

Thru-Tubing Integrity Assurance in CO₂-Injection Well Using Electromagnetic Corrosion Logging Tool: A Case Study in Minami Nagaoka, Japan

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Objectives/Scope

Despite the establishment of the Paris agreement to reduce CO₂ emission in 2015, the energy demand continues to grow and is expected to be around 33% in 2035. Aside from the use of low carbon footprint energy such as natural gas, technologies like carbon capture storage (CCS) and sequestration are keys to maintain the amount of CO₂ emission in the atmosphere. CCS project needs to securely contain the CO₂ injected into the formation by assuring the well integrity via corrosion monitoring. Although the well's life expectancy can be up to 50 years, frequent cycling of pressure injection may lead to pipe corrosion and reduce its lifespan. The well integrity assurance and monitoring are critical to ensure the maximum life expectancy and mitigate any risk to the environment from unwanted gas leaks to the nearby aquifer.

Methods, Procedures, Processes

Thru-tubing electromagnetic (EM) corrosion logging tool is deployed inside tubing and production casing to evaluate the pipe condition of the well after CO₂ injection. The EM tool measures high-definition electromagnetic arrays from multiple receivers in the frequency domain. It uses the acquired frequency and magnitude of the transmitted EM signal and enables inversion modeling to estimate metal thickness up to five tubular.

Results, Observations, Conclusions

The EM corrosion logging tool result indicates that the tubing and production casing are in good condition with less than 10% metal loss in general. The 2.375-in tubing indicates an 8% maximum metal loss, 5.5-in casing indicates 7% maximum metal loss, and 9.625-in casing indicates 4% maximum metal loss.

Novel/Additive Information

This study highlights the current tubular condition in this CO₂ injection well. It allows a reliable assessment of the casing corrosion without the need to retrieve the tubing or casing. The result can be used to evaluate the well's life expectancy, mitigate any remedial action, and serves as the baseline data for future well integrity monitoring.