A Predictive Model for Pressurization of SPR Caverns

Brian Ehgartner, Sandy Ballard, Michael Tavares,
Stephen Yeh, Tom Hinkebein and Ray Ostensen

Sandia National Laboratories*
Albuquerque, NM 87185-0706

ABSTRACT

A model, based on salt constitutive theory and heat conduction, has been developed to predict cavern pressurization. The model is available on an Excel** spreadsheet for use on personal computers. Daily cavern pressure data, collected over the past 5 years, are evaluated for U.S. Department of Energy Strategic Petroleum Reserve (SPR) caverns at West Hackberry and Bryan Mound sites. Collectively, these two sites contain over 40 oil filled caverns. Cavern specific parameters are developed to best fit the historic performance of individual caverns to the theoretical framework of the model. This requires an inversion scheme, such as the scheme that is available within Excel. Thus the personal computer model is readily available for use in defining optimized parameters for any fluid filled cavern. The predicted model pressures closely agree with those measured. In most cases, the differences between predicted and measured pressures fall within the accuracy of the measured pressures. In daily operation, the model can detect a 1000 bbl anomaly for most SPR caverns over a typical pressure cycle. On site use of this model can provide early detection of relatively small leaks (<0.01% of total cavern inventory) and presents a continuous, on-line approach to assuring cavern integrity.