New Software Predicts Results for Contamination Cleanup Strategies

October 18 2006

A software package developed at Virginia Tech, to predict results and timelines for cleaning up ground-water contamination, has proved itself at eight Department of Defense sites and is being offered free to environmental cleanup professionals.

Mark Widdowson of Blacksburg, professor of civil and environmental engineering at Virginia Tech, will present results at the at the Geological Society of America national meeting in Philadelphia Oct. 22-25.

The Natural Attenuation Software (NAS) was developed with funding from the U.S. Navy and in collaboration with U.S. Geological Survey for application to ground-water systems. It was designed to help environmental cleanup professionals estimate how far underground plumes of contamination will migrate from a source, such as a solvent spill or underground gasoline storage tank leak, and how long cleanup will take with natural attenuation in various environments with or without use of remediation technologies.

Tests have recently been completed at eight different sites with funding from the Department of Defense Environmental Security Technology Certification Program.

"The ability to return contaminated ground water to a pristine state is limited, so a heavy emphasis is placed on meeting achievable remedial action objectives," said Widdowson. "We want to at least limit the damage and to have an objective we can reach, such as to reduce the size

of the contamination plume and to take advantage of the natural attenuation capacity of an aquifer."

Natural attenuation is when, under the right conditions, microbes and minerals in the earth bind to or degrade contaminants into less harmful compounds. "But all things are not equal from site to site," Widdowson said. "For example, contaminants at sites in the U.S. West, where there is less moisture and carbon in the soil, often degrade more slowly than at sites in the East."

The first step is to define the site, then remediate or remove the source area as much as possible. "A plume is a symptom. We want to reduce the mass in the source and the amount of material that leaves the source. Then we want to take advantage of a sites attenuation capacity," Widdowson said.

"Once site data -- the type and numbers of contaminants and site characteristics -- is entered into NAS, you can decide what level of remediation should be performed to meet the goal and how long it will take to clean up the site," Widdowson said.

"The software lets you ask 'what if'. 'What if we remove 50 percent or 80 percent of the mass, how much benefit will there be over what time?' 'What if we remediate the source for 12 months, what will the response be in 10 years, 20 years, and 50 years?'" Widdowson said. "The software does not simulate the intricacies of the remediation process, but goes to expense and effort. We think this software will help save hundreds of thousands of dollars at each site and up to a billion dollars over the long haul. NAS is available free at www.nas.cee.vt.edu ."

The eight DOD test sites, located on the U.S. West Coast, Southeast, and Northeast, were diverse in terms of geography, hydro-geologic settings, and contamination source. They were sites with long-term data sets, such

as a leaking landfill site in Georgia which is a success story in terms of cleanup, Widdowson said. "We also learned from sites that are not succeeding."

The researchers used the information history had already presented to confirm the results the software predicted when site conditions were entered. "We tested how well the software replicated results," Widdowson said. "Then we did predictions continued or for alternative remediation strategies."

The researchers also tested the software with incomplete data, "because all the desired information is not necessarily known. It's always a case of how good the data is. In the process, we made the software more flexible for people to use," Widdowson said.

Results from two of the Department of Defense sites are being presented at the Geological Society of America meeting. "These were complex, fractured rock sites."

At one site, pumping wells are being used to clean the ground water. The results present good news and bad news. The good news is the pumping wells are cleaning the ground water. The bad news is the site is not being cleaned up significantly faster than natural attenuation.

"Until you deal with the source, you can run pumping wells until the end of time," Widdowson said. "We have clean up times running into centuries. Compared to source remediation, whether chemical or biological, pump and treat is a loser from a cost standpoint."

"There are sites it will take hundreds of years to clean, with current technologies. But the U.S. Environmental Protection Agency is promoting innovative environmental technologies at many sites," Widdowson said.

Source: Virginia Tech