

# Environmental Restoration

*The Environmental Science Division (EVS) assists government agencies in specialized approaches to their compliance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA); the Resource Conservation and Recovery Act (RCRA); and other environmental restoration programs, such as long-term monitoring and environmental stewardship.*

## PROBLEM/OPPORTUNITY

A legacy of federally funded activities from the Cold War era has been an inventory of wastes and contaminated facilities, soil, and groundwater. The clean up of these hazardous wastes and restoration of the contaminated environmental media have been a federal priority for over two decades. The magnitude and potential costs of the effort provide ample opportunities for technical innovation and improved processes.

In spite of 20 years of federal activity to clean up contaminated sites in the United States, significant challenges persist:

- Easy fixes are complete, and tough issues await;
- Remedy performance has been uneven, and many remedies appear costly; and
- Foundational science and technology understanding are inadequate.

## APPROACH

EVS technical roles are appropriate to current challenges and focus on:

- Strategies to enhance the technical basis for cleanup decision making,
- Development and introduction of new tools, and
- Piloting concepts and remedies.

A partial listing of innovative EVS approaches and related capabilities follows.

EVS developed the RESRAD methodology for assessing human health risk from environmental contamination. This family of computer codes, used to develop risk-based cleanup standards, has been applied to over 300 sites in the United States and other countries.

The companion RESRAD-ECORISK computer code developed by EVS estimates contaminant doses to wildlife based on environmental fate and transport models and food-web uptake models.

The Adaptive Sampling and Analysis Program (ASAP), a real-time data collection and decision support tool



developed by EVS, can dramatically reduce site characterization costs.

As an extension of the work in developing the ASAP, EVS has been a major technical supporter of the Triad approach being promoted by the U.S. Environmental Protection Agency (EPA). Triad integrates systematic planning, dynamic work plans, and real-time measurement technologies to achieve more cost-effective waste site cleanup strategies.

EVS has provided technical support to precision excavation techniques, which use innovative field radiation measurements, global positioning system technology, and advanced analysis procedures to modify traditional excavation strategies for removal of contaminated soils.

EVS has provided training in use of the Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM), which provides guidance on planning, conducting, evaluating, and documenting radiological surveys for demonstrating compliance with dose- or risk-based regulations or standards.

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As possible alternatives to pump-and-treat technologies, EVS is implementing and evaluating the efficacy of natural attenuation and phytoremediation to clean up groundwater contaminated with chlorinated and non-chlorinated organic pollutants.

EVS has supported the emergence of stewardship as an appropriate shift in the federal view from the short-term cleanup perspective of the past decade to a focus on the long-term performance of remedies and the effects of residual contamination at cleanup sites decades from now.

## RESULTS

EVS efforts related to environmental remediation have resulted in Division staff being recruited to provide input to National Academy of Sciences studies, including providing technical support to National Research Council task committees on long-term stewardship, adaptive site management, and non-stockpile chemical material disposal.

EVS work in cone penetrometer testing has resulted in an international course and patents. EVS's Expedited Site Characterization is the basis for an ASTM standard. EVS staff received an EPA bronze medal for their contributions to the Triad partnership.

Recent site restoration activities include:

- FUSRAP (Formerly Utilized Sites Remedial Action Program). Technological areas that EVS has brought to U.S. Army Corps of Engineers cleanup teams include human and ecological risk assessments, adaptive sampling and analysis methods, precision excavation techniques, and Internet-based data management tools.
- Aberdeen and Yuma Proving Grounds have had EVS focus on sites as diverse as the White Phosphorous Pit (Aberdeen) and the Fuel Bladder Spill Site (Yuma). EVS studies have led to creative characterizations and problem definition as well as pilot demonstrations of new remedial technologies.
- At the U.S. Navy's China Lake range, EVS employed the unique remote sensing assets of DOE's Remote Sensing Laboratory together with its own characterization approaches to investigate the risks posed by depleted uranium from munitions testing and training. The integration of Argonne's risk assessment group and sampling experts led to an efficient and cost-effective assessment of a large range area.
- EVS continues to support the U.S. Department of Agriculture's program to address carbon tetrachloride contamination of former grain storage areas throughout the Midwest. EVS's use of cone penetrometer technology has expedited the characterization of contaminated groundwater and

been a critical ingredient in the establishment of effective remedies. A recent remedy in Murdock, NE, combined spray irrigation, phytoremediation, and engineered wetlands to provide an effective means of meeting surface water compliance requirements while reusing contaminated shallow groundwater.

## FUTURE

EVS will continue applying its broad experience with remediation or clean up of legacy waste sites for several federal agencies under CERCLA and RCRA requirements.

Future directions will entail building on EVS competencies in the changing federal cleanup arena. Efforts will involve (1) refocusing on DOE sites with long-term, persistent problems, such as Hanford and Paducah; (2) meeting increasing monitoring and long-term stewardship needs, particularly via adaptive monitoring (joint University of Illinois at Urbana Champaign [UIUC] Argonne Environmental Management Science Program [EMSP] study) and new sensors and data systems; and (3) increasing connections with remediation science studies such as the Strategic Environmental Research and Development Program and the DOE Office of Biological & Environmental Research, Environmental Remediation Sciences Program.