Canadian Geoscience Council
Conseil Géoscientifique Canadien

www.geoscience.ca
Issues for decision makers: no. 1

Mitigating climate change:
Putting our carbon dioxide back into the ground

The problem

We contribute to the global problem of changing climate by our emissions of greenhouse gases - especially carbon dioxide – from industrial processes. A warming Earth has significant problems for Canada – instability in agricultural productivity, sinking of northern infrastructrure into melting permafrost, greater vulnerability of low-lying coastlines to storms.

What should we do?

We believe that Canadians would like to meet a commitment to the Kyoto accord that would lead to progressive reduction in Canadian emissions of carbon dioxide. But we enjoy and would like to maintain our economic prosperity, without a reduction in industrial output. Can we maintain industrial output and yet reduce emissions? If we can return some of the emissions back into the Earth, we can maintain industrial output and reduce NET emissions to the atmosphere.

A contribution to the solution

How can we go about this? Absorbing carbon dioxide is called sequestration. Geological sequestration puts it back into the rocks from which most of it came. There are several ways to do this. Turn the page to find out more about this intriguing possibility.

What can you do?

Support investment in proposals to test the viability of geological sequestration of carbon dioxide.

The Canadian Geoscience Council provides an open forum for communications, discussion and debate to ensure the effectiveness and influence of the geosciences in addressing the needs and desires of the people of Canada, especially with regard to the quality of life, economic prosperity, and the maintenance and improvement of the natural environment.

Geological sequestration of carbon dioxide

There is currently an intense debate about the whether anthropogenic emissions of so-called greenhouse gases into the Earth's atmosphere are having a significant impact on climate, particularly average global temperature. While the Canadian Geoscience Council is not at this time taking a particular position specifically on the issue of global warming, the Council is establishing a position on the use of geological sinks to mitigate emissions of greenhouse gases, particularly CO_2.

Injection of CO_2 into subsurface reservoirs has been well established by the petroleum industry. The challenge for sequestration of CO_2 is specifically to identify sites in which CO_2 can be stored safely for long periods of time (i.e., thousands of years), to develop technologies to monitor the sequestration process, and to understand the reactions between the injected gas and the host rocks and pore fluids.

A number of geological targets have been proposed for sequestering CO_2, namely, depleted petroleum reservoirs, coal beds, and deep saline aquifers. These targets are required to be located in tectonically stable basins. Depleted petroleum reservoirs allow efficient filling of the reservoir with injected gases. The production of coal-bed methane holds considerable promise for CO_2 sequestration. Injected CO_2 replaces methane and is adsorbed into the coal while methane is produced. Deep aquifers, particularly those contained in clastic sediments have significant potential for CO_2 sequestration.

It is the position of the Canadian Geoscience Council that CO_2 can, in principle, be sequestered in suitable underground reservoirs. However, considerable research is required to ensure that the sequestration process is understood properly, and that sequestration can be verified over long periods of time. It is important to establish how CO_2 will react chemically and mechanically with fluids already present in the target reservoir, or whether CO_2 will displace the existing fluids. Also, the CO_2-rock-fluid geochemical system needs to be studied for a range of temperatures and pressures and over long time scales. The hydrology of deep reservoirs is poorly understood and the physical properties of rocks in these reservoirs are required to be known. Research is needed to assess whether such properties can be identified remotely by geophysical measurements, such as seismic and electromagnetic methods, and whether changes in rock properties after CO_2 flooding can be detected by such methods. Thus, verification of greenhouse gas sequestration means that technologies must be in place to demonstrate that the gas remains in place in the subsurface formations. Monitoring means that technologies (e.g. geochemical, geophysical) are required to image the motion of the gas plume through the reservoir in order to optimize the placement of injection wells to ensure that the reservoir is optimally filled.

Requests for further information, comments or questions should be directed to Don C. Lawton, Department of Geology & Geophysics, University of Calgary. Email: dclawton@geo.ucalgary.ca