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Predictive analytics-based investigation of corrosion under CO_2 storage conditions

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Corrosion of carbon steel (L80-1Cr) tubing during the injection and storage of CO_2, especially due to the impurities present in the CO_2 such as water, H_2S, SO_2, NH_3, O_2 and other substances is one of the key challenges in carbon capture and storage (CCS) applications. Therefore, it is critical to benchmark the corrosion levels and to develop a corrosion prediction model to determine the allowable concentration of various impurities in order to estimate the integrity / service life of the wells. The required electrochemical parameters (e.g. polarization resistance, electrochemical impedance) and weight loss measurements will be determined to calculate the corrosion rate (CR) using ASTM standards from lab-scale parametric experiments conducted at ambient pressure in specially designed glass cells. A flow loop test facility will be used for simulating the actual well conditions and for calibrating the corrosion data determined from lab-scale to actual well conditions. Predictive analytics as the main part of the data analytical framework, identifying the likelihood of future outcomes based on input datasets using statistical, probabilistic, and machine learning approaches. Predictive analytics will be developed based on various effective factors such as temperature, impurities, and concentrations of impurities at different levels to predict CR values and investigate critical corrosive conditions combined with various factors/levels with no protective films present.