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Meeting Paper

Experiences after Flooding and Recompletion of Two Older Caverns on the Natural Gas Storage Site Bernburg

by

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1. Introduction and Status

The cavern storage Bernburg is the first natural gas storage of Verbundetz Gas AG. Since its commissioning in 1974, it has been of considerable importance in ensuring the stable supply of natural gas in Eastern Germany.

At this location, there are 26 gas storage caverns with a working gas capacity of around 750 Million m^3 and a maximum total withdrawal rate of 30 Million m^3/day now in use.
The individual caverns have a geometrical useable volume of around 110 x 10^3m^3 to 520 x 10^3m^3. Due to the relatively low depth of the salt deposit - a saddle shaped structure, from which the Staßfurt rock salt is used for cavern construction - with a casing shoe depth ranging from 450m to 540m, maximum gas storage pressures are between 85 and 95 bars.

The initial planning and construction of the caverns in Bernburg started at the beginning of the '70s. At this time, there was limited or no national and international experience regarding the storage of natural gas in caverns.

The underground completion of the first two caverns to be finished, (Bb 101 and 103 - see fig. 1) was characterised by a partially cemented 8 5/8" production string with welded connections. The string wasn't equipped with a landing nipple for the run in of wireline plugs. In order to reach a defined tensile load with the given temperature and pressure changing during storage operation, the casing string was set pre-loaded into the landing flange. There was a restriction in the operability of the 8 5/8" gas production string, as the well head had a reduced section of 5 3/4".

After a relatively short period of operation, a continual build up of annular pressure between the last cemented casing 10 3/4" and the partially cemented production casing 8 5/8" occurred at varying degrees in both of these caverns. The pressure increase didn't correspond to the cavern pressure. During the pressure release, it was annular protective fluid (i.e. potash solution) ,in later years NACI brine, that escaped and not storage gas.

Various investigations produced the following:

- the probable source was a brine reservoir below the casing shoe,. presumably from tightness testing while drilling
- increasing amounts of hydrogen sulphide in the brine, caused by microbiological processes and thus a presumably increased rate of corrosion.

To ensure continued and long-term operation of the storage, it was necessary to stop the entry of brine into the annular space.

A further characteristic of both caverns was the relatively small usable cavern volume with only about 100 x 10^3m^3. The leaching of these caverns was stopped early in 1973/74 to speed up the time of commissioning. Progressive rock mechanical dimensioning revealed large rock mechanical reserves, regarding the existing size and contour of both caverns.