HAND ARM VIBRATION SYNDROME (HAVS)

Background and interim guidance for PCA members

Introduction

Workers using vibrating tools or holding pieces of work subject to vibration for prolonged periods of time have developed a range of medical symptoms, including impaired blood circulation and damage to nerves and muscles. Collectively, these injuries are known as “Hand Arm Vibration Syndrome” (HAVS). Workers in mines, foundries and construction have been most affected.

HAVS Components

Circulation effects:
- Damage to small blood vessels in the hand, reducing blood flow in the fingers.
- The result is whitening of the fingers, lasting several minutes, followed by reddening of the hands and pain as the blood returns.
- As the condition develops, the attacks become more extensive, affecting more fingers and occurring in warm as well as cold weather.
- This effect is similar to a medical condition known as “Raynaud’s Phenomenon” which affects between 3 and 5% of adult males and 10% of females.

Nerve system injuries:
- Damage to nerves produces tingling and numbness in the fingers.
- These are usually the first sign of HAVS, occurring at the end of the working day and disappearing overnight and at weekends.
- As the condition develops, these symptoms become more severe, and are accompanied by reduced sensitivity of feeling, manual dexterity and grip.
- These changes are non-reversible and permanent.
Musculo-skeletal symptoms:
- The association between vibration and bone and joint disorders is not universally accepted, apart from Carpal tunnel syndrome.
- In this, the Median nerve, supplying sense and movement to the hand, is disturbed as it passes between the bones of the wrist. The nerve can become inflamed, causing pain, usually because tendons become swollen and overfill the tunnel.
- This results in numbness and tingling in the thumb, middle finger and ring finger of the hands.
- Carpal tunnel syndrome is a relatively common medical condition and is more common in women than men.

Medical causation of HAVS:
- The condition is dose-related and cumulative.
- There is a delay between exposure and onset of symptoms – which may be months or years depending on exposure and individual susceptibility.
- If symptoms show quickly after first exposure, an underlying or non-work related cause may be suspected.
- If symptoms show firstly more than about 2 years after exposure has ceased, an alternative non-work related cause may be suspected.
- Assessment of severity of symptoms is usually done by reference to the Taylor & Pelmear and Stockholm scales (See annex 4).

**Measurement of Vibration**

The magnitude of vibration is measured as acceleration, the rate of change of speed is expressed in metres per second per second (m/s²).

Vibration can occur in three dimensions and the Regulations (see below) require that these are added together.

Vibration is assessed in relation to the average magnitude that a person is exposed to during an 8 hour working day, referred to as A (8).

\[
A (8) = (\text{Tool vibration magnitude in m/s}^2) \times \sqrt{\text{(time in minutes)}} / 480
\]

From 1994, HSE used an A (8) figure of 2.8m/s² as the action level (Exposure Action Value or EAV) above which preventative measures and health surveillance were recommended, in HS (G) 88. However, this level has been reduced to 2.5 m/s² in the Control of Vibration at Work Regulations 2005. There is also an Exposure Limit Value (ELV) of 5.0m/s² which must not be exceeded.
Regulations

The EC Directive on this subject (The Physical Agents Directive 2002/44/EC), has been adopted into UK law as the Control of Vibration at Work Regulations 2005. The Regulations impose duties on employers to protect employees, who may be at risk from exposure to vibration at work, and other persons who might be affected by the work, whether they are at work or not.

The Regulations apply to both hand-arm and whole body vibration. They make provision for:

(a) Action values and limit values for daily exposure to vibration
(b) Risk Assessment
(c) Elimination or, where elimination is not reasonably practicable, reduction of exposure to vibration to as low a level as is reasonably practicable
(d) A programme of measures to be taken at the action values to reduce exposure to vibration to as low a level as is reasonably practicable
(e) Actions to be taken at the limit values and prohibition on exceeding the limit values
(f) Weekly averaging of exposure to vibration in certain circumstances
(g) Health surveillance
(h) Information, instruction and training

There are transitional periods for the commencement of the operation of the regulation concerning limit values (only). For work equipment first provided before 6 July 2007 commencement is postponed for all vibration until 6 July 2010, and for whole body vibration in agriculture and forestry only until 6 July 2014.

The Regulations allow the HSE to grant exemptions for emergency services, air transport and national security. They amend the Offshore Installations and Wells Regulations 1996 and the Provision and Use of Work Equipment Regulations 1998. Copies of Standards relating to measurement and evaluation of human exposure to hand-arm and whole body vibration are obtainable from BSI. A copy of the Regulatory Impact Assessment and the Transposition Note in relation to the implementation of Council Directive 2002/44/EC can be obtained from HSE.

HSE have produced a number of documents on this subject. In particular, ‘Control the risks from hand-arm vibration’ document INDG175 (rev 2) no C1500.

Other sources of further information are given in Annex 7.
**Application**

In the Remedial Treatment Industry, vibration exposure activities are commonly:
- Drilling holes into masonry (usually into mortar joints) for damp proof course installation
- Cavity Drain Membrane fixing
- Wall tie installations (usually in bricks) and masonry sterilisation with fungicide
- Use of mechanical hammers for removal of plaster from walls
- Mechanical preparation of masonry surfaces to receive coatings or renders/plasters
- Using needle guns, scabblers, or bush hammers
- Use of concrete breakers to cut channels for drainage channels in cavity drain membrane installations
- Use of chainsaws when cutting out decayed joist ends for timber repairs
- Drilling bolt holes in timbers for attaching repair section or resin fixings are other minor uses

Existing Risk Assessments on dpc installation etc concern exposure to the materials used, rather than the processes of the various work activities.

**Interim Guidance**

Members need to demonstrate an awareness of the Regulations, have control measures in place and documented and have emission data from drill suppliers in order to carry out preliminary Risk Assessments, pending further data.

Firstly, lists of employees using vibrating tools and the tools themselves (together with vibration emission data) should be made.

Either new Standard Operating Procedures (SOPs) and hence Risk Assessments should be drawn up for the various processes including consideration of use of power tools and their vibration risk, or additional Standard Operating Procedures and Risk Assessments need to be formulated on use of power tools, to consider exposure to vibration from work activities. The latter would seem to be more concise. See Annex 2.
Risks Assessments can be drawn up utilising drill emission data supplied by manufacturers, coupled with the HSE website Vibration calculator. These will establish time in use figures for the Exposure Action Values and Exposure Limit Values. However, they will not directly indicate the operating time for the activity in question. The potentially difficult part is to estimate the time the hands are in contact with the tool when it is vibrating.

Insurers views are that a documented Risk Assessment is essential, that good working practices including task rotation to minimise risk are in place and documented and that vibrating plant is selected with due regard to minimising vibration exposure to users, as well as being suitably maintained.
Annex 1: Typical Risk Assessment - Drilling

<table>
<thead>
<tr>
<th>Hazard</th>
<th>Person affected</th>
<th>Control Measure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eye damage from grit</td>
<td>Technician</td>
<td>Eye protection</td>
</tr>
<tr>
<td></td>
<td>Other trades</td>
<td>Keep out of area</td>
</tr>
<tr>
<td></td>
<td>Public/Clients</td>
<td>Keep out of area</td>
</tr>
<tr>
<td>HAVS</td>
<td>Technician</td>
<td>SOP</td>
</tr>
<tr>
<td>Muscular Strain</td>
<td>Technician</td>
<td>Choice of drill and</td>
</tr>
<tr>
<td></td>
<td></td>
<td>bit</td>
</tr>
<tr>
<td>Electric shock</td>
<td>Technician</td>
<td>110v Equipment</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Maintenance checks</td>
</tr>
</tbody>
</table>

Evaluation

<table>
<thead>
<tr>
<th>Likelihood of event</th>
<th>Severity of outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Slight (1)</td>
</tr>
<tr>
<td>Low (1)</td>
<td>1</td>
</tr>
<tr>
<td>Medium (2)</td>
<td>2</td>
</tr>
<tr>
<td>High (3)</td>
<td>3</td>
</tr>
</tbody>
</table>

Eye damage – Technician – 2-4      HAVS – Technician – 2-4
Eye damage – Other Trade – 1    Muscular Strain – Technician – 2
Eye damage – Public – 1         Electric shock – Technician – 3

HAVS – Hazard Reduction – Drill weight when renewed
Drill Vibration emission data from supplier
Drill emission criteria when renewed

HAVS – Hazard Control – Rotation of work, 2 man teams and/or fill holes
alternately at convenient time intervals, use of PPE (gloves)

Discipline – Provide information & training on use of drills, keep bits
sharp, activity rotation and supervision
Conclusion

3 possible conclusions:
- Unable to decide - More information needed – Stop in meantime?
- Risks adequately controlled – record and review
- Risks not adequately controlled – Carry on?, temporary measures?

Recording of findings:
Significant findings only, including identification of employees specifically at risk.
Identify existing controls, workers involved.

Review criteria:
If significant information becomes available, or evidence that assessment is inadequate, or on a periodic basis.
Annex 2 - Safe Systems of Work/Standard Operating Practices

This section should be read in conjunction with the COSHH risk assessment for the operation in question.

Materials – DPC fluids/creams – some alkaline liquids irritant, solvent based fluids rare now, likewise injection mortar (cement-alkaline).  
- Dry Rot Wall solution/Surface Biocide – Biocide/Pesticide, hazards described on label and in manufacturers data sheets. Hazardous by skin contact, ingestion & inhalation.


Environment – Some outside work, some cold weather work, vibration, noise in small rooms, lighting variable.

People – Technicians - Trained in-house, some on external courses, some by suppliers reps. Able-bodied, should be competent. Information in company manuals.

Drilling operations shall be carried out by trained technicians - Drilling shall be carried out in convenient sections, which may be a wall at a time, or a room at a time, or a specific drilling time, say 30 minutes. At the end of the section, the technician shall carry out the appropriate hole-filling function on the section, before continuing to drill an adjacent section. In some instances, such as CDM fitting, it may be preferable to fix mounting plugs individually to each hole before continuing to the next hole. This process shall be continued until the job is complete, with appropriate meal and tea/coffee breaks. This process spreads the use of the drill over the working day, rather than drilling the whole of the job continuously before filling holes. Similarly, when technicians work in pairs, they should alternate the drilling process regularly, to even out their exposure.

Technicians will wear suitable eye protection such as safety glasses, goggles or visors, as appropriate, and rigger type gloves when drilling. (Anti-vibration gloves shall be available should a technician wish to use them, though their effectiveness is doubtful. The secondary effect of keeping hands warm and, therefore, blood vessels open is thought to be more beneficial than any effect of the anti-vibration pads).
Drills shall be maintained in an effective state, with no breaks in electrical cables and drill bits shall be kept sharp. Blunt drill bits make the job harder and are thought to adversely affect vibration emission by lengthening the time needed to drill a hole. Drill bit design may also have an effect and selection of make and model should be documented.

It may be necessary to carry out time-and-motion sampling to assess the proportion of time that vibration is being absorbed, to check the validity of the calculation below.

Note: A similar document should be produced to consider Hacking off of Plaster.
Annex 3 - Typical Calculation – Exposure time to drill vibration

(Members should confirm from their own records and practices the assumptions used here, and amend results accordingly).

If a technician is working a full day on site, he will work from 0800 to 1630 less lunch break (30 mins), tea breaks x 2 (30 mins), less setting up and clearing up time (2x30 mins) = 6.5 hours

For a drill & inject dpc contract, with skirting boards already removed by others, productivity will be of the order of 45m per day. (150 ft run).

For a conventional aqueous dpc fluid with holes drilled at 150mm centres, this will involve 300 holes, approx 170mm deep, a total of some 51.5m drilling.

One next needs to consider the proportion of the time-spent drilling/filling. A figure of 60% drilling is not unreasonable, based on subjective judgement.

Thus drilling time will be 6.5 hours x 60% = 3.9 hours

This includes time withdrawing drill under no-load conditions and time lining up the next hole. As dpc’s are predominantly injected into mortar courses, which are friable compared to bricks, a similar factor of 60% seems not unreasonable. 3.9x 60% = 2.34 hours (2 hours 20.4 minutes).

From the HSE calculator, a drill with emission of 9 m/s² will have an EAV of 37 minutes and an ELV of 2 hours 28 minutes. This result is in the area between the EAV and ELV, so health surveillance should be provided. The emission calculated above is very close to the ELV, so it is important that the control measures listed above are put in place and used.

Consultation with an Occupational Health Service Provider is recommended, basic information can be gathered by means of a questionnaire. Consultation with employees’ representatives and employees concerned is recommended before introducing Health Surveillance, to ensure as far as possible that they understand the purpose is to protect them from developing advanced symptoms of ill-health so that they can continue to work.

It is already apparent, from work carried out by members, that drill design could have a significant effect, even from drills with similar emission figures, which can vary in the work possible before reaching Action and Limit values by up to 40%. Drill bits can also have an effect.
Annex 4 – Health Surveillance

Criteria for Health Surveillance:
- A link between exposure and an identifiable disease or adverse health effect
- Likelihood of the disease or effect occurring under the particular work conditions
- Valid techniques for detecting the disease or effect

If Risk Assessment identifies that employees are likely to be exposed to vibration at or above the EAV of 2.5 m/s² or there is a risk to their health for any other reason, the employees concerned should be under suitable health surveillance.

A questionnaire should be used both before hiring an employee and on a regular basis thereafter to ensure that employees who may be particularly sensitive or at risk are adequately monitored. Anyone with blood circulatory disease such as Raynauds Disease must be considered at greater risk than others. If there has been a past history of vibration exposure, or symptoms of HAVS have already been noted, further exposure will need to be strictly controlled. In the case of a prospective employee, it may be concluded that employment in a capacity likely to be exposed to vibration would be unwise and detrimental to his/her health, despite control measures in place.

Regular screening (at, say 6 or 12 month intervals) should be put in place for those who may be exposed and employees should be encouraged to report symptoms as soon as they arise.

This initial surveillance need not involve a health professional, but any positive responses should be referred to an occupational health services provider.

If HAVS or Carpal Tunnel Syndrome is identified, the employer is required to notify HSE under the Reporting of Injuries, Diseases and Dangerous Occurrences Regulations 1995 (RIDDOR).
Assessment of results from health surveillance will be done by health professionals and will usually be based on two scales, which are given below for information:

**Taylor & Pelmeare Scale**

<table>
<thead>
<tr>
<th>Stage</th>
<th>Condition of Digits</th>
<th>Work &amp; Social Interference</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>No blanching</td>
<td>No complaints</td>
</tr>
<tr>
<td>0_T</td>
<td>Intermittent tingling</td>
<td>No interference with activities</td>
</tr>
<tr>
<td>0_N</td>
<td>Intermittent numbness</td>
<td>No interference with activities</td>
</tr>
<tr>
<td>1</td>
<td>Blanching of one or more Fingertips with or without Tingling or numbness</td>
<td>No interference with activities</td>
</tr>
<tr>
<td>2</td>
<td>Blanching of one or more Fingers with numbness. Usually confined to winter.</td>
<td>Slight interference with home &amp; social activities. No interference with work.</td>
</tr>
<tr>
<td>3</td>
<td>Extensive blanching. Frequent episodes summer and winter.</td>
<td>Definite interference at work, at home and with social activities. Restriction of hobbies.</td>
</tr>
<tr>
<td>4</td>
<td>Extensive blanching. Most fingers; frequent episodes summer and winter.</td>
<td>Occupation changed to avoid further vibration exposure because of severity of signs and symptoms.</td>
</tr>
</tbody>
</table>

**Stockholm Scale**

This scale deals with vascular and sensorineural effect separately.

**Vascular tier**

<table>
<thead>
<tr>
<th>Stage</th>
<th>Grade</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>No attacks</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Mild</td>
<td>Occasional blanching attacks affecting tips of one or more fingers.</td>
</tr>
<tr>
<td>2</td>
<td>Moderate</td>
<td>Occasional attacks affecting distal and middle phalanges of one or more fingers</td>
</tr>
<tr>
<td>3</td>
<td>Severe</td>
<td>Frequent attacks affecting all phalanges of most fingers</td>
</tr>
<tr>
<td>4</td>
<td>Very severe</td>
<td>As in 3, with trophic skin changes on tips (rare)</td>
</tr>
</tbody>
</table>

**Sensorineural Stage**

<table>
<thead>
<tr>
<th>Stage</th>
<th>Symptoms</th>
</tr>
</thead>
<tbody>
<tr>
<td>0_{SN}</td>
<td>Vibration exposed, no symptoms</td>
</tr>
<tr>
<td>1_{SN}</td>
<td>Intermittent or persistent numbness with or without tingling</td>
</tr>
<tr>
<td>2_{SN}</td>
<td>As in 1_{SN} with reduced sensory perception</td>
</tr>
<tr>
<td>3_{SN}</td>
<td>As in 2_{SN} with reduced tactile discrimination and/or manipulative dexterity.</td>
</tr>
</tbody>
</table>

Note that the staging is made separately for each hand. The final grade of the disorder is indicated by the stage and number of affected fingers in both hands.
Annex 5 – Model Medical Questionnaire

Name

Address

Smoker

Do you have any circulation problems in your hands or arms?

Years employed by company

Do you work with drills?

Do you work with jackhammers?

Do you get “pins and needles” or tingling in your hands during or at the end of a working day?

Do you have one or more fingers feeling “dead” after working with drills/jackhammers?

Do you have any problems with grip after using drills/jackhammers?
Annex 6 - Information, Instruction & Training

If the Risk Assessment identifies that employees are likely to be exposed to vibration at or above the action value, or if there is a risk to their health for any other reason, the employer shall provide those employees with suitable and sufficient information, instruction and training to include:

- Organisational/technical measures identified in the Risk Assessment to reduce exposure to the lowest level
- Exposure limit and action values
- Significant findings of the Risk Assessment
- Why and how to detect and report signs of injury
- Entitlement to health surveillance
- Safe working practices to minimise exposure
Annex 7 – Additional Information


*Hand-arm Vibration: Advice for employees* Pocket card INDG296 (rev 1) HSE Books 2005 (single copy free or priced packs of 25 ISBN 0 7176 6118 0)

*Control back-pain risks from whole-body vibration: Advice for employees on the Control of Vibration at Work Regulations 2005* Leaflet INDG242 (rev 1) (single copy free priced packs of 10 ISBN 0 7176 6119 9)

*RIDDOR explained: Reporting of Injuries, Diseases and Dangerous Occurrences Regulations 1995* Leaflet HSE31 (rev 1) HSE Books 1999 (single copy free or priced packs of 10 ISBN 0 7176 2441 2)


HSE’s vibration web pages: www.hse.gov.uk/vibration