

# GEOTECHNICAL STUDIES ASSOCIATED WITH DECOMMISSIONING THE STRATEGIC PETROLEUM RESERVE FACILITY AT WEEKS ISLAND, LOUISIANA: A CASE HISTORY

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## ABSTRACT

The first sinkhole at the Weeks Island Strategic Petroleum Reserve (SPR) site was initially observed in May 1992. Concurrent with the increasing dissolution of salt over the mined oil storage area below, it has gradually enlarged and deepened. Beginning in 1994 and continuing to the present, the injection of saturated brine directly into the sinkhole throat some 76 m beneath the ground surface essentially arrested further dissolution, providing time to make adequate preparation for the safe and orderly transfer of crude oil to other storage facilities. This mitigation measure marked the first time that such a control procedure has been used in salt mining; previously all control has been achieved by either in-mine or from-surface grouting. A second and much smaller sinkhole was noticed in early 1995 on an opposite edge of the SPR mine, but with a very similar geological and mine mechanics setting. Both sinkholes occur where the edges of upper 152 m and lower 213 m mined storage levels are nearly vertically aligned. Such coincidence maximizes the tensional stress development, leading to fracturing in the salt. This cracking takes 20 or more years to develop. The cracks then become flow paths for brine incursion, which after time progress into the mined openings. Undersaturated ground water gradually enlarges the cracks in salt through dissolution, leading to eventual collapse of the overlying sand to form sinkholes. Other geologic conditions may also be secondary factors in controlling both mining extent and sinkhole location.

## KEYWORDS

Geology, Creep, Subsidence, Sinkholes, Case History, Salt Dissolution, Salt Domes

## INTRODUCTION

The U. S. Department of Energy has established one of the Strategic Petroleum Reserve's (SPR) facilities in a massive salt dome at Weeks Island, Louisiana, in a former room and pillar two-level mine in the salt. A sinkhole measuring 11 m across and 9 m deep was first observed in the alluvium overlying the salt dome in May 1992 (Sinkhole #1). However, based on initial surface appearance and subsequent reverse extrapolation of growth rates it was thought to be already about a year old. A second and much smaller sinkhole was identified in early 1995 (Sinkhole #2), nearly three years later. Their positions directly over the edges of the oil storage chamber has caused apprehension. The association of sinkholes with mines is well established. This occurrence suggested that groundwater influx was causing salt dissolution at shallow depth, and an associated collapse of soil at the surface. Leaks of groundwater into other salt mines in Louisiana and elsewhere have led