

# UNDERGROUND TACTICS

## Protecting Human Health and the Environment

The U.S. Army deploys a high-tech arsenal of hardware and strategies on its installations as it confronts contaminants released in the past. While the surface appears undisturbed, the work of cleanup takes place deep underground. A number of tactics could be selected as the Army contends with a typical solvent site.

### LAND USE CONTROLS

When active remediation is not the full solution, land use controls, such as fencing and signage, can work to limit the use and access to properties with residual contamination. Land use controls are often used when it is technically impractical to clean up the groundwater.

### AIR SPARGING

Sprinkling (sparging) or injecting air below the water table. Volatile chemicals enter the bubbles and an extraction system vacuums and filters the resulting vapor.

### PUMP-AND-TREAT

Extracting water from the ground, cleaning it and reinjecting it into the aquifer. Used most often to prevent a substance from moving further downstream or removing a contaminant that has settled in the aquifer.

### THE MILITARY CLEANUP PROGRAM

The Defense Environmental Restoration Program addresses cleanup at military installations and formerly used defense sites.

- The Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) authorizes federal response to releases or threatened releases of hazardous substances. It includes the National Contingency Plan, with response guidelines and procedures, and the National Priorities List of known or threatened releases.
- The corrective action provisions of the Resource Conservation and Recovery Act (RCRA) require federal agencies to address releases of solid waste in an environmentally sound manner.

### PERMEABLE REACTIVE BARRIER

A substance, generally iron filings, poured into a deep trench. The chemicals are trapped or made harmless as water carries the plume through the barrier.

### NATURAL ATTENUATION

Natural processes break down pollution in soil and groundwater. Environmental professionals closely monitor natural attenuation.

### IN SITU (IN PLACE) BIOREMEDIATION

Using natural organisms to consume organic contaminants. Injected nutrients, oxidizers or nitrates such as molasses or cheese whey may speed the process.

Solvent, spilled decades ago as the result of now abandoned practices, expands in the shape of a feather, or plume, as it moves through the earth.

A monitoring well helps scientists determine the scope of contamination and progress toward cleanup.

Air Injection  
Air Extraction

Air Extraction

Nutrient Injection

Drawing contaminated water from aquifer

Returning cleaned water

### MAJOR CATEGORIES OF ENVIRONMENTAL CONTAMINATION AND THE ARMY'S RESPONSE

Federal regulations require agencies to engage many substances when concentrations reach a specific level. These chemicals are suspected or known to harm humans, plants and wildlife.

TYPE	LIKELY SOURCE	POSSIBLE APPROACHES
Chlorinated Solvents <i>Trichloroethylene, PCE</i>	Manufacturing plants, power plants, dry-cleaning operations	<i>In-situ</i> sparging or remediation, land use controls, source removal
Explosives components <i>Perchlorate, RDX, TNT</i>	Weapons manufacturing, storage, use	Composting, other bioremediation, pump-and-treat, land use controls, source removal
Metals <i>Lead, arsenic</i>	Manufacturing operations, laboratories	Phytoremediation, pump-and-treat, land use controls, source removal
Petroleum products <i>Fuel, oil, petroleum distillates</i>	Motor pools, roadways, vehicle and machine maintenance	Source removal of soil, bioremediation, venting, monitored natural attenuation, land use controls, source removal

For more information, visit <http://aec.army.mil/usaec/cleanup/index.html>.

### CLEANUP PROCESS

CERCLA and RCRA require federal agencies to take specific steps.

RCRA steps	CERCLA steps			
Facility Assessment	Remedial Investigation/ Feasibility Study	Proposed Remedial Action Plan/ Record of Decision	Remedial Design, Remedial Action and Operation and Maintenance	Closeout
Facility Investigation	Corrective Measures Studies	Corrective Measure Implementation	Closeout	
Determining the threat and hazardous substances present, and whether the site should be placed on the National Priorities List.	Determining the nature and extent of contamination, technical practicality of taking action, possible actions to take and risks involved. A risk assessment is made.	Selecting and committing to a long-term plan in a document.	Designing, building, and operating based on the plan.	Requiring no further action other than long-term monitoring. Propose deletion from the National Priorities List.

Public involvement takes place throughout the process through Restoration Advisory boards, public meetings and comment periods, and fact sheet distribution.