THE CO2CRC OTWAY PROJECT STAGE 2

Project aim

The CO2CRC Otway Project is a world-leading international research project investigating the geological storage of carbon dioxide (CO_2). In Stage 1, over 65,000 tonnes of carbon dioxide-rich gas was stored in a depleted gas reservoir and comprehensively monitored.

Stage 2 of the project is focussing on CO_2 storage in saline formations – deep porous rocks containing formation water. Saline formations are very common worldwide and have the potential to store many years' worth of CO_2 emissions.

Key risks for large-scale commercial projects include uncertainties regarding how much CO_2 can be stored and how well the CO_2 is contained. This project will help reduce these uncertainties and provide the basis for a cost-effective process to evaluate saline formations.

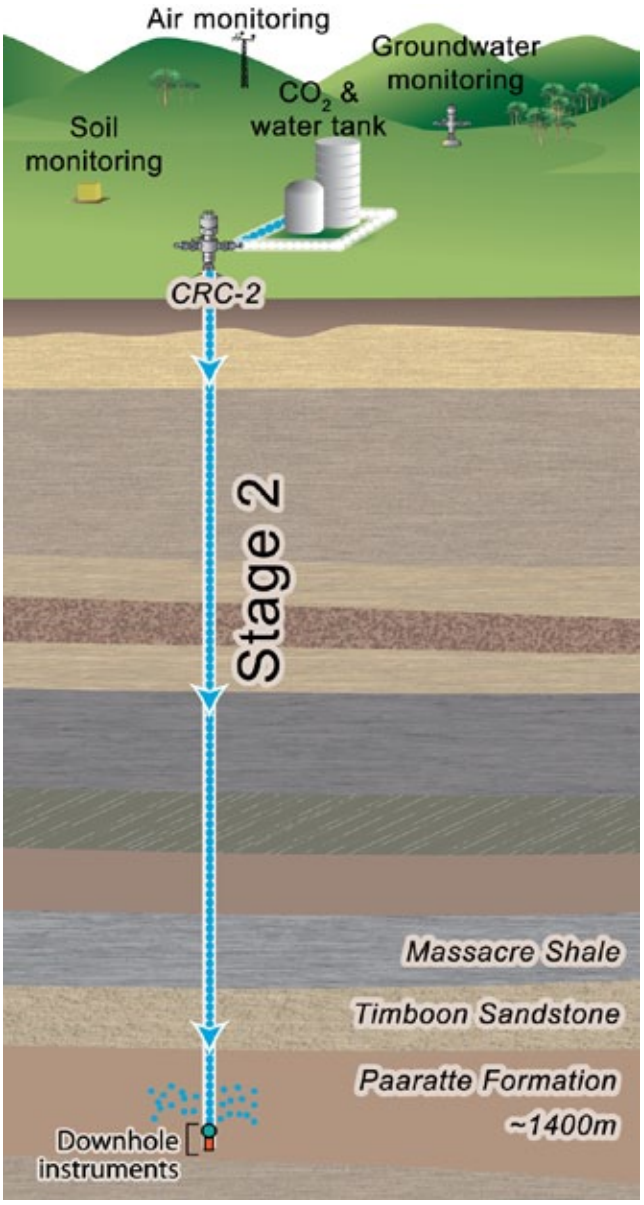
Storing CO_2

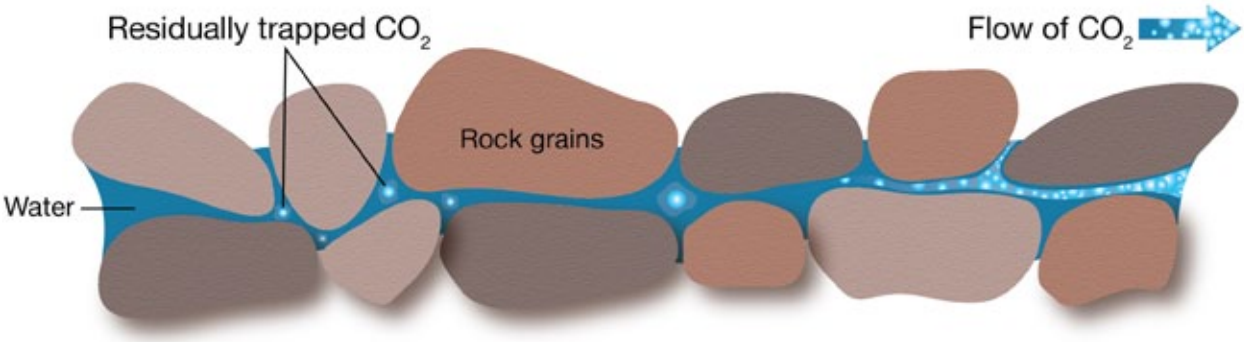
CO_2 is held underground in several ways, known as trapping mechanisms. In Stage 1 the CO_2 was stored in a depleted gas reservoir – trapped by a seal rock above the formation and a sealing fault at the side of the formation. This is known as *structural trapping*.

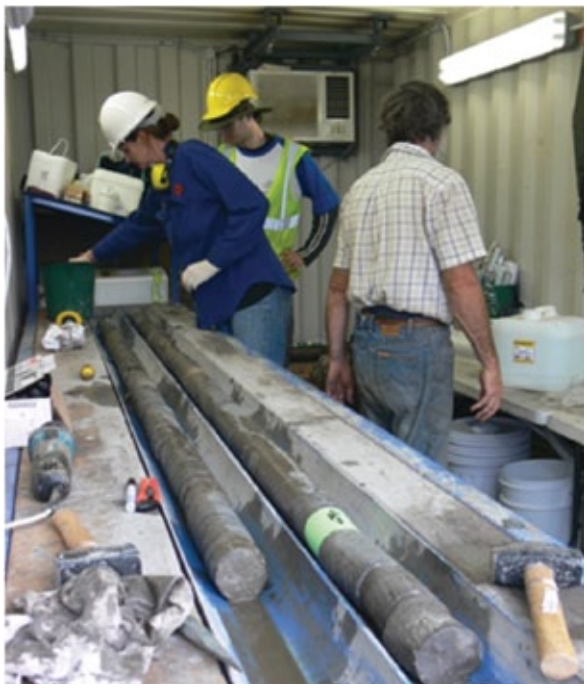
The first experiment for Stage 2 is designed to test two non-structural trapping mechanisms: *residual gas trapping* and *dissolution trapping*. Residual gas trapping and dissolution trapping are important mechanisms in geological storage but have not been demonstrated to the extent of structural trapping – this experiment will provide valuable information on how much CO_2 is trapped in this way.

Residual gas trapping occurs when a small amount of CO_2 becomes disconnected or 'snaps off' from the CO_2 plume as the CO_2 moves through the porous rock. The CO_2 is stored in the pores in tiny bubbles, trapped by surface tension. The CO_2 can't move out of the pore space and remains fixed underground.

Dissolution trapping refers to the portion of CO_2 that is dissolved in the formation water. Once the CO_2 dissolves, the water becomes denser, sinks towards the bottom of the formation and is more securely stored.







The experiment

Stage 2 work began with the drilling of a new 1565 metre well, CRC-2, in February 2010.

During the drilling, over 176 metres of rock samples, known as core, were obtained. These samples have been tested extensively to evaluate the amount of storage space in the rock (porosity) and how easily CO_2 can move through it (permeability).

Researchers will be able to compare these data with the results of the test injections to fine tune their computer models of storage capacity and security.

To test the trapping capacity of the rocks, the research team will undertake a series of small scale injections into the Paaratte Formation, using a series of instruments installed in the injection well at depths of around 1400 metres. The instruments include temperature and pressure sensors, as well as a system of U-tubes for deep formation sampling, similar to those used in Stage 1.

The aim is to break up the CO_2 within the rock pores (residual gas saturation), then remove any remaining mobile CO_2. A range of measurement techniques will help evaluate how much CO_2 is left behind (permanently stored). By correlating that information with their understanding of the formation rock qualities, the researchers will be able to estimate the storage capacity of the formation using these mechanisms and extend that knowledge through modelling to similar formations.

Experiment plan

The experiment will take about two months and involves a series of extractions and injections.

1. Before the residual gas test, formation water is extracted from the Paaratte Formation and stored on the surface in tanks. This water will be used for injections later in the experiment. A range of downhole instruments gather baseline data on the water saturated formation. Small quantities of tracer gases are injected in order to track how the CO_2 moves through the rock.
2. A relatively small amount of pure CO_2, around 150 tonnes, is injected into the formation. This is mimicking the storage of CO_2 as part of a Carbon Capture and Storage (CCS) operation and will fill the rock pores with CO_2.
3. After a period, formation water saturated with CO_2 is re-injected to drive the formation to residual gas saturation.
4. The amount of CO_2 trapped is evaluated in a range of ways including water extraction, pressure sensors, tracer concentrations, temperature sensors and borehole logging measurements. By using a variety of testing methods, the experiment will reduce variation in results.