ABSTRACT

Surface subsidence may be the only long-term visual evidence of underground solution and conventional (dry) mining of salt and potash. Subsidence occurs whenever a hole is created in the underground. Because surface subsidence over salt and potash mining facilities is usually slow to accumulate, and most often causes no problems, it has not been a primary issue in designing cavern and mine fields. However, subsidence and its attendant disturbance has from time to time caught significant media attention, public awareness, and regulatory scrutiny. A recent example is the national exposure afforded the subsidence concerns at the Retsof salt mine as it flooded during 1994–1995.

This paper focuses on subsidence over salt and potash mining facilities. Of necessity, much of the information is drawn generally from the mining and civil engineering literature; no significant body of information exists specific to solution mining-induced subsidence. The brief review includes basic principles, effects, and damage criteria for subsidence. While the review is not comprehensive, it does address most major issues related to subsidence over solution and dry salt mines.

INTRODUCTION

Mining-induced subsidence is a normal and unavoidable consequence of underground mining. Most of the research and technical work associated with subsidence has related to underground coal mining, but the principles and effects are similar between different types of mining so long as the timing and magnitudes of subsidence are properly accounted for. The term "subsidence" implies the total phenomenon of surface and subsurface movements associated with mining of minerals and not just the vertical displacement of the surface, as is sometimes inferred in the literature. A superb general reference on subsidence is Kratzsch [1983].

Subsidence theories can be divided into two broad categories: descriptive and continuum theories. Descriptive theories are those in which observations of surface movements above excavated underground openings form the basis for deducing subsurface movements between the surfaces and underground openings. Classical theories of continuum behavior are used to calculate strains induced in the rock because of creating the openings and their subsequent closure. Application of classical continuum theories is considerably more difficult because of complex variations of geological structures from area to area, imprecise boundary conditions, and inadequate knowledge of rock material properties. Consequently, most of our understanding of subsidence characteristics relies heavily on descriptive theories.

The general factors influencing the extent and magnitude of surface subsidence are:

- Salt deposit thickness, depth, and dip
- Width, heights, and length of the extraction area (cavern size)