The goal of this study is to better quantify the solubility of CO2 in brines. New experimental data on the solubility of CO2 in a mixed salt solution at CO2 sequestration pressure and temperature conditions are presented. A thermodynamic model for calculation of the phase equilibria of CO2–H2O–NaCl system is briefly described; notably, the solubility of the carbon dioxide in the aqueous phase. This model was used to check his validity by comparing the calculation results with new experimental measurements, available experimental observations and other models CO2 solubility results. Comparison with experimental data indicates that the model can predict accurately CO2 solubility in pure water and in aqueous NaCl solutions of ionic strengths up to 3 molal from 1 to 300 °C and from 1 to 300 bar. This model has been applied to CO2 storage at Sleipner, North Sea. The salinity of the porewater within the Utsira Formation (the CO2 host formation) is approximately the same as seawater. Predicted CO2 solubility is in good agreement with new experimental measurements.