Summary Report of my Training at Geoscience Australia

(05/09/2011-16/12/2011)

Liu Mei

My first day in Geoscience Australia was on 5/Sep/2011.During the three months period, I have learnt a lot, and I appreciate all the people who gave me a lot of help and assistance.

I joined in several seminars and training courses in Sir Harold Raggatt Theatre on the ground floor, read many papers on CCS project, learnt many experiment technologies in organic geochemistry lab of GA and did experiments of the second part of my proposal- carbon isotope for tracing microbial activities.

Completed training activities and achievements are listed below:

1. Seminars and Training Courses

02/Nov/2011
Leak detection for CO2 geological storage sites
Reporter: Andrew Feitz

08/Nov/2011
The petroleum geology of Southeast Asia: Why I hate the Gulf of Mexico
Reporter: Ian Longley

02/Nov/2011
Brief Overview of Capacity Estimation Methodologies for saline reservoirs
Reporter: Rick Causebrook

11/NOV/2011
A seminar on seismic wave

15/NOV/2011
Simulating the risk of leakage at the world's largest CO2 storage site
University of Edmonton

Also I participated in a meeting with Global of CCS Institute

2. Field work:

11/10/2011-14/10/2011

Purpose: Relocating the CO2 instruments in Otway Basin to Harsham
Team: Andrew Feitz, Tehani Kuske, Bofeng Cai, Mei Liu

Routes: Canberra-Otway Basin-Horsham-Canberra
Website: http://www.co2crc.com.au/

The CO_2CRC Otway Project, developed and led by the Cooperative Research Centre for Greenhouse Gas Technologies (CO_2CRC), is Australia's first demonstration project of deep geological storage of carbon dioxide (CO_2). The project is undertaken by CO_2CRC, in partnership with CO_2CRC members, international collaborators from the US, Canada, New Zealand and Korea, and supported by the Australian Federal and Victorian State governments and the US Department of Energy. The project provides technical information on storage, monitoring and verification processes and associated technologies to help inform the development and deployment of a commercial carbon dioxide capture and storage (CCS) industry.

As the CO_2 CRC Otway Stage 2 Release finished, we planned to move the CO_2 instruments to 7km west of Horsham, Victoria. The CO_2 instruments can give dynamic information on CO_2 concentration, humidity and temperature. They are used in Horsham to test the newly developed atmospheric tomography technique for measuring CO_2 emission. And also a sonic meter was installed to measure wind speed in 3D in order to provide information for dispersion modelling.

Our mainly work is to dismantle and number all the equipments at different positions on Otway Basin, pack the accessories into the truck, drive them to Victoria Horsham, then fix them up in certain locations. It took two whole days to finish the work. And it was really a great success.

3. Experiment of the Second Part

This experiment is in process and will be carried out into the second training phase.

1) Materials and chemicals

0.1% k_2SO_4 (potassium sulphate)
0.1% $FeCl_3.6H_2O$ (iron chlorides)
0.1%$CaCl_2.2H_2O$ (calcium chloride)
10%$NaHCO_3$ (sodium Bicarbonate)

Ground water, H_2, CO_2, 60ml serum bottles, Acetate, aluminium foil, needle tubing

2) Steps

①60ml serum bottle filled with 40ml water, 10ml CO_2, 10ml H_2, under different settings of temperatures (5 °C, room temperature, 40 °C). **Duplicated samples**
②60ml serum bottle filled with 40ml water, 10ml CO_2, 10ml H_2, add nutritional medium to it, put it in the 40 °C oven. **Duplicated samples**
③60ml serum bottle filled with 40ml water, 20ml CO_2, 20ml H_2, add nutritional medium to it, put it in the 40 °C oven. **Duplicated samples**

④60ml serum bottle filled with 40ml water, 10ml CO_2, 10ml H_2, add 0.1ml acetate and nutritional medium to it, put it in the room temperature and 40 °C oven. **Duplicated samples**

⑤60ml serum bottle filled with 40ml water, 20ml CO_2, 20ml H_2, add 0.1ml acetate and nutritional medium to it, put it in the room temperature and 40 °C oven. **Duplicated samples**

Optional:

⑥60ml serum bottle filled with 50ml water, 30ml CO_2, 30ml H_2, add acetate and nutritional medium to it, put it in the room temperature and 40 °C oven.

Wrap all serum bottles with aluminium foil to avoid the lights.
Detect the gas compositions and $\delta^{13}C$ of CO_2 and CH_4 at regular intervals, such as 40d, 80d, 100d, 130d, 150d, 180d, 200d, 230d.

3) Specific steps

①Prepare the labels
RN 16589 $10CO_2$ 10 H_2 5°C
RN 30651 $10CO_2$ 10 H_2 5 °C
RN 16589 $10CO_2$ 10 H_2 20 °C
RN 30651 $10CO_2$ 10 H_2 20 °C
RN 16589 $10CO_2$ 10 H_2 40 °C
RN 30651 $10CO_2$ 10 H_2 40 °C
RN 16589 nutrition $10CO_2$ 10 H_2 40 °C
RN 30651 nutrition $10CO_2$ 10 H_2 40 °C
RN 16589 nutrition $20CO_2$ 20 H_2 40 °C
RN 30651 nutrition $20CO_2$ 20 H_2 40 °C
RN 16589 nutrition 0.1 acetic acid 10CO2 10 H_2 20°C
RN 30651 nutrition 0.1 acetic acid $10CO_2$ 10 H_2 20 °C
RN 16589 nutrition 0.1 acetic acid $10CO_2$ 10 H_2 40 °C
RN 30651 nutrition 0.1 acetic acid $10CO_2$ $10H_2$ 40 °C
RN 16589 nutrition 0.1 acetic acid $20CO_2$ 20 H_2 20 °C
RN 30651 nutrition 0.1 acetic acid $20CO_2$ 20 H_2 20 °C
RN 16589 nutrition 0.1 acetic acid $20CO_2$ 20 H_2 40 °C
RN 30651 nutrition 0.1 acetic acid $20CO_2$ 20 H_2 40 °C

If there is any ground water left, maybe try the triple normal pressure?.
RN 16589 nutrition 0.1 acetic acid $40CO_2$ $20H_2$ 40 °C
RN 30651 nutrition 0.1 acetic acid $40CO_2$ $20H_2$ 40 °C

②Prepare the gas mixture
The total gas needed is 600ml
Find a container to mix the CO_2 and H_2 with the volume ratio of 1:1.
If the container is not easy to find, we can inject CO_2 and H_2 separately.

③Prepare 3 clean bakers. Fill up the serum bottles with ground water using the baker, put on the caps and make sure there is no bubble. Use the needle and pressure principles.

④Add certain gas and let the corresponding ground water out, to keep an equal pressure in the bottle, resemble the groundwater in a clean baker, and reuse it.

⑤Wrap the water bottles with aluminium foil. Put them in different settings of temperature.

⑥Test the pH value of the groundwater (RN 16589 8.45 RN 30651 7.20).

Notice: After finishing the first three bottles without nutrition, put the prepared powder (0.01g K_2SO_4, 0.0525g $FeCl_3.6H_2O$,0.05g $CaCl_2$, and 2g $NaHCO_3$) into the collect bottle (with only around 380ml ground water left) as the inorganic nutrients for microbes. Leave some groundwater in it original condition to analyse the concentration of the ions.

4. A review paper on Monitoring and verification Technologies for CO2 Geological Sequestration