

*Workshop on:*

***“Regulatory and technical requirements for responsible abandonment and re-use of salt caverns”***

*TNO Utrecht, 11 – 12 November 2019*

## **Session 3:**

# **Long-term behaviour of sealed salt caverns:**

## **Micro- to macro-scale**

### **Session Introduction:**

**Chris Spiers**

Utrecht University

Session Chairs:

**Chris Spiers & Serge van Gessel TNO**

Workshop on:

*“Regulatory and technical requirements for responsible abandonment and re-use of salt caverns”*

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## **Session 3: Aims**

To evaluate the micro-to macro scale processes  
influencing the long-term behavior of salt caverns

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To assess the implications and recommendations  
for abandonment practices

### **Contributors:**

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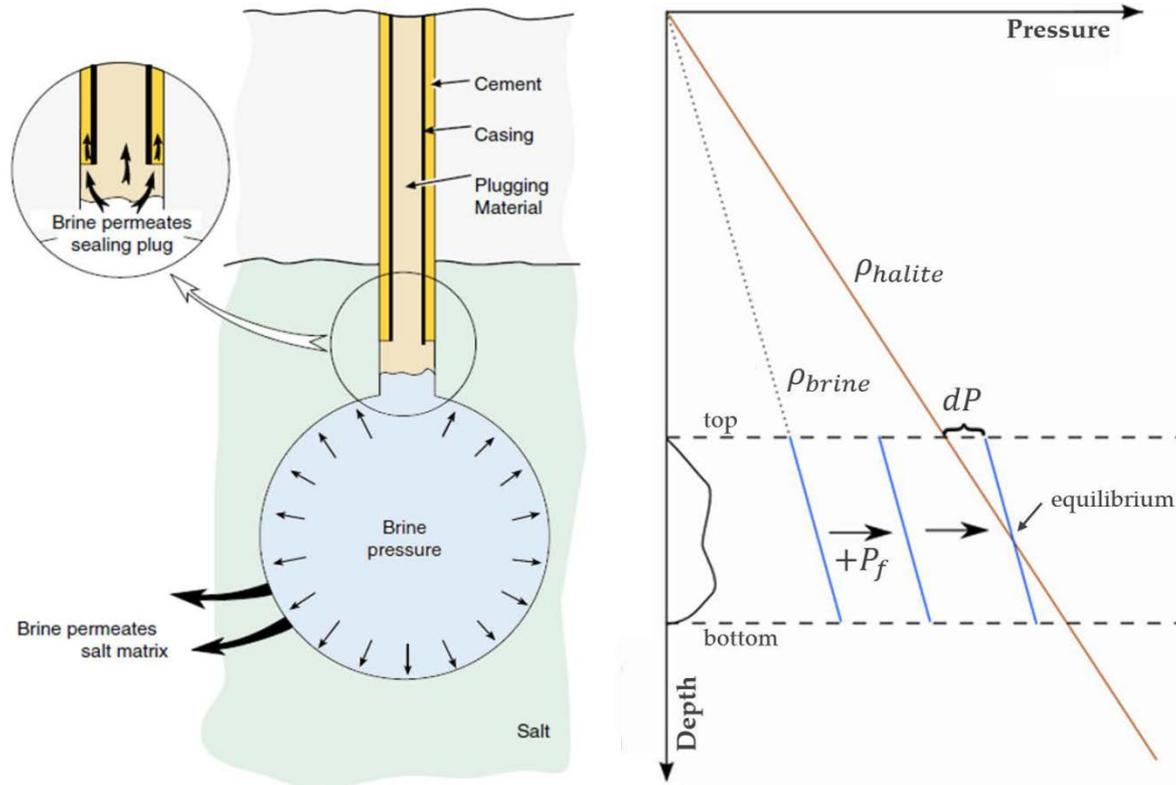
Antoine Duquesnoy (WEP)

Karl-Heinz Lux (TU Clausthal)

# Some controversial questions !

Will post abandonment convergence and thermal equilibration lead to:

1) P-build up and leakage along plugged/sealed boreholes



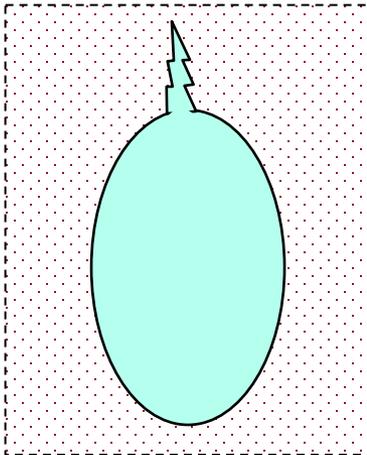
(after Brückner 2018; Ehgartner & Linn 1994; Ratigan 2000; Warren 2016).

# Some controversial questions !

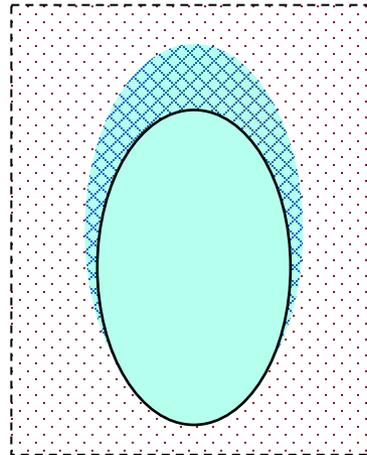
OR Will post abandonment convergence and thermal equilibration lead to:

- 2) P-build up and ultimately hydrofracture of the salt cavern roof / cover?
- 3) Permeation of brine into the salt roof/cover preventing fracking?
- 4) Localized deformation/permeation?

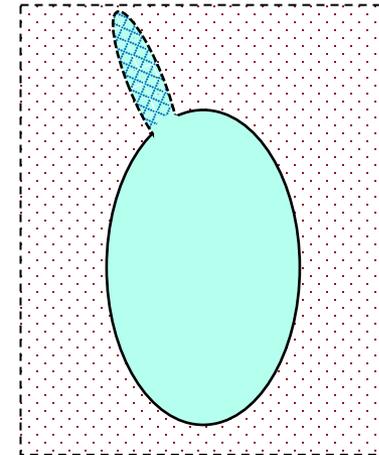
2. Hydrofracture



3. Permeation



4. Localized def + perm



... and what about upward/downward dissolution?

# The challenge faced

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## Inescapable truth:

A sealed, brine-filled cavern is gravitationally unstable ...  
..so leakage by one of the above mechanisms will presumably occur eventually!

## Issue is:

When? Timescale of years, decades, centuries, geological????

**Present macro-scale approaches** = Analytical, FEM and THM(C?) modelling  
(e.g. Berest/LMS EcolePolytechnique; Lux/Clausthal,..)

## Key questions:

- Are the active processes **ADEQUATELY** accounted for – at micro- & macro-scale?
- What are the effects of heterogeneous salt structure at macro-scale
- How does re-use for gas/energy storage influence post-abandonment behaviour?