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Physical Phenomena During CO2 Injection- From Lab to Field

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SUMMARY

CO2 Capture and Storage is a relatively new and a rapidly developing area which may benefit from knowledge acquired in both natural gas storage and Enhanced Oil Recovery projects. Some of the EOR methods like foam and polymer application to gas injection may be used to improve CO2 sweep in the underground storage cites and therefore, maximize storage capacity. Good understanding and correct representation of physical phenomena in simulation are essential to predict storage capacity of a site and CO2 migration over geological timescale.

A number of laboratory investigations and simulation studies performed in IRIS over a course of last years provided a deeper understanding of physical phenomena and highlighted potential problems in scaling up those phenomena to reservoir level. While those investigations were performed for CO2 EOR projects the effects of the above mentioned physical phenomena would be much more pronounced during millennia of storage compared to years of typical EOR applications. Several phenomena are addressed here:

CO2 dissolution in aqueous phase; The carbon dioxide would migrate inside the storage site both as a free and dissolved phase;

diffusive transfer in the formation;

carbon dioxide interaction with reservoir rock may result in changes in rock properties;

fractures and faults may be affected by the pressure changes during the CO2 injection / migration and may become conducting altering CO2 migration path and inducing leak-offs from the storage site.

A mechanistic investigation was performed to evaluate sensitivity of the CO2 storage and migration to uncertainty of the reservoir parameters for a typical formation in the North Sea.

It was shown that correct understanding and representation of physical phenomena is essential for designing the CSS project. The paper concluded with suggestions on how to apply modern reservoir simulators to the CSS problems and aid engineers in optimizing the storage projects.