

# PROJECT PROFILE

## RESEARCH ON SUBSIDENCE RESULTING FROM LONGWALL MINING

D'Appolonia was retained by the U.S. Department of Energy (DOE) and the U.S. Bureau of Mines to study ground subsidence caused by longwall mining. The three-year study involved monitoring ground subsidence and assessing correlations with mining activities for a longwall mine in the Central Appalachian region.

The study involved review of all longwall mines in operation in Appalachia and selection of a mine most typical of Appalachian conditions. D'Appolonia was further responsible for development and implementation of a monitoring program and reduction and analysis of the resulting data.

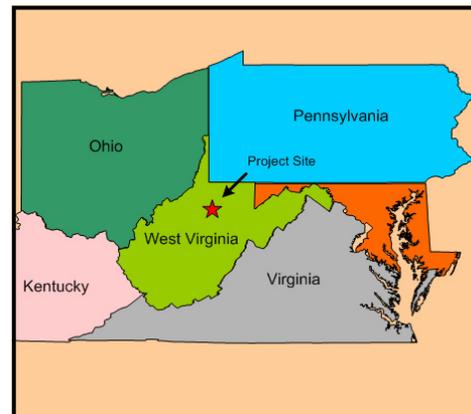
A mine in northern West Virginia was

chosen as the focus of the study. The selected mine was extracting coal from a six-foot-thick seam 700 to 900 feet below the ground surface.

D'Appolonia developed criteria for site instrumentation and procured the necessary equipment and supervised the installation of the geotechnical instrumentation at the site. The instrumentation included approximately 300 surface monuments, three 700-foot-long multi-point borehole extensometers, 17 stress meters, several roof bolt load cells and 30 mine floor/mine roof convergence stations.

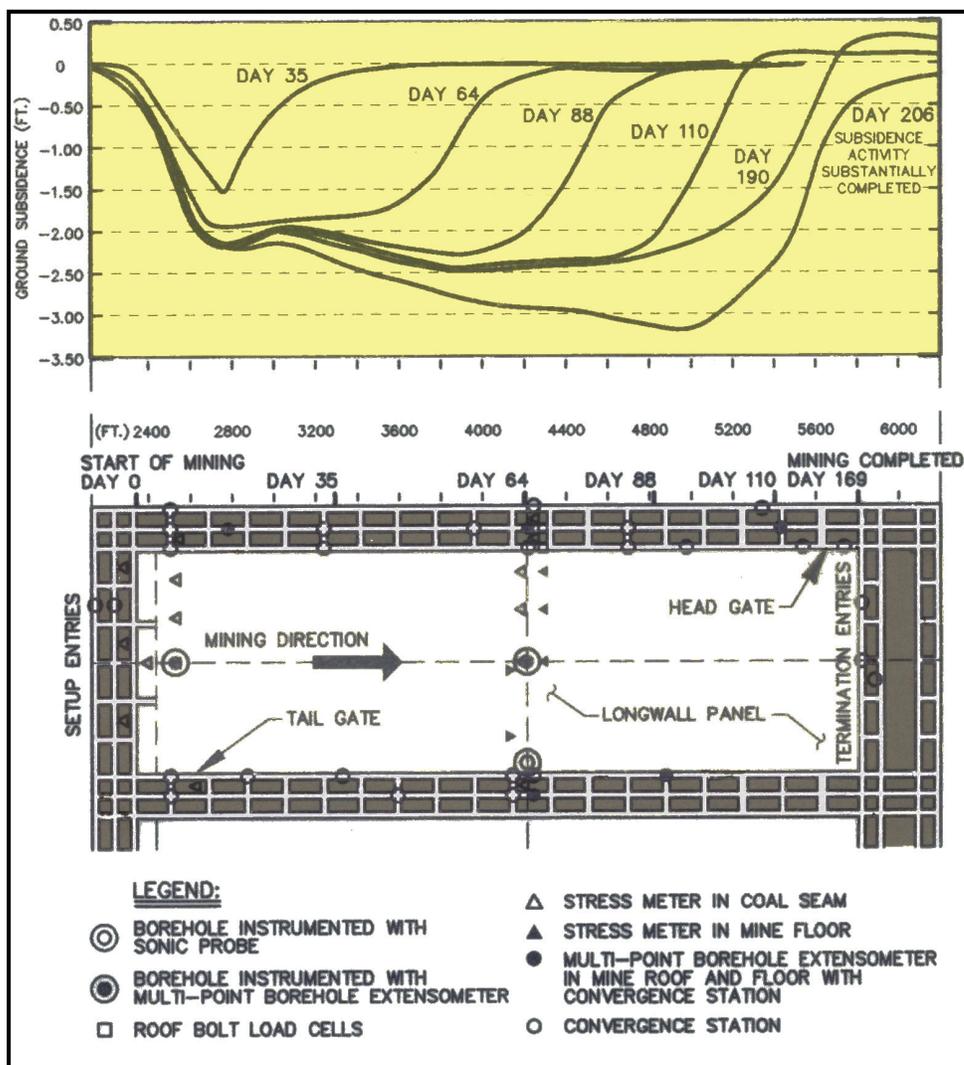
The surface monuments were installed at a depth of five feet below the ground surface on a concrete pad. The bore-

holes were provided with full-length protection collars to prevent instrument



Project location map.

heave due to frost action. The stress meters were installed in the coal seam and mine floor.



Ground subsidence plotted versus the time of advancement of the mining face (top) and plan layout of longwall panel instrumentation (bottom).

The results of this \$900,000 study provided useful data for development of mine design criteria related to:

- Aquifer protection,
- Surface structure protection
- Mine entries and longwall panel layout, and
- Prediction of the duration of post-mining subsidence activity.

This study proved to be particularly useful for the development of plans for the protection of surface structures sensitive to subsidence. As shown in the subsidence profile illustration, subsidence-induced ground surface heave of up to three inches occurred in some locations in advance of the actual coal extraction followed by a period of rapid ground lowering across relatively short horizontal distances.

The study provided valuable data for the design of structure-jacking systems used to provide protection to structures during the two- to three-month period of intense ground movement often associated with extraction of coal by the longwall mining method.