

Controlling Risks From Exposure to Vibration Guideline

Section 1 - Purpose and Scope

(1) The purpose of this Guideline is to offer advice regarding the management of musculoskeletal disorder risks, and hearing damage associated with vibrating tools, equipment, or vehicles. This Guideline applies to all University of Queensland (UQ) workers using vibrating tools, equipment, or vehicles.

Section 2 - Health Effects of Vibration Exposure

(2) Vibrating tools, equipment and surfaces, transfer vibration into the body creating mechanical oscillations of the musculoskeletal system. Vibration generates minute muscle reflexes, increases respiratory rate, heart rate and perceived exertion. Vibration can also impair the input of visual information, the output of information through muscle movements or the central processes that relate input to output (i.e. learning, memory, and decision-making). Vibration-induced health conditions progress slowly; symptoms may not develop until months or years of repeated exposure.

(3) Exposure to noise and vibration together can increase risk of hearing loss, compared to workers exposed to the same level of noise alone. For this reason, regular audiometric testing is recommended where workers are exposed to hand-arm vibration at any level and noise with LAeq,8h greater than 80 dB(A) or LC,peak 135 dB(C).

(4) Exposure to vibration on its own or in conjunction with repetitive or sustained force, high or sudden force, repetitive movement or sustained and/or awkward posture can increase the risk of developing a musculoskeletal injury.

Whole-body Vibration

(5) Whole-body vibration (WBV) involves very small, frequent, repetitive movements within the spine and associated muscles. WBV is most often associated with driving vehicles, i.e., trucks, tractors, ride-on lawn mowers, all-terrain vehicles, etc. Prolonged exposure to WBV may lead to the following symptoms:

- a. back pain and general muscle pain;
- b. decreased circulation to lower limbs, numbness and tingling in feet and legs;
- c. headache;
- d. increased heart rate, oxygen uptake, respiratory rate;
- e. shakiness;
- f. fatigue;
- g. insomnia;
- h. stomach and bowel problems;
- i. reduced hearing ability due to disturbances of vestibular system within the ear;
- j. visual impairment.

(6) For additional information on whole-body vibration, refer to the Safe Work Australia publication [Whole-Body Vibration Information Sheet](#).

Hand-arm Vibration

(7) Hand-arm vibration (HAV) involves very small, frequent, repetitive movements within the upper limbs and is common when using powered hand tools such as drills, dental tools, sanders, jackhammers, grinders, mixers, vortex machines, etc. Hand-arm Vibration Syndrome (HAVS) may develop after prolonged exposure to vibrating hand tools and is characterised by the following symptoms:

- a. spontaneous occurrences of whitening (blanching) of one or more fingers when exposed to cold;
- b. tingling or loss of sensation in the fingers;
- c. loss of light touch;
- d. pain and cold sensations between periodic episodes of white finger;
- e. loss of grip strength;
- f. bone cysts in fingers and wrists;
- g. arthritis in hand and/or wrist.

(8) Transmission of vibration from the tool to the hand(s) increases with grip force. Vibration-induced White Finger (VWF) is a health condition common among operators of hand-held vibrating tools and is characterised by permanent reduced circulation to one or multiple fingers and/or thumb.

(9) For additional information on HAV, refer to the Safe Work Australia publication [Hand-Arm Vibration Information Sheet](#).

Section 3 - Vibration Exposure Standards

(10) There are no Australian workplace standards for WBV or HAV, but the European Union's (EU) Directive* is widely used and accepted. The EU Directive specifies action values and limit values for both HAV and WBV. Exposure to WBV should be evaluated using the method in "AS 2670.1: Evaluation of human exposure to whole-body vibration - General requirements". Detailed practical guidance on this is available in "EN 14253:2003: Mechanical vibration - Measurement and calculation of occupational exposure to whole-body vibration with reference to health - Practical guidance".

*Exposure action value and exposure limit value for WBV under the EU 2002/44/EC Physical Agents (Vibration) Directive.

Section 4 - Risk Management

(11) Vibration-induced health conditions progress slowly, and vibration exposure can be effectively managed and reduced through implementation of appropriate controls.

Identify the Hazards

(12) To identify whether there is a significant risk from vibration, consider:

- a. if workers are regularly exposed to vibrating tools or equipment;
- b. vibration emission values (VEV) for the tools and equipment being used. These are usually specified in the instruction manuals or can be available from the equipment supplier. Note that these VEV are specified when

- the tool is new and under specific and controlled working conditions and usually underestimate the vibration exposure once the tool has been put into use;
- c. work practices (i.e., how long are vibrating tools used for, postures being adopted);
- d. if workers are experiencing symptoms of HAV or WBV. For example, if a worker reports tingling and numbness after using vibrating tools, a risk assessment should be undertaken.

Risk Assessment

(13) To assess if current controls are adequate, consider:

- a. if the task can be done in another way that eliminates or reduces the exposure to vibration;
- b. replacing tools/equipment/vehicles with alternatives to reduce vibration emission values;
- c. ensuring work activities are designed ergonomically and encourage optimal working postures;
- d. ensuring equipment and vehicles are maintained;
- e. reducing exposure through regular breaks, task rotation;
- f. providing suitable clothing to protect workers from cold and damp;
- g. providing suitable training and information for all those exposed to vibration, including risk management, reporting symptoms, etc.

Controlling the Risks

(14) A combination of control measures may be used if a single control is not adequate to minimise the risk. Consider all possible control measures and assess which controls are reasonably practicable. Determining which controls are reasonably practicable includes assessing availability and suitability of control measures, with regard to the level of risk. Hierarchy of controls should also be considered with a preference for substitution, isolation or engineering controls above administrative controls or personal protective equipment (PPE). Cost may be relevant factor in determining reasonably practicable controls but should not be the primary consideration.

(15) Control measures introduced to reduce exposure to vibration should follow the hierarchy of controls outlined in the [Hazardous Manual Tasks Code of Practice \(2021\)](#) and may include the following:

- a. use other work methods without or with less exposure to vibration;
- b. mechanically isolate the vibration source from the worker;
- c. install vibration dampening materials;
- d. ensure equipment is well maintained to avoid excessive vibration;
- e. limit duration of work involving vibrating tools or surfaces;
- f. avoid continuous exposure by taking rest periods;
- g. wear sufficient clothing, including gloves, to keep warm;
- h. educate workers about the risks of vibration and how to report symptoms;
- i. consult the Health, Safety and Wellness Division if experiencing symptoms likely to be associated with HAV or WBV.

Vehicle Design and Maintenance

(16) Tractors and farming equipment are often fitted with enhanced suspension, suspended vehicle cabins and operator seats incorporating their own suspension systems that reduce vibration and transference to the worker.

(17) Equipment should always be used in accordance with the manufacturer's instructions to limit vibration including:

- a. inflate tyres to correct pressures;

- b. operating at or reducing suggested speeds;
- c. ensure suspension systems are working effectively and vehicle maintained correctly;
- d. correctly position and utilise backrests and lumbar supports.

Equipment and Tool Design and Maintenance

(18) Successful reduction of hand-arm vibration usually requires a combination of controls and may include:

- a. using tool stands or isolated handles;
- b. using internal dampening hand tools;
- c. resting the tool on the work piece whenever practical;
- d. using pressure gauges to ensure pneumatic equipment is operating at correct pressures;
- e. employing a hand grip consistent with the safe operation of the tool or process;
- f. using slip resistant surfaces, including tool handles to reduce operator force exertion;
- g. using tools with speed adjustment and automatic shut-offs;
- h. replacement of wearing parts including seals, bearings, shock absorbers etc;
- i. refraining from using faulty tools;
- j. maintaining properly sharpened cutting tools;
- k. purchasing tools with lower vibration frequencies or better vibration dampening qualities.

(19) Vibration levels increase as the tool ages and wears, so tool maintenance is a key factor in minimising vibration. Lubrication of mechanisms and periodic replacement of shock absorbers will reduce vibration levels closer to those of when the tool was new.

Equipment and Tool Procurement

(20) When purchasing new tools or equipment, obtain as much information from the supplier as possible related to the vibration emission levels. Other factors to consider when purchasing new tools:

- a. tool weight;
- b. handle design and comfort;
- c. grip forces required;
- d. locking triggers;
- e. noise;
- f. dust;
- g. ease of use in a comfortable posture;
- h. direction of force application.

Vibration-absorbing Materials

(21) Use of vibration dampening gloves may reduce transference of vibration from the tool through the hand and arm. Some seat cushions or tractor/vehicle seats may be replaced with or retrofitted with vibration dampening materials.

(22) Machinery can also be positioned on vibration isolating mounting points or work platforms fitted with suspension systems.

Administrative and Personal Protective Equipment (PPE) Controls

(23) If after implementing the above control measures a risk remains, consider the following controls in the order below to minimise the remaining risk, so far as is reasonably practicable:

- a. Using administrative controls i.e., minimising how long workers use high-vibration tools in a shift by task design or by job rotation;
- b. Using PPE such as gloves to protect hands from cold and wet surfaces or working conditions which increase the likelihood of finger blanching. Note: Anti-vibration gloves are of limited effectiveness for minimising the transmission of vibration to the hands and depending on the frequency of the vibration may even increase transmission. Thick gloves should be avoided as the lack of feel can make workers grip tools more firmly than necessary which increases vibration transmission and fatigue.

Worker Education

(24) Educating workers of the effects of vibration and exposure control measures should help workers to adopt safe work practices and ensure proper maintenance of tools and equipment.

(25) Vibrating equipment and machines often produce loud noise, dust or moving particles so education should focus on controlling exposure to vibration, noise, dust, and particulate matter. Eye protection should be worn when work involves risk of flying debris or dust. A face mask or respirator may be required when work creates dust or particulate matter. Refer to the [Personal Protective Equipment Procedure](#) for further information regarding appropriate personal protective equipment.

(26) Please refer to UQ's [Hazardous Noise Risk Management Procedure](#), [Hazardous Noise Risk Management Guideline](#), and the [Managing Noise and Preventing Hearing Loss at Work Code of Practice 2021](#) for further information on controlling noise exposure.

Section 5 - Roles, Responsibilities and Accountabilities

Health, Safety and Wellness Division

(27) The Health, Safety and Wellness Division (HSW Division) is responsible for providing relevant advice and guidance related to the interaction of humans and vibration caused by machinery, and hazardous manual tasks.

Health, Safety and Wellness Managers and Work Health and Safety Coordinators

(28) Health, Safety and Wellness Managers (HSW Managers) and Work Health and Safety Coordinators (WHSCs) are responsible for providing risk management advice with consideration to the hierarchy of controls and can request further assistance or advice from the HSW Division.

Managers and Supervisors

(29) Supervisors and managers are required to ensure training in safe use of vibrating tools or equipment is provided. Refer to UQ [HSW training web page](#). They are also responsible for ensuring appropriate tools and equipment is provided, are used as intended, risk assessments completed, and appropriate controls are in place and followed, including tool and equipment maintenance program.

UQ Workers

(30) Workers are to report any symptoms that may be related to vibration. Workers must also comply with any reasonable instructions or advice to minimise exposure to vibrating tools or equipment.

Section 6 - Definitions

Term	Definition
Musculoskeletal disorder	Sprain or strain to soft tissues of the body, including nerves, tendons, ligaments, blood vessels and intervertebral discs. Examples: back pain, sciatica, neck strain.
WBV	Whole-body vibration.
HAVS	Hand-arm vibration syndrome.
VWF	Vibration-induced white finger.
UQ workers	For the purposes of this Guideline includes: <ul style="list-style-type: none">• staff - continuing, fixed-term, research (contingent funded) and casual staff;• contractors, subcontractors and consultants;• visiting academics and researchers;• affiliates - academic title holders, visiting academics, emeritus professors, adjunct and honorary title-holders, industry fellows and conjoint appointments; and• students (including, undergraduate, masters, honours and higher degree by research students).

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