Evaporites, Casing Requirements, Water-floods, and Out-of-formation Waters: Potential for Sinkhole Developments

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Abstract

Sinkholes have developed rapidly where drillholes penetrating shallow evaporites and beds with unsaturated (with respect to halite) water are uncased or inadequately cased and cemented. The recent (1998) Whitten Ranch sinkhole developed over deeper evaporites. In this area, modest casing requirements through the evaporites and water-flood operations with out-of-formation waters may increase the possibilities of more such events.

The Whitten Ranch sinkhole near Jal, NM, developed with little warning late in 1998. The uppermost halite, in the Permian Rustler Formation, is more than 1500 ft below ground surface; the top of the Salado Formation is about 2000 ft deep. Although a natural origin cannot be ruled out, it is more likely that a nearby plugged and abandoned (P&A) water well to the Capitan reef permitted circulation of fresh water, solution of overlying evaporites, and upward chimney collapse through the thick redbed section and Ogallala Formation to the surface.

In part of southeastern New Mexico, surface casing is required to protect part of the redbed sequence that locally bears groundwater. The evaporite section may not be protected by cement in the production string to deeper units. Some areas show strong evidence of out-of-formation (high-pressure) waters, from water-flooding operations, in evaporite and redbed sections. Producing wells and wells scheduled to be P&A get checked for evidence of casing integrity. Nevertheless older wells P&A, and some wells still in production, may be subject to the same process suspected for the Whitten Ranch sinkhole. Will there be more such sinkholes?

A reasonable survey of conditions of out-of-formation waters, casing and cementing practices, casing integrity, and evaporite depths would be helpful in developing a better idea of the significance of these conditions and indicating whether additional sinkholes are likely to develop. No doubt liability concerns will make such a survey difficult.