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Recommendations for Handling Materials in Low-Seam Coal Mines

Objective

Reduce the cost and incidence of low-back pain in underground coal mines through redesign of materials-handling tasks.

Background

Approximately 25 pct of all injuries in mining involve trauma to the back. These injuries account for at least 30-40 pct of worker compensation payments made by the industry, are the leading cause of lost work days in mining, and have been estimated to cost the industry \$50 million annually. It is clear that the traditional approach to reduce back injuries (i.e., training) has been largely ineffective. Thus, new approaches are necessary to control this problem. This document briefly describes methods that can be used to *redesign* hazardous materials-handling tasks to reduce the threat of worker injury.

Approach

A model for redesigning materials-handling tasks is shown in figure 1. The model outlines the sequence of steps that should be followed (and questions that should be asked) when developing new strategies for handling materials in underground coal mines.

A critical examination of the current supply-handling system is the first step to developing safer materials-handling procedures. The purpose is to identify hazardous tasks that can be modified to reduce injury risk. Accident analysis (a review of past accident records) and task analysis (usually a videotaped analysis of hazardous jobs or

tasks) are effective methods of distinguishing areas where job redesign is needed.

Once specific materials-handling problems have been identified, it is necessary to consider ways that tasks can be modified to increase the efficiency of the supply system and reduce the injury potential associated with manual handling tasks. As illustrated in figure 1, the major redesign techniques that should be considered (in order of preference) are: (1) task elimination, (2) task mechanization, (3) matching job demands to worker capabilities, and (4) worker selection and training procedures.

The optimal solution is to eliminate unnecessary materials-handling tasks. This may be as easy as having a supplier deliver items in a different configuration. For instance, at one mine, concrete stopping blocks were delivered in large banded loads. Unfortunately, the surface supply workers had to *unband* the blocks and manually load them on the supply car so that the blocks could clear a low section of the haulageway. However, the manual loading of blocks onto the supply car was eliminated simply by having the supplier band the blocks in smaller units—low enough to pass through the low area of the haulageway. This allowed the banded loads to be mechanically loaded on the supply car.

If a task cannot be eliminated, the next best redesign strategy is to use or develop a mechanical assist device to perform the job. Ideally, supplies should be handled mechanically until they *absolutely must* be handled manually. A common problem is that mines do not keep loads palletized or in unit loads long enough. Keeping loads unitized increases the number of times supplies can be mechanically (rather than manually) handled. In some cases, specialized tools or devices may need to be used or developed to reduce injury risk in certain tasks. Bureau

research has demonstrated that inexpensive and easily fabricated mechanical-assist devices can be developed to reduce manual lifting, thus decreasing risk of an expensive back injury.

Research has shown that back injury risk is sharply increased when workers are required to perform jobs whose demands overstress the physical strength capabilities of the worker. Thus, if materials-handling tasks cannot be eliminated or mechanized, it may be necessary to redesign jobs so that job demands do not exceed worker capabilities. As an example, Bureau research has demonstrated that lifting capacity of miners is significantly decreased when a kneeling posture is used. The recommended acceptable lifting capacity for compact, repetitively-handled supplies in the kneeling posture is 45 pounds. Thus, if a miner has to lift a 50-lb rock dust bag while kneeling, he will be at greater risk of experiencing a low-back injury. Repackaging rock dust in 40-lb containers would provide a better match between job demands and worker lifting capacity, and would reduce the threat of back injury.

Worker selection and training procedures represent a last resort to reducing injury risk. Worker selection generally includes evaluation of physical strength, aerobic capacity, or a clinical examination of an individual. However, it is crucial that tests administered be *directly related*

to job demands to avoid accusations of discriminatory selection procedures. Worker training does not appear as effective in controlling injuries compared to the previously described methods, but may assist the worker if the following areas are covered: risks of unsafe materials-handling, anatomy and biomechanics of lifting, use of mechanical-assist devices, and accident avoidance.

Proper implementation and evaluation of the redesign strategy are crucial to the success of the program. If miners are hostile to the new job practices, implementation will be difficult. Active communication and worker involvement in the process will improve the chances of successful implementation. Evaluation of the new practices is necessary as the new strategy may overlook important, unintended consequences. Feedback should be obtained to determine how well the new procedures have reduced injury risk, and how workers are accepting the new procedures.

For More Information

Additional information about the Bureau's recommendations for materials-handling can be obtained by contacting Sean Gallagher, U.S. Bureau of Mines, P.O. Box 18070, Pittsburgh, PA 15236, or telephone (412) 892-6445.

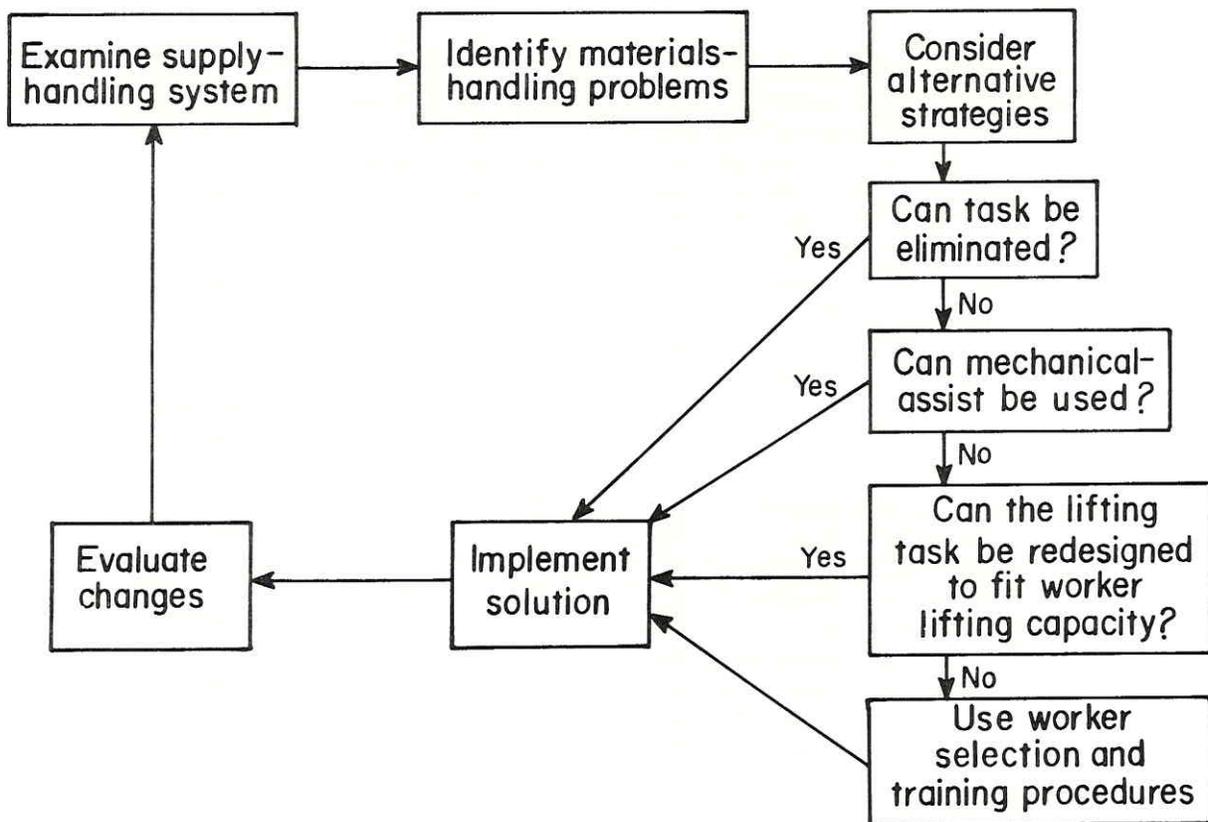


Figure 1.—Flowsheet: redesign of materials handling tasks