15th International Conference on Greenhouse Gas Control Technologies GHGT-15
5th - 8th October 2020, Abu Dhabi, UAE

Quest CCS facility: Halite Injectivity Damage Remediation in CO2 Injection Wells


Shell Canada Limited, 400 – 4th Avenue SW, Calgary, AB. T2P 2H5

Abstract

The Quest CCS facility (located in Alberta, Canada) is a fully integrated carbon capture, transport and storage facility operated by Shell Canada. It continuously captures and stores about 1.1Mt of CO2 per year, with injection expected to continue until 2040. Following a month of performance testing, commercial operations began in October 2015, and through November 2020, more than 5.6 Mt of CO2 have been sequestered.

The commercial scale deployment of Carbon Capture and Storage (CCS) as a viable greenhouse gas (GHG) emissions reduction technology requires that the CO2 be continuously injected at material and predictable rates into geological formations (e.g. saline aquifers). While the initial injectivity for the Quest CO2 injection wells was very high, significant injectivity reductions have been observed following short well shut-in periods associated with well intervention work. Although these injectivity reductions currently do not form an operational constraint, if the trend of injectivity reductions continue, it may become an issue for future operations. Developing the capability to reduce or even reverse these injectivity reductions may be key to maintaining reliable CO2 injection.

The Quest CCS project sequesters CO2 into the Basal Cambrian Sands (BCS) formation, which was initially filled with sodium chloride saturated brine. As dry CO2 is injected, water can evaporate from the brine into the CO2 driving precipitation of halite. This precipitation can occur in various locations including inside the wellbore, perforation tunnel, near wellbore area and further afield in the BCS formation. Plugging of the perforation tunnel and pore throats in the near wellbore area can cause injectivity damage. A downhole video log performed in April 2018 on the Quest IW 7-11 CO2 injection well showed solids plugging in numerous perforations. The most probable substance to precipitate in the downhole environment of a Quest CO2 injector well is halite. While the solids were not sampled for compositional analysis during the April 2018 downhole video log, downhole samples were obtained during the pre-work leading up to the halite remediation treatment. A viable mechanism for inducing halite damage during well intervention shut-in events is that deposited halite is dislodged and subsequently plugs the critical perforation tunnel and near wellbore areas.

One method to remediate halite damage is to inject a water-based fluid to dissolve the halite precipitate, thereby removing it from the perforation tunnel and near wellbore area, where it can damage the well injectivity performance. Quest performed the first halite remediation treatment on one of the CO2 injector wells in 2020. The objective of this paper is to present the design, execution and results of this initial halite remediation treatment. An outline of the design of the halite remediation treatment will be provided. Aspects of the treatment design including treatment volume, rate, pressure, treatment fluid composition, fluid diversion, tubing stress analysis and hydrate mitigation will be discussed. Subsequently the halite remediation treatment as executed in the field will be reviewed including the timing of operations and the pumping pressure and rate data. Finally, to evaluate the effectiveness of the treatment, skin analysis and injectivity trends pre and post remediation treatment shall be
presented.

Halite remediation treatments have the potential to become key methods for maintaining injectivity performance of CO₂ injection wells in saline aquifers.

Fig. 1. Partially plugged perforation from Quest CO₂ injection well IW 7-11 April 2018 Downhole Video Log