Solution Mining Research Institute Fall 2015 Technical Conference

Santander, Spain, 28 - 29 September 2015

The in-situ Sampling of Gas in Caverns and the Development of Software to avoid Hydrates and reduce the Admixture of Inhibitors

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Abstract

Thermodynamic calculations including hydrate formation conditions are becoming increasingly important to predict a safe withdrawal operation to avoid hydrates and reduce the inhibitor quantities in the surface facilities.

To satisfy the last two points it is essential to know the real water content in the cavern gas itself. For some years SOCON has had a tool for taking liquid samples in caverns, but as of recently it has been possible to take also gas samples in gas-filled caverns. The new sampling tool was developed in SOCON's Research & Development Department and has a modular design with an electronics module containing the CCL components and for measuring the temperature and pressure. It also includes the controls for opening and closing the individual sampling containers. Up to five carrier modules can be used to take gas samples at five different cavern locations.

Back at the surface the Swagelok sample cylinders are transported to a suitable laboratory for evaluation. Gas composition, dewpoint and water content are estimated in the laboratory analysis.

These parameters, in addition to pressure and temperature, are the relevant input variables for a new software algorithm for calculating hydrate formation conditions for a non-saturated cavern gas.

Knowing the realistic water content in the cavern gas the hydrate formation temperature (for 100% saturation) can be undercut and the admixture of inhibitors can be significantly reduced.

Initial measurements and simulation results show that the water content in the cavern gas varies from dry to wet and that the admixture of inhibitors can be reduced by up to 70% compared to a fully saturated cavern.

In parallel, the SOCON dewpoint sensor could be calibrated using laboratory results and used for running a continuous dewpoint log from the wellhead to the cavern sump.

Key words: Caverns for Gas Storage, Gas Hydrates, In-situ Sampling of Gas, Dewpoint, Computer Modeling, Thermodynamics