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Assessing Potential Influence Of Nearby Hydrocarbon Production On CO2 Storage At Smeaheia

H. Lauritsen[1]*, S. Kassold[1], R. Meneguolo[1], A. Furre[1]
[1]Equinor

Summary

In 2016, a study identified the Smeaheia area located 30km off the western coast of Norway, as a suitable storage site for CO2. A concept selection study requested by the Gassnova public enterprise was subsequently performed by the Northern Lights subsurface team, a group comprised of personnel from Equinor and partners. The study revealed challenges with the various geological structures planned for CO2 storage, as well as the importance of understanding the pressure connectivity with the neighbouring hydrocarbon producing Troll field. Due to these challenges Smeaheia was not found mature enough for concept selection at this stage

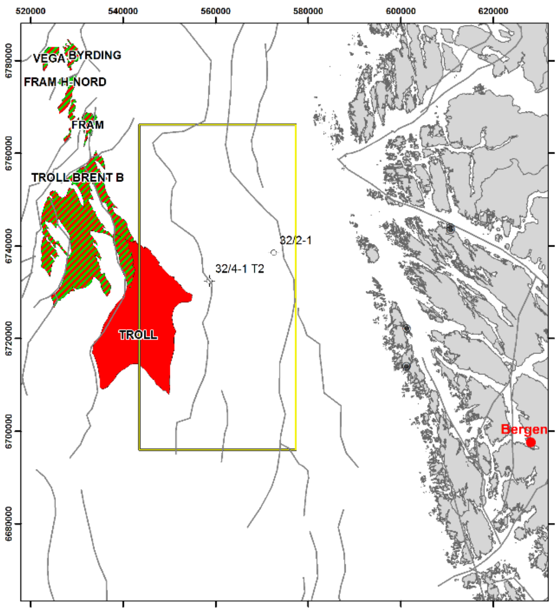

Figure 1 *Left: Area map with main structural elements and the Smeaheia area in magenta; Right: Figure from Meneguolo, R. 2018, Map showing the Smeaheia area with the main structures evaluated for CO_2 storage.*

Figure 2 *Seismic cross section including the main structural elements and stratigraphy (modified from Meneguolo, R. 2018). Seismic sections shown with courtesy of CGG.*

Reservoir technology

The reservoir simulations performed for Smeaheia mainly focused on identifying the key parameters influencing the theoretical storage capacity and estimating their relative importance by testing them dynamically in an Eclipse 300 (E300) simulation model. With the exclusion of Beta as a suitable storage structure, the storage capacity estimate is predominantly governed by the pressure depletion from nearby producing Troll fields that is assumed to carry on long after the planned CO_2 injection period. This depletion has great impact on the CO_2 density and hence the volume it will occupy in the pore space.

The project team successfully constructed a geological and dynamic model to be utilized in testing the most important parameters to CO_2 injection and storage (Figure 3). The model covers an area permitting the direct modelling of the two governing frame conditions: pressure influence from Troll production and monitoring of CO_2 migration towards the Beta structure. The model allows for testing of the main CO_2 trapping mechanisms of structural, residual, and dissolution trapping.

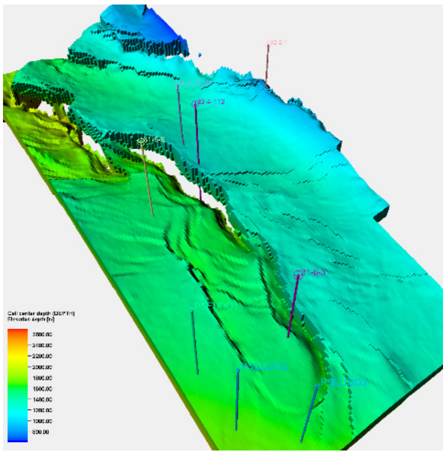

***Figure 3** Outline of the E300 dynamic model.*

The simulation work mainly focused on a scenario where 40 MT CO2 is injected in one well located in the Viking Gp and assuming strong pressure influence from nearby fields. The injection point was placed deep in Viking to allow for residual trapping of CO2 as it migrates to the shallowest point and structural trapping in Alpha. The simulation work performed showed that 5-20% of the injected CO_2 would elude trapping on Alpha and flow to the Beta structure where it could potentially escape through the Øygarden fault zone (Figure 4).

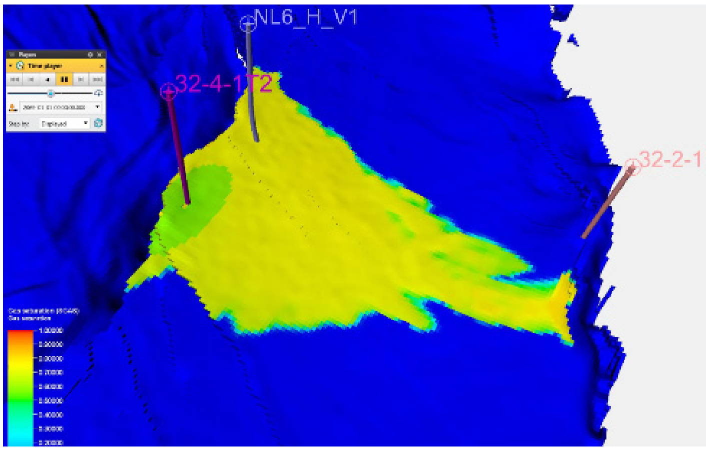

***Figure 4** Bird view on CO2 plume as it spills from Alpha to Beta.*

Conclusions

The project has acquired a good understanding of controlling elements and resulting scenarios for CO_2 storage capacity. Based on the modelling described above the storage capacity estimates are currently too low for full-scale development. A potential increase in capacity would require a larger development and higher investments than what is currently being evaluated. Methods or tools for confidently estimating aquifer recharge would help increasing storage capacity.

Acknowledgements

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