Into the abyss: Deep-sixing carbon

February 18 2008

Imagine a gigantic, inflatable, sausage-like bag capable of storing 160 million tonnes of CO_2 – the equivalent of 2.2 days of current global emissions. Now try to picture that container, measuring up to 100 metres in radius and several kilometres long, resting benignly on the seabed more than 3 kilometres below the ocean's surface.

At first blush, this might appear like science fiction, but it's an idea that gets serious attention from Dr. David Keith, one of Canada's foremost experts on carbon capture and sequestration. Keith will talk on the subject at the 2008 Annual Conference of the American Association for the Advancement of Science in Boston at a session entitled Ocean Iron Fertilization and Carbon Sequestration: Can the Oceans Save the Planet?

"There are a lot of gee-whiz ideas for dealing with global warming that are really silly," remarks Keith, an NSERC grantee and director of the Energy and Environmental Systems Group at University of Calgary-based Institute for Sustainable Energy, Environment and Economy. "At first glance this idea looks nutty, but as one looks closer it seems that it might technically feasible with current-day technology." But, adds Keith, who holds the Canada Research Chair in Energy and the Environment, "it's early days and there is not yet any serious design study for the concept."

The original idea of ocean storage was conceived several years ago by Dr. Michael Pilson, a chemical oceanographer at the University of Rhode Island, but it really took off last year when Keith confirmed its feasibility with Dr. Andrew Palmer, a world-renowned ocean engineer at

Cambridge University. Keith, Palmer and another scientist at Argonne National Laboratory later advanced the concept through a technical paper prepared for the 26th International Conference on Offshore Mechanics and Arctic Engineering in June 2007.

Keith sees this solution as a potentially useful complement to CO_2 storage in geological formations, particularly for CO_2 emanating from sources near deep oceans.

He believes it may offer a viable solution because vast flat plains cover huge areas of the deep oceans. These abyssal plains have little life and are benign environments. “If you stay away from the steep slopes from the continental shelves, they are a very quiet environment.”

For CO_2 to be stored there, the gas must be captured from power and industrial point sources, compressed to liquid, and transported via pipelines that extend well beyond the ocean’s continental shelves. When the liquid CO_2 is pumped into the deep ocean, the intense pressure and cold temperatures make it negatively buoyant.

“This negative buoyancy is the key,” explains Keith. “It means the CO_2 wants to leak downwards rather than moving up to the biosphere.”

The use of containment is necessary because CO_2 will tend to dissolve in the ocean, which could adversely impact marine ecosystems. Fortunately, says Keith, the cost of containment is quite minimal with this solution. He and his colleagues calculate that the bags can be constructed of existing polymers for less than four cents per tonne of carbon.

The real costs lie in the capture of CO_2 and its transport to the deep ocean. “If we can drive those down,” he notes, “then ocean storage might be an important option for reducing CO_2 emissions.”

Source: Natural Sciences and Engineering Research Council