DAY 2 Abstracts
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Morning Plenary

Barriers to flow: advancing aquitard assessments for energy and mineral resource projects

W. Timms
UNSW

Aquitards, low permeability barriers to flow, can limit potential impacts of depressurization or dewatering and migration of contaminants associated with energy and mineral resource projects.
Aquitard research addresses a lack of data and understanding of processes within rock strata above underground mines, and extraction of unconventional gas resources, and also within natural and engineered clayey-earth barriers to flow near open pit mines. An overall framework for aquitard assessments was developed, including various multi-disciplinary site, laboratory and modelling studies in a staged approach commensurate with risk to the project and water resources. Detailed research within this framework will be presented including 1) reliable drill core scale measurements of vertical hydraulic conductivity (K_v), 2) approaches for core-site-basin scale monitoring and modelling of aquitard-aquifer systems, and 3) identifying the potential of discontinuous or continuous preferential flow paths through aquitards. Results to date include: 1) numerous K_v data for various aquitards and conditions (between 10^{-6} and 10^{-12} m/s) and benchmarking of lab methods highlighting appropriate core sampling, test fluids and conditions to prevent bias; a site example verifying lab data with in situ, high frequency pore pressure data; 2) a work flow for core-site-basin with geo-statistical methods to test representative cores (with a specified degree of heterogeneity) followed by fluvial process modelling generating multiple permeability distributions for groundwater flow modelling; and 3) innovative characterisation of a dual porosity, low permeability media by numerical modelling of a new geotechnical centrifuge test (interrupted flow); and an isotope method (vapour equilibration of $\delta^{18}O$, $\delta^{2}H$ on drill core) which assists in identifying slow diffusive versus rapid transport through aquitards. In conclusion, aquitards can effectively disconnect groundwater systems, enabling development of underlying resources. However, innovative techniques for aquitard assessment may be required where the integrity of aquitards under varying stress conditions is a potential risk to projects and water resources.