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SUBJECT: Pillar Recovery Design, Technologies, and Procedures in Roof
Control Plan Reviews

Scope

This Procedure Instructional Letter (PIL) applies to personnel from Coal Mine Safety and Health and Technical Support.

Purpose

The purpose of this PIL is to establish guidance for Mine Safety and Health Administration (MSHA) personnel to use in assessing the quality and potential safety risk associated with roof control plans. This includes evaluating the pillar design, mining technologies, and mining procedures for pillar recovery (retreat mining).

Instructions Pertaining to Retreat Mining Pillar Design

Title 30 Code of Federal Regulations Section 75.203(a) states that "The method of mining shall not expose any person to hazards caused by faulty pillar recovery methods. Pillar dimensions shall be compatible with effective control of the roof, face and ribs and coal or rock bursts." To comply with this standard, the retreat mining submittal should include an engineering design and supporting analysis. The analysis method is at the discretion of the mine operator. Pillar recovery plans submitted to MSHA for approval should include:

- A brief description of the pillar design analysis method used including design software version (release number).¹
- The listing or identification of pillar stability factors or safety factors for the analysis method used.
- A pillar design that meets or exceeds the generally accepted, or recommended design criteria, for the analysis method used or meets mine-specific design criteria that is supported by sufficient documentation and mining history.

MSHA personnel should pay particular attention, including examining inputs and other factors used to support the proposal, when pillar recovery plans are submitted that propose pillar recovery under any of the following conditions:²

- Pillar recovery at depths exceeding 2000 feet may not be appropriate due to the heightened risk of bursts at such unusual and extremely deep cover. In most cases, when an entire pillar is over 2000 feet deep, careful analysis may determine that the pillar should be a "Leave Pillar" that should not be retreat mined. When any portion of a pillar is less than 2,000 feet deep (i.e., any portion of pillar is outside the 2000 ft depth of cover contour), and the pillar is judged to have a stability factor or safety factor that meets design criteria, then in many cases it may be technically sound to allow the pillar to be recovered by retreat mining following an approved roof control plan.
- At depths exceeding 1000 feet, the practice of pillar splitting may be particularly problematic, due the extremely high stresses and burst-prone conditions existing in the core of pillars adjacent to the gob. Plans including such a proposal should be carefully examined.
- At depths exceeding 1000 feet, properly designed barrier pillars are particularly important to effective control of the ground. The purpose of the barrier pillars is to isolate each new panel from previously mined ones. The retreat mining plan submittal should contain:
 - A brief description of the barrier design analysis used, and
 - The barrier pillar stability factor or safety factor for the analysis method used, and a statement indicating that the design meets the generally accepted or recommended design criteria for the analysis method used.

¹ For analyses using NIOSH Analysis of Retreat Mining Pillar Stability (ARMPS) and Analysis of Multiple Seam Stability (AMSS), ARMPS version 6.0.29 and AMSS version 2.0.26 or later are to be used. For further information see: PIL I11-V-01 Technical Support Assistance in Reviewing Roof Control Plans, PIB P09-03 General Guidelines for the Use of Numerical Modeling to Evaluate Ground Control Aspects of Proposed Coal Mining plans, PIB P10-23 Re-Issue of P08-08 – Precautions for the Use of the Analysis of Retreat Mining Pillar Stability (ARMPS) Computer Program.

² Room and Pillar Retreat Mining Plans at overburden depths of 1000 feet or greater should be forwarded to Technical Support for review (Procedure Instruction Letter No. 11-V-1)

Instructions Pertaining to Roof Control Technologies

MSHA personnel should pay special attention to the following roof control technologies when evaluating roof control plans or amendments for coal mine room and pillar retreat mining:

- Whether the plan leaves an engineered final stump rather than extracting the entire pillar. The final stump that is not to be mined should be clearly marked on the pillar rib and/or mine roof.
- For room and pillar retreat mining sections, whether supplemental roof bolts that are longer and stronger than the mine's primary roof bolting system are to be installed on advance, particularly in intersections.
- Whether the plan calls for mechanized Mobile Roof Support (MRS units), rather than traditional wood timbers, for the roof-to-floor standing support for the mining of cuts or lifts into the pillar.

Instructions Pertaining to Pillar Recovery Procedures

MSHA personnel evaluating roof control plans for coal mine room and pillar retreat mining should pay particular attention to the following pillar recovery procedures:

- Whether the mining plan for pillar recovery describes a cut and support sequence that maximizes ground stability and safety and takes into consideration the following:
 - o Whether the mine site ground conditions warrant limiting access to just one roadway into the intersection when the last lifts for a pillar are taken.
 - o Whether the mine site ground conditions warrant having supplemental support installed in the entry and/or crosscut in addition to being installed in the intersections.
- Whether the plan describes safe work locations for miners while coal is being mined or loaded.
- Whether the plan incorporates best practices for using MRS units identified in Program Information Bulletin P11-30 titled: Reissue of P05-19 – Use of Mobile Roof Supports (MRS) Units for Retreat Mining. (P11-30 includes information on MRS operation and operator positioning.)

Instructions Pertaining to Communication with the Mine Operator

When roof control plans for room and pillar retreat mining are being reviewed for approval, MSHA personnel should discuss the following items with the mine operator so that the mine operator can develop a suitable roof control plan:

- Pre-shift and on-shift examinations should include a thorough assessment of geologic conditions, and hazards should be reported and dangered off, or appropriately supported. Examinations should include areas outby the pillar line to anticipate geologic conditions prior to pillar recovery. Roof fall accident studies reveal that in more than one-third of the fatal incidents, poor conditions were observed in the area before the fatality occurred, but no action was taken.
- Conducting a geologic assessment of the entire panel before retreat mining begins is a prudent practice. The assessment should identify major roof fractures, which can then be marked, mapped, and supported. It is good practice to plan to skip lifts or not recover pillars in order to leave coal as support to avoid such adverse features.
- Test holes are useful to determine if there is roof separation and they can be monitored during retreat mining to see if conditions worsen.
- The pressures and loading rates of MRS units can provide information on roof stability. Mine-specific trigger points indicating unusually high loads or loading rates can be identified and procedures developed to respond to loading.
- Where retreat mining is proposed and the depth of cover exceeds 1,000 feet, mine operators should identify areas of high burst likelihood in advance of mining. The assessments should identify significantly elevated burst likelihood based on the depth of cover, the geological conditions, the potential for multiple seam interactions, and recent ground control experience. The assessments should be guided by an experienced ground control professional and should be conducted as mining conditions/experience warrant, but at least on an annual basis.

Background

Many new technologies and procedures have been identified with recent mining research³. This PIL provides guidance in applying the new pillar design, mining technologies, and mining procedures to retreat mining pillar recovery.

³ NIOSH, February 2010, Research Report on Coal Pillar Recovery under Deep Cover, available at <http://www.cdc.gov/niosh/mining/pubs/pubreference/outputid3470.htm>

Authority

The Federal Mine Safety and Health Act of 1977

Filing Instructions

This PIL should be filed behind the tab marked "Procedure Instruction Letters" in the binder for Program Policy Handbooks and Procedure Instruction Letters.

Issuing Office and Contact Persons

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Distribution

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