analysis of the explosives on site. This methodology can provide near real-time data on concentrations as well as a means of identifying unknown compounds present in the sample.

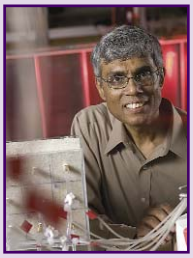
Parallel In Situ Screening of Remediation Strategies for Improved Decision Making, Remedial Design, and Cost Savings (ER-0914)

Principal Investigator: Rolf Halden/Arizona State University

Remediation strategies must be tailored to the hydrogeological and biological conditions at individual sites as well as the types and concentrations of contaminants present. Therefore, there is a need for a technology that can compare different strategies for remediating contaminated aquifers without impacting the integrity of the groundwater monitoring wells. This project will implement parallel screening of in situ remediation strategies in a self-contained device to produce guidance for better decision making, remedial design, and ultimately cost savings to DoD.

Congratulations to…

DoD's Emerging Contaminants Program, which was selected as a finalist for the 2009 Innovations in American Government Awards. Funded by the Ford Foundation, the Innovations in American Government Awards Program identifies and promotes excellence in the public sector and recognizes innovations at the city, county, state, and federal levels of government. The Emerging Contaminants Program promotes proactive, integrated risk management of chemicals used by DoD to facilitate informed risk-based decisions that better protect the environment and serve the Department's mission. SERDP and ESTCP partner with DoD's Emerging Contaminants Program in supporting innovative research and technology demonstrations in this area.



SERDP Principal Investigator **Dr. Tissa Illangasekare** from the Colorado School of Mines, who has been selected to serve as editor of the interdisciplinary *Water Resources Research (WRR)*, a journal focusing on integrating research in the social and natural sciences. WRR contains original contributions in hydrology; in the physical, chemical, and biological sciences; and in social and policy sciences, including economics, systems analysis, sociology, and law. In his new role, spanning a four-year term, Dr. Illangasekare will be responsible for editing subsurface-related papers.

Dr. Robert Norris from Brown and Caldwell, who was awarded the 2009 Lifetime Achievement Award presented at Battelle's Tenth International In Situ and On-Site Bioremediation Symposium. Dr. Norris was honored for his long career as a leader, innovator, and mentor in the fields of bioremediation and environmental chemistry. Dr. Norris, who serves as a SERDP and ESTCP In Situ Chemical Oxidation Project Review Panel member, has more than 20 years of experience with in situ and ex situ remediation and has conducted numerous monitored natural attenuation studies. Along with publishing more than 100 papers on bioremediation and other remedial technologies, four of his thirteen U.S. patents concern in situ bioremediation. His participation on committees for the U.S. EPA, National Academy of Sciences, and the American Academy of Environmental Engineers has led to the publication of six books.

Dr. Robert Norris (center) is joined by prior recipients of the Lifetime Achievement Award. From left, Dr. Richard Brown, Dr. Herb Ward, Mr. Richard Raymond, Sr., and Dr. John Wilson. The other prior recipient, not pictured here, is Dr. Perry McCarty.

Program Update

SERDP

Following the SERDP Technical Committee (STC) meetings in June, recommendations were made to the SERDP Executive Director for the FY 2010 Core and **SE**RDP **E**xploratory **D**evelopment (SEED) efforts. Notifications were completed in July. There were 46 proposals selected from the Core Solicitation and 9 from the SEED Solicitation. In September, the SERDP Council met and approved the FY 2010 Program Plan.

The FY 2011 SERDP Core and SEED Solicitations currently are under development and will be released on or about October 29. Refer to www.serdp.org under the *Funding Opportunities* link for specifics about the solicitations and deadlines.

ESTCP

Following the ESTCP Technical Committee (ETC) meetings in June, 58 full proposals were requested by August 6. These full proposals were further reviewed by the ETCs, and Principal Investigators presented their proposals to the ETCs at meetings held in September. Following these meetings, the ETCs made recommendations for funding to the ESTCP Director.

The FY 2011 ESTCP Solicitation will be released in early January. Refer to www.estcp.org under the *Opportunities* link for specifics about the solicitation process. ◆

MARK YOUR CALENDAR!

The SERDP FY 2011 Core and SEED Solicitations will be released on or about October 29, 2009. Visit www.serdp.org for Statements of Need and instructions for submitting proposals.

Recent Additions to the Online Library

New publications are 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: Biodegradation of Dense Non-Aqueous Phase Liquids (DNAPLs) Through Bioaugmentation of Source Areas - Dover National Test Site, Dover, Delaware (ESTCP ER-0008)
- Cost & Performance Report: Impact of Landfill Closure Designs on Long-Term Natural Attenuation of Chlorinated Hydrocarbons (ESTCP ER-0019)
- Final Report: Field Demonstration and Validation of a Bioavailable Ferric Iron Assay (ESTCP ER-0009)
- Final Report: In Situ Bioremediation of Chlorinated Solvent Source Areas with Enhanced Mass Transfer (ESTCP ER-0218)
- Final Report: Comparative Demonstration of Active and Semi-Passive In Situ Bioremediation Approaches for Perchlorate-Impacted Groundwater (Longhorn Army Ammunition Plant) (ESTCP ER-0219)
- Final Report: Reductions in DNAPL Longevity through Biological Flux Enhancement (ESTCP ER-0438)
- Final Report: Demonstration of an Integrated Compliance Model for Predicting Copper Fate and Effects in DoD Harbors (ESTCP ER-0523)
- Final Report: Direct Fixed-Bed Biological Perchlorate Destruction Demonstration (ESTCP ER-0544)
- Final Report: Abiotic Reductive Dechlorination of Tetrachloroethylene and Trichloroethylene in Anaerobic Environments (SERDP ER-1368)
- Protocol Report: Demonstration and Validation of a Water and Solute Flux Measuring Device (ESTCP ER-0114)

Munitions Management

- Interim Report: Demonstration Report for Discrimination Using the Geonics EM63 in a Cued Interrogation Mode at Fort McClellan, Alabama (ESTCP MM-0504)

  ESTCP Wide Area Assessment Pilot Program
- Cost & Performance Report: Demonstration of LiDAR and Orthophotography for Wide Area Assessment at Pueblo Precision Bombing Range #2 Colorado and Borrego Military Wash Area, California (ESTCP MM-0535)
- Final Report: Demonstration of Helicopter Multi-Sensor Towed Array Detection System (MTADS) Magnetometry Technology at Victorville Precision Bombing Range, California (ESTCP MM-0535)

  ESTCP Classification Pilot Program
- Interim Report: SAIC Analysis of Survey Data Acquired at Camp Sibert (ESTCP MM-0210)

Sustainable Infrastructure

- Final Report: Assessing and Controlling Blast Noise Emission (ESTCP SI-0006)
- Final Report: Maximizing Sampling Efficiency and Minimizing Uncertainty in Presence/Absence Classification of Rare Salamander Populations (SERDP SI-1393)

Weapons Systems and Platforms

- Cost & Performance Report: Development of Ferrium® S53 High-Strength, Corrosion-Resistant Steel (ESTCP WP-0304)
- Cost & Performance Report: Demonstration of Diesel Engine Air Emissions Reduction Technologies (ESTCP WP-0404)
- Final Report: Field Validation of Visual Cleaning Performance Indicator (VCPI) Technology (ESTCP WP-0410)
- Final Report: Characterization of Off-Road Diesel Emissions of Criteria Pollutants (SERDP WP-1336)

PARTNERS IN ENVIRONMENTAL TECHNOLOGY

STRATEGIC ENVIRONMENTAL RESEARCH AND DEVELOPMENT PROGRAM (SERDP)

&

ENVIRONMENTAL SECURITY TECHNOLOGY CERTIFICATION PROGRAM (ESTCP)

INFORMATION BULLETIN

EARLY FALL 2009 NUMBER 39

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DSN 426-2117

The Partners in Environmental Technology Information Bulletin is written and published quarterly by HydroGeoLogic, Inc., under contract N00173-07-2069. All written information contained in the Information Bulletin is public and not copyrighted.

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FOR SERDP AND ESTCP

OCTOBER 2009

October 20-22
SERDP Scientific Advisory Board meeting
Arlington, Virginia

October 27
Weapons Systems and Platforms (WP) IPR meeting

October 29
Federal Call for Proposals and Broad Agency Announcement for SERDP FY 2011 project funding to be released on or about this date

NOVEMBER 2009

November 2-6
Environmental Restoration (ER) IPR meeting

DECEMBER 2009

December 1-3
Partners in Environmental Technology Technical Symposium & Workshop, sponsored by SERDP and ESTCP, Washington, D.C.

RELATED CONFERENCES & EVENTS

October 26-29
OCEANS 2009 MTS/IEEE Biloxi
Biloxi, Mississippi
For more information, visit www.oceans09mtsieeebiloxi.org.

October 26-30
2009 ITRC Fall Meeting
Louisville, Kentucky
For more information, visit www.itrcweb.org.

November 11-13
Greenbuild International Conference and Expo 2009
Phoenix, Arizona
For more information, visit www.greenbuildexpo.org.

November 19-23
SETAC North America 30th Annual Meeting
New Orleans, Louisiana
For more information, visit neworleans.setac.org.

December 14-18
2009 AGU Fall Meeting
San Francisco, California
For more information, visit www.agu.org/meetings/fm09/index.php.

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