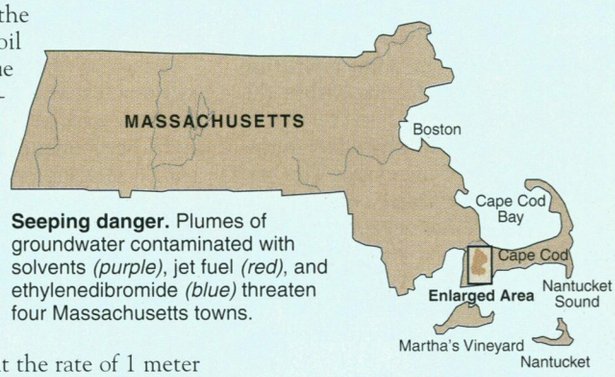
ENVIRONMENTAL REMEDIATION

Building a Wall Against Toxic Waste

BOSTON—Beneath the pine forests and sandy soil covering the picturesque Massachusetts peninsula of Cape Cod, 10 plumes of cancer-causing chemicals are rushing underground toward water wells in four towns. The plumes, leached from fuel dumps and other sites at a nearby military base, are moving at the rate of 1 meter every 2 to 3 days. They long ago forced the shutdown of a well that supplied 25% of the municipal water for the town of Falmouth and today are within 300 meters of another public well in Bourne. Standing between this contamination and the 67,000 townspeople of Bourne, Falmouth, Mashpee, and Sandwich, scientists hope, will be a wall.



Seeping danger. Plumes of groundwater contaminated with solvents *(purple)*, jet fuel *(red)*, and ethylenedibromide *(blue)* threaten four Massachusetts towns.

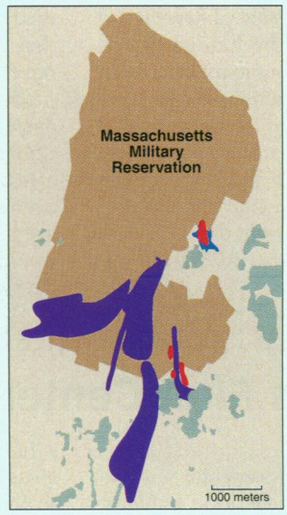
The wall is an experimental decontamination system that researchers are about to test for the first time on a large scale, and it's attracting the attention not just of beleaguered locals but of scientists nationwide. This fall, Robert Gillham, a hydrologist at the University of Waterloo in Ontario, Canada, intends to erect a "reactive wall": a bunker of iron filings intended to react with the toxic molecules of trichloroethylene (TCE), tetrachloroethylene (PCE), and other chemicals that make up the plumes and break them down.

Environmental scientists "are really excited that this technology is going to the field," says David Burris, an environmental chemist at Florida's Tyndall Air Force Base. As an alternative to costly pumping stations, "there's tremendous interest in this demonstration among remediation experts," says Paul Marchessault, the Environmental Protection Agency's restoration manager at the contaminants' source, the Massachusetts Military Reservation (MMR). "This way you don't have to pay to get the water out of the ground—it just flows through the wall, and you monitor to make sure all the contaminants have been removed."

Paying to get water out of the ground would be an expensive proposition. The Defense Department has plans to build a network of pumping and treatment stations at MMR, but the stations will have to operate for at least 20 years, at a total cost topping $250 million. So reactive walls could save millions. "This could revolutionize the way we treat chlorinated contaminants in groundwater, not just at military sites but worldwide," says Ed Pesce, manager of the MMR restoration project.

The walls operate on a simple principle. Steel sheets pounded several meters into the ground funnel groundwater into a small opening filled with a mixture of sand and iron filings. "Iron's cheap, and it releases the electrons that are necessary for the reduction of many chlorinated compounds," explains Gillham. As water flows through the iron, a corrosion reaction strips chlorine atoms from contaminants like TCE and PCE, breaking them down into harmless ethene and ethane gases.

There are still some unanswered questions about the technology, and once MMR officials decide which of the 10 plumes to try and decontaminate, researchers can begin using the field test to answer some of them. One question, Burris says, is whether the iron can dechlorinate organic compounds like TCE and PCE without letting toxic intermediate products, such as vinyl chloride, slip through the wall. In an above-ground test of the Waterloo system at an industrial site in New Jersey earlier this year, effluent water contained vinyl chloride at concentrations two times higher than federal drinking-water standards allow. But with a longer "strainer" in Cape Cod, Gillham thinks the iron will have enough time to break down even these intermediate products before they flow out the other side.



SOURCE: HAZARDOUS WASTE REMEDIAL ACTION PROGRAM

Because of its simplicity and cost-effectiveness, a reactive wall that achieved complete dechlorination would be "the Holy Grail of environmental remediation," says Paul Tratnyek, an organic chemist at the Oregon Graduate Institute of Science and Technology in Beaverton. At the rate the Cape Cod plumes are moving, residents and scientists alike hope this grail will be more attainable than the original.

–Wade Roush

GLOBAL CHANGE RESEARCH

From Russia With Love: U.S. Cloud Data

When Kremlin spymasters were using satellites to keep an eye on the United States during the Cold War, they probably gave little thought to the scientific value of the data they were collecting. But atmospheric scientists believe Russia's intelligence archives may contain a treasure-trove of information useful for global change research by providing a long-term record of cloud cover over the United States. These researchers are anxious to get a look at the Kremlin's picture files—and they may soon get their chance.

Under an agreement worked out last month by U.S. Vice President Al Gore and Russian Prime Minister Viktor Chernomyrdin, U.S. and Russian officials are considering opening their once top-secret archives to climate researchers in both nations. Although the United States has recently declassified some older spy satellite data and Russia has been selling some pictures taken from its spacecraft, there has not been a comprehensive exchange of the data between the two countries on the scale envisioned by the new agreement. And the two countries may even go a step further: Gore and Chernomyrdin also discussed trading more current spy satellite data to help warn of natural disasters. A team led by National Oceanic and Atmospheric Administration (NOAA) chief James Baker and V. I. Danilov-Danilyan, the Russian environment minister, is now working out the details of the exchange.

The cloud-cover record, stretching back to 1965, is of particular interest to American scientists. "It could be very valuable," says Tom Peterson, a research meteorologist at the National Climatic Data Center in Asheville, North Carolina, who has already been cooperating with Russian scientists in comparing data on evaporation rates in the two countries over the past 45 years. "If you are looking at global change, what's happening with clouds is certainly very important." Global change researchers say they are only now starting to grasp the enormous effect clouds have on heating and cooling the Earth. But a lack of long-term data hampers