

SOLUTION MINING RESEARCH INSTITUTE

679 Plank Road
Clifton Park, NY 12065, USA

Telephone: +1 518-579-6587
www.solutionmining.org

Technical
Conference
Paper



Aldbrough Hydrogen Storage - Legacy Data for New Caverns in Deep Bedded Zechstein Salt

Silvan Hoth¹, Hendrik Wilke², Patryk Tomaszewski², Farideh Sarikhany¹, Heinz Michael Springer¹,
Dirk Knaust¹, Janiche Beeder¹, Christopher McMichael², Fritz Wilke², Jamie Slingsby³,
Victoria Spooner³

¹Equinor ASA, ²AtkinsRéalis, ³SSE Thermal



SMRI Spring 2025 Technical Conference
27-29 April 2025
Wilhelmshaven, Germany

Aldbrough Hydrogen Storage - Legacy Data for New Caverns in Deep Bedded Zechstein Salt

Silvan Hoth¹, Hendrik Wilke², Patryk Tomaszewski², Farideh Sarikhany¹, Heinz Michael Springer¹, Dirk Knaust¹, Janiche Beeder¹, Christopher McMichael², Fritz Wilke², Jamie Slingsby³, Victoria Spooner³

¹Equinor ASA, ²AtikinsRéalisis, ³SSE Thermal

Abstract

Hydrogen storage in salt caverns is increasingly vital to facilitate the energy transition and allow for hard to abate industry decarbonisation. This paper focuses on the Aldbrough Hydrogen Storage (AHS) project in East England and the development of a hydrogen storage field south of the existing Aldbrough natural gas storage facility, utilising the same layered Zechstein salt deposits at a depth of ~1,800 m b.g.l. The observed vertical and lateral heterogeneity of the Zechstein deposits require a detailed and integrated subsurface characterisation. Such a multidisciplinary approach integrates (i) legacy data, including well data (e.g., wireline logs and cores), (ii) 2D seismic sections, (iii) solution mining histories, (iv) cavern development records, (v) brine samples, (vi) bromide analysis, and (vii) microbiological data to ensure safe, efficient and economic development of the cavern field, its operation and abandonment. In particular, the correlation between petrophysical log responses and core observations provided valuable insights into salt stratigraphy, salt composition, presence of insoluble, e.g. shale, anhydrite and highly soluble salt intervals, e.g. carnallite.

In the first phase, wireline petrophysical logs, in conjunction with core analysis, formed the basis for a lithostratigraphic subdivision of the encountered Zechstein Group deposits. Depth maps for key horizons were generated on the basis of these interpretations. In the next step, well data were linked with 2D seismic lines to understand the structural position of the wells, and to extrapolate well information into 3D. Isochore maps for several Zechstein Group intervals were calculated, constraining palaeogeography during Zechstein deposition to (i) identify suitable cavern design and locations, (ii) determine operating pressures, and (iii) estimate storage capacity.

The early phase cavern design involved a thermodynamic assessment, coupled thermal-mechanical analysis, and a development of a solution mining concept. The latter was specifically designed for the local geology and involved the analysis of historical solution mining records and brine chemistry data to predict leaching behaviour, to finally achieve optimal cavern development.

Integration of petrophysical logs with brine sample analysis and microbiological growth experiments, revealed a direct connection between salt rock composition, brine chemistry, its degree of chaotropy, i.e. the ability of certain substances (chaotropes) to disrupt the structure of macromolecules, and the growth of hydrogen consuming microbes.

Results presented here, highlight the need to define a site-specific leaching concept, requiring operational and organisational flexibility during execution and operation. This emphasises that geology directly influences infrastructure, which in turn affects the storage capacity, operational flexibility, and ultimately the economic viability of the project. Lastly, a tight integration with topside facility planning and finance is required, to ensure safe and efficient operations.

Key words: Hydrogen salt cavern storage, salt geology, seismic interpretation, petrophysical analysis, leaching concept, rock mechanics