Laboratory performed this study to reduce workers' risks from exposure to moving appendages on underground mining machinery. Accident investigation reports do not usually contain enough information to aid in studying this problem and laboratory experiments with human subjects are also not feasible because of safety issues. As an alternative, researchers developed a computer-based three-dimensional model and simulation approach as the primary means to gather data on mishaps. The computer simulation was augmented by a laboratory validation. Significant findings are presented on operator-machine hits as related to boom speed, operator size, seam height, operator response time and risky behaviors. Collisions versus speed, operators' posture, and seam height proved the most significant factors in the data obtained from the model. Relative importance of each factor was determined by prioritizing the factors by significance using statistical analysis. By simulating an operator's random behavior and the machine's appendage velocity, researchers can accurately identify hazards, and use that information to form safe design parameters for mining equipment. Computer modeling and simulations provided an alternative and safe approach to data gathering in that there was no need for human subjects and logistics – test sites and costs associated with experiments. The use of this type of methodology, computer model and simulation, shows potential to conduct safety studies of other human machine interaction situations.

H3.2

Title: Developing an Innovative Multi-disciplinary Approach: Electric Arc-induced Injuries in the Mining Industry
Authors: Kowalski-Trakofler KM, Brnich MJ, Cawley JC, Homce GT, Vaught C, Yencheck, M.

This presentation discusses an innovative, multi-disciplinary method developed by PRL researchers to examine ways to reduce the incidence and severity of traumatic injuries resulting from electric arc blasts in the mining industry. The problem is 1) defined and 2) the methodology detailed. In addition, 3) preliminary results are presented with 4) a discussion of future direction.

Maintenance or repair of electrical equipment is responsible for approximately one-half of all mine electrical injuries and fatalities and often results in electrical arcing and burn injury to workers. Two-thirds of nonfatal mine electrical injuries are burns. Electrical arc burn injuries are also a serious problem in other industries, for example, in construction. The PRL project is focused on the identification and development of specific interventions to reduce worker exposure to electrical arc energy. The goal of the problem-solving focus was to move beyond one-dimensional thinking. The methodology presented was developed within Socio-Technical Systems Theory which views the problem from a holistic, comprehensive, inter-disciplinary viewpoint. This theory is guided by two principal concepts. One, most task-oriented situations involve a social system of people needed for the work and a technological system made up of the tools and technology necessary to get the work done. Second, these interrelated systems of people, tools and activities are in turn part of a larger environment that includes and is influenced by the socio-technical system. The open-structure approach to real world situations highlights the need for a basic understanding of organizational phenomena. Within this framework, PRL researchers with expertise in electrical and mining engineering, sociology and psychology developed an approach to understand and analyze this serious problem. In addition to the methodology, preliminary results of the data analysis and future directions will be discussed.

H3.3

Title: Caught-In Injury Protection System for Wood Chippers
Authors: Ammons DE, Powers JR, Newbraugh BH

Data from the Census of Fatal Occupational Injuries from 1992 - 1997 show that there have been 920 deaths due to a worker being caught in running machinery. The data also shows that 225 of these occurred while the workers were servicing, loading, or clearing material from the machine. To address the need for improved worker safety and decrease the likelihood of being caught in running machinery, the Division of Safety Research, National Institute for Occupational Safety and Health, integrated a proximity warning and shutoff circuit into a simulated wood chipper. The project began as a radio frequency based intervention for caught-in injuries and evolved into a capacitive proximity sensor that provides warning and shutoff signals when the worker enters the chipper's feed chute.

The capacitive proximity sensor consists of two subsystems. The first subsystem consists of sensing electrodes integrated into the feed chute of the chipper. The second subsystem is a programmable control circuit used to detect warning and shutoff levels and activate the corresponding alarms and shutoff mechanisms respectively.

The capacitive proximity sensor has undergone laboratory testing in a simulated feed chute. Field testing of the sensor is scheduled to begin in 2004. The overall design of the safety system as well as the results of the lab testing will be discussed.

H3.4

Title: Amputations at a U.S. Heavy Manufacturing Company From 1998 to 2002
Authors: Reeve GR, Stout AW

The purpose of this study was to describe the patterns of amputation injuries in a heavy manufacturing setting from 1998 to 2002, and to determine what job functions pose the greatest risk for these injuries. The study data were abstracted from a vali-

NOIRS 2003 ABSTRACTS

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