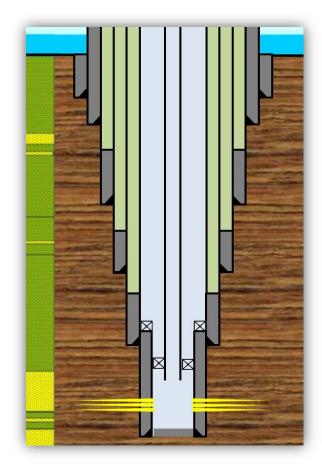


## Well integrity



Research on this topic was initiated in BIGCCS in 2012

#### NORSOK D-010r3

"... the application of technical, operational and organizational solutions to reduce the risk of uncontrolled release of formation fluids throughout the <a href="mailto:entire life cycle">entire life cycle</a> of the well ...".

Drilling, cementing, completion



Production/injection

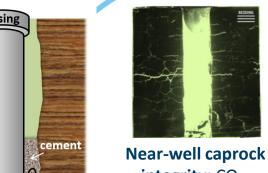


Plugging and abandonment

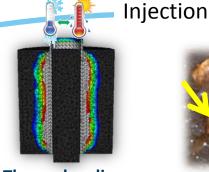


## Well integrity related spin-offs





Near-well caprock integrity: CO<sub>2</sub>permeability along cement-shale interfaces. (FP INTERFACCS)



Thermal cycling:
Well integrity
impact of changes
in p/T.
(KPN Well Integrity)

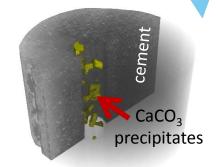


Injectivity: Studying permeability reduction in near-well region (salt, wax, hydrates).

(FP INJECT, KPN POREPAC)



**COMPLETE:** Study materials recovered from Ketzin wells.



Well plugging: Study how to best plug CO<sub>2</sub> wells. (FP CO2PLUG)



RePlug: Helping
Norwegian company
develop new CO<sub>2</sub> well
plugging material.

(IPN REPLUG, IPN REPLUG READY)

#### Well construction:

rock

Cement placement and post-job cement evaluation

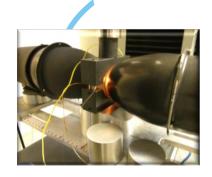
(FP FLUCCS)





### Good coupling to "family" of geomechanical projects

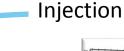
Monitoring & preparations

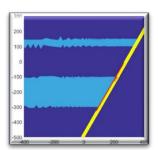


Handling pressure effects:

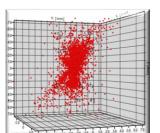
Better monitoring and remediation of pressure distribution in reservoir.

(ACT Pre-ACT)





Stress-effects on CO<sub>2</sub>
containment: Fault
reactivation, near-well
geomechanics.
(FP SPHINCCS)

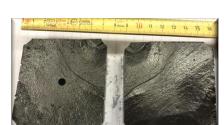


Microseismicity:
Studying
microseismic events
in CO<sub>2</sub> storage pilot in
USA
(DOE GSCO2)





Subsurface risk mitigation: Study leakage mechanisms common for CO<sub>2</sub> storage and shale gas. (H2020 SECURE)



Caprock integrity: Effects of CO<sub>2</sub>-on caprock strength and wettability.

(KPN FECRP)







## **US-Norway collaboration has been key to success**



Susan Carroll (LLNL)
during one of her visits
to Trondheim

(LLNL collaboration in KPN Well Integrity, NCCS, POREPAC, SPHINCSS)



LLNL during virutal participation to the "NCCS Day" in Trondheim



Bill Carey (LANL)
meeting with SINTEF at
Mission Innovation

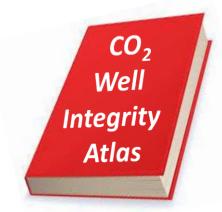
(LANL collaboration in INTERFACCS)



# **New:** CO<sub>2</sub> Well Integrity Atlas

- Perform large scientific survey and interview operators
- Describe issues reported from CO<sub>2</sub>
   storage projects
  - Field based assessment to understand them
  - Prevent similar occurrences from happening
  - Define future R&D/technology needs

Atlas will not expose commercial operators, will be focusing on well integrity topics









Dr. Nicolas Huerta





Dr. Malin Torsæter







## Most important topics for future R&D

- Collect field data on CCS-related well integrity issues (ongoing in Atlas) and compare with laboratory work
  - Understand downhole situation and parameters affecting well integrity
  - Understand how to establish, demonstrate and forecast well integrity
- Well integrity diagnostics esp. plugged & abandoned wells
  - Improved in-well logging and log interpretation
  - Non-invasive logging/monitoring of well integrity
- Remediation of problems esp. plugged & abandoned wells
  - Reliable and cost-efficient methods for dealing with "problem wells"

