photos by Jonas N. Jordan

Wes Smith, technical manager for the remediation project at Hunter AAF, views Six-Phase Heating system, which uses electrodes (inset) to heat soil and groundwater to the boiling point, the steam stripping away contaminants.

Electricity used to remove contaminants from soil, groundwater

by Verdelle Lambert

Ten years ago it would have been impossible to remove contaminants from an area between an active runway and a taxiway without significantly impacting the use of both. But last April, the Savannah District and Fort Stewart team used an innovative technology called Six-Phase Heating™ (SPH) to remove petroleum contaminants from the soil *and* groundwater on a project site that lay between the runway and one of the taxiways at Hunter Army Airfield without interrupting the use of either.

From about 1953 to the early 1970s, the project site was an aviation gas fuel island (pumphouse #2) that consisted of ten 25,000-gallon underground storage tanks (USTs). Prior to the district removing eight of the USTs in 1995, the pumphouse had been inactive for almost 20 years. The two remaining USTs and the pumphouse were removed by the customer, Fort Stewart/ Hunter AAF Directorate of Public Works, in 1998. It's not known how long the site had been contaminated and whether from spills, pipeline leaks, or both.

"This project has been going on for a long time," said Ana Vergara, project manager. "Under the state's underground storage-tank program, installations are obligated to clean up these sites. But remediation projects are not like construction projects, with a construction start date and a completion date one or two years later. This type of project takes years, and you go through several phases: from investigation to planning, to recommendation (where the methododology is decided), to remedial action, which is the final phase. The length of remediation projects also depends on whether funding is available or not."

The investigation phase identified benzene and indeno (1,2,3-cd) pyrene in the soil and BTEX (benzene, toluene, ethylbenzene, and xylenes) as well as PAH (polyaromatic hydrocarbons) in the groundwater. According to the findings, nearly 1,236 gallons of free product were floating on the groundwater table at the project site, which covers about four acres.

The Corrective Action Plan (CAP), developed under the recommendation phase, evaluated several clean-up methods and recommended Six-Phase Heating. The state regulators— Georgia Environmental Protection Division— concurred with the recommendation.

"This particular technology was recommended *because of the site*," said Vergara. "Removing the soil would have been difficult, with trucks having to go back and forth across the taxiway and runway.

"What is unique about this system," Vergara continued, "is that it addresses dissolved as well as free product contamination, and soil as well as groundwater contamination— *all at the same time.* Most of the other technologies out there cannot do this." While more costly initially, there is significant payback with SPH, according to Vergara, because cleanup can be accomplished in a much shorter period compared to passive methods like oxygen injection, bacterial injection, or natural attenuation, which can take years.

SPH uses low-frequency electricity *in situ* to heat soil and groundwater. A series of six electrodes is arranged in a circle, with a seventh electrode (which is also a soil vapor extraction well) in the center. Electricity is applied to the six electrodes, heating the groundwater and soil up to the boiling point of water. The steam strips volatile and semi-volatile contaminants from soil particles.

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Patti Stoll (center), project manager, Science Applications International Corporation (SAIC), discusses operation of the remediation system with (l-r) Ana Vergara, project manager, Savannah District; and William Logan and Ron Wallace, Georgia Environmental Protection Division.

Contaminants

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"The steam is drawn out of the center electrode," explained Wes Smith, geologist and technical manager for the project. "The steam condenses, is passed through an oil-water separator to remove any free product, and then goes into a holding tank; from there it is pumped through an air stripper to remove any volatile contaminants; finally, the cleaned water is re-injected into the ground."

Smith said that the electrodes don't have to heat up to the same temperature, and the temperature doesn't have to reach the boiling point (212 F/100C) for SPH to be effective, although, ideally, that's the goal. A computer is used to track the temperature of each electrode, and thermocouples in several of the wells monitored the temperature of the groundwater and soil.

"We did a chemical analysis of the vapors coming out," said Smith. "We also collected groundwater samples from a series of groundwater wells and analyzed them. After two months of operation, it appeared that all free product was removed and the groundwater on the site was clean, but we continued the remedial action another couple of months just to be sure."

The power control unit, which was housed in a trailer on site, was in operation 24/7 for four months (April 5 to August 5), sending 13,800 volts into the ground. For obvious safety reasons, the site was fenced off during the project and the perimeter checked regularly to make sure that no voltage leaked out beyond the site.

"We ended up with about 400 gallons of free product (liquid gasoline), which we disposed of as a waste material at a permitted facility," said Smith. "Any remaining contamination in the groundwater was volatilized out in the air stripper."

"We are going to wait until next year, February 2003, to go back and take more samples and draw conclusions on how the system worked," said Vergara.

The new technology was developed by the Department of Energy (DOE), who owns the power unit and lent it to the district for this project.

The prime contractor, Science Applications International Corporation (SAIC), Oakridge, Tenn., subcontracted with Current Environmental Solutions (CES) to design and operate the system.

"It's my understanding," said Vergara, "that only two contractors in the nation know how to implement this technology, and CES is one of them."

Installing the wells, getting the electrical supply in place, putting up the system and running it for four months cost about $900,000, according to Vergara.

LDP looks at soldier training

by Julie Hiscox and Edna Warden, *LDP participants*

August roared in cooler than usual and that was a very good thing, because some of our training got physical when South Atlantic Division moved the "classroom" for its Leadership Development Program (LDP) here to Savannah District. We all truly stepped out of our box and saw a new side of leadership through the eyes of a soldier.

Here are the highlights.

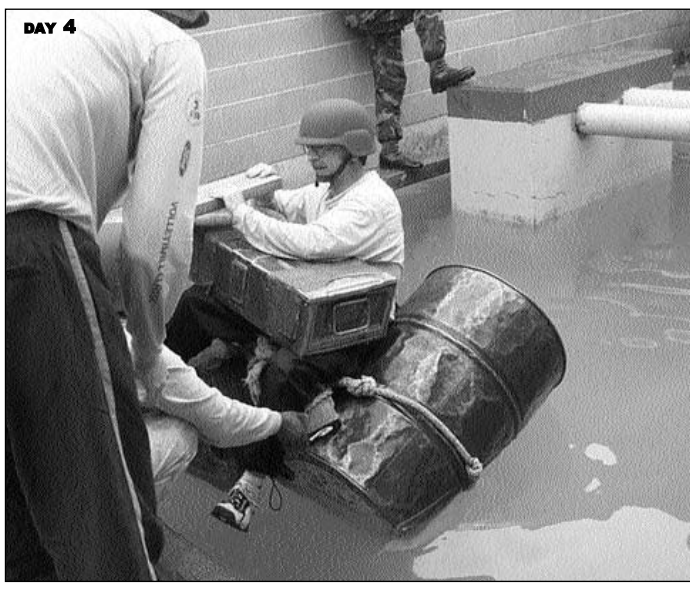
Day 1. Capt. Mindy Rosito and Folke Alhquist, PM forward, briefed us on Fort Benning and followed up with a short film, where the background music kept asking… *ARE YOU READY? ARE YOU READY?* Those words would prove to be the theme for this trip.

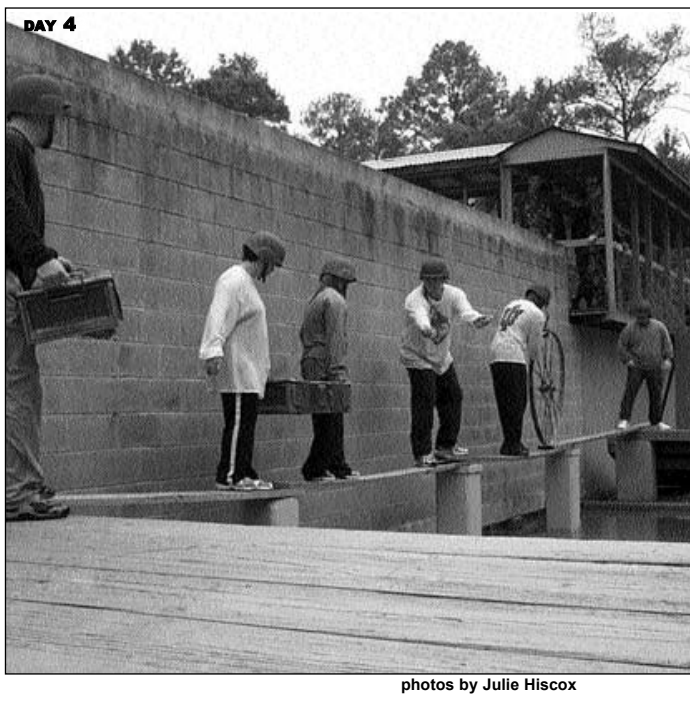
Day 2. During a tour of the installation we saw projects in various stages of construction. That afternoon, we watched a class of airborne rangers do their pre-graduation jump— a demonstration of focus, concentration and personal courage (or the power of the instructor's boot) to conquer the fear of heights.

We began **Day 3** with a briefing by the Airborne Training School instructors, and the brave souls who were willing (and slightly misled) had the opportunity to suit up and jump from the 34-foot airborne training tower. Although all were apprehensive in the beginning, once they took that first step out of the tower, many were hooked and spent hours repeating the adventure.

Day 4. The LRC (Leadership Reaction Course) was an extremely vigorous experience. At each "station" we were given a problem and tools to solve the problem (which usually involved two boards, a rope and crossing water via a very high, narrowly constructed platform). Each station had a leader, who received the briefing (problem), devised a plan and briefed the team, who then implemented the plan. The team concluded the exercise with an After Action Review (AAR). At the end, we were all soaking wet, dirty, and had multiple scrapes, cuts, and bruises— *and there are pictures* .

Day 5. Time to wrap up and head home. Our last order of business was a team meeting to discuss our group project, which we presented in October at our last official training.





photos by Julie Hiscox