

SOLUTION MINING RESEARCH INSTITUTE

679 Plank Road
Clifton Park, NY 12065, USA

Telephone: +1 518-348-6995
www.solutionmining.org

Technical
Conference
Paper



Rapid Neck Closure of Domal Salt Caverns - Observation, Remediation, and Prevention

R. Coleman Hale, P.E., Lonquist & Co., Houston, Texas
Colten Long, Lonquist & Co., Houston, Texas
Latasha McMullen, P.Eng., Lonquist & Co., Regina, Saskatchewan
Josh Bradley, Westlake, Lake Charles, Louisiana

SMRI Fall 2023 Technical Conference
2-3 October 2023
San Antonio, TX, USA

Rapid Neck Closure of Domal Salt Caverns –

Observation, Remediation, and Prevention

R. Coleman Hale, P.E., Lonquist & Co., Houston, Texas

Colten Long, Lonquist & Co., Houston, Texas

Latasha McMullen, P.Eng, Lonquist & Co., Regina, Saskatchewan

Josh Bradley, Westlake, Lake Charles, Louisiana

Abstract

Anomalous and rapid salt neck “closure” has been observed impacting several brine production salt caverns at the Starks Salt Dome in Louisiana. The modern-day development of these large, domal salt caverns requires that a 3,000 – 4,000-foot (900 – 1200 m) tall cavern neck be maintained (typically drilled to a 22-inch (558.8 mm) diameter). The neck height is progressively shortened through regressive (upward) movement of the roof control pad throughout the multi-decade operational mining life of the cavern, ultimately targeting a fully developed cavern volume of more than 70 million barrels (11 million m³). Throughout this long mining duration, rapid salt “closure” has been observed occurring in discrete intervals of the cavern neck in some of the salt caverns. The neck “closure” has been observed to occur within time periods as short as 1-year constricting a 22-inch (558.8 mm) diameter borehole around the outer hanging string (typically 11¾-inch (298.45 mm) or 13 ⅜-inch (339.73 mm) casing), prohibiting fluid movement within the outer annulus, and leading to loss of mechanical integrity of the outer hanging string. The term “closure” is utilized within this paper to refer to the general movement of the salt within the salt cavern neck. The salt neck closure is believed to be related to the characteristics of “geologic planes” that exist within the salt dome, such as shear, boundary, or fault planes. Currently, the rapid closure discussed in this paper is not thought to be related to steady-state or transient creep closure.

This technical paper presents the following topics:

- An introduction of the Starks Dome and an overview of the solution mining technique implemented.
- Three case studies in which rapid salt neck closure was observed and remediated.
- A discussion of the geological characteristics driving the rapid neck closure phenomenon.
- A discussion of proactive prevention techniques and measurement techniques to mitigate and evaluate the rapid salt neck closure.

Key words: Salt Cavern, Neck, Borehole, Rapid Closure, XMAC, Anomalous, Shear, Plane, Creep, Salt Dome, Domal Salt, Casing Collapse