

STUDY OF LEAKAGE FROM A STORAGE CAVERN THROUGH A JOINT

Purpose(s): Study of a possible escape route for liquefied gas stored in a cavity, 160 m below the surface, in a fractured medium

Client: GEOSTOCK

Date: 2005

Location: France

Partners: None

Project executive manager:
Céline BOURDEAU

Code(s) or Software used:
UDEEC

In order to improve the design of a “water curtain” being built above a **gas storage cavern in a fractured medium**, GEOSTOCK asked Itasca Consultants SAS to analyze the **mechanisms of a possible escape route for a gas out of a cavity**. In particular, we checked how far from the cavity a critically placed horizontal joint caused by due to excavation-induced tensile stresses and liquid pressures that daylight in the cavity wall could open.

To achieve this goal, we used **UDEEC**, the most appropriate tool for studying fractured media. We studied the **hydro-mechanical behavior of the “joint + rock” system** with respect to variations in block material characteristics (Young’s modulus and Poisson’s ratio) or joint characteristics (normal and shear stiffnesses, initial joint aperture). Figure 2 shows joint aperture at the end of the simulation.

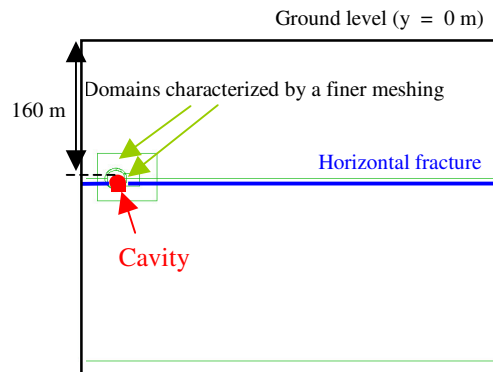


Figure 1 : 2D model showing the cavity and the horizontal fracture

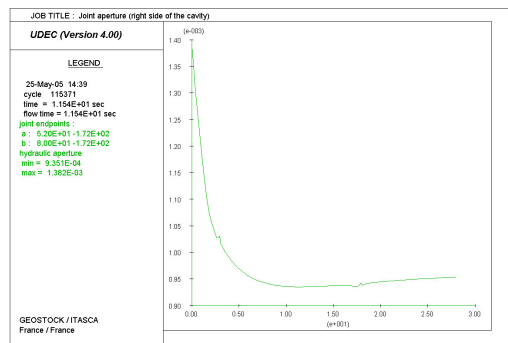


Figure 2 : **Joint aperture** along the right side of the cavity at the end of the simulation. The initial joint aperture is equal to 1 mm.

KEYWORDS:

- Joint aperture
- Joint stiffnesses

⇒ **RESULTS:**

From this study, it can be concluded that:

- 1) the joint opening length is equal to 3-4 m in all conditions;
- 2) the closure/aperture of the joint is independent on the block material characteristics but is strongly dependent on various joint characteristics;
- 3) the closure/aperture of the joint is the more enhanced the smaller the joint normal stiffness; and
- 4) the flow rate inside the fracture strongly depends on the minimum joint aperture.