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Hydrogen Salt Cavern Design

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Abstract

Energy produced from renewable sources can be stored in the form of hydrogen in subsurface solution mined salt caverns for later use. Storage of substantial quantities of hydrogen in salt caverns has been done successfully for many years but continues to be a field of active research. Compared to other commonly stored gases, (i.e. natural gas) hydrogen has a lower energy density per unit volume, lower dynamic viscosity, and a higher compressibility factor. These peculiarities of hydrogen gas result in smaller pressure differences between the cavern and the wellhead, less temperature variations within the cavern, and smaller working gas and base gas volumes than are commonly seen with natural gas. Additionally, the small diameter of hydrogen molecules can present greater concern for permeation into surrounding rock. Material selection for steel and polymer/elastomer components are also specific for hydrogen applications. The unique characteristics of hydrogen therefore present special considerations for hydrogen cavern design and hydrogen storage operations.

This paper presents a high-level overview of current hydrogen storage cavern design in North America, along with standard operational practices and current difficulties. Considerations concerning cavern design, materials of construction and MIT design are provided. Future challenges and further research regarding the storage of hydrogen in salt caverns is also addressed.

Key words: Renewable Energy, Salt Cavern Hydrogen Storage.