Innovative Technology Highlights

SITE Program Case Studies

This section presents case studies of innovative remediation technologies for vendors that have participated in the SITE Program through the Demonstration Program (case studies 1 and 2).

The case studies provide brief descriptions on the use and status of representative technologies and, where available, general information on the cost of applying each technology. These case studies represent the SITE Program's approach to promoting innovative technologies by identifying user needs. In response to user needs, the Demonstration Program assessed the performance of solvent extractions technology for treatment of PCB - contaminated soil and sediment and iron reactive barrier technology for in situ groundwater remediation.

The technologies presented in these case studies are typical of the SITE Program and represent SITE's remediation problem focus, which is driven by the needs of the hazardous waste community. These technologies represent real or potential solutions to actual cleanup problems faced by the environmental community.

Case Study 1: Terra-Kleen Response Group Inc. (Solvent Extraction Technology)

Terra-Kleen Response Group, Inc. is the world leader in PCB-contaminated soil and sediment treatment with solvent extraction technology and has successfully completed more jobs than any other company in their field. Recently, Terra-Kleen began international operations by licensing its proprietary technology to Mitsubishi Heavy Industry (Tokyo, Japan), and is teaming with Canadian partners for work in Canada. In addition, Terra-Kleen is currently discussing application of its technology in Europe with several European companies. Terra-Kleen's mobile, on-site extraction technology provides environmentally safe, cost-effective treatment of soil and sediment.

The reliability and performance of the technology has been studied by several U.S. government agencies. Terra-Kleen has been granted a United States nationwide commercial operations permit from the United States Environmental Protection Agency (U.S. EPA), and participated in many U.S. government verification programs including four Superfund Innovative Technology Evaluation (SITE) programs, the Navy Environmental Leadership Program (NELP), and the White House Rapid Commercialization Initiative (RCI).

Waste Applicability

Terra-Kleen's patented technology uses a common industrial, non-toxic solvent, and operates at ambient temperature and pressure. Its modular design enables cost-effective treatment of small and large waste volumes. The process has been successfully used in the full-scale treatment of polychlorinated biphenyls (PCBs), chlorinated pesticides (such as DDT and toxaphene), polynuclear aromatic hydrocarbons (PAHs), chlorinated volatile organic contaminants (VOCs), and petroleum waste.

Status

Mitsubishi Heavy Industries (MHI) has announced its entry into the soil remediation business. With the multi-year license and technical assistance agreement MHI has signed with Terra-Kleen Response Group, Inc., MHI projects a sales amount of at least 2

billion Japanese yen within 2 or 3 years and regards solvent extraction of contaminants in soil as one of its new core businesses.

Case Study 2: Iron Reactive Barrier (In-Situ Groundwater Remediation)

The U.S. EPA began working with the U.S. Department of Energy (DOE) in 1995 to characterize a contaminated groundwater plume at DOE's Rocky Flats site outside Denver, CO. DOE is working to achieve closure of the Rocky Flats site by 2006, and considers remediation of this plume a crucial element of site closure. Based on the results of site characterization and ongoing commitment to utilize innovative treatment technologies, DOE decided to remediate the contaminated groundwater through use of a passive barrier.

Groundwater contamination in this area originated from a former waste drum storage area used by DOE in the late 1950s. Consisting of shallow groundwater collected in a French drain and funneled to the reactors at a flow rate of 0.5 to 2.0 gallons per minute, the plume extends horizontally approximately 220 feet. Its primary contaminants are uranium and volatile organic compounds (VOCs), including carbon tetrachloride, tetrachloroethene, trichloroethene, and vinyl chloride. Following excavation and removal of the contamination source in 1997, the passive barrier (designed by EnviroMetal Technologies, Inc.) was installed in the summer of 1998.

Waste Applicability

This passive barrier system requires no operational energy and minimal maintenance, which results in a substantial cost savings over use of an alternative pump and treat system. Performance assessment of the barrier indicates that the barrier system is removing approximately 99% of the plume's primary contaminants.

This barrier system begins with the downgrade-side collection of groundwater in a subsurface hydraulic barrier (French drain) lined with high-density polyethylene. The drain is located in the unconfined aquifer at depths ranging from 8 to 15 feet below ground surface. Ground water is diverted through the drain to piping that transfers it by gravity to the reactive media treatment system. The system consists of two 10-foot (wide) by 5-foot (deep) cylindrical reactors in series, each of which contains 337 cubic feet of granular, reactive (zero-valent) iron. The reactors were installed below surface grade and were sized to treat groundwater at a flow rate of 1 gallon per minute for a duration of 20 hours. In the reactors, VOCs are dechlorinated to nonchlorinated hydrocarbons, and uranium in the oxidized state (U^{6+}) is converted to uranium in the reduced state (U^{4+}) and precipitated. Following treatment, ground water exits the barrier system directly through surface water that flows to retention ponds.

Status

EPA and DOE have monitored the influent and effluent of this barrier system on a quarterly basis since September 1998. In addition, water samples in 1-foot increments throughout the reactive media have been collected since project start-up to monitor containment breakthrough. To date, breakthrough of VOCs and uranium has been confined to the top 3 feet of the first reactor in the treatment sequence.

Case Study 3: Update

ITT Night Vision (In situ Enhanced Bioremediaiton of Groundwater) was highlighted in last year's Report to Congress and will not be described in great detail here. However, it is desired to provide an update on the status of the technology at the site. After the SITE Demonstration was completed in late 1999, the site owner, ITT Night Vision, proposed to expand the technology from a pilot system to a full-scale system that would treat a much larger area of contamination, including the contamination source. US EPA Region 3 agreed with the approach, and in January 2000, the full scale system was brought on line. Results from the SITE Demonstration provided much insight and understanding into the various phenomena occurring in the subsurface and thus greatly aided in the design of the full-scale system.