Risking of Hydrocarbon Exploration and CO2 Storage - Similarities and Differences

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Evaluation of potential CO2 storage sites involves assessments of storage potential, injection strategy and geological risking of seal quality and reservoir performance. Likewise, assessments of in-place volumes, development scenarios and risking of source, reservoir and trap / seal are cornerstones of hydrocarbon exploration. Experiences from the mature industry of hydrocarbon exploration should thus be of great value for the emerging CO2 storage business.

Calculations of fluid volumes within structural traps and reservoir quality assessments should be broadly similar in the two industries. Risking of seal integrity is also similar in many respects, although differences exist with respect to seal property changes due to wettability variations, leakage rate considerations and fault reactivation risk due to mineral dissolution. Storage of large quantities of CO2 in the form of dispersed CO2 outside structural closures is an important aspect of CO2 storage that does not have a close parallel in hydrocarbon exploration

One major difference between the two industries is that of calibration. Whereas prospect risk assessments can be calibrated to match previous exploration success rates, no such calibration is possible for leakage risk from a CO2 depository. Calibration of CO2 flow models can only be performed to a few cases worldwide, and only to the first few years after injection. The possibilities of model calibration for long-term CO2 flow in the subsurface are slim, whereas history matching of hydrocarbon production models results in fairly accurate understanding of hydrocarbon flow in producing reservoirs. As a result, the flow behaviour of subsurface CO2 will carry uncertainties that typically exceed those of reservoir modelling, and the CO2 leakage risk will be less well constrained than risk attached to prospect evaluation. This observation clashes with the desire to demonstrate high confidence in geological evaluations, a. o. to satisfy the general public and authorities for access to storage acreage. Communication of realistic confidence in geological evaluations combined with clarification of the (often small) consequences of CO2 leakage in various settings remains a major challenge for the upcoming CO2 storage industry.