

A CASE HISTORY OF THE THREADED COUPLING PRODUCTION CASING FAILURE IN GAS CAVERNS— PART 1: DETECTION AND GEOMECHANICAL ANALYSIS

By:

John D. Osnes
Kerry L. DeVries
RESPEC
Rapid City, South Dakota, USA

Joe L. Ratigan
Mark W. Meece
PB Energy Storage Services, Inc.
Houston, Texas, USA

Mark Thompson
Gary W. Spencer
Enterprise Products Operating LLC
Houston, Texas, USA

ABSTRACT

Enterprise Products Operating LLC operates a four-cavern compressed gas storage facility in the Boling salt dome in south-central Texas. In the fall of 2005, Well No. 4 was being filled with gas. After the cavern was near full, continuous pressure monitoring indicated a pressure loss rate that was atypical of what operations staff believed was normal. Continuous pressure monitoring and temperature logging indicated the possibility of a production casing leak in the vicinity of the cavern roof. Enterprise began a controlled process of removing gas and injecting water into the cavern.

Detailed logging performed after the cavern was filled with water indicated significant casing collar separations from the depth of the casing shoe to nearly 350 feet above the shoe. Detailed finite element modeling was in agreement with the observations. Modeling was undertaken for the three other caverns at the storage facility, which indicated likely coupling failures in two of the remaining three storage wells. Gas withdrawals and water injection programs were initiated in both wells, and logging subsequent to water filling validated the modeling predictions. Geomechanical modeling was performed to design a well rehabilitation program described in a companion paper.

Keywords: gas storage caverns, rock mechanics, well casing, threaded connections, computer modeling, leak detection, casing damage