SOLUTION MINING RESEARCH INSTITUTE

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MEETING PAPER

SUBSIDENCE MONITORING: IS THERE A BETTER WAY?

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Abstract

Records of elevation change obtained from successive leveling surveys of subsidence monuments are widely used to detect the initial surface displacements caused by the collapse of solution cavities beneath brine fields. Subsidence monuments are usually anchored in overburden rather than in bedrock, and they increase in number with brine field development. Unfortunately, the large number and small size of the monuments often results in damage from vehicles, and the changes in elevation which they undergo are the result of motions that originate in overburden as well as bedrock. In some brine fields located on valley floors, cyclical vertical motions of as much as several tens of millimeters have been shown to result from contraction and expansion of unconsolidated aquifers in response to discharge and recharge of ground water. Such motions exhibit both seasonal and multiyear cycles, and, during some time intervals, upward motions could completely mask downward motions that result from subsidence within bedrock. For this reason, it is important that successive leveling surveys be conducted during the same season of the year. Additional vertical motions caused by soil creep, though not cyclical, are of comparable magnitude in brine fields located in areas where hill slopes are sufficiently steep. In brine fields where soil creep is suspected, records of vertical and horizontal displacements should be analyzed together in order to identify coordinated motion. Because many overburden processes cause vertical displacements, the initiation of brine cavity collapse is unlikely to be clearly discernable by this method.

The use of brine well casings as subsidence monuments would provide a means of obtaining records of bedrock motions that are independant of overburden processes. Motions that originate in bedrock are unlikely to exhibit a seasonal pattern so that successive leveling surveys need not be conducted during the same season of the year. Brine wells are less numerous and more conspicuous and therefore less likely to be damaged by vehicles. The cost of each successive leveling survey of brine well casings would be lower because of the smaller number of monuments to be surveyed. The combination of lower cost and data which can be interpreted with less ambiguity would result in a better, more cost effective monitoring program. If evidence of bedrock subsidence is observed, additional monuments anchored in overburden could be emplaced as needed.