

South African Centre for Carbon Capture & Storage

South African Carbon Capture and Storage Geoschool report

From the 17th to the 23rd of October 2011, the South African Centre for Carbon Capture and Storage (SACCCS) co-hosted the first South African Carbon Capture and Storage (CCS) Geoschool as part of the South Africa- European Cooperation in Carbon Capture and Storage (SAfECCS) project.

The SAfECCS project is aimed at furthering the understanding of CCS in South Africa in four specific areas: local geology, legal and regulatory, finance and capacity building. The SAfECCS project team consists of a consortium that include international organisation: British Geological Survey (BGS) from the UK and Nederlandse Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek (TNO) from the Netherlands as well as South African organisations: Ecometrix, Imbewu, Council for Geoscience (CGS) and the Petroleum Agency of South Africa (PASA).

The programme for the Geoschool was divided into two parts;

- One day introductory Geoschool (17th of October 2011 in Pretoria).
- Six day advanced Geoschool including a field trip to the Algoa Basin (18th to the 23rd of October 2011 in Port Elizabeth).

It takes many years to develop geological expertise in the field of CCS. The Geoschool was a small step in this development process in South Africa.

One day Geoschool

The one day Geoschool provided an introduction to geological storage of CO₂ and was held at the CGS premises in Silverton, Pretoria on the 17th of October 2011. The course was presented by personnel from BGS. The course focused on the principles of geological storage of CO₂ using real case studies and cutting edge research results. The topics that were covered by the course were;

- Why use CCS?
- The concept of CCS

- Types of geological storage and site screening
- Estimating CO₂ storage capacity
- How is injected CO₂ trapped in the subsurface?
- Modelling underground storage of CO₂
- Site assessment methods, monitoring and verification
- Risk and remediation
- Case studies and future deployment

The one day Geoschool was well attended with people from CGS, PASA, University of Pretoria, SACCCS and Exxaro. The feedback from those who attended was that they learned a lot with regard to various aspects of CCS.

Six day Geoschool

The six day Geoschool looked more in-depth into the technical issues surrounding CO₂ geological storage and was held in Port Elizabeth, South Africa, from October 18th to 23rd. The six day Geoschool was ran by TNO, BGS and CGS with support from SACCCS.

The Geoschool focused on the general workflow and activities involved in the selection and characterization of potential geological storage locations for CO₂. Experts brought in valuable lessons learned from sites around the world through presentations and interactive workshops. The workshops included group evaluations of dedicated data sets and computer-based exercises. The participants actively contributed to the workshops and to the discussions based on the workshop results. A field trip to the Algoa Basin was held for the participants to conclude the workshop.

The program was as follows;

- Day 1: *Capture of CO₂, EU regulations, public perception, site characterization workflow, CSLF capacity estimations and an introduction to the two virtual cases.*
- Day 2: *Capacity estimates assignment during exploration and verification phase, scenario definitions, dynamic modelling assignment.*
- Day 3: *Risk assessment and bowtie approach, ground movement modelling assignment, leakage, impacts and remediation, well integrity assignment.*

Day 4: *Monitoring technologies, long-term performance of the storage site assignment to set-up a monitoring plan, economics of a CCS project.*

Day 5 and 6: *Geological excursion to Algoa Basin (voluntary)*

The programme

The course was set-up around two virtual storage locations (an onshore saline aquifer and an offshore gas field) that were evaluated throughout the course using technical information provided in presentations, followed by active involvement of the participants in break-out sessions. In these sessions, the theory was put into practice. The participants learned about the necessary evaluation stages in setting up a storage project. The participants ended the first half of the week by giving brief presentations of their results of the workshop.

Geological excursion

The second half of the week was set aside for a visit to the Algoa Basin. The aim of the visit was to familiarise the Geoschool course participants with the locations similar to those that may be used for storing CO₂. The visit would further help the participants, in applying the theoretical knowledge that was learned during the course to preliminary assess the suitability of the Algoa Basin as a potential CO₂ storage site. On that aspect, the visit would be a good contributor to the CCS capacity building efforts in South Africa.

The visit to the Algoa basin included going to Swartkops River Valley to view the Enon Formation and its contact with the Kirkwood Formation, and the contact with the Coega Fault. Other areas that the team visited were the Kirkwood Formation, the fault block at Heatley's Kranz and just east of the type section of the Sundays River Formation.

The six day Geoschool was well attended with people from CGS, PASA and SACCCS. A questionnaire was circulated to the participants at the end of the course, to assess the overall satisfaction of the participants. The survey indicated 87% satisfaction rating.

Highlights

The project was aimed at building human capacity for CCS in South Africa, by starting the process of developing experts focused on computer modelling of CO₂ storage which will be required for the SACCCS CO₂ Test Injection Project. It takes many years to develop CO₂ storage modellers. The participants highly valued the course for the in-depth knowledge that it gave, regarding computer simulations exercises, CO₂ storage capacity estimation, well integrity and monitoring plan assessments. The Geoschool is the first step in the

development process that will end up with the participants becoming the CCS experts in many years to come.

Following the first Geoschool, a number of next steps are under consideration by SACCCS:

- Leveraging the knowledge that the participants acquired to support the SACCCS programme. Most of the participants in the Geoschool are geologists who had a general understanding of the CCS. The participants were however not familiar with some of the knowledge areas that were covered, especially the computer simulations. It is hoped that the participants, from the knowledge that they acquired will help in stimulating the interest in CCS in their respective companies. The interest in CCS will result in many students wanting to participate in CCS activities or research which may help SACCCS.
- Acquisition of software that was used in Geoschool to make available for future training. The training for the Geoschool in Port Elizabeth was presented to a limited number of students. In future, SACCCS may want to embark on more trainings of similar nature to the Geoschool. The purchase of the software for the Geoschool will be necessary for such trainings.
- The holding of further Geoschool's and other training programmes. The participants of the Geoschool were so impressed with the course, that they requested a follow up Geoschool course. A follow up Geoschool course will be aimed at people who are interested in CCS. The period that may be considered for holding the Geoschool is August 2012.

Learnings from the students

Appendix A below, shows the comments from the participants on the Geoschool that are based on the questionnaire that was given at the end of the course.

A comment, *“The CCS course was very informative and hands on. It gave an objective and realistic view of the technologies as well as the risk involved with CCS. The audience is left with a better understanding and can respond back to the South African science community with enthusiasm”* indicates that the participants benefited from the course since it covered a wide range of CCS topics. The knowledge that was acquired from the course will benefit the participants when they communicate about CCS in other CCS forums.

A comment, *"A great opportunity for the South Africans as the information is not readily available in a single textbook nor are there so many experts available in one place at any institution."* indicates that the participants valued the experience that the international presenters brought to the course.

For more information please see the SACCCS website – www.sacccs.org.za or contact Ronald Munyai on (010) 201 8108 or via email: ronaldm@sanedi.org.za.

Appendix A: Comments from participants that are based on the questionnaire that was given at the end of the course

To what extent did the course fulfill its stated objectives?

"Working in groups was a great idea since other people had a more simple way of explaining, which benefited everyone in the group."

"Excellent work executed."

To what extent did the course fulfill its stated objectives?

"All the presenters are superbly fluent and articulate."

"Optimism when presenting keeps the audience interested, however style of presentation was perfect."

"Good training and presentation work."

Were the working group sessions effective?

"Working in group sessions was a brilliant [...] It helped me to better understand the material taught in the presentations in a more hands on approach which afforded me an opportunity to test my understanding of the material and also benefitting from my group mates who have different geological background."

Comments for the overall course

“The CCS course was very informative and hands on, It gave an objective and realistic view of the technologies as well as the risk involved with CCS. The audience is left with a better understanding and can respond back to the South African science community with enthusiasm. Thank you!!”

“The course was well structured in terms of content

- Presentations*
- Group work ”*

“Excellent. Would be good to maybe customise the exercises to custom fit specific site variation in different areas. Eg. In South Africa we have poor porosity of 50 Md (could maybe adapt the lectures to suit the sites that the students will work in and can relate to)”

“Well informative presentation and training. This can formulate a very good CCS project in South Africa. The training have introduced the best practices of CCS capture to storage facility.”