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REVIEW AND ANALYSIS OF HISTORICAL LEAKAGES FROM STORAGE SALT CAVERNS

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Abstract

Twelve incidents involving well casing and/or cement leaks in the salt caverns storage industry are described. These incidents occurred at the following storage sites: Eminence salt dome, Mississippi; Elk City, Oklahoma; Conway, Kansas; Yodder, Kansas; Mont Belvieu, Texas; Teutschenthal/Bad Lauchstädt, Germany; Clute, Texas; Mineola, Texas; Hutchinson, Kansas; Magnolia, Louisiana; Boling, Texas; Epe, Germany. The featured incidents are relatively few, when it is borne in mind that more than 2000 salt storage caverns have been operated successfully and without incident, sometimes for more than 50 years. However, lessons must, and can be, drawn to prevent further accidents.

Mechanisms leading to a casing leak and consequences are discussed. In most cases, a breach in a steel casing occurred at a depth where a single casing was isolating the stored product from the geological formations. The origin of the breach was due in most cases to poor welding/screwing conditions and corrosion, or excessive deformation of the rock formation and casing overstretch. In this, the age of the well is often influential. In many cases, the leak path does not open directly at ground level; fugitive hydrocarbons first escape and accumulate in the subsurface prior to migrating through shallower horizons and escaping at ground surface. A pressure differential between hydrocarbons in the borehole and fluids in the rock mass favours high leak rates. A wellhead pressure drop often is observed, even when the stored product is natural gas. The incidents described suggest that thorough monitoring (including tightness tests) and a correct well design lessen considerably the probability of a casing leak occurring.

Key words: Cavern Incident, Leakage, Well failure, Well integrity