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Underground Coal Gasification / Coal Seam Gas Investigations
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ABSTRACT

Standardised scientific approach to measurement of hydrogeological impacts from underground coal gasification (UCG)

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1. Background and Objectives

Using new technology and best practices such as carbon capture and storage (CCS), underground coal gasification (UCG) has potential to improve recovery of energy from coal. The unique needs of UCG require regulation modification for successful and safe management of its development. The objectives of this study are: to demonstrate the spatial distribution of temperature and fluid pressure trends in and around the UCG chamber throughout operations; and to identify measurable criteria using fluid pressure trends to define a fluid active zone (FAZ). The aim of defining FAZ is to aid both operators and regulators in the assessment of UCG chamber conditions and potential groundwater contamination risks.

2. Method

Density corrected fluid pressure data from vibrating wire piezometers monitoring a UCG site were converted to hydraulic head. Fluid temperature for density correction was estimated from chamber proximity and operational parameters. The temporal and spatial differences in head relative to background levels (determined from regional hydrographs) were contoured, showing the evolution of FAZ through burn progression.

3. Results

The contour maps show FAZ evolution (in terms of head) both temporally and spatially. Drawdown rates are highest in the target coal and closest to the chamber, with much lower rates recorded in the distal overburden (radius 50–450 m). Fluctuations in coal seam head mirroring operational pressure changes confirm the importance of active management to maintain the protective cone of depression.

4. Conclusion

The delineation of FAZ around a UCG chamber is crucial for effective UCG operation and compliance monitoring. With the application of a simple but standardised scientific method, UCG operators can track FAZ evolution. This interpretation of monitoring data: 1. delivers real-time information for operation controls to reduce groundwater contamination risk; and 2. gives an objective and meaningful monitoring tool for compliance. Additionally, inclusion of FAZ definition in initial modelling for site selection purposes enables identification of unacceptable potential impacts.