

This Guide provides information on how to manage risks associated with vibrating plant in the workplace, in particular hand-held power tools. A summary is available in the information sheet on *Hand-Arm Vibration*.

This Guide is part of a series guidance material on:

- *Measuring and assessing workplace exposure to hand-arm vibration*
- *Managing risks of exposure to whole-body vibration in workplaces*, and
- *Measuring and assessing workplace exposure to whole-body vibration*.



## What is hand-arm vibration?

Hand-arm vibration (HAV) is vibration transmitted to a person's hand and arm when using hand-held power tools or hand-guided machinery like powered lawn-mowers or while holding materials being processed by machines. HAV is commonly experienced by people who use jack-hammers, chainsaws, grinders, drills, riveters and impact wrenches.



## What are the health effects of exposure to hand-arm vibration?

Regular long-term exposure to excessive HAV can disrupt a person's circulation in their hand and forearm, and cause damage to nerves, tendons, muscles, bones and hand and arm joints. These conditions are collectively known as hand-arm vibration syndrome (HAVS) and include:

- Carpal tunnel syndrome – a disorder of the hand and arm which may involve tingling, numbness, pain and weakness in parts of the hand.
- Musculoskeletal disorders – muscular and vascular disorders like weakness, pain and stiffness in the joints of the hands and arms and little or no grip strength.
- Vibration white finger (Raynaud's phenomenon) – a sudden constriction of the blood vessels which slows blood flow to the extremities, most often fingers and toes. The skin will change in colour, usually accompanied by discomfort like pain, tingling and numbness. Severe cases can result in complete loss of touch sensation and manipulative dexterity which can interfere with work and increase the risk of acute injuries due to incidents.
- Dupuytren's contracture – fingers becoming permanently curled towards the palm and reduced grip strength.

Workers with HAVS may find it impacts their work, social and family life. Periodic attacks of reduced blood circulation may happen at any time and everyday tasks like handling small buttons on clothing, opening jars and turning door knobs may become difficult.

There is evidence to suggest that workers who are exposed to both HAV and noise are more likely to suffer hearing loss than workers exposed to the same level of noise alone. Exposure to both vibration and noise may also increase musculoskeletal problems.



## Who has duties under the law?

Everyone in the workplace has work health and safety duties. The main duties related to exposure to HAV are set out in Table 1.

**Table 1** Duties in relation to hand-arm vibration

Who	Duties
<b>A person conducting a business or undertaking</b>	<p><b>A person conducting a business or undertaking</b> has the primary duty to ensure, so far as is reasonably practicable, workers and other people are not exposed to health and safety risks arising from the business or undertaking.</p> <p>This duty includes eliminating exposure to HAV, so far as is reasonably practicable, and if it is not reasonably practicable to eliminate exposure to HAV, minimising the risks so far as is reasonably practicable. This includes ensuring so far as is reasonably practicable the:</p> <ul style="list-style-type: none"> <li>■ provision and maintenance of safe plant including hand-held power tools, and</li> <li>■ safe use, handling, storage and transport of plant.</li> </ul> <p>The duty covers businesses and undertakings with management or control of plant including those which own, lease or hire out the plant.</p>
<b>Designers, manufacturers, importers, suppliers, and installers</b>	<p><b>Designers, manufacturers, importers, suppliers and installers of plant</b> must ensure, so far as is reasonably practicable, the plant they design, manufacture, import or supply is without risks to health and safety. This duty includes carrying out analysis, testing or an examination and providing specific information about the plant. Information must, so far as is reasonably practicable, be passed on from the designer through to the manufacturer and supplier to the end user.</p> <p>Also see the <i>Guide to the safe design of plant</i>, <i>Guide for manufacturing safe plant</i> and the <i>Guide to importing and supplying safe plant</i>.</p>
<b>Officers</b>	<p><b>Officers</b>, such as company directors, have a duty to exercise due diligence to ensure the business or undertaking complies with the WHS Act and Regulations.</p> <p>Also see the <i>Interpretive Guideline – model Work Health and Safety Act – the health and safety duty of an officer under section 27</i></p>
<b>Workers and others</b>	<p>Workers and other people at the workplace like visitors, must take reasonable care for their own health and safety, co-operate with reasonable policies, procedures and instructions and not adversely affect other people's health and safety.</p>



## How can hand-arm vibration risks be managed?

The following steps should be used to ensure, so far as is reasonably practicable, workers and other people are not harmed by exposure to HAV in the workplace:

**1. Find out what could cause harm.** The following can help you identify potential vibration hazards:

- Observe the workplace and work tasks to identify where workers may be exposed to HAV and how workers interact with the plant.
- Visually inspect the plant before and during operation.

- Ask your workers about problems they encounter at the workplace when interacting with plant including operation, inspection, maintenance, repair, transport and storage requirements.
  - Review your incident and injury records looking for any symptoms e.g. dropping tools or difficulty climbing a ladder due to an inability to maintain a strong grip.
- 2. Assess the risks if necessary.** When you have identified the hazards at your workplace you may need to assess the risks—**the likelihood of somebody being harmed by the hazard and how serious the harm could be**. Think about how incidents could happen and who might be harmed. The most important factors include:
- The vibration emission of the tool. To help other duty holders minimise exposure to HAV, suppliers of plant should provide information on the vibration emission of plant according to the relevant standards.
  - How long workers are exposed to vibration, both day-to-day and longer term.

The main factors influencing harmful HAV exposures are:

- Tool and task characteristics - high vibration emission, poor tool maintenance, minimal handle insulation, weight of tool, large amount of surface area in contact with hand and hardness of material being contacted.
- Work organisation - how long workers are exposed day-to-day and over their working life, length and frequency of rest periods, cold temperatures, awkward postures and overhead work.
- Individual characteristics - gripping of handle more tightly than needed, low operator skill and poor technique.

If a worker reports symptoms like tingling and numbness after using vibrating tools you should immediately modify work methods or organisation of work to reduce their exposure. For example, by reducing the time the worker uses powered tools.

A risk assessment can help you work out what should be done to control the risk and how urgently action needs to be taken. A vibration specialist or other competent person can assist in making this assessment.

**3. Take action to control the risk.** The WHS laws require a business or undertaking to do all that is reasonably practicable to eliminate or minimise risks.

The ways of controlling risks are ranked from the highest level of protection and reliability to the lowest. This ranking is known as the hierarchy of control. You must work through this hierarchy to manage risks.

You should consider if risks from using the vibrating plant can be eliminated, for example replacing hand operated jack-hammers with backhoes or other mobile plant-mounted breaking tools, or substituting manual fettling using hand-held grinders with robotic fettling machines or jig mounted grinders.

If it is not reasonably practicable to completely eliminate the risk then consider implementing the following options in the order they appear below to minimise risks, so far as is reasonably practicable:

- Substituting high-vibration tools with tools that have lower vibration emission levels and replacing older tools with new vibration-reduced tools.
- Isolating the hazard by changing the path the vibration takes to the worker's hand e.g. on a grinder a rubber bush can be added to the side handle to reduce vibration being transmitted to the supporting hand. The choice of material for the rubber bush will be important in working out which vibration is reduced.
- Using engineering controls by modifying existing tools to either minimise the vibration or prevent the vibration from moving into the handle of the tool e.g. directing cold air from the exhaust of air powered tools away from the worker's hand and maintaining tools regularly.

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

- Using administrative controls e.g. minimising how long workers use high-vibration tools in a shift by task design or by job rotation.
- Using personal protective equipment (PPE) like 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.

A combination of control measures may be used if a single control is not enough to minimise the risks.

You should consider all possible control measures and make a decision about which ones are reasonably practicable for your workplace. Deciding what is reasonably practicable includes the availability and suitability of control measures with a preference for using substitution, isolation or engineering controls to minimise risks before using administrative controls or PPE. Cost may be relevant but you can only consider this after all other factors have been taken into account.

**4. Information, instruction and training** must be provided to workers who use, maintain or purchase vibrating equipment and should cover:

- health effects of HAV
- sources of HAV and how vibration can be minimised, like the choice of process or equipment
- how to recognise and report symptoms, and
- where necessary, training in how to use equipment to minimise vibration and how to reduce grip force.

**5. Check your control measures regularly to make sure they are working as planned.**

Control measures should be regularly reviewed so they remain effective, taking into consideration any changes, the nature and duration of work and whether the system is working as planned.

More information on the risk management process is in the [Code of Practice: How to manage work health and safety risks](#), and

More information on managing the risks of plant is in the [Code of Practice: Managing risks of plant in the workplace](#).



## Who is involved?

You must consult your workers and their health and safety representatives (if any) when deciding how to manage the risks of using vibrating plant in the workplace.

If there is more than one business or undertaking at your workplace you must consult them to find out who is doing what and work together so risks are eliminated or minimised, so far as is reasonably practicable. This may involve discussing site-specific requirements including the type of plant to use and operator training.

Further information on consultation requirements is in the [Code of Practice: Work health and safety consultation, co-operation and co-ordination](#).

## BEFORE USING VIBRATING PLANT



### Choosing the right tool

You should consider vibration emissions when purchasing or leasing tools for your workplace. This information should be provided by manufacturers, importers or suppliers of the tools. You should get as much information about the vibration produced by the tool as possible.

Information on the vibration produced by a specific tool can be provided by the tool manufacturer or supplier. Specifications and product data sheets for tools which are supplied to the European market are likely to contain information on the vibration emitted by the tool under standard conditions.

Tools that are too powerful for the job can expose workers to unnecessary high vibration. Tools should be selected for tasks based on their vibration emission, suitability and ability to do the work efficiently. Tools which are not designed for the job or not powerful enough are likely to expose workers to vibration for longer than is necessary due to the extra time and grip force required to complete the job.

When selecting tools you should also consider the worker, ergonomic and other factors including:

- tool weight
- handle design and comfort
- trigger mechanisms like whether the device has a locking button to reduce the force needed under the trigger finger
- grip forces needed to support and operate the tool
- ease of use and handling with consideration for posture and direction of force application
- hand heat loss from grip surfaces or from exhaust air on pneumatic tools
- noise, and
- dust.



## Pre-start checklist

The pre-start checklist in Table 2 can help you identify work activities which may expose workers to HAV. It should be completed every time an operator uses a different type of power tool. If a worker answers 'yes' to a question in Table 2 this indicates they may be exposed to hazardous vibration levels and action may need to be taken to minimise exposure.

**Table 2** Pre-start checklist for workers

Item	Yes	No
Do you operate vibrating tools for more than half the working day?	<input type="checkbox"/>	<input type="checkbox"/>
Do you need to be in awkward postures when using a tool?	<input type="checkbox"/>	<input type="checkbox"/>
Do the manufacturers of power tools you use warn of HAV risks?	<input type="checkbox"/>	<input type="checkbox"/>
Do you suffer from discomfort in the hand or forearm due to work?	<input type="checkbox"/>	<input type="checkbox"/>
Have you been provided with training on the work task and how it should be carried out?	<input type="checkbox"/>	<input type="checkbox"/>



## Operating vibrating plant

The longer a worker is exposed to HAV the greater their risk of developing HAVS.

To minimise the risk, a person conducting a business or undertaking should make sure:

- vibrating plant or power tools are suitable for the work to be done and are in a safe condition
- work areas are designed, established and maintained for safe operation
- pre-start safety checks are completed, and
- safe work procedures for operation and maintenance are prepared and followed.

If a worker reports symptoms like tingling and numbness after using vibrating tools you should immediately modify work methods or organisation of work to reduce their exposure. For example by reducing the time the worker uses powered tools.



## Is it necessary to measure hand-arm vibration?

If workers report symptoms, for example tingling and numbness after using vibrating tools, it is likely their exposure to vibration is reaching a level which may lead to HAVS. This may indicate a HAV problem and you should take steps to reduce exposure using information found in this Guide.

Measurement of HAV may be needed in situations where there is no information about the vibration emission of the tool, the tool is being used in an unusual way or if you are uncertain about the effectiveness of controls you have put in place to reduce exposure to HAV. This should be carried out by a competent person.

More information is in the [\*Guide to measuring and assessing workplace exposure to hand-arm vibration\*](#).



## When to seek medical advice

Workers should seek medical advice or be referred to a medical practitioner if they experience discomfort, tingling, numbness or pain during use or following use of plant which exposes them to HAV. Seeking early medical advice may help identify:

- early signs of HAVS
- whether risk controls are effective, and
- workers at risk because of pre-existing conditions e.g. workers with Raynaud's disease or diabetes.

Workers can complete an annual questionnaire to identify if they should be checked by a medical practitioner.

An example of the questionnaire has been developed by the [Health and Safety Executive \(UK\)](#).



## More information

- Safe Work Australia reports on vibration
  - [Implementation and Effectiveness of the European Directive Relating to Vibration in the Workplace](#)
  - [National Hazard Exposure Worker Surveillance: Vibration exposure and the provision of vibration control measures in Australian Workplaces](#)
- Health and Safety Executive (UK)
  - [Hand-arm vibration at work: A brief guide](#)
  - [Hand-arm vibration - Advice for employees](#)
  - [Hand-arm vibration - The Control of Vibration at Work Regulations 2005](#)
  - [Vibration solutions: Practical ways to reduce the risk of hand-arm vibration injury](#)

For more information see the [Safe Work Australia](#) website ([www.swa.gov.au](http://www.swa.gov.au)).