

## **New Safety Requirements for Gas Caverns and their Affect on Wellhead Design**

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### **Abstract**

With the progress in the requirements and derived technical designs of well completions, the complexity of components has meanwhile reached a highly sophisticated standard. This applies especially for rising safety requirements either set up by the operators or demanded by regulation authorities, which also end up in new technical developments. Currently this is also reflected in the processing of standards and the ongoing discussion about Well Integrity Management.

The recent developments certainly affect the wellhead equipment representing the interface between surface and subsurface installations, which possibly makes it the most important element of a well completion.

During the last years, demands concerning safety aspects, technical features and regulatory restrictions for wellheads have increased. This has led to a variety of further technical solutions requiring high efforts in engineering and planning and will at last be reflected in new designs and wellhead assemblies.

The relevance of these developments covers new gas storage construction projects that implement high safety standard as well as recompletion projects that stipulate these new state-of-the-art wellhead components in order to fulfill the requirements derived from applied Well Integrity Management systems.

The paper will deliver insight into an ongoing project of an underground gas storage (Jemgum, Germany, operated by astora) with defined safety requirements. It will show how these requirements are met by the installed wellhead equipment. For this project, the gas wellheads for operation and the debrining wellheads for the phase of gas first fill were jointly developed in cooperation between the operator (astora) and the wellhead manufacturer (Hartmann). The different specific requirements, i.e. redundancies of barriers, will be pointed out and the evolved technical solutions for these demands are explained in detail and illustrated with corresponding drawings.

To a certain extent, this paper draws on the SMRI Fall 2014 paper “Technical Requirements and Recent Developments in Well Completions and their Effects on Wellhead Design”, where technical solutions from different projects are presented.

**Key words:** gas storage, salt caverns, safety, wellhead design, Germany