Microbe can eat toxic waste underground

Scientists have identified a microbe that gobbles up toxic waste deep underground, offering a potential way to clean up a particularly nasty chemical that has contaminated the water underneath hundreds of the nation's industrial and military sites.

Microbiologist Frank Loeffler said the bacterium, known as BAV1, was found in soil samples 20 feet down at a hazardous waste site in Oscoda, Mich. BAV1 flourishes in the packed earth where there is no oxygen, feeding off certain toxic compounds, he said.

Other microbes that eat toxic waste have been discovered over the years and are used in some limited fashion to clean up contaminated sites. However, this is the first one found that thrives on vinyl chloride underground.

Vinyl chloride is one of the most common and hazardous industrial chemicals. It can linger in the soil for hundreds of years and is present at about a third of the toxic Superfund sites listed by the Environmental Protection Agency. It usually accumulates as a deteriorated form of more complex compounds found in dry cleaning fluid and metal cleansers.

Brief contact with vinyl chloride can cause dizziness, drowsiness and headaches. Long-term exposure can raise the risk of a rare form of liver cancer, according to the EPA.

Loeffler has already tested the bacterium on vinyl chloride at the contaminated site in Michigan. Its ability to eat the toxic compound — and render it harmless — was hastened in one test by adding plant fertilizer and other nutrients to the soil. In another trial, vinyl chloride was destroyed by injecting the soil with concentrated amounts of BAV1 developed in the lab.

His work is presented in Thursday's issue of the journal *Nature*.

"It's pretty exciting stuff," said David L. Freedman, an environmental engineering professor at Clemson University.

Loeffler said the use of the microbes requires only the approval of the land owner. He said the microbe remains in the soil, and even when used in large concentrations, it has been shown not to harm humans.

"These organisms can only grow when the contaminants are present," he said. "When the material is gone, their numbers decline because they don't have any food. So really it's a perfect system."

The way most cleanup crews now deal with vinyl chloride is to pump the contaminated water out of the ground and spray it into the atmosphere as a fine mist, letting sunlight break down the chemical naturally.

But hazardous chemicals have a way of sticking to the soil underground, so pumping out the aquifer never quite gets rid of all the contaminants, Loeffler said.

Scientists have long suspected that deep in the ground some type of microbe found vinyl chloride palatable. Loeffler spent four years searching for it, isolating BAV1 from a bustling community of microscopic organisms that included thousands of kinds of bacteria.

James Gossett, a Cornell University researcher who identified a bacterium in 1997 that could eat organic chlorides but had problems with vinyl chloride, called BAV1 "another in a long list of discoveries or isolations" that will illuminate research into cleaning toxic waste with bacteria.

Gossett said the discovery will help scientists determine which enzyme breaks down vinyl chloride. If the enzyme is found, Gossett said more robust bacteria that can survive in the presence of oxygen or eat faster than BAV1 could be genetically engineered to digest vinyl chloride.

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