

## **Predicting Systems Interactions in the Design Process**

*Lisa Steiner, Fred Turin, and Kim Cornelius*

*National Institute for Occupational Safety and Health, United States*

With emerging new technologies, accidents may occur because human-system interactions were not considered adequately in the development process. Development of new methods and equipment is inspired by the promise of increased productivity and reduced costs. It is important to consider the system, man-machine-environment, and their interactions in its entirety in the design phase of a new or changing process. A trend observed in underground coal mining can be used to illustrate the necessity of a systematic method to identify hazards and reduce the probability of mishaps. In the case study of extended cut mining, remote control mining methods have replaced previously employed manual on-board methods of coal extraction. The interactive, systematic methods used to identify and predict the probable effects of this new technology include literature review, accident and fatality analysis, interviews and activity analysis. The question to be answered: "What effect do equipment and method changes have on the operator and other workers?" Researchers found that minimal human factors consideration was given when switching from manual on-board to remote control operation despite the dramatically modified role of the human component. The effects imposed on operator, helpers, shuttle car drivers and roof bolters were significant. Problems that could have been avoided through careful and early integration of ergonomics included inadequate operator feedback, poor illumination provisions, and increased exposure to roof and rib. It is essential to attempt to determine and predict the effects of equipment and method changes prior to their implementation and to continuously evaluate the change after implementation.