1. Introduction

In recent years the number of gas storage caverns in Germany has risen strongly. One of the largest storage companies in the German natural gas market is the EWE GASSPEICHER GmbH with a storage capacity of approx. 2 billion cubic meters* of working gas. For more than 40 years EWE has operated caverns at several sites in northern Germany. These were dimensioned according to the rock mechanics with the limits of the maximum and minimum cavern internal pressure /1/ /2/.

For some years now the demand for the storage of natural gas has changed. If the operation was characterized seasonally with moderate operating procedures, the demand in the last few years was to operate the gas storage caverns as flexibly as possible at a maximum possible withdrawal and refilling rate at any time of the year /3/ /5/ /6/ /7/ /8/ /15/.

For this reason, thermodynamic changes of the gas must be calculated with a thermodynamic simulator, since relatively large temperature changes occur in a cavern when gas is removed from the cavern or filled into the cavern at a constantly high rate /9/ /10/ /11/ /13/.

Observations show that a macroscopic cracking in the rock salt can occur if the temperature-induced stress change in the vicinity of a cavern is so strong that tensile stresses occur /12/ /14/. As a result of the low tensile strength of the rock salt, cracks on the wall of the caverns can occur, in which the gas then penetrates with high pressure. It is currently the subject of research into the extent to which a temperature-induced and gas-pressure driven crack can propagate into the rock mass surrounding a storage cavern.

The dimensioning of the withdrawal and filling rates is based on thermo-mechanical coupled simulation calculations. The characteristics of the parameters thermal conductivity λ, specific heat capacity c and thermal coefficient of expansion αT can be determined laboratively.

Other essential parameters such as the heat transfer coefficient α, the primary rock temperature T in the vicinity of the cavern and the ratio of volume to thermally effective surface V/S of the cavern must usually be estimated before the cavern is completed. After the completion it is necessary to get information about the shape of the cavern for a further assessment /4/.

With these parameters a so-called dimensioning load case (DLC) with several withdrawal, refilling and standstill phases is applied in a rock mechanical manner. The DLC is used for the dimensioned of a gas storage cavern with respect to maximum pressure, minimum pressure and operating rates.

Due to the fact that some of the thermal parameters have to be estimated before operating the cavern within a bandwidth of experience and on the basis of the available data, it is essential to carry out an analysis of the operating data after several years of operation.

The paper deals with the recalculation of the operating data of a real gas storage cavern in northern Germany and points out the aspects to be taken into account with regard to the proof of stability.