



Safety analysis of surface haulage accidents—Part 2 (Part 1 appeared in the May-June Bulletin)

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Abstract

Research on improving haulage truck safety, started by the U.S. Bureau of Mines, is being continued by its successors. Fatal haulage accidents most often involve loss of control or collisions caused by a variety of factors. Lost-time injuries most often involve sprains or strains to the back or multiple body areas, which can often be attributed to rough roads and the shocks of loading and unloading. Part 2 describes research to reduce these accidents, including improved warning systems, shock isolation for drivers, encouraging seatbelt usage, and general improvements to system and task design.

In 1995, the USBM laid out new initiatives for improving surface haulage safety based on a history of research (May and Aldinger, 1995). Although the USBM was abolished by Congress in 1996, the health and safety research functions in Pittsburgh, Pennsylvania, and Spokane, Washington, were continued. The

surface mining hazard reduction project, formerly conducted out of the USBM's Minneapolis, Minnesota, center, is continuing in Spokane. The project, "Hazard Reduction for Surface Mining", is continuing to build on past accomplishments while refocusing future goals to meet the needs of the newly formed health and safety research centers. The objective for the project is to reduce accidents and injuries associated with coal and metal/nonmetal surface mining. Several strategies are being investigated, including improved operating practices, hazard recognition, and safety and warning devices.

Equipment manufacturers are working to incorporate alarms, improve vision, and improve ergonomics on large equipment. Other approaches involve the development of remote-controlled or autonomous vehicles for specific extremely hazardous or repetitive, simple tasks. Improvements in sensing technology such as GPS, radar, laser, and infrared offer an

opportunity to introduce these technological improvements as an aid to vehicle operation and/or control.

Currently the efforts for the Hazard Reduction for Surface Mining project are aimed at:

- **Safety Analyses.** This will review MSHA accident data to determine root causes of recorded accidents. For example, slips and falls from powered equipment are a major cause of injuries. But in evaluating the accident narratives, nearly half the slips and falls are affiliated with jumping from a vehicle or conveyor. Of those jumping, over half were from vehicles which had lost power or brakes. This analysis will help identify operating practices that should be modified or avoided to improve safety.
- **Early Warning.** Existing and developing sensing technology will be reviewed to determine what systems might be easily incorporated onto existing equipment or into current operations to provide warning to

operators and others in the immediate proximity. Currently, engine performance (rpm, oil pressure) and machine operating conditions (speed, tilt, load) will be reviewed as possible parameters that could be used or recorded to define machine operating safety. In addition, geotechnical sensing devices, laser surveying, slope monitoring, proximity warning and optical sensing devices will be investigated to determine the potential of short- and long-term applications that might be used to improve equipment operating safety.

• **Operator Safety.** Methods to minimize injury to operators during accidents will be investigated. Previous research on vibration testing done by TCRC will be continued to define and isolate elements that could lessen shock loads to the operator. Methods to promote seatbelt use will also be investigated.

• **Human Factors.** Work will continue to be coordinated with the Human Factors section at PRC to develop effective training and ergonomic support designs for small- to medium-sized coal and metal/nonmetal surface mining operations. In addition, this task will involve investigations of the psychological and physiological factors of reducing operator-induced accidents.

Conclusions

There is sufficient evidence from a variety of studies, including the data presented here, to identify several key problem areas in surface haulage truck usage. These include:

• **Driver fatalities involving loss of vehicle control.** These accidents can be addressed through a combination of solutions, including haulage roads with less-steep grades, better signs, and longer sight lines. Also, driver visibility can be improved through mirrors, video cameras, and cab design. Drivers can be educated about keeping their equipment within controllable limits. Finally, seatbelt usage should be promoted for those

times when loss of control cannot be averted.

• **Strains and sprains from rough roads, and the shocks of loading or unloading**

Road maintenance can smooth out washboarding and other types of bumps. Loading and unloading techniques, such as lining the truck bed with small material before loading large boulders, can reduce shocks. Also, suspensions can be used to dampen the transmitted shocks.

• **Strains and sprains resulting from a slip or fall while mounting or dismounting the truck.** Improved railings, nonskid surfaces, and damage-resistant ladders are some of the ways of helping drivers to mount and dismount their vehicles safely.

Despite the range of data presented here, there are still many unanswered questions to pursue:

- How often are seatbelts used, and how can usage be increased? How many truck drivers are in the mining workforce, and how many of them are contractors? Do any of these groups have a disproportionate number of accidents?
- What range of truck sizes are in use. Are some types of accidents more likely for different-sized trucks?
- What haulage safety problems will be solved by automation? What new hazards will be created?
- How can the existing information on improving haulage safety be communicated more effectively?

These issues, and others that will emerge from more detailed analysis planned during the next year, will guide the development of tools and strategies for improving haulage truck safety.

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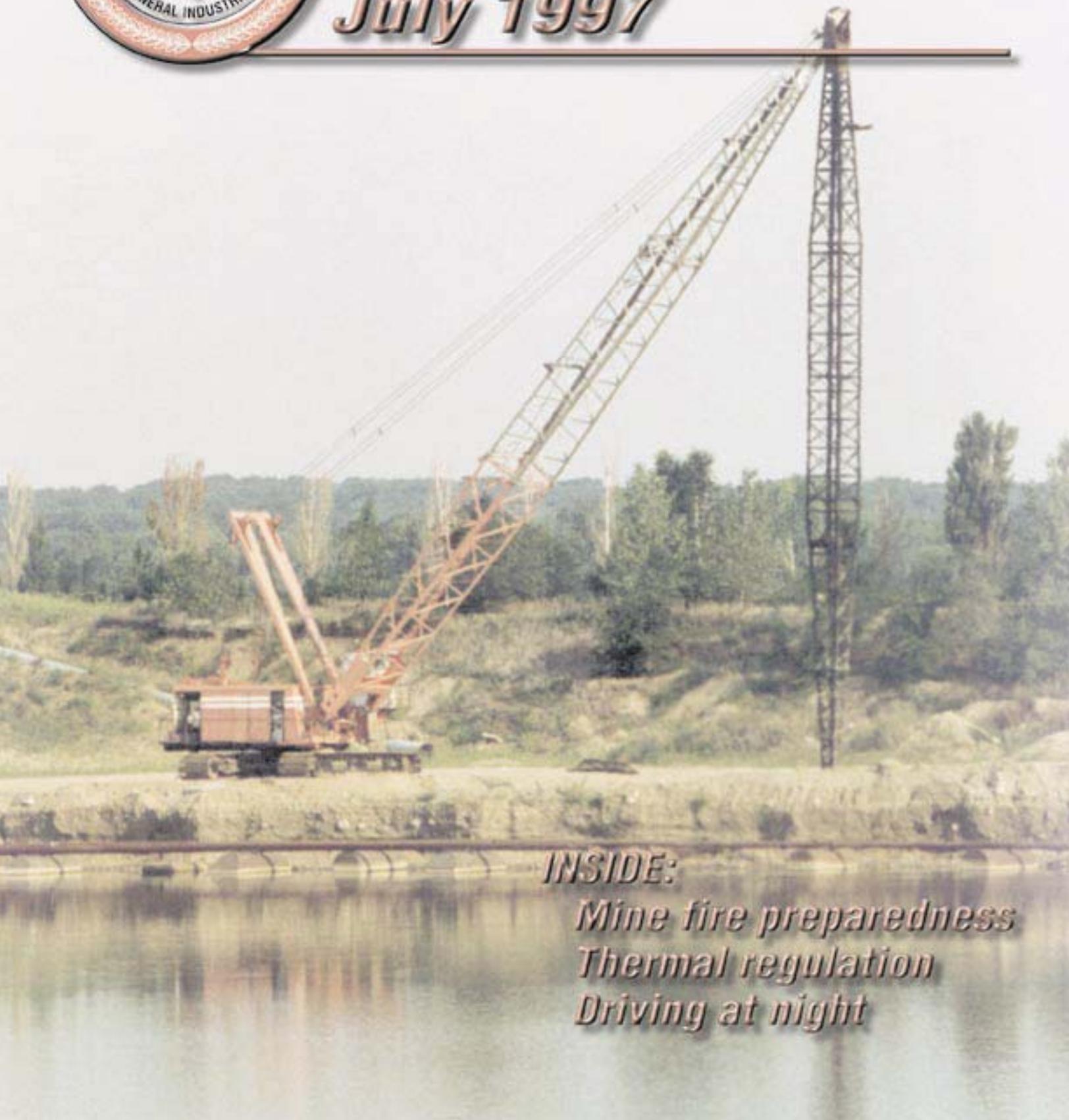
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