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# Sinkhole Progression at the Weeks Island , Louisiana, Strategic Petroleum Reserve (SPR) Site

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## ABSTRACT

The initial sinkhole at the Weeks Island SPR site that was first observed in May 1992 gradually enlarged and deepened, concurrent with the increasing dissolution of salt over the mined storage area below. Beginning in 1994 and continuing to the present, the injection of saturated brine directly into the sinkhole throat some 250 feet beneath the surface essentially arrested further dissolution, buying time to make adequate preparation for the safe and orderly transfer of crude oil to another storage facility. This mitigation measure marked the first time that such a control procedure had been used in salt mining; previously all control had been achieved by in-mine and surface grouting.

A second and much smaller sinkhole was first 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 upper (-500 ft) and lower (-700 ft) storage levels are nearly vertically aligned. Such coincidence maximizes the tensional and dilatant stress development, leading to fracturing in the salt. Such cracking takes years to develop, perhaps 20 or more. The cracks then become passageways for brine incursion, and after time find their release into mined openings. Undersaturated ground water gradually enlarges the cracks, leading to further dissolution and eventual collapse of the sand overlying the salt to form sinkholes.

The en echelon alignment of sinkholes elsewhere over mine edges is commonplace. Thus most likely areas of future occurrence at Weeks Island are adjacent to the existing sinkholes; surface inspections are now concentrated at those locations. Although neither timing nor location is predictable with precision, the study of numerous sinkholes elsewhere shows that progression is inevitable, provided that relevant conditions and enough time exists for development. These principles should provide mine designers and operators the knowledge to minimize the occurrence of sinkholes, and to plan for their progression when they occur.