7

HAND-ARM VIBRATION

Workers using hand-held power tools in mining workplaces can be exposed to harmful levels of hand–arm vibration. Reducing exposure reduces the risk of musculoskeletal disorders.

What is hand–arm vibration?

Hand–arm vibration is when vibration is transmitted to the hand and arm. The vibration can be transmitted during the operation of hand-held power tools and hand-guided equipment, or when holding materials being processed by machines. Hand–arm vibration is commonly experienced in mining workplaces by workers who regularly use tools such as jackhammers, grinders, drills, riveters and torque wrenches.

Health effects

The longer a worker undertaking manual tasks is exposed to hand–arm vibration, the greater the risk of developing musculoskeletal disorders.

Exposure to hand–arm vibration can result in disrupted blood and oxygen circulation in the hand and forearm, as well as damage to nerves and tendons, muscles bones and joints. It can cause a range of conditions collectively known as *hand–arm vibration syndrome* (HAVS) and specific disorders such as carpal tunnel syndrome and lateral epicondylitis (commonly known as 'tennis elbow'). The most common condition resulting from exposure to hand–arm vibration is aptly named 'vibration white finger'.

The development of hand–arm vibration syndrome is gradual and increases in severity over time. It may take a few months to several years for the symptoms to become noticeable as there is commonly a latency period between exposure and onset of symptoms. Affected workers typically report one or more of the following symptoms:

- tingling and numbness in the fingers;
- decrease in light touch resulting in not being able to feel things properly;
- loss of grip strength;
- whitening of one or more fingers, particularly when exposed to cold; and
- pain and cold sensation between attacks of vibration white finger.

Factors influencing the effects of exposure to hand–arm vibration

The effects of exposure to hand–arm vibration are influenced by factors such as:

- acceleration and frequency of the vibration;
- duration of exposure during each work shift and number of years of exposure;
- state of tool maintenance;
- level of insulation on the tools;
- duration and frequency of work-rest periods;
- grip forces applied (the tighter the grip, the more vibration is absorbed);
- part, mass and surface area of the hand in contact with the source of vibration;
- hardness of material being contacted;
- posture of arm and hand during tool operation;
- type of handle on the tool;
- temperature of work environment (cold affects circulation);
- use of personnel protective equipment, including gloves;
- individual operator's skill and technique;
- individual's personal habits (smoking and use of drugs affects circulation);
- individual's susceptibility to vibration; and
- individual's medical history, in particular disease or prior injury to fingers, hands or wrists.

Assessing and measuring exposure

Measurement and assessment of hand–arm vibration exposure levels can help identify tools and activities that are producing excessive vibration levels. This information can be useful in establishing priorities and assessing

the effectiveness of control measures in reducing these levels.

Vibration data may be obtained from the equipment handbook, supplier or manufacturer. Alternatively, hand–arm vibration can be measured by a competent person such as an appropriately trained occupational safety and health professional, maintenance technician or engineer, or vibration specialist.

Typically, hand–arm vibration is measured by placing an accelerometer on the handle of the power-tool under investigation. Vibrations transmitted to the hand are measured along three axes, labelled x_h, y_h and z_h. The measurements can be recorded for later analysis or displayed in real-time.

Australian Standard AS 2763:1988 *Vibration and shock-hand-transmitted vibration – Guidelines for measurement and assessment of human exposure* provides guidance for assessing exposure to hand–arm vibration. Exposure is expressed as an averaged reading over a four-hour period in a shift. Any workers exposed to an acceleration value of 2.9 m/s^2 or more should be medically examined for the presence of or susceptibility to vibration white finger, which would preclude them from performing manual tasks that expose them to hand–arm vibration.

Reducing harmful exposure

Measures to eliminate or minimise exposure to hand–arm 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 hand–arm 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, including the selection and trialling of new power hand-tools. Successful hand–arm vibration exposure reduction usually requires a combination of control measures. Such measures, listed in order of the hierarchy of controls, include:

- substituting alternative methods or processes to eliminate the need to use vibrating hand-held tools;
- selecting tools to eliminate or minimise exposure to vibration;
- modifying existing tools to either dampen the vibration or prevent the vibration from moving into the handle of the tool;
- modifying the work methods to reduce exposure to vibration;
- altering work practices and the way work is organised to reduce exposure to vibration;
- maintaining equipment on a regular basis to minimise vibration;
- providing personal protective equipment, such as gloves and protective clothing, to keep workers warm and dry and encourage good circulation; and
- providing training, including advice on good work practices and tool maintenance, and information on the effects on vibration white finger of personal habits affecting circulation (e.g. smoking, drug use), and recognising and reporting symptoms of hand–arm vibration syndrome.

Gloves should not be relied upon to provide protection from vibration.

Further information

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 the Risks from Hand–Arm Vibration – Advice for Employers* and *Hand–Arm Vibration – Advice for Employees* provide guidance on managing risks from hand–arm vibration for employers and employees. They can be downloaded at www.hse.gov.uk/vibration

Australian Standard AS 2763:1988 *Vibration and shock – Hand-transmitted vibration – Guidelines for measurement and assessment of human exposure* sets out general methods for measuring and reporting hand–arm transmitted vibration exposure, and provides guidance for the evaluation of hand-transmitted vibration. The standard can be purchased at www.saiglobal.com/shop

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.

HEALTH AND SAFETY EXECUTIVE, 2005, Control the Risks from Hand–Arm Vibration – Advice for Employers on the Control of Vibration at Work Regulations 2005: HSE, Sudbury, UK, 12 pp.

HEALTH AND SAFETY EXECUTIVE, 2005, Hand–Arm Vibrations – Advice for Employees: HSE, Sudbury, UK, 8 pp.

STANDARDS AUSTRALIA, 1988, Vibration and shock – Hand-transmitted vibration – Guidelines for measurement and assessment of human exposure: Australian Standard 2763, 14 pp.