UMass builds bugs to eat MTBE

Derek Lovley, director of the microbiology department at the University of Massachusetts at Amherst

An area university's process to destroy a toxic gasoline component might be just what the doctor ordered for Maine's contaminated groundwater problem.

Derek Lovley, director of the microbiology department at the University of Massachusetts, at Amherst, has been using microbes to clean benzene in petroleum-contaminated sites.

Lovley and Kevin Finneran, a graduate assistant, expect to use the method this fall on a California site contaminated with methyl tertiary butyl ether (MTBE), which is found in gasoline.

Once the first field trial is complete, the question will be whether New England will take advantage of this technology to clean up at home.

Maine in particular has suffered from MTBE contamination because of the abundance of groundwater in the state, said Jim Brooks, director of the air quality bureau at the state Environmental Protection Agency.

It has gone through extensive remediation efforts for the past two years.

Maine became the only state to opt out of the reformulated gasoline program (RFG) .The gasoline, which contains 11 percent MTBE, was developed for use in areas not meeting national air quality standards.

And the Maine Legislature recently approved a resolution to eliminate MTBE from Maine's gasoline by 2003.

Lovley's method of dealing with MTBE might come in handy as the state prepares for that target date. State officials are aware of the research. But Brooks says he wonders if.. the microbes can truly keep up with the rapidity of MTBE and take care of the damage that already. has been done.

"MTBE takes off really quickly," he said. "A few days delay and you have lost your window of opportunity."

The process used on MTBE so far has been successful in the laboratory, however, and Lovley expects that to carry over into testing at a real site

In the case of the benzene Enviroet application, field results turned out to be better than lab results.

"In the field, we didn't disrupt the microbial community very much," Lovley said. 'They are complex communities."

That - three-year project at an Oklahoma site was completed at the end 'of last year. The American Petroleum Institute provided about $250,000 in funding, Lovley said.. -

Contamination that can be treated through the microorganism process often occurs atgas stations, as gasoline drips onto the pavement at the pump or seeps into the ground from an underground tank or pipe.

Lvley's method is based on the idea that microorganisms use benzene as food; by pumping sulfate into the sediment below an aquifer, the microbes were encouraged to handle the remediation process .

The Oklahoma site had been contaminated with petroleum·for more than 50 years and all traditional approaches to cleanup had failed.

Efforts to pump oxygen into such a site to start the microbial remediation process is expensive and often leads to other problems, like plugging the aquifer with iron oxides, Lovley said.

The researchers installed 40 injection wells over a portion of the aquifer and several observation wells along the groundwater flowpath. They dripped sulfate into the contamination site through the injection walls for about seven months and ran tests in the observation wells.

"When we added sulfate to the aquifer, we saw virtually inunediate stimulation of benzene removal," he said. "The bacteria oxidized benzene and produced carbon dioxide."

One aspect of the experiment that surprised Lovley was that sulfate actually worked better than iron, which is naturally found in the soil.

Sulfate was easier to use because it is soluble, and easier to add to water than insoluble iron.

Lovley and Finneran in preparation for the new project have collected sediments from MTBE-contaminated sites from around the country. They have reduced the amount of MTBE in the soils by about 3 percent a week through the same anaerobic process.

"One of the major advantages of using an anaerobic technique is it lets you remove MTBE at the source, before it has a chance to spread," Lovley said.

Other advantages are the widespread presence of the microbes and a significant cost reduction associated with adding oxygen to dean up a contaminated site, he said

'The microbes can be found anywhere from river mud to subsurface aquifers.

"It's a good technology for remediat ing petroleum contamination," Lovley said. "Most systems lack oxygen. When you add it, it's expensive and technically difficult"

Back in Maine, a few small spills (about 10 to 12 gallons per incident) have meant contamination in many wells. A groundwater study done two years ago found a 16 percent MTBE contamination rate in wells, Brooks said. He said he considers anything more than 5 percent to be a problem.

Although Brooks says the UMass work is admirable, his attention today remains on public policy.

"It's just too bad they weren't around 10 years ago," he said. "It's kind of nice enough things have happened that policy is the ultimate (way to eliminate MME) "