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# WHOLE-BODY VIBRATION

**Operators, drivers and passengers of machines and vehicles in mining workplaces can be exposed to harmful levels of whole-body vibration. Reducing exposure reduces the risk of musculoskeletal disorders.**

## What is whole-body vibration?

*Whole-body vibration* is when vibration is transmitted to the whole body by the surface supporting it (i.e. seat or floor). It is commonly experienced in mining workplaces by drivers, operators and passengers in a variety of vehicles and machines. The term 'rough ride' is sometimes used for the jolting and jarring that may be experienced.

## Health effects

The longer a worker undertaking manual tasks is exposed to whole-body vibration, the greater the risk of musculoskeletal disorder. The most commonly reported musculoskeletal disorder from exposure to whole-body vibration is low-back pain.

Some studies have associated degeneration of the lumbar spine with long-term exposure to high levels of whole-body vibration, but not a lot is known about the specific effects of exposure to whole-body vibration on the musculoskeletal system.

Exposure to whole-body vibration may also cause other health effects such as:

- cardiovascular, respiratory, endocrine and metabolic changes;
- problems with the digestive system;
- reproductive damage in females;
- impairment of vision, balance or both; and
- interference with activities and discomfort.

## Sources

The main sources of harmful whole-body vibration in vehicles and machines are:

- rough road and poor work surface conditions;
- vehicle activity; and
- engine vibration (to a lesser extent).

Factors that can decrease or increase exposure include:

- road construction and maintenance;
- vehicle type and design;
- age and condition of vehicle;
- maintenance of vehicle suspension systems;
- seat design, suspension and maintenance;
- cab layout, design and orientation;
- vehicle speed, driver skills and awareness;
- lighting and visibility; and
- task design and work organisation.

## Assessing and measuring exposure

Measurement and assessment of whole-body vibration exposures can help identify:

- workers exposed to potentially damaging vibration levels; and
- vehicles or machines that produce excessive vibration.

This information is useful in establishing priorities and assessing vibration reduction strategies.

Whole-body vibration measurements should be collected and analysed by a competent person such as an appropriately trained occupational safety and health professional, maintenance technician or engineer, or vibration specialist.

Typically, whole-body vibration is measured by placing a vibration sensor on the seat of a vehicle. The sensor detects vibration in three axes — x (forward to back movement), y (side to side) and z (up and down).

An attached vibration meter or data logger amplifies and records the vibration signal. After analysis, the vibration exposure can be assessed against health, fatigue or comfort criteria in standards for whole-body vibration. The applicable standard is Australian Standard AS 2670.1:2001 *Evaluation of human exposure to whole-body vibration – General requirements*.

## Reducing harmful exposure

Measures to eliminate or minimise exposure to whole-body vibration consist of controlling:

- vibration at the source;
- the paths of the vibration; and
- vibration at the position of the worker performing the task.

The control measures introduced to reduce harmful whole-body vibration exposure should follow the hierarchy of controls. Elimination, redesign and engineering controls should be implemented over administrative controls. Training is required as a complementary control measure.

Workers should be consulted and involved in setting priorities and identifying solutions. Successful whole-body vibration exposure reduction usually requires a combination of control measures. Such measures, listed in order of the hierarchy of controls, include:

- modifying the process to eliminate the task or the risk;
- redesigning the task;
- designing machines or vehicles that reduce the vibration transmitted to the operator;
- improving road and surface conditions;
- implementing speed limits;
- implementing safe work procedures and standard operating procedures;
- implementing work breaks or job rotation to reduce exposure; and
- providing training on adjusting and operating equipment to reduce exposure.

## Further information

*Bad Vibrations: a Handbook on Whole-Body Vibration Exposure in Mining*, produced by McPhee et al. in 2001, provides guidance to help mining workplaces identify and manage risks associated with exposure to whole-body vibration. The handbook can be downloaded at www.jkgroup.com.au/index.php?papers or purchased at www.coalservices.com.au

Australian Standard AS 2670.1:2001 *Evaluation of human exposure to whole-body vibration – General requirements* describes methods for the measurement of periodic, random and transient whole-body vibration, and indicates the principal factors that combine to determine the degree to which vibration exposure is acceptable. The standard can be purchased at www.saiglobal.com/shop

In August 2007, the Australian Safety and Compensation Council (ASCC) declared the *National Code of Practice for the Prevention of Musculoskeletal Disorders from Performing Manual Tasks at Work*. Appendix 3B provides guidance on controls to eliminate or minimise the risks from exposure to vibration during manual tasks. The code can be downloaded at www.ascc.gov.au

The UK-based Health and Safety Executive's publications *Control Back-Pain Risks from Whole-Body Vibration – Advice for Employers* and *Drive Away Bad Backs – Advice for Mobile Machine Operators and Drivers* provide guidance on managing risks from whole-body vibration for employers and employees. They can be downloaded at www.hse.gov.uk/vibration

## References

AUSTRALIAN SAFETY AND COMPENSATION COUNCIL, 2007, National Code of Practice for the Prevention of Musculoskeletal Disorders from Performing Manual Tasks at Work: Australian Government, Canberra, 127 pp.

McPHEE, B., FOSTER, G., and LONG, A., 2001, Bad Vibrations: a Handbook on Whole-Body Vibration Exposure in Mining: The Joint Coal Board Health and Safety Trust, Sydney, 48 pp.