In the late 1990s, the analytic ability to detect perchlorate in the environment significantly improved. Since then, perchlorate has been detected in drinking water sources across the country. In the last few years, the perchlorate issue has grown exponentially in terms of its area of impact, the level of public interest, and the projected costs to the Department of Defense (DoD). Perchlorate (ClO$_4^-$) is a component of rocket fuels and munitions that has been used in the United States since the 1940s. The high solubility of perchlorate coupled with its chemical stability in water leads to expansive groundwater plumes. In January 2002, the U.S. Environmental Protection Agency proposed a draft Oral Reference Dose (RfD).

SERDP and ESTCP have adopted a proactive approach in examining perchlorate contamination. Before perchlorate was being reported routinely in the daily press, SERDP and ESTCP initiated a program to develop the cleanup technologies needed to address this new issue. From basic research through field-scale demonstrations, this program sought to develop cost-effective treatment options. This article summarizes recent advances by SERDP and ESTCP projects in developing in situ bioremediation to treat perchlorate-impacted groundwater.

The Vision: In Situ Bioremediation

In FY 2000, SERDP began funding three projects to assess the scientific feasibility and predict the economic feasibility of in situ bioremediation for perchlorate. Basic questions addressed by this research included (1) Is it possible for perchlorate to be biodegraded in situ? (2) Is it possible to quantify the microbial populations that can degrade perchlorate? (3) Can the site conditions, including geochemistry, be elucidated that affect perchlorate degradation? and (4) By combining this data, can a successful pilot demonstration be conducted to remediate perchlorate in situ? The groundbreaking findings of these projects follow. Through their willingness to collaborate, researchers made significant progress toward developing successful in situ bioremediation technologies to treat perchlorate-impacted groundwater.

Researchers from Southern Illinois University investigated the microorganisms that degrade perchlorate under the project In Situ Bioreduction and Removal of Ammonium Perchlorate (CU-1162). More than 30 perchlorate-reducing bacteria, collected from a broad diversity of subsurface environments, were isolated and characterized. The enumeration studies of perchlorate-reducing bacteria demonstrated that microbial perchlorate reduction is ubiquitous in the environment. Since these bacteria are capable of degrading perchlorate and are readily found at many sites, researchers developed a universal probe for rapid detection of perchlorate-reducing bacteria in soil. The probe is able to determine if perchlorate-reducing bacteria found in the soils contain the chlorite dismutase enzyme that is essential for the reduction of perchlorate.
Looking and Listening for Marine Mammals

Each year the Navy invests nearly $8 million on marine mammal research to help ensure compliance with the Marine Mammal Protection Act and the Endangered Species Act. These laws protect marine mammals by prohibiting their unauthorized “taking” in U.S. waters or on the high seas. Despite this significant funding from the Navy, there remain many research gaps on topics such as marine mammal monitoring, physiological research, and predictive modeling. Over the years, SERDP has sought to help fill these knowledge gaps by funding innovative marine mammal research efforts.

To address the need for better marine mammal monitoring, SERDP is funding Dr. John Hildebrand from the University of California, San Diego, Scripps Institution of Oceanography, to develop acoustic techniques for marine mammal population assessment. Dr. Hildebrand’s project, Acoustic and Visual Monitoring for Marine Mammals at the Navy’s Southern California Off-Shore Range (CS-1189), is comparing methods for monitoring marine mammals using four techniques: aerial visual surveys, ship-based visual surveys at SCORE assess marine mammal abundance four to six times per year during varying seasons. Teams of observers record sightings, species identifications, and group sizes. The ship-based surveys also allow the collection of biopsy tissue samples, photo identification, and detailed behavioral information using acoustic recording tags. These data characterize gender and genetic relations between individual mammals as well as a time history for whale migrations and associations.

During ship-based surveys, sonobuoys are used as the primary acoustic tool to detect marine mammal presence. The processed data provide bearing estimates for marine mammal calls, allowing calls from individual mammals to be differentiated. These data can be compared directly to population estimates made from simultaneous visual surveys. Fixed seafloor acoustic recording systems are another tool for studying marine mammal populations, and they provide a continuous year-round survey for marine mammal presence. These recordings yield data on the species for marine mammal calls, their relative abundance, and their seasonality. Presently, algorithms are being developed under this project for automated call recognition to aid in data processing. Using these data, an acoustic census is being conducted based on the number of calls detected from a given species.

As an additional task under this project, researchers have attached acoustic recording tags to blue and fin whales within SCORE during their ship-based surveys. Results reveal that calling and feeding are complementary behaviors, that is, during feeding dives the animals do not produce calls. During a recent tagging expedition, the team of investigators used the research platform FLIP (FLoating Instrument Platform) to conduct a simultaneous visual and acoustic survey for marine mammals within SCORE. FLIP is a 355-foot-long non-propelled research platform owned by the U.S. Navy and operated by the
**Program Development Update**

**SERDP**

Almost all proposals submitted in response to the FY 2004 solicitation that have been recommended for funding have completed their review phase, most recently by the SERDP Scientific Advisory Board (SAB) at its September and October meetings. A few that are in need of revision will be presented at the March 2004 meeting. The SERDP Council met on September 30 to approve the FY 2004 Program and the Thrust investment guidance for FY 2005. SERDP’s Executive Director, Mr. Bradley Smith, is working with his staff to make adjustments to the FY 2004 Program in accordance with the Council’s approval and congressional direction. Principal Investigators (PI) will be notified regarding their funding expected for this coming execution year and should expect to prepare Project Plans and an Execution Plan in the online reporting system, SEMS, as well as to discuss them with their designated SERDP Program Manager during scheduled kickoff conference calls. Projects under contract must negotiate their contracts with a government Contracting Official prior to release of funding. As part of this negotiation, PIs should expect to prepare a subcontracting plan.

With the FY 2004 Program Plan nearly complete, the SERDP staff has been working on the FY 2005 Program build. The FY 2005 Core and SERDP Exploratory Development (SEED) solicitations were released on November 6 and 7, 2003. Check the SERDP web site under the Funding & Opportunities link for information and details regarding the Statements of Need and schedule for submission.

**ESTCP**

The Defense Appropriations Bill approved the FY 2004 ESTCP budget request. ESTCP continues to grow in order to handle the significant number of technologies ready for demonstration, primarily in the UXO arena. ESTCP’s Director, Dr. Jeffrey Marqusee, has worked with his staff to prepare a 2004 Program that recently was approved by Mr. Raymond Dubois, Jr., the Deputy Under Secretary of Defense (I&E). Project Leads will be contacted to submit Project Plans and Obligation/Expenditure Plans, as well as to schedule kickoff conference calls with the appropriate ESTCP Program Manager. These plans must be submitted prior to release of funding.

A solicitation to develop the FY 2005 Program is planned for release early in January 2004. Check the ESTCP web site under the Opportunities link for details and updates on these announcements.

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**MARINE MAMMALS, from page 2**

Marine Physical Laboratory at Scripps Institution of Oceanography. FLIP provides a stable platform for oceanographic research and can accommodate 16 researchers and crew for up to 30 days. Dr. Hildebrand and his team were able to position the FLIP fortuitously within a large feeding aggregation of blue and fin whales and collected more than 2 weeks of dense visual and acoustic census data.

To date, several important results have emerged from this project, which may help make acoustic techniques a powerful new tool for marine mammal population assessment. For instance, blue and fin whales are seen and heard within SCORE primarily during the summer and fall seasons. Interestingly, they are seen in greatest numbers in the late summer, yet their calls are heard in greatest numbers in the fall. One possible explanation is that calling is enhanced during the fall as part of a breeding cycle. Another observed pattern for blue whale calling is a diel cycle in which more calls are produced during the nighttime, especially just after sundown and just before sunrise.

These acoustic population estimation techniques offer the potential for efficient and economical monitoring of marine mammals. These techniques could be used to better understand the impact of naval activities on marine mammal behavior. Research findings will transition for use by Navy and by National Oceanic and Atmospheric Administration personnel as a real-time system for marine mammal detection and classification and as a database of seasonal marine mammal presence within SCORE. Other data obtained through investigations under this project will contribute to a predictive model for marine mammal association with environmental conditions.

For more information about this project, please contact Dr. John Hildebrand, University of California, San Diego, Scripps Institution of Oceanography, La Jolla, CA, at (858) 534-4069 or via e-mail at jhildebrand@ucsd.edu.
To develop a remedial strategy for perchlorate-impacted groundwater, researchers at Envirogen, Inc., (now Shaw Environmental and Infrastructure, Inc.) conducted laboratory studies under the project *In Situ Bioremediation of Perchlorate (CU-1163).* Investigators determined (1) the most effective substrates for stimulating perchlorate reduction by naturally-occurring bacteria; (2) the role of commonly found alternate electron acceptors, such as nitrate, ferric iron, and sulfate on perchlorate reduction; and (3) the impact of co-contaminants and other environmental factors on perchlorate biodegradation. Laboratory studies also revealed that perchlorate-reducing bacteria are widely distributed in groundwater environments with differing geochemistry, and with the addition of the appropriate substrate, these organisms in most cases can be stimulated to degrade perchlorate to below detection limits. A kinetic model that describes the degradation of perchlorate in the presence of competing terminal electron acceptors was developed. This model has been incorporated into an existing reactive transport model and currently is being used as a tool for describing perchlorate transport and degradation at the laboratory and field scale.

Leveraging information obtained in the two SERDP projects described, researchers from GeoSyntec Consultants, Inc., completed a field pilot test that demonstrated in situ bioremediation of perchlorate using an active groundwater capture, amendment, and recharge approach under the project *In Situ Bioremediation of Perchlorate-Impacted Groundwater (CU-1164).* Perchlorate-impacted groundwater was extracted via two wells and combined with approximately three times the amount of electron donor (e.g., ethanol or acetate) that is required to reduce the oxygen, nitrate, and perchlorate. The extracted water was then re-injected into the ground daily to the same depth interval of the aquifer. Perchlorate concentrations declined quickly from the steady state influent of 8 mg/L to less than the practical quantitation limit of 0.004 mg/L within several weeks of electron donor addition. This value, corresponding to 4 parts per billion, is within the maximum contaminant level range that now is being considered by the state of California. Using this innovative technique, a biobarrier was formed across the plume that not only reduced concentrations but also prevented further migration of the perchlorate plume.

### In Situ Bioremediation Put to the Test

Although these combined SERDP efforts answered many of the basic research and development questions about in situ bioremediation of perchlorate, a larger scale demonstration and validation approach was needed to test the viability of the approach. Information and technologies developed under SERDP have transitioned to ESTCP for evaluation under varying field conditions. In FY 2002, ESTCP began funding three projects that have different approaches for implementing in situ bioremediation. As with the SERDP projects, there is a strong emphasis on collaboration to minimize duplication of effort and to maximize progress in preparing in situ bioremediation of perchlorate for full-scale implementation at impacted field sites. Brief descriptions of these recently initiated projects follow.

Building on their earlier field pilot test completed with SERDP funding, researchers from GeoSyntec Consultants, Inc., under the project *Comparative Demonstration of Active and Semi-Passive In Situ Bioremediation Approaches for Perchlorate-Impacted Groundwater (CU-0219),* are generating design and cost information required to implement in situ bioremediation at perchlorate-impacted sites. The different electron donor delivery methodologies being evaluated include (1) an active in situ biobarrier in which groundwater is captured and amended with an optimized concentration of a soluble electron donor such as food-grade acetate (e.g., vinegar) or sugars and (2) a semi-passive approach involving rapid batch injection of soluble electron donors via injection wells installed across a section of the perchlorate plume.

Under the project *Edible Oil Barriers for Treatment of Chlorinated Solvent- and Perchlorate-Contaminated Groundwater (CU-0221),* researchers from Solutions Industrial & Environmental Services, Inc., are continuing research initiated by SERDP through the development and installation of a pilot-scale edible oil permeable reactive barrier at two DoD locations to control the migration of a chlorinated solvent plume and a perchlorate plume. As these dissolved groundwater contaminants migrate through the barrier, the contaminants are removed or degraded, and uncontaminated water emerges downstream from the barrier. Biodegradation of contaminants entering the barrier will be enhanced by the slow dissolution of the trapped residual oil phase.

Building on laboratory studies conducted under SERDP, researchers from Shaw Environmental and Infrastructure, Inc., under the project *In Situ Bioremediation of Perchlorate in Groundwater (CU-0224),* are demonstrating and validating the combined use of two innovative technologies: (1) bioremediation of perchlorate-impacted groundwater through electron donor addition and (2) horizontal flow treatment wells (HFTW) to achieve in situ mixing of the electron donor with the perchlorate-contaminated water. The HFTW system employs dual-screened treatment wells that are placed in pairs to create a recirculation cell within a contaminated aquifer. The electron donor will be mixed with groundwater passing through each well to promote perchlorate biodegradation within the recirculation zone.

Not limiting its investments to in situ bioremediation, ESTCP has also begun exploring abiotic approaches to treat perchlorate. Under the project *Perchlorate Removal, Destruction, and Field Monitoring Demonstration (CU-0312),* researchers from the Air Force Center for Environmental
TECHNOLOGY TRANSFER
Access to SERDP and ESTCP Project Information Simplified via Online Library

Are you interested in learning more about research conducted under SERDP or technologies demonstrated under ESTCP? Do you want to find out more about projects addressing a particular environmental requirement? If so, SERDP and ESTCP technical project information is now readily available via an online library. We invite you to explore the new Technical Document Online Library and search page that is available through the SERDP or ESTCP web sites or at the following web address: http://docs.serdp-estcp.org.

Within the online library, search capabilities facilitate the retrieval of information. Using key words, you can access information as broad as all SERDP and ESTCP project documents or as fine-tuned as a few highly relevant documents. Users can also search the library by selecting a Thrust (e.g., Pollution Prevention) and Sub-Thrust (e.g., Green Energetics). This ever-growing library of SERDP and ESTCP project information currently contains more than 700 documents, including Final Reports for completed projects, Fact Sheets for ongoing and completed projects, and other associated works produced for SERDP and ESTCP. The documents are available as PDF files, and the web sites provide a free download of the Acrobat software required to open the files.

In addition to accessing information via the online library, interested individuals are welcome to contact Principal Investigators directly to discuss results and obtain additional information.

PERCHLORATE, from page 4

Excellence are working to demonstrate a perchlorate-selective ion exchange resin and ferrate ion displacement regeneration technique.

To expand its portfolio of in situ bioremediation technologies, ESTCP has selected three additional projects that are expected to begin receiving funds in FY 2004. Under the project Permeable Mulch Biowall for Enhanced Bioremediation of Perchlorate in Groundwater at a DoD Facility (CU-0427), researchers from Parsons Corporation will evaluate the efficiency and design criteria of a permeable mulch biowall to degrade perchlorate in groundwater. Researchers from Solutions Industrial & Environmental Services, Inc., under the project Evaluation of Potential for Monitored Natural Attenuation of Perchlorate in Groundwater (CU-0428), will identify sites where monitored natural attenuation (MNA) may be appropriate for management of perchlorate releases and will demonstrate to regulatory agencies its effectiveness. Under the project In Situ Bioremediation of Perchlorate in Vadose Zone Source Areas (CU-0435), researchers from the Naval Surface Warfare Center-Indian Head Division will demonstrate the ability to treat perchlorate in vadose zone source areas via in situ bioremediation.

In Situ Remediation Positions DoD to Address Future Requirements

With perchlorate about to become a regulated compound, SERDP and ESTCP’s proactive approach means the military is ready with a suite of remediation technologies to address this future requirement. Researchers collaboratively have identified the factors controlling the efficiency with which microorganisms degrade perchlorate. Demonstrations of in situ remediation in the field are anticipated to show significant cost savings over the use of long-term pump-and-treat systems. Given the number of large perchlorate-impacted DoD and related contractor sites that may require groundwater remediation in the coming years, in situ remediation could represent cost savings on the order of several hundred million dollars to DoD.

For additional information on the projects described in this article, please visit SERDP and ESTCP’s recently launched online library (see related article above). Questions may also be directed to Dr. Andrea Leeson, the SERDP and ESTCP Cleanup Program Manager, at (703) 696-2118 or via e-mail at Andrea.Leeson@osd.mil.

Additional Funding Available for Future Efforts

In furthering SERDP and ESTCP’s proactive approach, SERDP has released six FY 2005 Statements of Need (SON) that call for research and applied studies to address perchlorate. Three of the SONs are in the Compliance Thrust, two are in Cleanup, and one is in Pollution Prevention. Individuals with innovative approaches to address these needs are encouraged to submit proposals.

Guidance for submitting proposals and further information on all FY 2005 SERDP SONs is available at http://www.serdp.org/funding/funding.html.
SERDP and ESTCP Promote Collaboration Through DNAPL Source Zone Initiative

Chlorinated solvents are by far the most prevalent contaminants at DoD facilities. A recent estimate indicates that DoD owns more than 3,000 sites contaminated with chlorinated solvents in the United States alone. Many sites have chlorinated solvents as dense non-aqueous phase liquids (DNAPL) in the subsurface that serve as long-term sources of dissolved-phase contamination. Because complete cleanup of these sites historically has been considered technically impracticable, the typical response has been containment. New technologies designed to remove subsurface sources of contaminants, particularly DNAPLs, have received tremendous interest. Examples include thermal treatment, chemical oxidation, bioremediation, and enhanced physical removal (e.g., using cosolvents or surfactants). Under appropriate conditions, these technologies can remove a large fraction of the total mass. However, there is uncertainty regarding the benefits of using such technologies. Key questions for site managers include (1) Are the costs for source removal technologies justified in terms of reduced need for or duration of active containment? (2) How much source removal is required to cease active containment at a given site and to ensure protection of human health and the environment? and (3) How much contaminant migration can occur outside the treatment zone?

To address this need, SERDP and ESTCP are funding a number of DNAPL source zone characterization and remediation projects. Anticipated results include an increased fundamental understanding of the long-term impact of DNAPL source zone removal technologies, performance assessment tools, technical guidance on the selection and use of these technologies, and economic and performance models that define the site conditions and specific objectives for which source zone treatment would be effective.

To encourage a high level of cooperation and coordination between Principal Investigators working on these efforts, SERDP and ESTCP formed an independent DNAPL Source Zone Technical Review Panel composed of one Chair and four members, all renowned experts in the field who meet twice each year. Ten projects, including four SERDP and six ESTCP, currently are under the review of the Panel. Project-specific information can be found at http://www.serdp-estcp.org/DNAPL.cfm, a site devoted to the DNAPL Source Zone Initiative. Beginning in January 2004, Annual Summary Reports on the progress of the projects under the Panel’s review will be posted on the DNAPL Source Zone Initiative site. Final Reports for most of these projects will be available in mid to late 2005.

For additional information related to investments in this area, please contact Dr. Andrea Leeson, the SERDP and ESTCP Cleanup Program Manager, at (703) 696-2118 or via e-mail at Andrea.Leeson@osd.mil.

Initial Demonstrations of Flux Measuring Device Produce Promising Results

Subsurface contaminant mass flow and flux measurements are needed to address issues pertinent to source strength assessments and aquifer and groundwater remediation. The University of Florida has developed a passive flux meter as a monitoring technology that provides simultaneous, direct, and in situ point measurements of cumulative or time-averaged contaminant mass flux and water flux. The flux meter is a self-contained permeable unit that passively intercepts groundwater flow but does not retain it. The technology currently is being demonstrated and validated for several contaminants at five sites through the ESTCP-funded project Demonstration and Validation of a Water and Solute Flux Measuring Device (CU-0114).

Demonstrations have been completed at the Groundwater Research Facility, Base Borden, Ontario, Canada; Launch Complex (LC)-34, Cape Canaveral, Florida; and Operable Unit (OU)-2, Hill Air Force Base, Utah. Results from Base Borden show that the flux meter produced accurate field measurements of groundwater fluxes within 10% of the true aquifer mass flow induced in controlled flow systems. The flux meter also was used to measure local trichloroethylene (TCE), tetrachloroethylene (PCE), and methyl tert-butyl ether (MTBE) mass fluxes in the same control systems, yielding contaminant mass flows that reflected 70 to 95% of the true mass flow. The demonstration at the OU-2 site compared TCE fluxes from a modified integral pump test that showed TCE mass flow reductions ranging from 67 to 75% to a transect of the flux meters that estimated 90% reduction. Finally, at the LC-34 site, the flux meter was used to characterize the effectiveness of enhanced bioremediation. Results revealed a significant decrease in TCE fluxes with a corresponding increase in fluxes associated with dichloroethene (DCE) and vinyl chloride. Demonstrations also will be initiated in 2004 at the Naval Base Ventura County, Port Hueneme, California, and the Naval Surface Warfare Center, Indian Head, Maryland, to study MTBE and perchlorate, respectively.

Results to date have shown that the flux meter can yield accurate local measures of both water and contaminant flows and that measured water fluxes may be spatially integrated to yield excellent mass discharge estimates. By monitoring cumulative flux with a flux meter rather than measuring contaminant concentrations, decisions regarding remedial efforts can be made based on reducing risk. These results indicate that a passive flux meter can be used to cost effectively assess the performance of remedial activities.

The Cost and Performance Report and the Final Report for this project are estimated to be complete in January 2005. For further information on this ongoing ESTCP project, please contact Dr. Kirk Hatfield, University of Florida, at (352) 392-9537, ext. 1441 or via e-mail at khatf@ce.ufl.edu.

SERDP Research Projects Characterize Energetic Materials in the Environment

The types of energetic contaminants, the extent of their distribution, and their concentrations in soils vary widely for different types of military ranges. For example, sampling of hand grenade ranges reveals RDX and trinitrotoluene (TNT) in soil at low part per million (ppm) concentrations, distributed homogeneously. At artillery ranges, RDX and TNT are detected in surface soils in the low part per billion (ppb) range and are distributed more heterogeneously. At antitank ranges, HMX was detected in soil at up to thousands of ppm, with concentrations declining with distance from the targets.

Some are of the preliminary findings from a number of SERDP-funded research projects on the extent and fate and transport of energetic compounds such as TNT, HMX, and RDX on military testing and training ranges. SERDP-funded projects are measuring the residues in soils from weapons firing and ordnance explosions to assess their environmental impact. In addition, innovative sampling techniques are being explored to determine the distribution and concentration of these compounds on training ranges. Environmental samples are collected where weapons functioned properly and where the munitions only partially detonated and left explosive compounds in the ground. Air emissions from both the firing and detonation points are being measured. Firing point emissions are different from those at the detonation point because the formulation of propellants used to fire weapons is different from the formulation of explosives in the shells.

See NOTEWORTHY EFFORTS, page 7
AS A REMINDER TO SERDP PRINCIPAL INVESTIGATORS, ANNUAL TECHNICAL REPORTS ARE DUE December 1, 2003. These reports provide a summary of the project’s activities, results, and accomplishments. Appendices include technical publications produced under the project. Guidance on preparing and submitting these reports can be found within the Reporting Requirements link after logging in to the online reporting system, SEMS.

THE SOLICITATIONS FOR THE SERDP FY 2005 CORE AND SEED PROGRAMS were released on November 6 and 7. Visit the SERDP web site (www.serdp.org under the Funding & Opportunities link) for specifics about the solicitations and the schedules.

QUARTERLY PROGRESS REPORTS (i.e., the quarter’s technical accomplishments, updated completion dates for milestones, and any concerns regarding technical/financial progress) for the first quarter of Government FY 2004 are due January 15, 2004. For assistance, contact your Program Manager Assistant.

A FEDERAL CALL FOR PROPOSALS AND A BROAD AGENCY ANNOUNCEMENT FOR ESTCP FY 2005 PROJECT FUNDING are expected to be released on or about January 8, 2004. Watch the ESTCP web site (www.estcp.org under the Opportunities link) for specifics about the solicitation and schedules.

SERDP FY 2005 CORE AND SEED PROGRAMS

CP-1226: UXO Corrosion—Potential Contamination Source
http://www.serdp.org/research/CP/CP-1226.pdf

CP-1227: Measurement and Modeling of Energetic Material Mass Transfer to Pore Water
http://www.serdp.org/research/CP/CP-1227.pdf

CP-1194: Characterization of Scrap Materials for Mass Detonating Energetic Materials
http://www.serdp.org/research/CP/CP-1194.pdf

CP-1196: Removal, Degradation, and Recovery of Energetic Residues from Range Scrap

NEW PUBLICATIONS NOW AVAILABLE ON THE ESTCP HOME PAGE (www.estcp.org under the Documents link)

Final Report:
Cleanup
- Evaluation of Performance and Costs Associated with Anaerobic Dechlorination Techniques (CU-0125)

Cost and Performance Reports:
Compliance
- The Use of Wetting Agents/Fume Suppressants for Minimizing the Atmospheric Emissions from Hard Chromium Electroplating Baths (CP-0003)

UXO
- Matched Filter Processor for Detection and Discrimination of Unexploded Ordnance (UX-9918)

NOTEWORTHY EFFORTS, from page 6

For additional information about the SERDP-funded research projects currently in progress that address Energetic Materials in the Environment, please visit the following web sites:

CP-1155: Distribution and Fate of Energetics on DoD Test and Training Ranges
http://www.serdp.org/research/CP/CP-1155.pdf

CP-1159: A Predictive Capability for the Source Terms of Residual Energetic Materials from Burning and/or Detonation Activities
http://www.serdp.org/research/CP/CP-1159.pdf

CP-1226: UXO Corrosion—Potential Contamination Source
http://www.serdp.org/research/CP/CP-1226.pdf

CP-1227: Measurement and Modeling of Energetic Material Mass Transfer to Pore Water
http://www.serdp.org/research/CP/CP-1227.pdf

CP-1194: Characterization of Scrap Materials for Mass Detonating Energetic Materials
http://www.serdp.org/research/CP/CP-1194.pdf

CP-1196: Removal, Degradation, and Recovery of Energetic Residues from Range Scrap
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| December 2-4 | **February 3** Full proposals requested from qualified proposers responding to the SERDP FY 2005 Core Solicitation Broad Agency Announcement (BAA)  
**February 5** Proposals due in response to the SERDP FY 2005 SERDP Exploratory Development (SEED) Solicitation | **January 8** Non-federal pre-proposals due in response to the SERDP FY 2005 Core Solicitation  
**January 8** A federal Call for Proposals and a Broad Agency Announcement (BAA) for ESTCP FY 2005 Project Funding to be released on or about this date  
**January 15** SERDP quarterly progress reports due for the first quarter of Government FY 2004  
**January 15** ESTCP quarterly reports due for the first quarter of Government FY 2004 |
|                |               | **January 5-8, 2004** Sustainable Range Management Conference New Orleans, Louisiana  
For more information, visit www.battelle.org/rangecon.  
**March 9-12, 2004** The UXO/Countermine Forum—10th Anniversary St. Louis, Missouri  
For more information, visit www.TheForum2004.com or call (865) 379-7065. |

**RELATED CONFERENCES & EVENTS**

**December 8-11, 2003**  
14th Annual International Workshop on Alternatives to Toxic Materials in Industrial Processes Scottsdale, Arizona  
For more information, visit http://www.exchangemonitor.com/workshop_dec.pdf.