

## **TOPIC INSPECTION PACK**

### **HAND-ARM VIBRATION**

**Revised March 2008**

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## 1.0 Introduction

This document provides guidance for inspectors on the inspection of work activities involving risks from hand-arm vibration (HAV), and on enforcement of the Control of Vibration at Work Regulations 2005. It is supplemented by supporting information in a series of appendices.

### 1.1 Hand-arm vibration syndrome

Hand-arm vibration (HAV) is a widespread hazard in many industries and occupations involving the use of hand-held power tools (such as grinders or hammer drills), hand-guided machinery (such as lawnmowers and plate compactors) or hand-fed machines (such as pedestal grinders). Prolonged and regular exposure to this vibration can affect the operator's health, resulting in painful and disabling disorders of the nerves, blood supply, joints and muscles of the hands and arms. These disorders are collectively known as hand-arm vibration syndrome (HAVS). The symptoms affecting blood supply to the fingers are also known as vibration-induced white finger (VWF). The risk of onset or worsening of HAVS increases with daily exposure and varies widely between individuals.

### 1.2 The scale of the problem

HSE research during the 1990s estimated that around five million British workers were exposed to hand-arm vibration in the workplace. Approximately 1.7 million were believed to be exposed at levels above the exposure action value (see below) with around 900,000 of these exposed above the current exposure limit value. About 288,000 people were estimated to have VWF.

## 2.0 The Control of Vibration at Work Regulations 2005

### 2.1 Exposure action and limit values

The Vibration Regulations introduced for the first time a statutory daily exposure action value (EAV) and exposure limit value (ELV) for HAV. The daily vibration exposure depends on the level of the vibration and the exposure time (i.e. total 'finger-on-trigger time'). It can be expressed as a value in  $\text{m/s}^2 A(8)$  units or in exposure points. See [Appendix B](#) for more information on daily exposure and exposure assessment.

**Table 1: Exposure action and limit values (Vibration Regulations 2005)**

Exposure action value (EAV)	2.5 $\text{m/s}^2 A(8)$ or 100 exposure points
Exposure limit value (ELV)	5 $\text{m/s}^2 A(8)$ or 400 exposure points

### 2.2 Duties of employers

HSE guidance on the Regulations can be found in Part 1 of publication L140.

**Table 2: Summary of duties of employers (Vibration Regulations 2005)**

Requirement	Circumstances	Regulation
Conduct vibration <b>risk assessment</b> and assess likely exposure	Where the work is liable to expose employees to risk from HAV	Reg 5(1) Reg 5(2) Reg 5(3)
Review risk assessments	Regularly and when circumstances change	Reg 5(4)

Requirement	Circumstances	Regulation
Record significant findings and produce action plan for compliance with Regs 6, 7 and 10	As indicated by the risk assessment	Reg 5(5)
<b>Eliminate risk</b> from HAV exposure at source or reduce it ALARP	Any level of exposure (but subject to reasonable practicability)	Reg 6(1) Reg 6(3)
<b>Reduce HAV exposure ALARP</b> (programme of organisational/technical measures)	EAV likely to be exceeded	Reg 6(2) Reg 6(3)
<b>Do not exceed ELV</b> ; if exceeded, take immediate action	ELV exceeded	Reg 6(4)*
Provide suitable <b>health surveillance</b> and take appropriate action on the results	There is a risk to health from HAV or the EAV is likely to be exceeded	Reg 7
Provide <b>information, instruction and training</b> for employees	There is a risk to health from HAV or the EAV is likely to be exceeded	Reg 8

\*In certain circumstances Reg 6(4) is subject to a transitional period until 6 July 2010. See [Appendix F](#).

### 3.0 When to focus on hand-arm vibration

If it is likely that the EAV is frequently and regularly exceeded, there is a clear duty to reduce the exposure ALARP (Reg 6(2)), provide health surveillance (Reg. 7) and provide information, instruction and training (Reg 8). Hand-arm vibration should be considered to be a matter of evident concern where:

- one or more of the known high-risk processes listed in [Appendix G](#) is encountered;
- use of power tools or other vibrating equipment is of sufficient duration to be of concern (see the 'rough guide' below);
- there is evidence of vibration-related ill health (e.g. a RIDDOR report of HAVS); or
- employees report tingling when using tools which persists for 10 minutes or more afterwards.

#### Rough guide:

It is likely that the EAV will be exceeded if:

- state-of-the-art rotary action power tools or machines (e.g. grinders, polishers, chainsaws) are used for more than about an hour per day; or
- state-of-the-art hammer action tools (e.g. breakers, scabblers, chipping hammers) are used for more than about 15 minutes per day.

For some tools or processes, the EAV will be exceeded in a much shorter time.

Where you find employees apparently using power tools or other vibrating equipment for long periods, it can be helpful to keep in mind the following questions:

- What are you doing?
- Why are you doing it at all?

- Why are you doing it that way?
- How long does it take?

## **4.0 Risk and exposure assessment**

The employer's risk assessment should establish whether the EAV or ELV is likely to be exceeded and, if this is the case, should result in an action plan for control of risk and compliance with the Vibration Regulations.

Daily vibration exposure is dependent on the vibration level and total 'finger-on-trigger' time and should be assessed by the employer using vibration data representative of the working conditions, preferably corroborated using data from a second source. However, for the work activities listed in [Appendix G](#), it will usually be possible for employers and inspectors to establish whether the EAV is likely to be exceeded by using the information on typical tool vibration levels from the relevant table and knowledge of daily tool use times. This should be sufficient to establish where the relevant duties in Reg. 6 (elimination/control of exposure), Reg. 7 (health surveillance) and Reg. 8 (information, instruction and training) apply.

The vibration risk assessment required by Reg. 5 is not an end in itself, but should result (where appropriate) in an action plan to achieve compliance with Regs 6 to 8. Where there is evidence of failure to comply with Regs 6(1), 6(2), 7 and 8, enforcement of Reg. 5 alone will not usually be the appropriate action.

## **5.0 Control and management of risk**

### **5.1 Alternative work methods**

The work activities listed in column 5, of the relevant [Table 1 in Appendix G](#) have been established as good practice in the industries concerned and will often be reasonably practicable, depending on local circumstances (the list is not exhaustive). Inspectors should seek to secure compliance with Regs 6(1) and 6(2) through interventions to ensure that, where reasonably practicable, the employer adopts suitable alternative work methods; thereby ensuring vibration exposure is eliminated or reduced to as low as reasonably practicable (ALARP).

### **5.2 Management of residual exposure**

If exposure is still likely to exceed the EAV (after all reasonably practicable actions have been taken to eliminate/minimise the use of hand-operated vibrating machinery, or where changes of process have not yet been implemented) employers must manage the residual vibration risks, ensuring that exposure is ALARP and risk is controlled. This will require an appropriate combination of measures such as selection of suitable work equipment, maintenance of equipment, providing employees with information, instruction and training, limiting exposure time and health surveillance (see below). Regs 6, 7 and 8 apply. The relevant [Table 2 in Appendix G](#) contains further information.

### **5.3 Health surveillance**

A suitable health surveillance programme must be in place for employees whose HAV exposures are likely to exceed the EAV on a regular basis. This should enable new cases

of HAVS to be detected and diagnosed, existing cases to be monitored, recommendations to be made on individual employees' fitness for work and provision of anonymised results for groups of employees to help the employer monitor the effectiveness of the controls. Regulation 7 applies. The employer should also have a clear policy for the future management of affected employees. Inspectors can refer to an Occupational Health Inspector any concerns over:

- the service provided by an occupational health provider;
- an employer's failure to take account of recommendations and/or information supplied by the health surveillance provider; or
- inadequate health records

## 6.0 Risk control indicator

**Table 3: Risk control indicator**

Hand-arm vibration	Has exposure to vibration been reduced to ALARP by adoption of alternative working methods (or is a viable plan in place to achieve this); is any continuing and residual risk managed, e.g. by equipment selection & maintenance, operator training, management of exposure duration; is exposure below the legal limit (where reasonably practicable); and is a suitable health surveillance programme in place?
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The risk control indicator should be assessed against the scale shown in Table 4.

**Table 4: Risk control indicator scale**

<b>Risk Control Indicators – Assessment Scale:</b> each risk control indicator should be assessed against the following 1-6 scale.					
<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>
High standards with some aspects meeting best practice.	Good standards meeting minimum legal requirements.	One or more minor shortcomings are present. As these shortcomings are not serious, they can be dealt with informally with oral advice.	Standards are patchy. It is necessary to address one or more shortcomings by giving formal instructions for remedial action to be taken. Formal instructions may be implemented by, eg, obtaining a verbal undertaking from the company to take specific action, sending a letter, or physical removal/disposal of items.	Standards generally unsatisfactory. Typically, at least one contravention that gives rise to a discernible risk gap.	Standards unacceptable. Unless application of the EMM identifies duty holder factors that provide strong mitigation, the issuing of a notice and/or prosecution is likely to be appropriate.

## 7.0 Inspection aide memoire

**Table 5: topics to consider during HAV inspections, and applicable legislation**

<p><b>Risk assessment and action plan</b>          Has the employer made a suitable and sufficient risk assessment, i.e.:</p> <ul style="list-style-type: none"> <li>• identified employees at risk from HAV;</li> <li>• made a valid estimate of their exposures, compared with the EAV and ELV;</li> <li>• considered the available and appropriate options for controlling risk;</li> <li>• produced an action plan for control and arrangements to monitor progress against the action plan (to comply with Regs 6, 7 &amp; 8);</li> <li>• made arrangements for periodic review of the assessment and for ongoing action as new options for risk control become available?</li> </ul>	<p>HSWA S2          COVAWR R5</p>
<p><b>Adoption of alternative working methods</b>          Where exposure is likely to exceed the EAV, has the employer:</p> <ul style="list-style-type: none"> <li>• identified and adopted, where reasonably practicable, established industry good practice for eliminating or reducing traditional high exposure operations, including full or partial automation (see <a href="#">Appendix G</a>) or planned to do so, with an appropriate timescale;</li> <li>• demonstrated that HAV risks are considered at the design and specification stage for new processes and projects?</li> </ul> <p>If exposure exceeds the ELV, a process change will usually be necessary, and exposure must be brought below the ELV in all circumstances where it is reasonably practicable. (See Appendix F.)</p>	<p>HSWA S2          COVAWR R6(1)          COVAWR R6(2)          COVAWR R6(3)           COVAWR R6(4)</p>
<p><b>Management of residual HAV risk</b>          Where risk remains after introduction of reasonably practicable alternative working methods, or where they have not yet been introduced, has the employer reduced exposure and risk ALARP, using, as appropriate:</p> <ul style="list-style-type: none"> <li>• an appropriate procurement policy, selecting suitable work equipment for the job (note, efficiency is important - a machine with low vibration emission could result in a higher vibration exposure than a faster, more efficient machine with a greater vibration emission);</li> <li>• good ergonomic design in the workplace, allowing reduced grip and push forces;</li> <li>• maintenance and replacement of tools and consumables as required, to prevent unnecessary increases in vibration exposure;</li> <li>• limits on individual daily exposure (to bring exposure at least below the ELV);</li> <li>• operator training (see below);</li> <li>• gloves* and clothing to keep workers warm and dry?</li> </ul> <p>See Table 2 in the appropriate part of <a href="#">Appendix G</a> for industry-specific good practice.</p> <p>*Anti-vibration gloves should not be accepted as a means of reducing exposure to ALARP. (See L140, paragraph 184 for more information.)</p>	<p>HSWA S2          COVAWR R6</p>



<p><b>Information, instruction and training</b></p> <p>Employees at risk from vibration should have received information on:</p> <ul style="list-style-type: none"> <li>• the risks from HAV and how to help reduce them (see above);</li> <li>• the importance of correct operation and maintenance of equipment;</li> <li>• arrangements for health surveillance and their duty to cooperate.</li> </ul> <p>Look for evidence that tools are being used correctly, as recommended by the manufacturer. This may require operators to receive specified training: are the operators and their supervisors aware of the need? For example, breakers with suspended (sprung) handles must be used correctly, and with appropriate downward force, or the potential reduction in vibration will not be achieved.</p>	<p>HSWA S2 COVAWR R6(3)(f) COVAWR R8</p> <p>HSWA S7</p>
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## 8.0 Enforcement guidance

When applying the Enforcement Management Model (EMM) to HAV, the benchmark is set at 'Nil/Negligible risk of serious health effect'<sup>1</sup>. [Appendix C](#) describes the application of the EMM to hand-arm vibration, and shows that the Initial Enforcement Expectation will usually be an Improvement Notice where exposure exceeds the EAV (or where existing ill health shows that people are at risk).

Although the Vibration Regulations were introduced in 2005, HSE has been actively working to minimise HAV risks since guidance (HSG88, now withdrawn) was first published in 1994. Formal enforcement action should therefore be taken where non-compliance is encountered, unless there are strategic or dutyholder factors indicating that this would not be appropriate.

The emphasis for HSE enforcement of the Vibration Regulations should be to secure elimination or reduction to ALARP of vibration exposure and risk, where the exposures are likely to exceed the EAV and reasonably practicable solutions exist. Enforcement of Regs 6(1) or 6(2) will usually be appropriate, together with enforcement of Reg. 7 and Reg. 8 as required.

Formal enforcement action will usually be appropriate only where the EAV is likely to be exceeded. However, the duties under Regs 6(1), 7 and 8 are not dependent on the level of exposure, and enforcement should be considered at exposures below the EAV where people's health is at particular risk (for example if they have existing HAVS, carpal tunnel syndrome or other diseases of the hand, nerve disorders or circulatory disorders). Information on a particular individual's health may be available from health surveillance records.

The higher the exposure is above the EAV, the greater the risk, and where exposure is likely to exceed the ELV, formal enforcement action is expected (if exposure and risk are not ALARP) since HSE aims to maximise compliance with the ELV by 2010.

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<sup>1</sup> Prior to the introduction of the Vibration Regulations the benchmark was set at 'Remote risk of serious health effect'; the change reflects the requirements of the Regulations, which represent a Europe-wide consensus on acceptable vibration risk. The revised benchmark is also in line with the HSE Noise & HAV Programme's objective for the elimination of disabling HAVS.

If the ELV is exceeded, Reg. 6(4) applies, and can be enforced (subject to the transitional arrangements until 6 July 2010, see [Appendix F](#)). However, inspectors should note that enforcing the duties to keep risk and exposure ALARP (i.e. Regs 6(1) and 6(2) respectively) is often more straightforward, does not require evidence that exposure is definitely above the ELV and will bring exposure below the ELV where this is reasonably practicable. Where Reg 6(4) is also to be formally enforced, evidence that the ELV is exceeded should be confirmed by a Noise and Vibration Specialist Inspector. If Reg. 6(4) is formally not enforced, the employer should be advised by letter that urgent action is required to bring exposure below the ELV.

In many cases inspectors will find [Appendix G](#) helpful, both for establishing whether exposure is likely to exceed the EAV and for identifying risk control measures appropriate to the work activity. Inspectors should look out for updates in the guidance in [Appendix G](#), and new industry-specific guidance, or obtain advice from Noise and Vibration Specialist Inspectors.

Prosecution should be considered where the extent of risk, and strategic and duty holder factors, indicate such action would meet the principles and expectations of the HSC enforcement policy statement. A Noise and Vibration Specialist Inspector should be consulted if prosecution is proposed.

### 8.1 Initial enforcement expectation:

The following enforcement guidance has been prepared applying the EMM framework to health risks from HAV. The initial enforcement expectations have been derived from the risk gap relevant to the situation described, and the authority of the relevant standard. Initial enforcement expectations needs to be considered in light of dutyholder and strategic factors. See [Appendix C](#) for further information.

**Table 6: Initial enforcement expectation – Improvement Notices**

	<b>Situation</b>	<b>Initial Enforcement Expectation</b>
1 (Control)	Exposure is likely to exceed the EAV of 2.5 m/s <sup>2</sup> A(8) and it is reasonably practicable to eliminate the risk by changing the work process.	Require change of process: Improvement Notice HSWA S.2(1) COVAWR Reg. 6(1)
2 (Control)	Exposure is likely to exceed the EAV of 2.5 m/s <sup>2</sup> A(8), is not ALARP and it is reasonably practicable to reduce the exposure by changing the work process.	Require change of process (and other measures to manage residual risk where required) Improvement Notice HSWA S.2(1) COVAWR Reg. 6(2)
3 (Control)	Exposure is likely to exceed the EAV of 2.5 m/s <sup>2</sup> A(8), is not ALARP and reasonably practicable alternative processes have not been identified.	Require control through equipment selection, training, maintenance, etc. Improvement Notice HSWA S.2(1) COVAWR Reg. 6(2)
4 (Control)	Exposure is well above the ELV of 5 m/s <sup>2</sup> A(8) and it is reasonably practicable to reduce exposure below the ELV.	As 1, 2 or 3 above, but consider including Reg 6(4) on Improvement Notice

5 (Control)	Exposure is well above the ELV of 5 m/s <sup>2</sup> A(8), and is not ALARP, but no reasonably practicable measure can be identified to reduce exposure below the ELV.	As 1, 2 or 3 above to ensure risk is ALARP, plus advice on ELV. (to be reviewed before end of the transitional period)
6 (Health surveillance)	Exposure is likely to exceed the EAV of 2.5 m/s <sup>2</sup> A(8) , or employees are otherwise at risk, and there is no health surveillance, or health surveillance is not suitable.	Improvement Notice COVAWR Reg. 7(1), 7(5)
7 (Information, instruction & training)	Employees at risk from HAV have not been provided with suitable and sufficient information, instruction and training.	Improvement Notice HSWA S.2 COVAWR Reg 8(1)
8 (Risk assessment)	Exposure appears significant (e.g. rotary tool* with contact time > 1 hour, percussive tool* with contact time > 15 min), novel tool or process for which no information is available. No risk assessment and insufficient information to determine whether the EAV is likely to be exceeded. *For state-of-the-art tools. Shorter times are appropriate for older tool types.	Improvement Notice HSWA S.2 COVAWR Reg 5

**Table 7: Initial enforcement expectation – Prohibition Notices**

	<b>Situation</b>	<b>Initial Enforcement Expectation</b>
1	Exposure is likely to exceed the EAV of 2.5 m/s <sup>2</sup> A(8) (demonstrating risk) and is not ALARP. HSE sector has agreed with the industry that the method is no longer acceptable and will be prohibited where seen. (Examples: in shipyards, use of old-design chipping or scaling tools for more than 1 hour per day. In construction, extensive use of breakers for pile cap removal.)	Prohibition Notice HSWA S.2 COVAWR Reg 6(1)  Also consider what is necessary to secure compliance in accordance with Table 6.

## 9.0 Specialist support

Specialist advice and support for inspectors is available and you should always ask for advice if in doubt. Lists of people providing specialist support to inspectors can be found via the “Specialist Support” link on the HSE Intranet home page.

Noise and Vibration Specialist Inspectors can:

- advise on reasonably practicable control measures in complex or novel situations;
- provide evidence (for example, where needed for enforcement of the ELV) of daily exposure, using information on patterns of hand-tool usage and direct measurement of the vibration (in some situations this will be provided by HSL staff<sup>2</sup>); and

<sup>2</sup> Inspectors wishing to call on support from HSL on matters relating to hand-arm vibration should in the first instance contact a Noise & Vibration Specialist Inspector, who will act as Technical Customer for any such work, see Science and Innovation Programme - Guide to Procedures - Chapter 4 - Procedures for commissioning support ([http://intranet/science/mainstream\\_st\\_proc/chapter4.htm](http://intranet/science/mainstream_st_proc/chapter4.htm)).

- advise on compliance with the Vibration Regulations.

Occupational Health Inspectors, Medical Inspectors and Scientists in Central Medical Unit can:

- advice on the quality and suitability of health surveillance services;
- provide clarification on the requirements of the Vibration Regulations relating to health surveillance; and
- advice on appropriate management of employees diagnosed with HAVS or otherwise at particular risk from vibration.

Noise and Vibration Specialist Inspectors, Occupational Health Inspectors and Medical Inspectors can also provide expert evidence for prosecution.

## Appendix A - Typical vibration emission values

1. The information in the table below is taken from the HAV guidance L140 and INDG175(rev2). These values are examples of vibration magnitudes measured by HSE on equipment in use at work. The table also shows the associated daily tool operating times ('trigger times') required to reach the exposure action value (EAV).

Tool Type	Condition	Vibration magnitude	'Trigger time' to reach EAV
Road breakers	Typical	12 m/s <sup>2</sup>	20 m
	Modern tool designs, good operating conditions and trained operators	5 m/s <sup>2</sup>	2 h
	Worst tools & operating conditions	20 m/s <sup>2</sup>	8 m
Demolition hammers	Modern tools	8 m/s <sup>2</sup>	45 m
	Typical	15 m/s <sup>2</sup>	15 m
	Worst tools	25 m/s <sup>2</sup>	5 m
Hammer drills/combi hammers	Typical	9 m/s <sup>2</sup>	40 m
	Best tools and operating conditions	6 m/s <sup>2</sup>	80 m
	Worst tools and operating conditions	25 m/s <sup>2</sup>	5 m
Needle scalars	Modern tool designs	5 – 7 m/s <sup>2</sup>	1 h – 2 h
	Older tool designs	10 – 25 m/s <sup>2</sup>	5 m - 30 m
Scabblers (hammer type)	Typical	20 – 40 m/s <sup>2</sup>	< 10 m
Angle grinders (large)	Modern vibration-reduced designs	4 m/s <sup>2</sup>	3 h
	Other types	8 m/s <sup>2</sup>	45 m
Angle grinders (small)		2 – 6 m/s <sup>2</sup>	80 m – 12 h
Clay spades/jigger picks	Typical	16 m/s <sup>2</sup>	12 m
Chipping hammers (metal-working, foundries)	Typical fettling	18 m/s <sup>2</sup>	9 m
	Modern tool designs	10 m/s <sup>2</sup>	30 m
Pneumatic stone-working hammers	Vibration-reduced hammers and sleeved chisels	10 m/s <sup>2</sup>	30 m
	Older tools, conventional chisels	30 m/s <sup>2</sup>	< 5 m
Chainsaws	Typical	6 m/s <sup>2</sup>	80 m
Brushcutters	Typical	4 m/s <sup>2</sup>	3 h
	Best	2 m/s <sup>2</sup>	12 h
Sanders (random orbital)	Typical	7 - 10 m/s <sup>2</sup>	30 – 60 m

2. Trigger time to reach the exposure limit value (ELV) is four times that to reach the EAV.

3. The information here will often be sufficient to allow dutyholders or inspectors to form the opinion that the exposure is likely to exceed the EAV or ELV. This should give inspectors confidence that, for example, Reg 6(2) applies. Employers may use other data, provided it is representative of their use of the equipment, or their own measurements, to demonstrate, for example, that the EAV is unlikely to be exceeded.

## **Appendix B - Assessing vibration exposures**

### **General**

1. The Regulations require an assessment of exposure. The main purpose is to determine whether the exposure action value (EAV) or exposure limit value (ELV) are likely to be exceeded, so that the employer's duties are clear. HSE does not expect employers to make a precise or detailed assessment of exposure beyond what is required to identify the need for action; resources should then be directed towards implementing the action plan and controlling the risk. Similarly, inspectors just need sufficient information on exposure levels to decide whether Regs 6(2), 7(1), 8 and 6(4) apply.

### **Daily exposure**

2. Daily exposure (the A(8) value) depends on the magnitude (level) of the vibration and the total exposure time during the day. The vibration exposure could arise from a single source or multiple sources; the pattern of exposure could be, for example, intermittent throughout the working day, or periods of continuous exposure.

3. The vibration magnitude used for an exposure assessment should be a triaxial value (obtained from measurement in three directions at the worst hand position) and should have been measured on a similar tool, machine or workpiece in working conditions representative of those being assessed. This may be available from databases, tool manufacturers (see below), trade associations, etc. In some cases employers may need to make measurements.

4. The exposure time is the time spent with the hands in contact with the vibrating tool, handle, workpiece, etc. and is usually considerably shorter than the 'time on the job'. It is often referred to as trigger time and is usually evaluated by observation of a sample of the work and taking account of the work done by an individual in a day.

5. Guidance on estimating vibration exposure, is given in the employers' leaflet on HAV (INDG175(rev2)) and in greater detail in the guidance book L140. Any measurement of vibration should be done in accordance with BS EN ISO 5349-1:2001 and BS EN ISO 5349-2:2002.

### **Uncertainty**

6. Any assessment of daily exposure to HAV is subject to a very high level of uncertainty. An assessment carried out using best practice will have an uncertainty of  $\pm 20\%$  and it is not unusual for the uncertainty to be much greater. This may affect enforcement decisions, particularly regarding the exposure limit value.

### **Ready reckoner and exposure points system**

7. A ready reckoner for vibration exposure is available on the HSE website at : [www.hse.gov.uk/vibration/hav/readyreckoner.htm](http://www.hse.gov.uk/vibration/hav/readyreckoner.htm)

8. This allows a daily exposure to be obtained from any combination of vibration magnitude and exposure time, for single sources of exposure or multiple sources. The exposure is expressed in points – where 100 points is equivalent to the EAV and 400 points is equivalent to the ELV. Exposure points can be added where an employee uses more

than one vibrating tool or process in a day, and are a convenient way to assess daily exposure. The use of a 'points per hour' value for a tool can be useful when planning work to minimise exposure.

### **Exposure calculator**

9. A spreadsheet to calculate vibration exposures, is available at: [www.hse.gov.uk/vibration/hav/vibrationcalc.htm](http://www.hse.gov.uk/vibration/hav/vibrationcalc.htm)

10. This will calculate exposure in A(8) values and exposure points, times to reach the EAV and ELV, and points per hour.

### **Vibration information from tool manufacturers**

11. When employers request vibration emission data from suppliers, manufacturers etc., the data provided may not be suitable for assessment of exposure. The declared emission value should be measured in accordance with the appropriate harmonised standard. However, some harmonised test methods:

- specify unrealistic, artificial operating conditions;
- specify measurement of vibration in an inappropriate hand position; and/or
- specify measurement of vibration in a single direction.

12. The harmonised standards for electric and pneumatic machines are currently under revision, and it is hoped that declared emission values, and supplementary information from manufacturers on vibration risks, will be improved in future. If in doubt, you should consult a Noise and Vibration Specialist Inspector.

## Appendix C - Enforcement management model (EMM) Application to hand-arm vibration

### Introduction

1. This Appendix to the HAV Topic Pack gives guidance to inspectors on applying the EMM to health risks from hand-arm vibration. It supersedes and replaces OC 246/32. General guidance on applying the EMM principles to health risks, including occupational health descriptors, is in OC 130/5.
2. Hand-arm vibration syndrome (HAVS) is a disease listed in RIDDOR 1995, Schedule 3, Column 1. When advanced beyond the initial stages it is an irreversible and disabling condition, i.e. a **serious health effect**.
3. The Control of Vibration at Work Regulations 2005 require that risks from vibration are eliminated or reduced to as low a level as is reasonably practicable (ALARP), whatever the initial exposure level. Where the daily exposure action value (EAV) is likely to be exceeded, the employer must reduce the exposure ALARP through a programme of appropriate technical and organisational measures, ensure that exposed employees have suitable health surveillance and provide information, instruction and training. In any case, the daily exposure limit value (ELV) must not be exceeded (subject to transitional arrangements until 2010, see [Appendix F](#)).

### Benchmark

5. The benchmark for HAV is set at a '**nil/negligible**' risk of a **serious health effect**. The serious health effect, in this case, is HAVS that reaches a disabling severity before retirement age. This benchmark standard is met if there is full compliance with the Vibration Regulations **and** (if the exposure, although ALARP, continues to exceed the EAV) the employer acts on the results of health surveillance to prevent progression of any HAVS cases to an advanced stage. In summary, compliance with the benchmark standard requires that:

- (i) exposure is likely to be below the EAV and there is no evidence of disease and no reported tingling during/after tool use; OR
- (ii) if exposure is likely to be above the EAV, the risk/exposure is ALARP, and there is adequate health surveillance with procedures in place to prevent anyone from advancing to a disabling stage of HAVS (i.e. stage 2 on the Stockholm Scale, see L140) .

### Risk matrix

4. It is widely agreed that the risk of HAVS (new cases or worsening of an existing condition) increases with increased daily vibration exposure, and with the number of years of exposure. BS EN ISO 5349-1:2001 includes a tentative dose-response relationship, restricted to the vascular component of HAVS (i.e. vibration white finger). This suggests that 10% of individuals will have finger blanching symptoms after 12 years if exposed at the EAV of  $2.5 \text{ m/s}^2 \text{ A}(8)$  and after 6 years if exposed at the ELV of  $5 \text{ m/s}^2 \text{ A}(8)$ . Exposure below the EAV cannot be considered safe, although the risk will be relatively low. No dose-response relationship is available for the sensorineural component of HAVS, which is considered to be the more disabling condition, or for the musculoskeletal component.

5. The risk matrix below is HSE’s interpretation of the tentative guidance on risk in BS EN ISO 5349-1:2001. It is therefore an Interpretive Standard. It assumes the exposure will continue throughout the employee’s working life (up to 40 years). The limited information on the dose-response relationship for HAVS is not sufficient to establish numerical levels of exposure that reflect ‘possible’ and ‘probable’ risks of serious health effect in the risk matrix below.

DESCRIPTOR	APPLICATION/ INTERPRETATION	LIKELIHOOD			
		PROBABLE	POSSIBLE	REMOTE	NIL/ NEGLIGIBLE
SERIOUS HEALTH EFFECT	Disabling HAVS before retirement age	Much greater than the EAV of 2.5m/s <sup>2</sup> A(8)	Greater than the EAV of 2.5m/s <sup>2</sup> A(8)	Less than the EAV of 2.5m/s <sup>2</sup> A(8)	Less than 1m/s <sup>2</sup> A(8)

### Risk gap

6. The risk matrix, when used with Table 2.1 in the EMM, will indicate an **extreme** risk gap for any exposure above the EAV (2.5 m/s<sup>2</sup> A(8)). An Improvement Notice is therefore the Initial Enforcement Expectation where exposure is likely to exceed the EAV **and** there is a breach of the Regulations (e.g. risk/exposure has not been reduced to ALARP, health surveillance is not in place, etc.). For enforcement guidance, see part 8 of the main part of this Topic Inspection Pack.

7. The EMM gives a **substantial** risk gap where exposures are below the EAV but exceed 1 m/s<sup>2</sup> A(8). This suggests an initial enforcement expectation of a letter/inspection form, where the Regulations have not been complied with (e.g. it is reasonably practicable to reduce risk further by straightforward and low cost actions).

8. Assessing HAV risk can sometimes appear difficult and complex and the level of exposure will rarely be known precisely. However, the primary question is whether the exposure and risk are ALARP. When making decisions about the risk gap, inspectors should consider enforcement action where information on likely exposures and established industry good practice for HAV risk control (see [Appendix G](#)) suggests that the exposure is likely to be above the EAV (indicating risk) and is not ALARP.

### Relevant standards

9. The principal standards are:

Title	Authority
Risk matrix in HSE’s HAV Topic Pack, <a href="#">Appendix C</a>	Interpretive
Guidelines for the measurement and evaluation of human exposure to hand-transmitted vibration. Part 1: General requirements. BS EN ISO 5349-1:2001	Established
L140 ‘Hand-arm vibration’, Health & Safety Executive 2005	Established
Health and Safety at Work, etc. Act 1974, Section 2(1)	Defined
The Control of Vibration at Work Regulations 2005	Defined

## Appendix D - Example Improvement Notices

### Notice 1. Elimination or control of exposure to vibration at the workplace

This Notice is appropriate where:

- there is a high-risk activity (e.g. those listed in [Appendix G](#));
- the vibration exposure is likely to be above the action value, in the inspector's judgement; and
- the risk and exposure are not ALARP, in the inspector's judgement.

#### Contravention

Health & Safety at Work etc. Act 1974, Section 2(1)  
Control of Vibration at Work Regulations 2005, Regulations 6(1) and 6(2)

#### Reason

Your employees engaged in **[activity]** are exposed to hand-arm vibration such that their daily exposure is likely to be at or above the exposure action value of 2.5 m/s<sup>2</sup> A(8), and you have failed either to eliminate the risk to health from vibration at source or to establish and implement a programme of measures to reduce vibration exposure to as low a level as is reasonably practicable.

When drafting a Schedule for this Notice, inspectors should consider the most appropriate actions for compliance, taking account of the hierarchy of control and the actions listed in Regulation 6(3). Two examples are suggested below.

Example 1. An alternative process, with lower vibration exposure, is reasonably practicable in the inspector's judgement; and there is no evidence of proper consideration of alternative working methods.

#### Schedule

In order to comply with this Notice you should take the following action:

1. Determine those working methods appropriate to the activity which will be effective in reducing your employees' exposure to vibration such that risk from exposure is eliminated or, where elimination is not reasonably practicable, exposure is reduced to as low a level as is reasonably practicable

AND ALSO

2. Put in place effective arrangements to ensure that the working methods identified are put in place

Or alternatively, any other no less effective means.

Example 2. Use of vibrating equipment is unavoidable (either indefinitely or until an alternative process has been introduced) and there is no evidence that vibration risks are taken into account when selecting and/or planning the use of work equipment.

## Schedule

In order to comply with this Notice you should take the following action:

Establish effective arrangements to ensure that in selecting work equipment you provide for employees' use which is likely to expose them to hand-arm vibration you take account of:

- availability of reduced vibration designs of equipment;
- availability of equipment with appropriate ergonomic design to avoid strain on the user's hand and arms;
- information on vibration emission provided by manufacturers of equipment;
- information provided by the manufacturers of equipment, or other reliable sources, on likely vibration emission during the conditions of intended use of the equipment;
- efficiency of equipment for carrying out the intended work, and the effect on likely vibration exposure;
- information provided by the manufacturers of equipment, or other reliable sources, on correct operation and maintenance of the equipment;
- information provided by the manufacturers of equipment, or other reliable sources on the selection of suitable inserted tools or consumables for use with the equipment;
- general suitability of the work equipment for the intended work.

Or alternatively, any other no less effective means.

## Notice 2 Information, instruction and training

This Notice is appropriate where:

- there is a high-risk activity (e.g. those listed in [Appendix G](#));
- the vibration exposure is likely to be above the action value, in the inspector's judgement; and
- there is no evidence that suitable and sufficient information, instruction and training has been provided to employees, with regard to risks from vibration.

## Contravention

Health & Safety at Work etc. Act 1974, Section 2(1)  
Control of Vibration at Work Regulations 2005, Regulation 8

## Reason

Your employees engaged in **[activity]** are exposed to hand-arm vibration such that their daily exposure is likely to be at or above the exposure action value of 2.5 m/s<sup>2</sup> A(8) and you have failed to provide those employees and their representatives with suitable and sufficient information, instruction and training [on safe working practices to minimise exposure to vibration/their entitlement to appropriate health surveillance and its purposes]

## Schedule

In order to comply with this Notice you should take the following action:

1. Provide each of your employees engaged in... [specific case] / each of your employees whose health is at risk from exposure to hand-arm vibration, including whose

daily vibration exposure is likely to be at or above 2.5 m/s<sup>2</sup> A(8) (general case), with information, instruction and training which shall include:

[select as appropriate to deal with the specific lack of training, or draw in other items to deal with general lack of training on HAV risks & HAVS]

- safe working practices to minimise exposure to vibration, in particular correct use of **[specific equipment]**
- entitlement to appropriate health surveillance and its purposes
- why and how to detect and report signs of injury,
- the organisational and technical measures taken in order to comply with the Control of Vibration at Work Regulations 2005,
- the exposure limit value and action value relating to hand-arm vibration
- the significant findings of the risk assessment,
- the collective results of any health surveillance undertaken, in a form calculated to prevent those results from being identified as relating to a particular person

AND ALSO

2. Establish effective arrangements to ensure that the same information, instruction and training is provided to all employees who are assigned to work such that their daily exposure to hand-arm vibration is likely to be at or above 2.5 m/s<sup>2</sup> A(8).

Or alternatively, any other no less effective means.

### **Notice 3. Health surveillance**

This Notice is appropriate where:

- there is a high-risk activity (e.g. those listed in [Appendix G](#));
- the vibration exposure is likely to be above the action value, in the inspector's judgement; and
- there is no evidence of suitable health surveillance.

### **Contravention**

Control of Vibration at Work Regulations 2005, Regulation 7

#### **Reason**

Certain of your employees including **[Named Employee]** are exposed to hand-arm vibration such that their daily exposure is likely to be above the exposure action value of 2.5 m/s<sup>2</sup> A(8) and you have failed to ensure that those employees are placed under suitable health surveillance.

#### **Schedule**

In order to comply with this Notice you should take the following action:

1. Establish effective arrangements to identify those employees whose health is at risk from exposure to hand-arm vibration, including those whose daily exposure to vibration is likely to exceed the exposure action value of 2.5 m/s<sup>2</sup> A(8).

AND ALSO

2. Establish effective arrangements to ensure that those employees are placed under suitable health surveillance, meaning a programme of systematic health checks to identify early signs and symptoms of disease and to allow action to be taken to prevent its progression.

Or alternatively, any other no less effective means.

**Notes (not part of the notice) [Relevant to all notices]**

Further information relevant to this Notice is contained

- on the HSE website at [www.hse.gov.uk/vibration/hav](http://www.hse.gov.uk/vibration/hav)
- in the free leaflet INDG175(rev2) 'Control the risks from hand-arm vibration'
- in the HSE publication 'Hand-arm vibration: The Control of Vibration at Work Regulations 2005' (HSE reference L140, ISBN 0 7176 6125 3).

Your Trade Association may also be a useful source of information and advice.

## **Appendix E - Further sources of guidance**

### **HSE guidance on hand-arm vibration**

Hand-arm vibration. The Control of Vibration at Work Regulations 2005.  
L140. HSE Books. ISBN 0-7176-6125-3

### **HSE leaflet for employers**

Control the risks from hand-arm vibration. Advice for employers on the of Vibration at Work Regulations 2005.

INDG175(rev2). Pack of 10: ISBN 7176-6117-2  
[www.hse.gov.uk/pubns/indg175.pdf](http://www.hse.gov.uk/pubns/indg175.pdf)

### **HSE pocket card for employees**

Hand-arm vibration . Advice for employees.

INDG296(rev1)

Pack of 25: ISBN 7176-6118-0

[www.hse.gov.uk/pubns/indg296.pdf](http://www.hse.gov.uk/pubns/indg296.pdf)

### **HSE website**

[www.hse.gov.uk/vibration/hav](http://www.hse.gov.uk/vibration/hav)

Other guidance, which pre-dates the vibration regulations but still contains useful information.

**Hard to Handle** Hand-arm vibration – manage the risk  
Video.

**Vibration Solutions** Practical ways to reduce the risk of hand-arm vibration injury  
HSG170. HSE Books. ISBN 0-7176-0954-5

**Hand-arm vibration in the cast stone industry: reducing the risk**  
(Information sheet MISC493)

**Hazards associated with Foundry processes - Hand Arm Vibration: The current picture** (Foundries Information Sheet No. 8)

**Hazards associated with Foundry processes - Hand Arm Vibration: Symptoms and solutions** (Foundries Information Sheet No. 9)

**Hand-arm vibration in foundries: furnace and ladle relining operations** (Foundries Information Sheet No. 11)

**A purchasing policy for vibration reduced tools in foundries** (Foundries Information Sheet No. 12)

**Hand-arm vibration in Foundries** FIAC, 2001. HSE Books. ISBN 0-7176-1798-X

## **Appendix F - Transitional arrangements for the exposure limit value**

### **Introduction**

1. This temporary Appendix deals with the transitional period for the exposure limit value which will end in July 2010.

### **Transitional provisions in the Vibration Regulations**

2. Regulation 6(4) of Vibration Regulations requires that daily vibration exposures shall not exceed the exposure limit value (ELV). However, Reg 3(2) states that this requirement shall not apply until 6<sup>th</sup> July 2010 in certain circumstances.

3. The ELV does not apply during the transition period where the work equipment used:

- was first provided to employees prior to 6<sup>th</sup> July 2007 by any employer; and
- does not permit compliance with the ELV;

but in using such equipment the employer shall take into account the latest technical advances and the organisational measures taken in accordance with Reg 6(2).

### **Discussion**

4. The purpose of the transitional period is to give employers sufficient time to bring exposures from existing work processes below the ELV where it is not currently reasonably practicable to do so.

5. It is important to note that Reg 6(2) is not affected by the transitional arrangements and requires the exposure to be as low as reasonably practicable (ALARP). It follows that, if it is reasonably practicable to bring the exposure below the ELV, this is required by Reg 6(2), despite the transitional period for Reg 6(4).

6. The transitional period does not apply if the work equipment is of a new type (i.e. introduced after 6<sup>th</sup> July 2007). This aspect of Reg 3(2) creates an apparent disincentive regarding the replacement of old equipment with a new type, if the exposure is still likely to remain above the ELV. However, if the replacement equipment would reduce the exposure and risk (even if the ELV is still exceeded) then, in the absence of a court ruling to the contrary, inspectors are advised to pursue compliance with Reg 6(2) and apply discretion regarding enforcement of Reg 6(4).

7. If exposure and risk are not ALARP, Reg 6(2) should be the first option for enforcement. Any enforcement of Reg 6(4) will usually be additional to action under Reg 6(2).

## **Appendix G - Industry good practice**

This appendix contains the tables prepared in 2006 for:

- Construction;
- Foundries; and
- Heavy Fabrication.

These tables are currently located at:

[www.hse.gov.uk/vibration/hav/campaign/index.htm](http://www.hse.gov.uk/vibration/hav/campaign/index.htm)

and appear as annexes to OM 2006/07.

Further tables, in a similar format, will be added in due course for other industries. This is expected to include:

- General engineering; and
- Estate management (to include agriculture/forestry and grounds maintenance.
- Stone masonry;
- Cast stone;
- Utilities;
- Motor vehicle manufacturer and repair; and
- Mines and quarries.

**Foundries Table 1: Established alternative processes to avoid/reduce use of vibrating equipment**

Activity or process	Example vibration magnitude (m/s <sup>2</sup> )	Corresponding time to reach:		Alternative methods	Further information (links on HSE website)
		EAV	ELV		
Knock-off, cut-off and fettling castings using:				<p>Eliminate or reduce the need for manual knock-off/cut-off or fettling using, where appropriate:</p> <ul style="list-style-type: none"> <li>• good foundry practice and investment casting (lost wax) or lost foam casting techniques to improve casting precision</li> <li>• design castings to minimise fettling (number of joint lines etc.)</li> <li>• decrease ingate/feeder size and reduce cut-off time</li> <li>• design castings suitable for direct machining</li> <li>• challenge inappropriate customer specifications for high standard of finish</li> </ul> <p>Substitute alternatives to manual fettling using, for example:</p> <ul style="list-style-type: none"> <li>• robot fettling machines</li> <li>• automated grinding and manipulators</li> <li>• semi-automatic cut off</li> <li>• cropping machines</li> <li>• jig-mounting for grinder or castings</li> </ul> <p>Design casting and runner systems should allow for these methods.</p> <p>Note: These methods for elimination and substitution will usually be reasonably practicable for large production runs; some may also be appropriate in jobbing foundries.</p>	<p>Hand-arm vibration in foundries (FIAC 2001) Example: eliminate fettling by improving casting quality.</p> <p>Example: machining as a substitute for fettling.</p> <p>Example: automatic fettling Example: jigs for hands free grinding Example: semi-automatic cut-off Example: isolated cut-off machine Example: hydraulic cropping</p>
Large angle grinders	4 (best) 8 (the rest)	3 h 45 m	12 h 3 h		
Large straight grinders	- 10 (best)	- 30 m	- 2 h		
Chipping hammers	18 (typical)	10 m	40 m		
Pedestal grinders	10 (typical)	30 m	2 h		
Knocking off ceramic mould shells with chipping hammer:	18 (typical)	10 m	40 m	<p>Hands-free alternative processes:</p> <ul style="list-style-type: none"> <li>• Frame-mounted breaker</li> </ul>	<p>Example: shell knockout 1 Example: shell knockout 2</p>
Furnace/cupola descaling/lining removal with breaker or chipping hammer	8 (lowest) 15 (typical) 25 (highest)	45 m 15 m 5 m	3 h 1 h 20 m	<p>Eliminate the use of hand-operated tools:</p> <ul style="list-style-type: none"> <li>• water-cooled cupola without lining (for capacity &gt;9 tonnes/hr)</li> <li>• hydraulic lining “push-out” for furnace lining</li> <li>• hydraulic machine-mounted breaker;</li> </ul> <p>Reduce the frequency of lining renewal or slag chipping by:</p> <ul style="list-style-type: none"> <li>• Maximising life of lining through good cupola operating practice</li> <li>• Reduce build-up of slag by control of impurities</li> </ul>	<p>Foundries Information Sheet 11</p> <p>Example: hydraulic push-out Example: ladle slag chipping</p>

Activity or process	Example vibration magnitude (m/s <sup>2</sup> )	Corresponding time to reach:		Alternative methods	Further information (links on HSE website)
		EAV	ELV		
Ramming moulds with: sand rammers	10 (lowest) 50 (highest)	30 m 1 m	2 h 5 m	In jobbing foundries, where hand-ramming of moulds cannot be eliminated, the risk can be controlled by; <ul style="list-style-type: none"> <li>• mounting an electric hammer in a frame on a balancing rig</li> <li>• mounting a pneumatic rammer in a semi-rigid balancing arm</li> </ul> (See HSE guidance for the cast stone industry)	Information Sheet MISC493
electric demolition hammers	15 (typical)	15 m	1 h		

Note 1: The vibration magnitudes, and associated trigger times to exceed EAV/ELV, are indicative only and will vary depending on equipment type and conditions of use.

Note 2: Changes of process to eliminate or reduce vibration may introduce other hazards to safety or health or safety (e.g. chemical, fume, spatter, noise, dust) which must be addressed and managed.

**Foundries Table 2: Management of HAV risks where use of vibrating equipment is unavoidable**

Issue	Expectation	Further information (links on HSE website)
<b>Selection of work equipment</b>	<p>Tool selection can make a substantial difference to the vibration level (see Table 1, column 2) but the tool must be suitable for the task and used correctly.</p> <p>Employers should demonstrate a sound procurement policy for power tools and hand-guided machines, showing they have considered the following:</p> <ul style="list-style-type: none"> <li>• There is no reasonably practicable alternative method with no (or less) vibration exposure (see Table 1)</li> <li>• Equipment is generally suitable for the job (safety, size, power, efficiency, ergonomics, cost, user acceptability, etc.)</li> <li>• Reduced vibration designs are selected provided the tools are otherwise suitable (e.g. grinders with automatic spindle balancing)</li> <li>• Declared vibration emission is not high compared with competing machines of similar capacity to do the job</li> <li>• Information on likely vibration emission in use (e.g. from manufacturer, hire company, databases)</li> <li>• Available information from the manufacturer or elsewhere on control of vibration risks through:               <ul style="list-style-type: none"> <li>• maintenance of tools and accessories (e.g. servicing grinders, sharpening chisels)</li> <li>• selection of consumables (e.g. suitable grit size and hardness of abrasive wheels, pitch of teeth on rotary files/burrs)</li> <li>• correct operation and operator training (see below)</li> <li>• maximum daily trigger times or maximum daily work done with the tool</li> <li>• etc.</li> </ul> </li> </ul>	<p>Selecting equipment</p> <p>Employers' leaflet on HAV</p> <p>Foundries Information Sheet 12</p> <p>Hand-arm vibration in foundries (FIAC 2001)</p>
<b>Limiting daily exposure time</b>	<p>Restricting exposure time ("finger-on-trigger" time) may be required to bring exposures below the ELV, even after all reasonably practicable measures to reduce vibration levels are in place.</p> <p>Maximum times can be determined using the exposure points system or supplier's "traffic lights" tool categories, but these should be derived from sound "real use" vibration emission values.</p> <p>Note: Employers tend to ask "How long can we use this tool?" The exposure must be reduced to the <b>lowest level that is reasonably practicable</b> (Reg 6(2)), so the ELV should not be used as a target, if a lower exposure is reasonably practicable.</p>	<p>Reduce the period of exposure</p> <p>Exposure points system and ready reckoner</p>
<b>Other risk controls</b>	<p>Control of HAVS risk by means other than reducing vibration exposure:</p> <ul style="list-style-type: none"> <li>• Ergonomic aids such as tensioners or balancers to support weight of tool and reduce forces applied by operator</li> <li>• Pedestal grinders: mount the work rest independently of the machine, to reduce transmission of vibration</li> <li>• Suitable workplace temperature or provision of warm clothing and gloves</li> <li>• Regular breaks from work involving vibration and encourage operators to exercise fingers</li> </ul>	<p>Gloves and warm clothing</p> <p>Other measures</p> <p>Example: pedestal grinder</p> <p>Employees' leaflet on HAV</p>

Issue	Expectation	Further information (links on HSE website)
<b>Information, instruction and training</b>	<p>Employees at risk from vibration should have received information on:</p> <ul style="list-style-type: none"> <li>• the risks from HAV and how to help reduce them (see above)</li> <li>• the importance of correct operation and maintenance of equipment</li> <li>• arrangements for health surveillance and their duty to cooperate.</li> </ul> <p>Look for evidence that tools are being used correctly, as recommended by the manufacturer. This may require operators to receive specified training – are operators and their supervisors aware of the need? For example, if an unsuitable abrasive is used, operators may resort to “bumping” the grinder against the casting; this can result in distortion of the wheel and increased vibration, and there is also a risk of wheel breakage.</p>	<p>Employees’ leaflet on HAV</p> <p>Information and training</p> <p>Hand-arm vibration in foundries (FIAC 2001)</p>
<b>Health surveillance</b>	<p>Required where the EAV is likely to be exceeded. Expect to see, as a minimum:</p> <ul style="list-style-type: none"> <li>• use of a periodic health screening questionnaire – ideally annually and for new employees</li> <li>• arrangements for referral of relevant cases to an occupational health provider with HAVS expertise for diagnosis and on-going monitoring</li> <li>• arrangements to receive medical advice on management of affected employees</li> <li>• arrangements for RIDDOR reporting of HAVS cases</li> <li>• arrangements to receive anonymised information to demonstrate effectiveness of controls</li> </ul>	<p>Employers’ leaflet on HAV</p> <p>Health surveillance guidance</p>

**Steel fabrication/shipyards Table 1: Established alternative processes to avoid/reduce use of vibrating equipment**

Activity or process	Example vibration magnitude (m/s <sup>2</sup> )	Corresponding time to reach:		Alternative methods	Further information (links on HSE website)
		EAV	ELV		
Manual cutting of steel plate and re-working to correct component profile using:  angle grinders  straight grinders  chipping hammers (rarely)  Nibbling machine (hand-fed type)	4 (lowest) 8 (highest)  6 (typical) 15 (highest)  18 (typical)  10 (typical)	3 h 45 m  1½ h 15 m  10 m  30 m	12 h 3 h  5½ h 1 h  40 m  2 h	Expect to see accurate pre-prep, cutting components to correct size, with a minimum of “green” . “Measure twice, cut once.” Significant exposures from re-work using grinders etc. should be challenged.  Select suitable modern, precision processes for cutting out, as appropriate: <ul style="list-style-type: none"> <li>• CNC oxy-fuel flame cutting</li> <li>• CNC machining</li> <li>• laser profiling (up to approx 5 mm plate thickness)</li> <li>• abrasive water jet cutting (up to 150 mm thickness) – cold process with no heat distortion</li> <li>• submerged plasma cutting</li> <li>• submerged spark erosion (electrical discharge machining)</li> </ul> Note: improving accuracy and minimising manual reworking is also usually cost-effective.	BMT “Noise Reduction in Shipyards” booklet  Example: machining Example: laser cutting  Plasma cutting
Weld preparation and finishing using tools as above	As above	As above	As above	<ul style="list-style-type: none"> <li>• Apply bevelled edges for welding while cutting out to avoid unnecessary grinding</li> <li>• Use single sided welding (with a suitable backing material) to avoid routine back gouging associated with double sided welding (resulting distortion can be managed with “strongbacks”, heat line straightening, etc.)</li> </ul>	Noise reduction in the ship repair industry – research report 1992  Control of noise in heavy fabrication SIM 03/1001/14
Removing fairing aids, lifting lugs, etc. using grinders (see above)	As above	As above	As above	Design fairing and lifting processes to avoid temporary welded aids which must be removed by grinding. <ul style="list-style-type: none"> <li>• Use magnetic, vacuum or screw clamps and anchors instead of welded fairing aids</li> <li>• Bolt fairing aids to welded studs which require less grinding to remove</li> <li>• Design welded lifting lugs that can be left in place</li> <li>• Use lifting clamps instead of welded lifting lugs</li> <li>• Use bolted lugs or shackles instead of welded lifting lugs</li> </ul>	BMT “Noise Reduction in Shipyards” Booklets 1 and 2  Noise reduction in the ship repair industry – research report 1992

Activity or process	Example vibration magnitude (m/s <sup>2</sup> )	Corresponding time to reach:		Alternative methods	Further information (links on HSE website)
		EAV	ELV		
Surface preparation using:				Cleaning steel surfaces and preparing for painting. Use of scaling tools should be minimised (small and awkward areas only) and modern vibration-reduced tools should be used.  Where reasonably practicable an appropriate alternative process should be used, for example: <ul style="list-style-type: none"> <li>• shot blasting</li> <li>• abrasive vacuum blasting</li> <li>• ultra high pressure water jetting</li> <li>• dry ice pellet blasting (non-abrasive, "clean" method)</li> <li>• ice blasting (wet)</li> </ul>	Noise reduction in the ship repair industry – research report 1992  Control of noise in heavy fabrication SIM 03/1001/14  Example: abrasive blasters
needle scalers	5 (lowest) 18 (highest)	2 h 10 m	8 h 35 m		
scaling hammers (piston type)	10 (lowest) 40 (highest)	30 m 2 m	2 h 7 m		
deck planers, leaf-type scalers, peening tools	15 (typical)	15 m	1 h		

Note 1: The vibration magnitudes, and associated trigger times to exceed EAV/ELV, are indicative only and will vary depending on equipment type and conditions of use.

Note 2: Changes of process to eliminate or reduce vibration may introduce other hazards to safety or health or safety (e.g. chemical, fume, spatter, noise, dust) which must be addressed and managed.

Note 3: For shipyards, HSE policy since 1998 has been to serve IN for action plan/control where no progress has been made; PN for old design chipping or scaling tools used for more than 1 hour.

**Steel fabrication/shipyards Table 2: Management of HAV risks where use of vibrating equipment is unavoidable**

Issue	Expectation	Further information (links on HSE website)
<b>Selection of work equipment</b>	<p>Tool selection can make a substantial difference to the vibration level (see Table 1, column 2) but the tool must be suitable for the task and used correctly.</p> <p>Employers should demonstrate a sound procurement policy for power tools and hand-guided machines, showing they have considered the following:</p> <ul style="list-style-type: none"> <li>• There is no reasonably practicable alternative method with no (or less) vibration exposure (see Table 1)</li> <li>• Equipment is generally suitable for the job (safety, size, power, efficiency, ergonomics, cost, user acceptability, etc.)</li> <li>• Reduced vibration designs are selected provided the tools are otherwise suitable (e.g. grinders with automatic spindle balancing)</li> <li>• Declared vibration emission is not high compared with competing machines of similar capacity to do the job</li> <li>• Information on likely vibration emission in use (e.g. from manufacturer, hire company, databases)</li> <li>• Available information from the manufacturer or elsewhere on control of vibration risks through: <ul style="list-style-type: none"> <li>• maintenance (e.g. servicing grinders, sharpening drills and chisels)</li> <li>• selection of consumables (abrasive discs, chisels, drills, etc.)</li> <li>• correct operation and operator training (see below)</li> <li>• maximum daily trigger times or maximum daily work done with the tool</li> <li>• etc.</li> </ul> </li> </ul>	<p>Selecting equipment</p> <p>Employers' leaflet on HAV</p>
<b>Limiting daily exposure time</b>	<p>Restricting exposure time ("finger-on-trigger" time) may be required to bring exposures below the ELV, even after all reasonably practicable measures to reduce vibration levels are in place.</p> <p>Maximum times can be determined using the exposure points system or supplier's "traffic lights" tool categories, but these should be derived from sound "real use" vibration emission values.</p> <p>Note: Employers tend to ask "How long can we use this tool?" The exposure must be reduced to the <b>lowest level that is reasonably practicable</b> (Reg 6(2)), so the ELV should not be used as a target, if a lower exposure is reasonably practicable.</p>	<p>Reduce the period of exposure</p> <p>Exposure points system and ready reckoner</p>
<b>Other risk controls</b>	<p>Control of HAVS risk by means other than reducing vibration exposure:</p> <ul style="list-style-type: none"> <li>• Ergonomic aids such as tensioners or balancers to support weight of tool and reduce forces applied by operator</li> <li>• Suitable workplace temperature or provision of warm clothing and gloves</li> <li>• Regular breaks from work involving vibration and encourage operators to exercise fingers</li> </ul>	<p>Gloves and warm clothing</p> <p>Other measures</p> <p>Employees' leaflet on HAV</p>
<b>Information, instruction and training</b>	<p>Employees at risk from vibration should have received information on:</p> <ul style="list-style-type: none"> <li>• the risks from HAV and how to help reduce them (see above)</li> <li>• the importance of correct operation and maintenance of equipment</li> <li>• arrangements for health surveillance and their duty to cooperate.</li> </ul> <p>Look for evidence that tools are being used correctly, as recommended by the manufacturer. This may require operators to receive specified training – are operators and their supervisors aware of the need? For example, percussive tools with suspension systems designed to absorb vibration must be used correctly, and with appropriate force, or the potential reduction in vibration will not be achieved.</p>	<p>Employees' leaflet on HAV</p> <p>Information and training</p>

Issue	Expectation	Further information (links on HSE website)
<b>Health surveillance</b>	Required where the EAV is likely to be exceeded. Expect to see, as a minimum: <ul style="list-style-type: none"> <li>• use of a periodic health screening questionnaire – ideally annually and for new employees</li> <li>• arrangements for referral of relevant cases to an occupational health provider with HAVS expertise for diagnosis and on-going monitoring</li> <li>• arrangements to receive medical advice on management of affected employees</li> <li>• arrangements for RIDDOR reporting of HAVS cases</li> <li>• arrangements to receive anonymised information to demonstrate effectiveness of controls</li> </ul>	Employers' leaflet on HAV  Health surveillance guidance

**Construction Table 1: Established alternative processes to avoid/reduce use of vibrating equipment**

Activity or process	Example vibration magnitude (m/s <sup>2</sup> )	Corresponding time to reach:		Alternative methods	Further information (links on HSE website)
		EAV	ELV		
<b>Tunnelling</b> by hand with clay spade or jigger pick.	16 (typical)	10 m	45 m	Mechanised tunnelling methods, to eliminate hand digging. This is expected for all but the smallest tunnelling jobs.	British Tunnelling Society code of practice on hand-arm vibration  Tunnelling and Pipejacking: Guidance for Designers
<b>Breaking</b> concrete, asphalt, etc. with hand-operated breakers in ground work, road maintenance, etc.	5 (lowest) 12 (typical) 20 (highest)	2 h 20 m 10 m	8 h 90 min 30 min	Plan construction work (e.g. casting-in ducts, detail box-outs) to minimise breaking through new concrete/masonry.  Use alternative method/equipment as appropriate:	Construction Industry Council guidance  Example: mounted breaker
<b>Demolition</b> of concrete/masonry using hand-held hammers/breakers	8 (lowest) 15 (typical) 25 (highest)	45 m 15 m 5 m	3 h 1 h 20 m	<ul style="list-style-type: none"> <li>• machine-mounted hydraulic breakers</li> <li>• floor saws</li> <li>• directional drilling/pipe jacking to avoid trenching</li> <li>• hydraulic crushers</li> <li>• hydraulic bursters</li> <li>• diamond core drilling</li> <li>• diamond wire cutting</li> <li>• hydro-demolition (UHP water jetting)</li> </ul>	Example: directional drilling Example: crushing concrete Example: Bursting concrete  Example: diamond wire cutting Example: water jetting Codes of Practice from the Waterjetting Association
<b>Pile cropping</b> using hand-held hammers/breakers	8 (lowest) 15 (typical) 25 (highest)	45 m 15 m 5 m	3 h 1 h 20 m	Pile cap removal using hand-operated breakers is <b>not acceptable</b> . Use alternative method as appropriate: <ul style="list-style-type: none"> <li>• Elliott method</li> <li>• Recipieux method</li> <li>• suspended hydraulic pile cropper</li> <li>• the above alternatives to hand-operated breakers, especially machine-mounted breakers</li> <li>• design pile spacing and pile re-bar for mechanised cropping</li> </ul>	Pile cropping. A review of current practice (HSE Inspector information leaflet, Aug 02)  Information from Loughborough University
Note: some dressing using hand-operated tools may still be required.					

Activity or process	Example vibration magnitude (m/s <sup>2</sup> )	Corresponding time to reach:		Alternative methods	Further information (links on HSE website)
		EAV	ELV		
<b>Scabbling</b> using: needle scalars hammer type scabblers pole type scabblers	5 (lowest) 18 (highest) 40 (highest) 10 (lowest) 40 (highest)	2 h 10 m 2 m 30 m 2 m	8 h 40 m 8 m 2 h 8 m	Scabbling purely for architectural aesthetic effect is <b>not acceptable</b> . Specify finishes that do not require scabbling. (Some finishes can be designed into shuttering using special moulds or chemical retardants and water jetting.) Surface preparation to ensure a good concrete bond. Use alternative methods where technically appropriate: <ul style="list-style-type: none"> <li>grit blasting (wet or dry)</li> <li>use of chemical retarders and pressure washing</li> <li>cast in proprietary joint formers e.g. mesh formwork</li> <li>UHP water blasting (refer to CoP for safety guidance)</li> </ul>	Example: grit blasting Example: paint-on retarder Example: special formwork Codes of Practice from the Waterjetting Association
<b>Wall chasing</b> using hand-held breakers	8 (lowest) 15 (typical) 25 (highest)	45 m 15 m 5 m	3 h 1 h 20 m	<ul style="list-style-type: none"> <li>in new buildings, specify built-in ducting</li> <li>in existing buildings, consider overcoating existing plaster and building in the ducts</li> </ul>	Construction Industry Council guidance
<b>Drilling</b> masonry/concrete using: electric hammer drills or "combihammers"	6 (lowest) 9 (typical) 25 (highest)	1½ h 40 m 5 m	5½ h 2½ h 20 m	Design and plan to avoid unnecessary drilling. Use, where appropriate: <ul style="list-style-type: none"> <li>jig-mounted drilling</li> <li>diamond core drilling (clamped in rig)</li> <li>cast-in anchors and channels for wall fixings instead of drill-and-fix types</li> <li>use of direct fastening tools</li> </ul>	

Note 1: The vibration magnitudes, and associated trigger times to exceed EAV/ELV, are indicative only and will vary depending on equipment type and conditions of use.

Note 2: changes of process to eliminate or reduce vibration may introduce other hazards to health (e.g. noise, dust) or safety which must be addressed and managed (e.g. hazards associated with lifting operations in some mechanised methods for pile cap removal).

**Construction Table 2: Management of HAV risks where use of vibrating equipment is unavoidable**

Issue	Expectation	Further information (links on HSE website)
<b>Selection of work equipment</b>	<p>Tool selection can make a substantial difference to the vibration level (see Table 1, column 2) but the tool must be suitable for the task and used correctly.</p> <p>Employers should demonstrate a sound procurement policy for power tools and hand-guided machines, showing they have considered the following:</p> <ul style="list-style-type: none"> <li>• There is no reasonably practicable alternative method with no (or less) vibration exposure (see Table 1)</li> <li>• Equipment is generally suitable for the job (safety, size, power, efficiency, ergonomics, cost, user acceptability, etc.)</li> <li>• Reduced vibration designs are selected provided the tools are otherwise suitable (e.g. breakers with handle suspension)</li> <li>• Declared vibration emission is not high compared with competing machines of similar capacity to do the job</li> <li>• Information on likely vibration emission in use (e.g. from manufacturer, hire company, databases)</li> <li>• Available information from the manufacturer on control of vibration risks through recommendations for:               <ul style="list-style-type: none"> <li>• maintenance (e.g. sharpening chisels)</li> <li>• selection of consumables (chisels, drills, abrasive discs, etc.)</li> <li>• correct operation and operator training (see below)</li> <li>• maximum daily trigger times or maximum daily work done with the tool</li> <li>• etc.</li> </ul> </li> </ul>	<p>Selecting equipment</p> <p>Employers' leaflet on HAV</p>
<b>Limiting daily exposure time</b>	<p>Restricting the exposure time ("finger-on-trigger" time) may be required to bring exposures below the ELV, even after all reasonably practicable measures to reduce vibration levels are in place.</p> <p>Maximum times can be determined using the exposure points system or supplier's "traffic lights" tool categories, but these should be derived from sound "real use" vibration emission values.</p> <p>Note: Employers tend to ask "How long can we use this tool?" The exposure must be reduced to the <b>lowest level that is reasonably practicable</b> (Reg 6(2)), so the ELV should not be used as a target, if a lower exposure is reasonably practicable.</p>	<p>Reduce the period of exposure</p> <p>Exposure points system and ready reckoner</p>
<b>Other risk controls</b>	<p>Control of HAVS risk by means other than reducing vibration exposure:</p> <ul style="list-style-type: none"> <li>• Ergonomic aids to support weight of tool and reduce the grip and other forces applied by the operator</li> <li>• Suitable workplace temperature or provision of appropriate warm clothing and gloves</li> <li>• Regular breaks from work involving vibration and encourage operators to exercise fingers</li> </ul>	<p>Gloves and warm clothing</p> <p>Other measures</p> <p>Employees' leaflet on HAV</p>
<b>Information, instruction and training</b>	<p>Employees at risk from vibration should have received information on:</p> <ul style="list-style-type: none"> <li>• the risks from HAV and how to help reduce them</li> <li>• arrangements for health surveillance and their duty to cooperate.</li> </ul> <p>Look for evidence that tools are being used correctly, as recommended by the manufacturer. This may require operators to receive specified training: are the operators and their supervisors aware of the need? In particular, breakers with suspended (sprung) handles must be used correctly, and with appropriate downward force, or the potential reduction in vibration (e.g. from 20 to 5 m/s<sup>2</sup>) will not be achieved.</p>	<p>Employees' leaflet on HAV</p> <p>Information and training</p> <p>Example: training provided by breaker manufacturer</p>

Issue	Expectation	Further information (links on HSE website)
<b>Health surveillance</b>	<p>Required where the EAV is likely to be exceeded. Expect to see, as a minimum:</p> <ul style="list-style-type: none"> <li>• use of a periodic health screening questionnaire – ideally annually and for new employees</li> <li>• arrangements for referral of relevant cases to an occupational health provider with HAVS expertise for diagnosis and on-going monitoring</li> <li>• arrangements to receive medical advice on management of affected employees</li> <li>• arrangements for RIDDOR reporting of HAVS cases</li> <li>• arrangements to receive anonymised information to demonstrate effectiveness of controls (although this may not be meaningful for casual/short-term workers)</li> </ul> <p>In construction, short-term employment presents difficulties for managing health surveillance; cooperation between employers should be encouraged.</p>	<p>Employers' leaflet on HAV</p> <p>Health surveillance guidance</p>