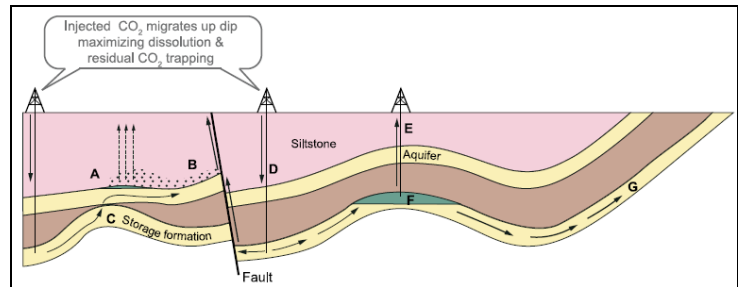


# CO<sub>2</sub> sequestration: Determination of flow and leakage pathways to surface aquifers and to the surface

<b>Location:</b>	Worldwide
<b>Client(s):</b>	various
<b>Date Completed:</b>	2008 - ongoing
<b>Project Budget:</b>	various



IPCC Special Report on Carbon Dioxide Capture and Storage, (2005 , Figure 5.25). The figure summarizes the concepts currently used.

## Summary

Carbon Capture and Storage (CCS) is seen as the means to facilitate the shift from petroleum and coal-based energy to systems with no or greatly reduced CO<sub>2</sub> output. The Intergovernmental Panel on Climate Change (IPCC, 2005) made CCS the apparent method of choice to help reduce the rate of climate change while shifting to alternate energy sources. Subsequently, IPCC and Al Gore were awarded the 2007 Peace Nobel Prize for their work. Nevertheless there is a need to improve significantly on the concepts and physics used by IPCC (2005) for the planned injection and storage of CO<sub>2</sub>.

IPCC (2005) adopted calculation methods widely used in reservoir engineering. There the subsurface movement of fluids (water, oil, gas, CO<sub>2</sub>) is described in terms of pressure, buoyancy forces and caprock.

In September 2008, WDA was invited by PetroBras (a leading Brazilian petroleum company) to show what effect the application of a correct physics-based fluid dynamics would exert on the concepts presently prevailing in the risk-analysis of CO<sub>2</sub> storage. As an outcome it was shown that, in the on-shore subsurface, vertical buoyancy forces are rare and that they may even be directed vertically downwards (Buoyancy Reversal). The direction of CO<sub>2</sub> migration (as gas, supercritical fluid, or dissolved in saline aquifers) is determined in dependence upon force fields in groundwater flow systems. Caprock does not exist in the sense that it would be generally impermeable to movement of hydrous fluids. These and other conceptual and calculation changes are contained in [www.wda-consultants.com/co2-main.htm](http://www.wda-consultants.com/co2-main.htm)

## Services Provided

- \* WDA provides to governmental agencies and the petroleum and coal industry advice to change present concepts to a physics-based injection planning of CO<sub>2</sub>.
- \* WDA provides advice in undertaking realistic risk analysis with respect to migration pathways, amounts and velocity of CO<sub>2</sub> seepage and leakage from the injection site to shallow aquifers and to the surface.
- \* WDA offers the long term gas sampling system GASSYS for long-term monitoring of CO<sub>2</sub> seepage to the surface.
- \* WDA helps in redesigning existing simulator codes to take the hydrodynamic pressure potential forces properly into account, thus eliminating the use of vertical buoyancy forces.