Feasibility Study of Utilizing Water Disposal Wells to Inject Carbonated Water into Selected Formations in Oklahoma for the Purpose of CO_2 Storage

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Abstract

This paper examines the practical and economic feasibility of utilizing existing water disposal wells, with focus on areas with low seismicity events recorded, to sequester CO_2 and benefit from the 45Q tax code.

The UIC (Underground Injection control) program in Oklahoma regulates the activity from class II permits and monitors the injection rates/ volume/ pressure. Based on UIC-2019 record, there are about 11, 000 UIC wells which are utilized to inject about 2 billion barrels of saltwater annually (an average rate of 500 B/D) into underground geological formation(s).

As operators within Oklahoma still experience high water cuts with produced water being re-injected back into underground formation(s), this presents an excellent opportunity for Carbonated Water Injection (CWI).

Injection of carbonated water for EOR projects has been well documented. In our study, we adopt concept of carbonated water for the purposed of CO_2 storage: mixing of captured CO_2 with (slightly processed) produced water at the surface and injecting it into underground formation.

We use a simulation approach to evaluate cost to benefit analysis of carbonate water injection for the purpose of geological storage of CO_2. We select counties with the least observed seismicity events over the last decades and identify existing disposal wells in those areas. Next, we select the geological formations that are suitable for the CO_2 storage based on the state's storage catalogue. We use SIMCCS® to conduct simulations of various scenarios.

The amount of CO_2 dissolved in water is a function of pressure, temperature, and salinity. Based on our initial evaluation, we can dissolve about 156 SCF in one barrel of salt water based on average pressure, temperature, and salinity of Oklahoma UIC wells. This will yield sequestration of an average 75 MCF per day of CO_2 stored in target formations through each disposal well with average rate of 500 B/d injection rate per day. To meet the IRS-45Q tax credit eligibility requirement of capturing & storing 100,000 metric tons of CO_2 (~ 2BCF) annually, about 75 wells spread across clusters are required for individual operators.

Our results indicate that the economic gain of storing CO_2 through carbonated water injection is significant and can be considered as considerable cash flow generator for oil and gas operators in the state. The tax credit revenue will easily surpass the related expenses incurred due to surface facility modification for handling and mixing process of fluids, monitoring the acidity of carbonated water and the cost of

corrosion treatment for tubular.

This study outlines a novel methodology for CO_2 sequestration via CWI. In addition, we demonstrate the economic benefit of utilizing existing UIC class II permits wells for this purpose without having to incur extra costs and time to apply for class VI permits.