

ANALYSIS OF A SALT FALL IN BIG HILL CAVERN 103, AND A PRELIMINARY CONCEPT OF SALT DOME STRUCTURE

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ABSTRACT

This paper examines the important field observations and recent analyses used as a basis for our understanding of the recent salt fall event involving about two million cubic feet salt in Big Hill Cavern 103, one of the caverns of the Strategic Petroleum Reserve (SPR). The fall was the result of stress-driven mechanical instabilities, the manifestations of which are discussed. The work suggests important conclusions concerning the caverns and the Big Hill salt dome. Specifically, at Big Hill, the most recent SPR site, caverns were constructed using state-of-the-art solutioning methods to develop nominally well-formed, right-circular cylindrical shapes. Furthermore, examination of the pressure history records indicates all Big Hill SPR caverns have been operated similarly. While the analysis of the behavior of Big Hill Cavern 103 was very instructive, perhaps the greatest insight was provided by the examination of all of the SPR caverns and the implications on the structure of the salt dome.

Relatively new three-dimensional (3-D) imaging methods, applied to old (original) and more recent sonar survey data, have extracted much more detailed views of cavern walls, roofs, and floors. This has made possible the documentation of the presence of localized deviations from “smooth” cylindrical cavern walls. These deviations are now recognized as isolated, linear and/or planar features in the original sonar data (circa early 1990s), which persist, and sometimes alter, with time. These elements represent either sites of preferential leaching or localized spalling.