Trapping Greenhouse Gases (Without Leaks)

November 19 2008

Of all the possible ways of reducing future greenhouse gas emissions, one of the most immediately feasible is carbon dioxide "sequestration," which involves compressing the gas into a liquid and piping it deep underground instead of releasing it into the atmosphere. The Earth has abundant geological formations known as saline aquifers that would seem to be ideal storage bins for such sequestered carbon.

However, says Jerome Neufeld of the University of Cambridge in England, if carbon sequestration is to play a major role in reducing greenhouse gas emissions, the process needs to be deployed on a global scale, and new tools will be needed to monitor the long-term stability and fate of trapped gas.

The principle of sequestration is simple. Saline aquifers are basically porous regions of rock soaked with brackish fluids. The density of carbon dioxide is much less than that of the brine, so gas pumped into the aquifer will rise through the porous rock until it hits an impermeable "cap" rock. Over very long time scales, trapped carbon dioxide will saturate the brine and become mineralized. But what happens in the short term? If you pump carbon dioxide into saline aquifers, will it stay put and mineralize or leak away completely?

Neufeld and his colleagues have created a simple tool to predict the fate of carbon dioxide "plumes" rising though aquifers after being pumped underground. Their model shows how the shape of rising plumes is influenced by the structure of the surrounding rock, and it suggests that there are advantages to injecting carbon dioxide into reservoirs that are

like geological layer cakes, with alternating stacks of porous and seal rock. When a plume reaches an impermeable boundary, it spreads until it can rise again, filling out a shape that looks like an inverted Christmas tree. As the plume pools it mixes with the brine, ultimately resulting in a more stable long-term sequestration.

Neufeld's talk, "Plume dynamics in heterogeneous porous media" will be held on Tuesday, November 25, 2008, at the 61st Annual Meeting of the American Physical Society.

Provided by American Institute of Physics