8 MACHINERY & VEHICLE CAB DESIGN

Machinery and vehicle cab design strongly influences the way drivers and operators work. Optimising the cab design, layout, orientation and seating reduces the risk of drivers and operators developing musculoskeletal disorders.

Some mining workers spend much of their work day operating machinery and driving vehicles such as bulldozers, dump or haul trucks, graders, loaders, personnel and equipment transport vehicles and load-haul-dump machines. An analysis of workplace injuries in the WA mining industry for 2004-05 to 2006-07 indicated that mobile plant operators had one of the highest incidences of musculoskeletal disorders.

Risk of musculoskeletal disorders

The cab design, including the layout, orientation and seating, strongly influences the way drivers and operators work. Employees operating machinery and driving vehicles with poorly designed cabs can be exposed to hazards that increase the risk of musculoskeletal disorders, including:

- awkward postures for operating controls and driving machinery and vehicles;
- excessive forces required to operate levers and pedals;
- sustained, unsupported, uncomfortable seated postures;
- exposure to excessive levels of vibration; and
- impeded safe entry and exit from the machinery or vehicle.

Furthermore, poor cab design can increase operator or driver discomfort and reduce productivity, as well as reducing any benefits derived from good seating and work breaks.

Cab design

Some common aspects of machinery and vehicle cab design that result in an increased risk of musculoskeletal disorders for operators and drivers are listed below.

Limited cab space – Inadequate cab space constrains the operator or driver's posture. For example, taller drivers cannot adjust their seats correctly if there is insufficient room within the cab.

Poor location and design of controls – Controls or information displays that are difficult to read can result in operators and drivers adopting awkward postures. Furthermore, the design of the controls can result in excessive forces being required to operate levers and pedals.

Poor seat design, suspension and maintenance – Inadequate seating can result in operators and drivers working in sustained poor seated postures, being exposed to vibration, having hindered ability to access and operate controls, and having difficulty getting into and out of the cab because of obstructions.

Different orientation to direction of travel – If the cab is oriented at an angle to the travel direction, the operator or driver may have to twist to see the route.

Location of cab – A poorly located cab on the machinery or vehicle may result in impeded access, leading to an increased risk of injury from slips, trips and falls when entering and leaving the cab.

Reducing risks

The most effective risk control strategy is to eliminate hazards at the design stage. Machinery and vehicle cabs should incorporate ergonomic design principles to achieve safe access, operation and seating.

If influencing the design is not possible, alternative strategies to

consider are equipment selection and modification.

Mining equipment is often selected based on its suitability for the job, cost, robustness, power and maintainability, rather than for operator or driver comfort, safety and health. Just as there is a 'buy quiet' program to reduce injuries due to noise, a checklist could be developed to assess equipment for its 'hazardous manual task rating' before purchase.

There are many practicable ways to improve machinery and vehicle seating and seat suspension. Optimum seat design should provide adequate support, not place unnecessary stress on any part of the body and facilitate the optimal posture to allow for comfort, efficiency and minimisation of muscle fatigue. Specific seating checklists and guidelines have been developed to assist workplaces to assess and improve seating in machinery and vehicles.

Administrative control measures can be implemented in the short term while engineering controls are developed, or as complementary controls to minimise risk.

Administrative controls include varying work schedules, incorporating regular rest breaks and managing the pace of work. Operator and driver training can also be beneficial.

Further information

The 1993 handbook *Ergonomics for the Control of Sprains and Strains in Mining* by B. McPhee provides guidance and a checklist for seat design in mining machinery and vehicles. It also includes a general checklist for ergonomics of mining equipment. The handbook can be downloaded at www.jkgroup.com.au/documents/ErgonomicsSprainsStrainsMining.pdf or purchased at www.coalservices.com.au

In 2003, K. Kittusamy produced a checklist for evaluating cab design entitled *A checklist for evaluating cab design of construction equipment*, published in volume 18 of the *Applied Occupational and Environmental Hygiene*. The checklist is recommended for mining machines and vehicles and can be downloaded at www2a.cdc.gov/nioshtic-2

The handbook produced in 2007 from ACARP Project C14016 *Reducing Injury Risks Associated with Underground Coal Mining Equipment*, funded by the Australian Coal Association Research Program, provides information and guidance on risk assessment tools and examples of best practice associated with underground coal mining equipment. The handbook can be downloaded or purchased with accompanying DVD at www.burgess-limerick.com

The Earth Moving Equipment Safety Round Table (EMESRT) is developing *Design Philosophies* for key issues that impact on the human factors design of earth moving equipment. They can be downloaded at www.mirmgate.com/emesrt.asp

Data source

Injury data for 2004-05 to 2006-07 sourced from AXTAT database, Resources Safety, Department of Consumer and Employment Protection.

References

BURGESS-LIMERICK, R., 2007, Reducing Injury Risks Associated with Underground Coal Mining Equipment: Burgess-Limerick and Associates, Australian Coal Association Research Program and Xstrata Coal NSW, Brisbane, 45 pp.

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