

Deploying Passive/Microseismic Technology to Monitor Subsurface Reservoir During CO₂ Injection – CO₂ – EOR/CO₂ Storage.

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CO₂ Storage Monitoring

Introduction and Solution: Cuttlefish Carbon Guard

For CCS to **gain traction, investment, and public acceptance**, it is paramount that operating companies are able to **demonstrate the safety and security of injected CO₂**, ensuring that the **integrity of the storage site** and **behaviour of injected CO₂** is well understood.



About Cuttlefish Carbon Guard (CCG):

CCG is TensorGEO's passive seismic monitoring solution that combines Low Frequency Seismic and Microseismic Full Wave Location technologies to track CO₂ storage across 0.1 - >100 Hz frequency ranges. This environmentally friendly technology enables safe CO₂ storage monitoring by tracking the integrity of the reservoir and spatial velocity changes without active seismic sources.

Acquisition and Deployment Design

- Combination of sensors 3c and 1c
- Full grid deployment

Sensor and Model Calibration

- Calibrating surface sensors and model at depth to increase accuracy

Processing and Interpretation Workflow

- Filtering of noise
- Model building
- Combined interpretation methods (Method A and Method B) integrating frequencies from 0.1 to > 100Hz

Method A (LFS)

Freq 0.1hz - 5hz

Analyse the spectral response of vertically directed P-waves from ambient background noise.

Method B (FWL)

Freq 5hz - > 100hz

Aims to locate the microseismic events and determine the moment tensor in the reservoir rock

CO₂ Storage Monitoring

The Solution: Cuttlefish Carbon Guard

Pilot Trial Objectives & Deployment



Test the Combined Application of Method A (LFS) and Method B (FWL) in one deployment/application – Cuttlefish Carbon Guard (CCG)

Monitor the Microseismic Events Induced By Injected CO₂.

Monitor the Integrity/Stability of the Reservoir Caprock.

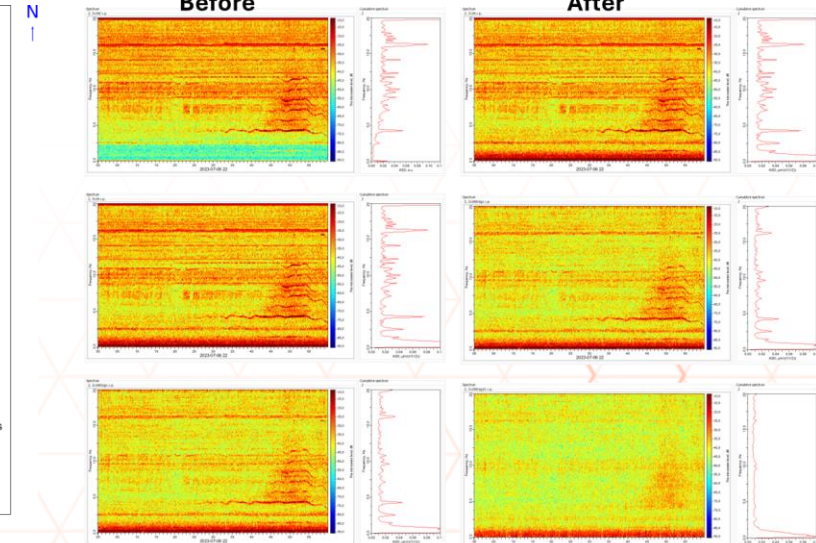
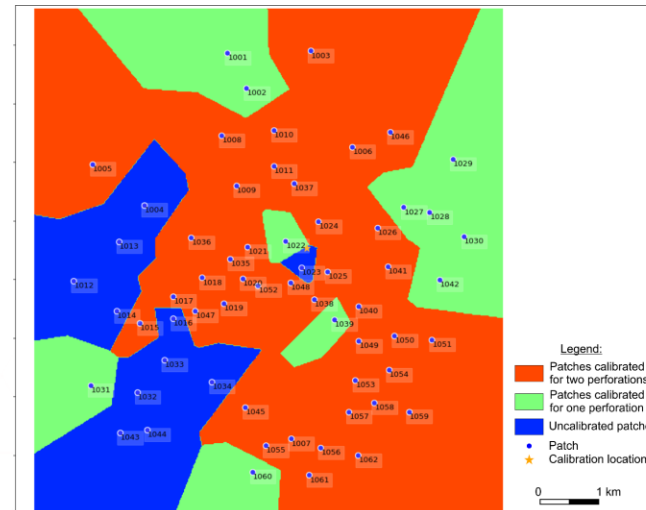
Locate fluid filtration channels and Track the distribution contour of the injected CO₂.

Delineating Hydrocarbon Deposits and Oil Water Contact

Limitations
Detecting Injected CO₂ in an Oil-bearing Reservoir

Data Acquisition (Grid & Sensor Deployment)

Calibration, Data Analysis, Filtration and Processing

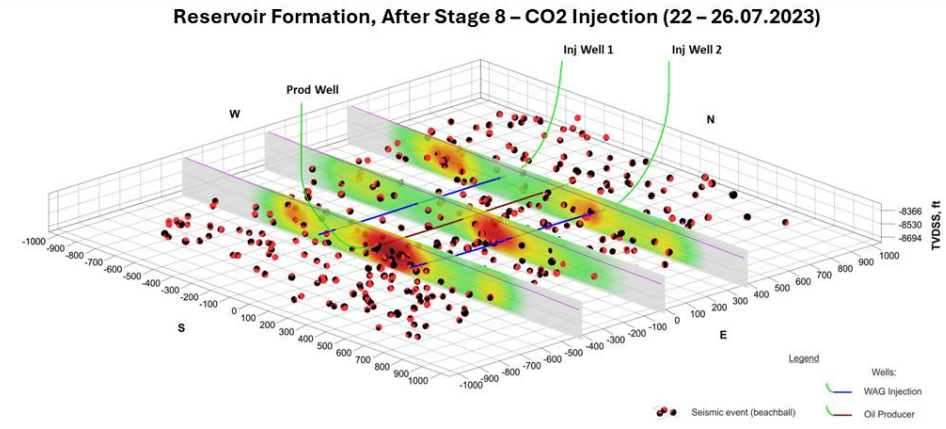
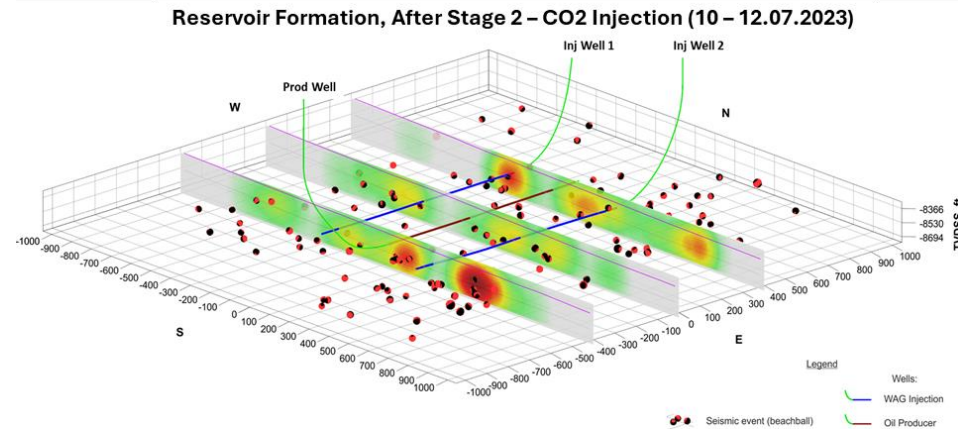


Volume of CO₂ injected – ca. 8mmscf/d/well
Injection in cycles of 2days/injection and 2days/no injection
Total recording – 26 days

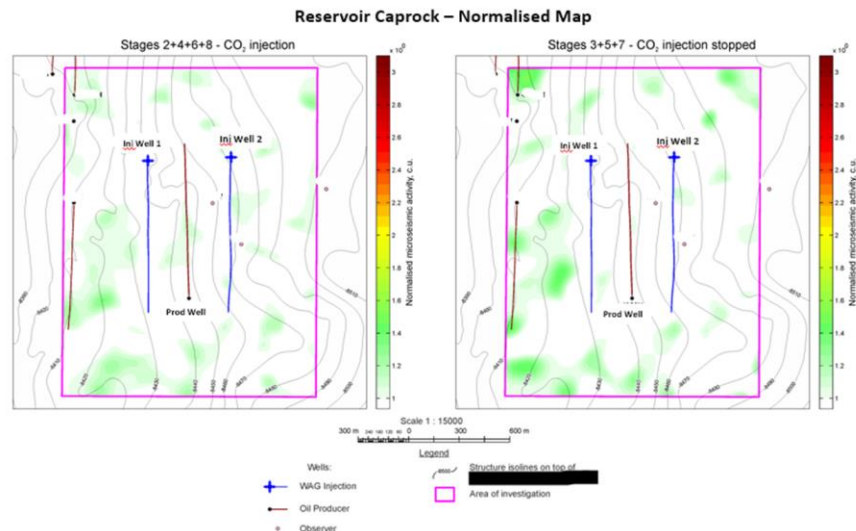
CO₂ Storage Monitoring

Cuttlefish Carbon Guard (CCG): Results

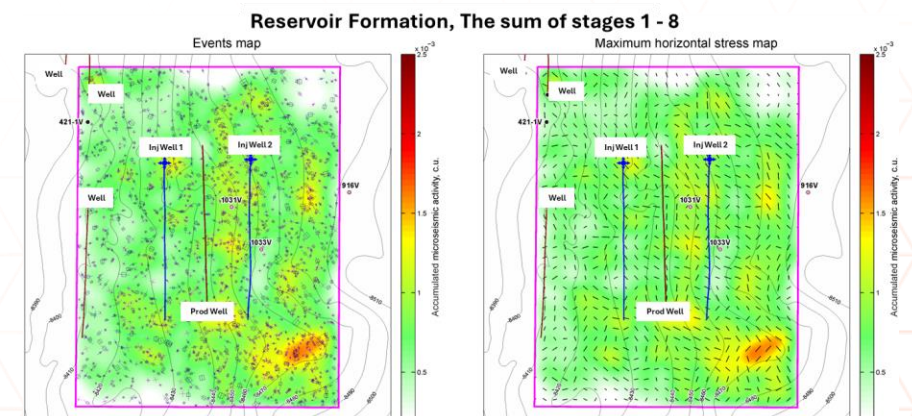
Objective 1 – Locating Microseismic Events Induced by Injected CO₂
Events map in beachball view for the field after the 2nd stage and 8th stage of recording.



Objective 2 – Monitor the Integrity/Stability of the Reservoir Caprock.



Objective 3 – Map the Horizontal Stress Distribution



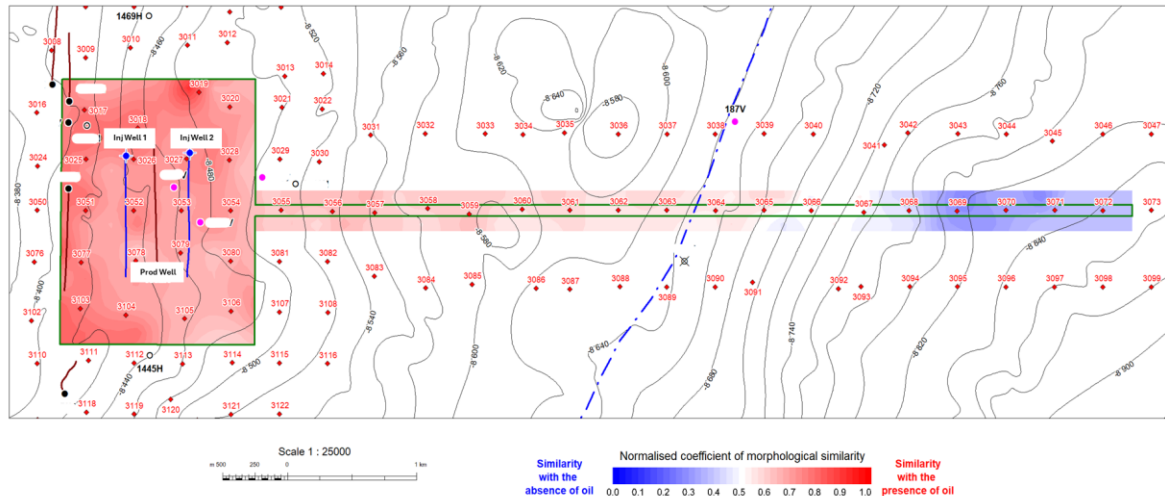
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Subsea Microseismic Technology

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Objective 5 – Tracking the Fluid Front Movement/Change in Pressure Paths



LFS, Stage 3 - Stage 1



CO₂ Storage Monitoring

Cuttlefish Carbon Guard (CCG): Value Proposition



- Monitor the Integrity of the Reservoir
- Monitor the Integrity of the Caprock
- Detect and Visualise/Image the Injected CO₂
- Characterise the Horizontal Stress Distribution
- Map the CO₂ Fluid Front Movement and Pressure Fronts
- Timelapse Monitoring of Microseismic Events in the Reservoir



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Aberdeen

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