

## New Technology for Ground Control in Multiple-Seam Mining

Research by the National Institute for Occupational Safety and Health (NIOSH) on multiple-seam mining has resulted in two new ground control products.

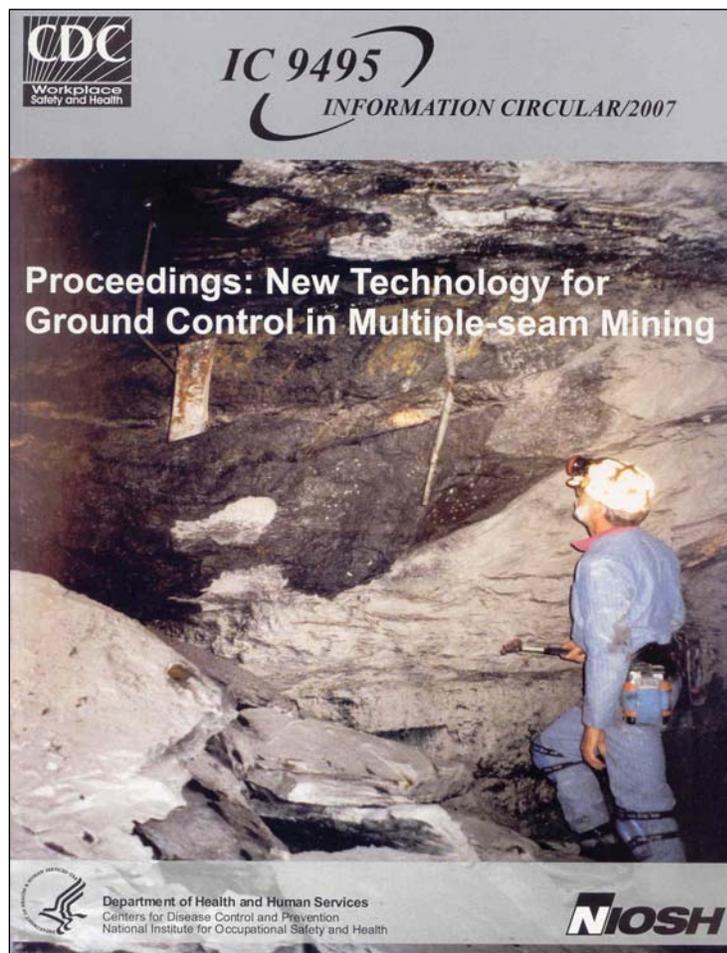
### Information Circular (IC) 9495

In some U.S. coalfields, particularly in central Appalachia and the West, most mines are operating above and/or beneath previously mined seams. The effects of multiple-seam interactions can include roof falls, rib spalling, and floor heave. These can seriously threaten the safety of miners and disrupt mining operations.

Information Circular (IC) 9495 is a proceedings document containing a variety of papers that summarize recent knowledge about multiple-seam mining. A NIOSH study that analyzed case histories collected from 44 U.S. coal mines is described in detail. The study confirmed that overmining is much more difficult than undermining, and isolated remnant pillars cause more problems than gob-solid boundaries. The study's results were the basis for the *Analysis of Multiple-Seam Stability* (AMSS) software package.

The proceedings also contain two papers describing the LaModel family of software. The original three-dimensional version of LaModel is essential for detailed analyses of complex multiple-seam scenarios. LaM2D implements a simplified, two-dimensional model suitable for quick approximations of the multiple-seam stresses and strains.

Three papers in the proceedings focus on case histories. One describes the extensive multiple-seam experience at the Harris No. 1 Mine in West Virginia, a second contains examples of "extreme" multiple-seam mining from the central Appalachian coalfields, and a third describes interactions with regard to longwall mine experiences in Pennsylvania, West Virginia, and Utah. The final paper reports on a numerical modeling study that provided some insight into the mechanics of multiple-seam mining.



### AMSS Software Package

NIOSH has developed a simple, user-friendly computer program called *Analysis of Multiple-Seam Stability* (AMSS). AMSS can help mine planners to evaluate each potential multiple-seam interaction and take steps to reduce the risk of ground control failure.

AMSS begins by evaluating the pillar design. It first calculates the single-seam pillar stability factor (SF)

using the familiar Analysis of Longwall Pillar Stability (ALPS) or Analysis of Retreat Mining Pillar Stability (ARMPS) method. Then it automatically generates a numerical model that provides the additional multiple-seam stress. If the final multiple-seam SF seems inadequate, then AMSS warns that the pillar size should be increased.

Next, AMSS predicts the severity of the potential interaction in terms of three risk levels:

- **Green** (where a major multiple-seam interaction is considered unlikely);
- **Yellow** (where adding a pattern of cable bolts or other equivalent supplemental support could greatly reduce the probability of a major interaction); or
- **Red** (a major interaction should be considered likely, and it may be desirable to avoid the area entirely).

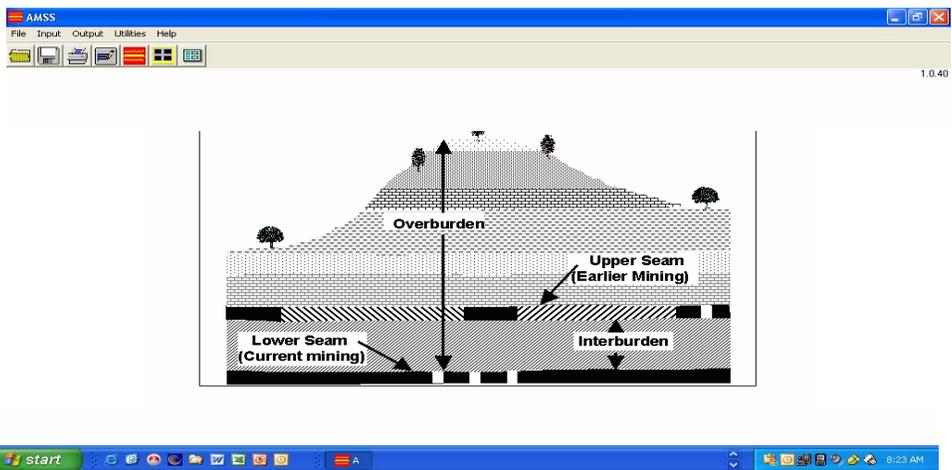
AMSS can then be used to analyze the effects of installing supplemental support, reducing the entry width, eliminating crosscuts, or increasing the entry spacing.

### For More Information

IC 9495 may be downloaded from the NIOSH Mining Web site at <http://www.cdc.gov/niosh/mining/pubs/pubreference/outputid2436.htm>. The AMSS software may be downloaded at <http://www.cdc.gov/niosh/mining/products/product154.htm>. You may also order a copy of IC 9495 and/or the AMSS software by sending an e-mail to: [pithealth@cdc.gov](mailto:pithealth@cdc.gov). Or you may complete the order form below, detach, and mail to: Office of the Director, Health Communications, NIOSH Pittsburgh Research Laboratory, P.O. Box 18070, Pittsburgh, PA 15236-0070, or fax to (412) 386-6780.

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The Analysis of Multiple-Seam Stability (AMSS) software start screen.

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Please send me a copy of IC 9495, "Proceedings: New Technology for Ground Control in Multiple-Seam Mining."

Please send me a copy of the *Analysis of Multiple-Seam Stability* (AMSS) software.

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