SOLUTION MINING RESEARCH INSTITUTE
679 Plank Road
Clifton Park, NY 12065, USA

Telephone: +1 518-579-6587
www.solutionmining.org

Technical Conference Paper

Maximum Hydrogen Velocity in Salt Caverns Wells

Mejda Azabou, Yvan Charnavel, Grégoire Hévin, Paule Labaune, Célia Vincendeau

Storengy, Bois-Colombes, France

SMRI Fall 2024 Technical Conference
22-25 September 2024
Edmonton, Alberta, Canada

Solution Mining Research Institute Fall 2024 Technical Conference
Edmonton, Alberta, Canada 22-25 September 2024

Maximum Hydrogen Velocity in Salt Caverns Wells

Mejda Azabou, Yvan Charnavel, Grégoire Hévin, Paule Labaune, Célia Vincendeau
Storengy, Bois-Colombes, France

Abstract

The maximum hydrogen velocity allowed in salt caverns wells is an important economic parameter for the design of underground hydrogen storage sites and/or the repurposing of existing natural gas ones. The purpose of this paper is to look at the maximum hydrogen velocity to be allowed in salt caverns wells, for pressures ranging between 30 and 250 bar and temperatures between 10 and 50°C.

The volumetric calorific value of hydrogen is about 3 times less that of natural gas, consequently, all else being equal, hydrogen should flow at a higher speed than natural gas in order to maintain an equivalent energy capacity. However, an increased gas velocity is associated with many integrity risks such as erosion, flow induced vibration and pulsation, and external noise. Thus, hydrogen speed must be high enough to meet the energy capacity requirements but low enough not to damage the tubing.

We look at the risks associated with an increased hydrogen velocity using current standards and norms (API, ISO, DNV…), a literature review as well as specific case calculations.

Key words: Hydrogen Storage, Salt Cavern, Gas Velocity, Erosion, Energy Capacity

1. Introduction

Gas velocity in wells should be high enough to meet the energy capacity (HP)[1] requirements but low enough not to damage the tubing. In this paper, we attempt to investigate the maximum hydrogen velocity allowed in salt caverns wells, for pressures between 30 and 250 bar (435 psi and 3626 psi) and temperatures between 10 and 50°C (50°F and 122°F). The calorific value of hydrogen is about 3 times less than that of natural gas, consequently, all else being equal, hydrogen should flow at a higher speed than natural gas in order to maintain an equivalent energy capacity.

In the first part of this study, we identify hydrogen velocity requirements compared to natural gas in order to maintain an equivalent energy capacity, for theoretical operation conditions. The second part focuses on the risks associated with an increased gas velocity in wells. A comparative study is performed using current standards and norms (API, ISO, DNV…), a literature review as well as specific case calculations.

The technical-economical aspect and the physical constraints pertaining to surface facilities were not taken into account.

---

[1] We define the energy capacity as the heat power of a gas flow (HP). It is given as:

HP [kW] = gas flow [Nm3/h] * Higher Heating Value [kWh/Nm^3]