

Plugging and Abandoning (Decommissioning) Oil & Gas Wells with Bentonite

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Supervisors: Professor Brian Towler & Dr. Mahshid Firouzi - CSSG Project Title: Plugging CSG Wells with Bentonite

Research Aims

The result of this study will help to find an alternative method of plugging and abandoning coal seam gas wells.

Wells are currently plugged with cement. This study is investigating the use of bentonite (a swellable clay) as an alternate plugging material.

Bentonite is proposed as its performance characteristics indicate that it has several physical advantages over cement. Bentonite plugs would also be more cost effective than cement.

Plugging and Abandoning (P&A)

Wells are closed permanently, either after logs determine there is insufficient hydrocarbon potential to complete the well, or after production operations have drained the reservoir.

Different regulatory bodies have their own requirements for plugging operations. Most require that cement plugs be placed and tested across any open hydrocarbon-bearing formations, across all casing shoes, across freshwater aquifers, and perhaps several other areas near the surface, including the top 20 to 50 ft [6 to 15 m] of the wellbore.

Materials

Bentonite for the laboratory tests has been obtained from Amcol Australia's sodium bentonite mine near Gurulmundi, 40 km north of Miles (350 km inland of Brisbane in Queensland, Eastern Australia).



Fig. 1: Bentonite samples from Amcol Australia's sodium bentonite mine

Lab Methodology

We are using an experimental setup in the laboratory to investigate the performance of bentonite plugs. Key factors being assessed include:

- Plug failure mode (Plug & wall friction / shear force)
- Swelling behaviour of the clay (bentonite)
- Bentonite/steel casing friction factor

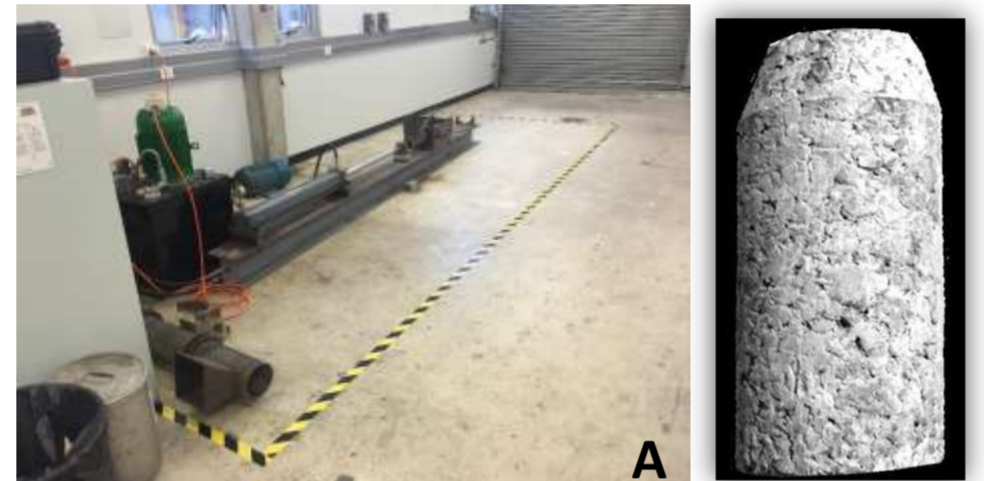


Fig. 2: (A) Experimental equipment for making cylindrical bentonite plugs shown in (B)

Experimental Results

Figure 3 shows the behaviour of bentonite plugs at different compressing pressures (in tonne) and Poly-Vinyl-Pyrrolidone (PVP) concentrations as the binding material.

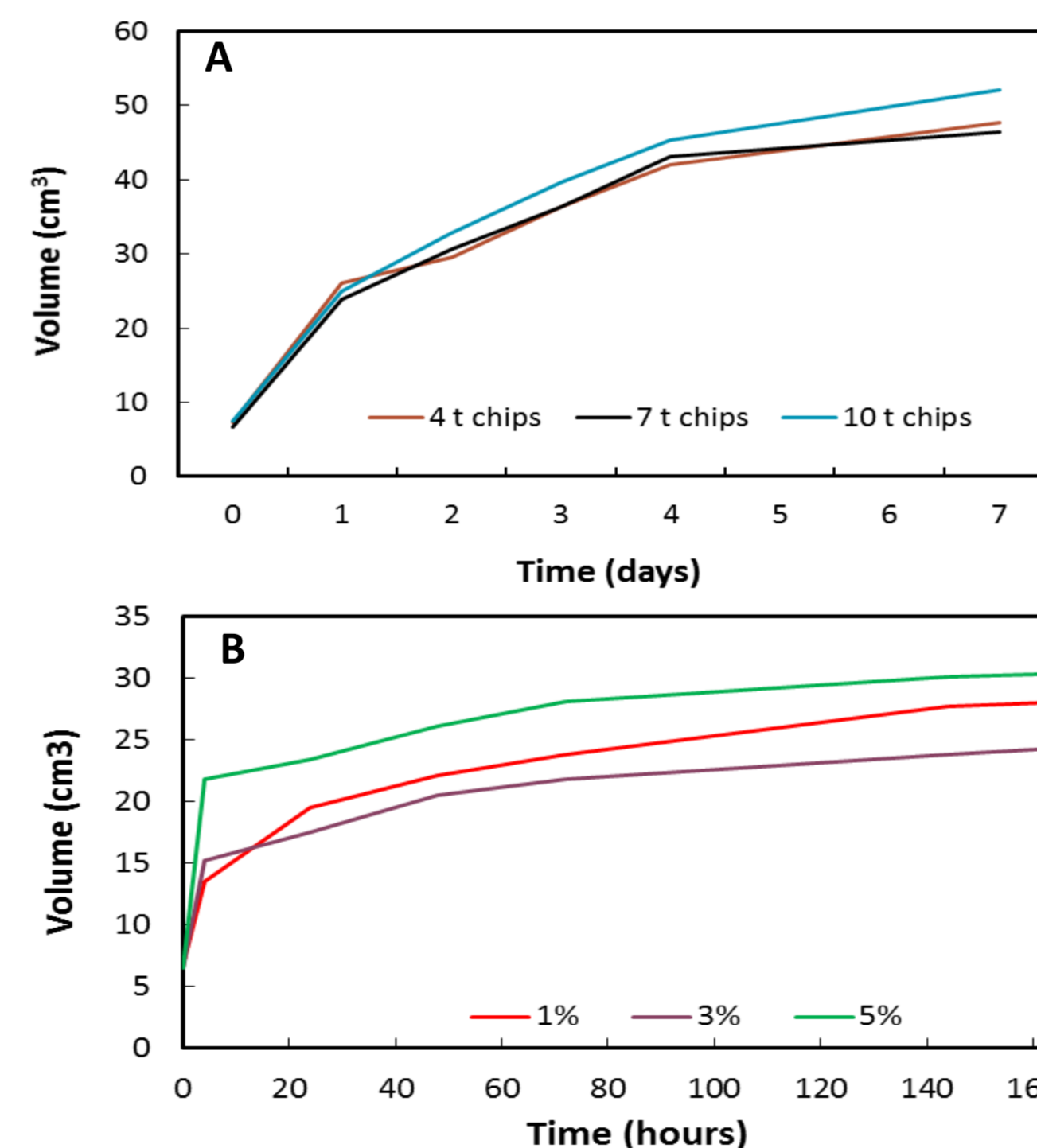


Fig. 3: Volume of bentonite plug over time at different pressures (A) and PVP concentrations (B)

Historical Use and Field Trial

Bentonite is currently widely used for plugging shallow water wells in USA.

Over the past 15 years Chevron has successfully plugged approximately 10,000 oil and gas wells in the San Joaquin Basin in California with bentonite.

Chevron Australia examined the application of bentonite nodules (Zonite) to plug wells in Barrow Island located approximately 88 km north of Onslow on the west coast of Australia.

Future Activities

The research team will:

- Undertake one or more field trials to demonstrate the effectiveness of bentonite as a plugging material
- Develop an operational procedure for decommissioning CSG wells with bentonite that incorporates international best practice
- Consult with the government regarding the regulatory requirements for using bentonite plugs.

Conclusion

- Bentonite creates a more reliable plug because it is malleable and self-healing when disturbed
- Internal swelling pressure depends on moisture content and density of the plug
- Monitoring and controlling the moisture content has high importance for increasing plug strength

Acknowledgements

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