Solution Mining Research Institute Fall 2011 Technical Conference
York, United Kingdom, 3–4 October 2011

NEW DEVELOPMENTS IN THE GAS FIRST FILL PROCESS OF NATURAL GAS STORAGE CAVERNS

Heike Bernhardt and Sebastian Boor
KBB Underground Technologies, Hanover, Germany

Wolfgang Micus
3S Consult GmbH, Garbsen, Germany

1 Abstract

The first-fill of natural gas storage caverns involves simultaneous gas injection and brine displacement. With the standard completions used for this purpose in Europe, this process can sometimes take more than a year depending on the size of the cavern. This length of time is largely attributable to the need to subsequently snub the brine displacement string under pressure, and the mandatory stipulation to install a safety shut-off valve. The first-fill time can however be significantly reduced by departing from the use of standard completions, and especially by installing a bigger debrining string. The benefits and risks of this advancement depend on parameters such as cavern size, height and pressure range. Constraints also involve the capacities of the gas supply, brine disposal, gas compressors and brine disposal pumps, as well as limits to the flow velocities of gas and brine. Modifications have to be compatible with the existing gas completion system of the cavern, and must guarantee conditions for safe snubbing operations.

The new developments in the as first fill process in comparison to the conventional gas first fill process will be presented. Based on practical experience with this new development significant time savings, and therefore earlier commissioning of the cavern can be stated. The technical and economic aspects will then be discussed.

Furthermore it will be dealt with the important safety aspects involving gas first fill, particularly the pressure surge problem during the first-fill process. The safety shut-off valve must close immediately if the debrining string breaks off – this rapid closure can give rise to extremely high pressure surges. The associated risk to the surface installations increases over-proportionally with the use of larger string diameters, and with faster closing times of the safety shut-off valve. The findings of a parameter study on the basis of a finite element simulation reveal the effects on the size of the pressure surges.

Key words: Cavern Design, Caverns for Gas Storage, Gas Storage, Gas First Fill, Gas completion, Pressure Surge