USING HORIZONTAL DRILLING TO DETERMINE THE EDGE OF A GULF COAST SALT DOME — CASE HISTORY

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INTRODUCTION

Coastal States Crude Gathering Company (Coastal) stores LPG in seven underground storage caverns at Pierce Junction Salt Dome, just south of Houston, Texas. An additional cavern (Cavern No. 2) on the terminal property is plugged and abandoned. In the fall of 1997, Coastal engaged RESPEC to perform a geomechanical evaluation of Cavern No. 1/1A. Cavern No. 1/1A is in relatively close proximity to Cavern No. 2, which was believed to potentially be in close proximity to the edge of the salt dome. Cavern No. 2 has been out of service for approximately 12 years and has been plugged and abandoned. As depicted in Figures 1 and 2, it was determined that Cavern No. 2 could be as close as 200 feet from the edge of the dome, based on a top of salt contour map developed in 1986. This gave rise to a concern that in a worst-case scenario, Cavern No. 1/1A could hydraulically connect to Cavern No. 2, which could in turn, hydraulically connect to the edge of the dome.

The salt dome contours had been mapped using drilling data from storage wells on the dome in addition to oil and gas wells that had been drilled on the flank of the dome. Unfortunately, there was a scarcity of reliable well data for the upper flank of the dome near the Coastal storage wells, and the shape of the "shoulder" of the dome was subject to interpretation.

This paper discusses the method used to define the edge of the dome and log an extensive vertical and horizontal domain of the salt dome. Several methods were considered to determine the edge of the dome in a more definitive manner, including two-dimensional Seismic, three-dimensional Seismic, Vertical Seismic Profile (downhole seismic), microgravity survey, and exploratory drilling. After reviewing the options, it was determined that the accuracy required (approximately ± 50 feet) would necessitate an exploratory drilling program. The drilling program could also be used to obtain salt core from the dome for use in the geomechanical analysis of the storage caverns. A trade-off study determined that it would be more cost effective to temporarily deepen existing Brine Disposal Well No. 2 and directionally drill a horizontal borehole to the edge of the dome than to drill a completely new exploratory well near the edge of the dome. This is because Brine Disposal Well No. 2 had already been drilled through the geologic formation that causes the most drilling problems — the caprock.