SOUTH WEST HUB
RESERVOIR MODELLING

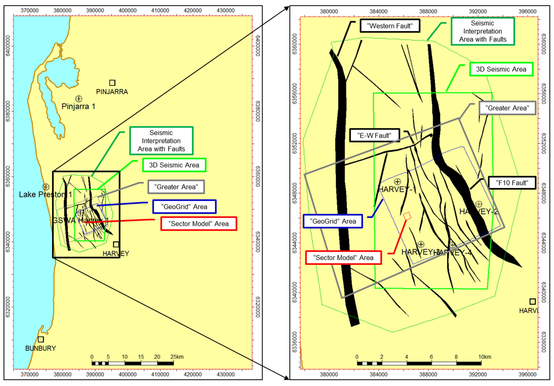
STORING CO_2

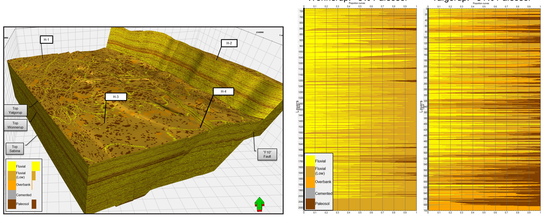
The South West Hub project is investigating the stratigraphy in the Harvey-Waroona area with a view to confirming the Lesueur Sandstone formation as an underground reservoir for the permanent storage of industrially generated carbon dioxide (CO_2).

Carbon capture and storage (CCS) is a proven technology which involves the capture of CO_2 from industrial processes, the transport of the CO_2 to a suitable site and injection of the compressed, or supercritical, CO_2 deep into the earth where it becomes trapped in the pore space of rocks.

The South West Hub CCS feasibility project is part of the Department of Mines and Petroleum and operates with support from the Australian Government.

Masses of data acquired by the South West Hub during six years of investigation has been processed and combined to create a virtual scale model of the underground area of interest, containing more than 166 million cells.



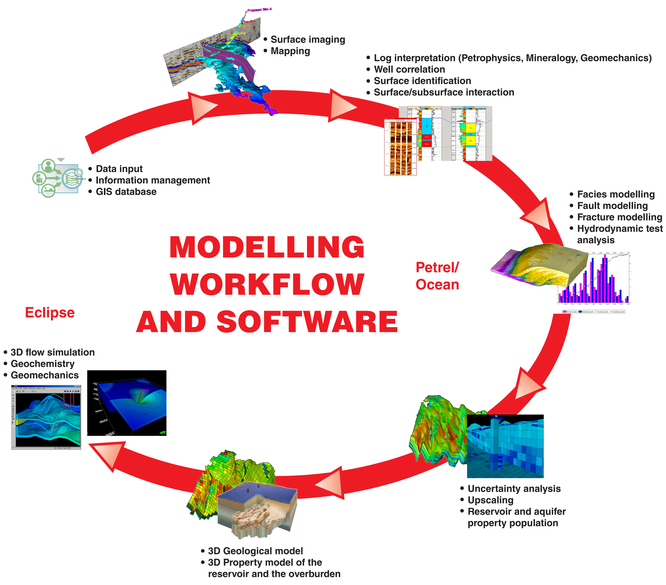


MODELLING

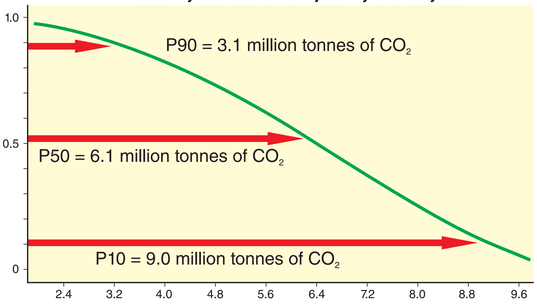
Once rock properties were assigned across the virtual reservoir, analysts ran various computer scenarios to understand how injected supercritical CO_2 would disperse through the saline aquifer and how long the plume continues to move.

ODIN Reservoir Consultants conducted simulations to:

1) assess the suitability of the Wonnerup Member, or lower part of the Lesueur Sandstone, as a CO_2 geosequestration reservoir and
2) provide confidence the plume would remain below 800 m for a period of 1000 years.



Probability distribution of injectivity over 30 years



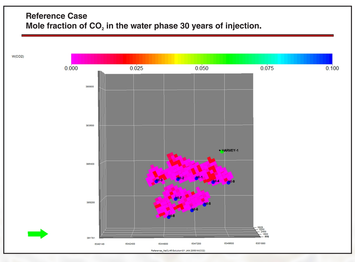
The results of the modelling show that it could be feasible to inject 800 000 tpa of CO_2 over 30 years in the Yalgorup and Wonnerup Formations in the Harvey area. The modelling studies show that all of the injected CO_2 remains in the Wonnerup and that the main factors controlling CO_2 plume migration are trapped gas saturation and the solubility of CO_2 in brine. Uncertainties in end point relative permeability, vertical permeability or the fraction of high energy facies in the Wonnerup are a second order effect.

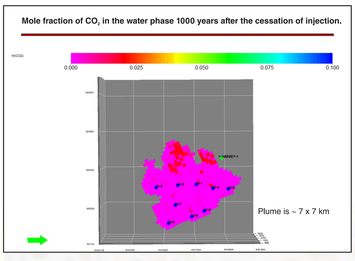
DYNAMIC MODEL

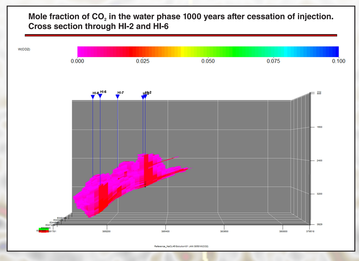
Reservoir simulation studies were conducted to assess the suitability of the Lesueur Sandstone as a potential CO_2 geological sequestration site.

The objective of the simulation study is to provide a suite of full field simulation models which cover a range of subsurface uncertainties.

- Use Static Model to develop dynamic models
- Simulate cases of CO_2 injection and movement using wells
- Generate plume maps as per the example below





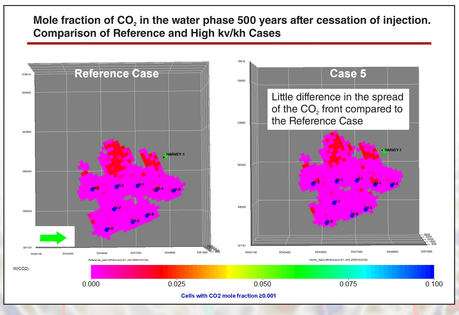


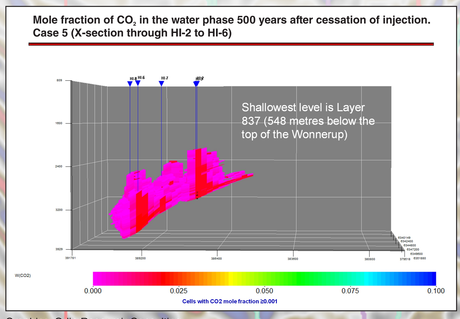
SCENARIO TESTING

The 'Reference Case' was subjected to a range of different scenarios which tested the assumptions on which the modelling was based.

Saturation after injection and after 1000 years

Case	Model Name	Geological Model	Trapped Gas Saturation	Brine Salinity (g/L NaCl Eq.)	Internal Faults	End Point Gas Relative Permeability
Reference	Reference	Reference	0.19	45600	Not sealing	0.12
1	Holey Faults	*Vertical permeability of cells adjacent to faults is increased by 10 times.*	0.19	45600	Not sealing	0.12
2	HighKrg	Reference	0.19	45600	Not sealing	0.23
3	LoHyst	Reference	*0.10*	45600	Not sealing	0.12
4	HighPerm	*Proportion of High Energy Facies in Wonnerup Increased to 90%.*	0.19	45600	Not sealing	0.12
5	Hikvkh	*Vertical and horizontal permeability are equal. Used Seismic Trend (Deterministic Case) to populate Paleosols in the Wonnerup.*	0.19	45600	Not sealing	0.12
6	Seismic_Trend		0.19	45600	Not sealing	0.12
7	Fault_Trans	Reference	0.19	45600	*Fault transmissibility multiplier of 0.1*	0.12
8	LoSol	Reference	0.19	200000	Not sealing	0.12





Graphics: Odin Reservoir Consulting

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