Control of hand-arm vibration in the workplace

Paul Pitts
HSE Science Division

Research - HSE funded to provide evidence which underpins its policy and regulatory activities
Guidance - freely available to help people comply with health and safety law
Who am I

Paul Pitts

- HSE Scientific noise and vibration technical lead
- 39 years experience in HSE as a specialist scientist on workplace hand-arm vibration, noise and whole-body vibration
- Involved with the development of many of the key ISO and CEN standards on human exposure to vibration
- Chair of the International Advisory Committee on Hand-Arm Vibration
Where do I work

HSE, Science Division
Buxton, Derbyshire
The Health and Safety Executive (HSE) is Britain’s national regulator for workplace health and safety. It prevents work-related death, injury and ill health.

HSE is an executive non-departmental public body, sponsored by the Department for Work and Pensions.

HSE NI a separate body, works closely with HSE.
How we work

- **Research & Investigation**
- **Information**
- **Enforcement**
- **Employer & supplier engagement**

**Reduced risk in the workplace**
HAV and HAVS: **Definitions**

**Hand-Arm Vibration (HAV):**
- Vibration experienced at the hand
  
e.g. from hand-held, hand-guided and hand-fed power tools

**Hand-arm vibration syndrome (HAVS):**
- All-encompassing term describing the signs and symptoms of disorder caused by vibration exposure
Duties under other workplace H&S legislation

- **General duties:**
  - Health and Safety at Work etc. Act (HSW) 1974
  - Management of Health and Safety at Work Regulations (MHSWR) 1999 (EU Management Directive)

- **Specific duties:**
  - Control of Vibration at Work Regulations 2005 (EU Vibration Directive)

- **Duty to report ill health:**
  - Reporting of Injuries, Diseases and Dangerous Occurrences Regulations (RIDDOR) 2013

- **Supplier duties:**
  - Supply of Machinery (Safety) Regulations (SMSR) 2008 (EU Machinery Directive)
HAV in the UK

HSE Workplace Health Expert Committee: 2020

- In 2000
  - > 4.8 million workers in GB exposed to hand-transmitted vibration in 1 week
  - 1.2 million of those likely to exceed exposure action value
- Data from The Health Occupational Research Network (THOR) indicates:
  - Late 1990s: HAVS reporting rising
  - Just after 2000: HAVS reporting peaked
  - 2000-2010: HAVS reporting fell
  - Now: HAVS reporting back at 2000 level
- HAVS RIDDORS continue to run at 700 to 900 cases per year
- HAVS remains a significant occupational health issue
HAV iceberg

- In 2019, HAVS accounted for 48.0% of all RIDDOR ill health reports
- RIDDOR – does not identify all cases
- Civil compensation
  - Compensation: £5,000 to £30,000 per person
  - Other costs: x2 – x4 (many) times more
HAVS is: serious, disabling, costly

...but preventable
The CVAWR 2005

- Came into force on 6 July 2005
- Introduced with
  - Guidance book
  - Information leaflets
  - Web-based information & tools
Employer duties under CVAWR 2005

Employers have duties to:

- Assess risk to health
- Control of risk
- Provide information, instruction and training
- Health surveillance
- Record & monitor

Employee duties:

- Worker participation
– Assess risk to health
  – Control of risk
  – Provide information, instruction and training
  – Health surveillance
  – Record & monitor
Evidence & solutions

Look for evidence of risk:

- Industry/process/tools with known HAVS risk?
- Significant daily operating time?
- HAVS symptoms in workforce?
- Tingling, etc. during/after tool use?

Look for solutions:

- Good practice being applied?
- Can more be done?

https://www.napofilm.net/en
### “Rule of thumb”

<table>
<thead>
<tr>
<th></th>
<th>MEDIUM RISK</th>
<th>HIGH RISK</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Rotary tools:</strong></td>
<td>More than 1 hour</td>
<td>More than 4 hours</td>
</tr>
<tr>
<td><img src="image1.png" alt="Image" /></td>
<td><img src="image2.png" alt="Image" /></td>
<td></td>
</tr>
<tr>
<td><strong>Percussive tools:</strong></td>
<td>More than 15 minutes</td>
<td>More than 1 hour</td>
</tr>
<tr>
<td><img src="image3.png" alt="Image" /></td>
<td><img src="image4.png" alt="Image" /></td>
<td></td>
</tr>
</tbody>
</table>
# HSE exposure calculator

## HAND-ARM VIBRATION EXPOSURE CALCULATOR

### Instructions for use:
- Enter vibration magnitudes and exposure durations in the white areas.
- To calculate, press <Enter>, or move the cursor to a different cell.
- The results are displayed in the yellow areas.
- To clear all cells, click on the 'Reset' button.
- Tick the 'Lock tool or process name' check box to prevent 'Reset' clearing these cells.
- For more information, click the 'Help' button.

<table>
<thead>
<tr>
<th>Tool or process name</th>
<th>Vibration magnitude m/s² r.m.s.</th>
<th>Exposure points per hour</th>
<th>Time to reach EAV 2.5 m/s² A(8) hours</th>
<th>Time to reach ELV 5 m/s² A(8) hours</th>
<th>Exposure duration hours</th>
<th>Partial exposure m/s² A(8)</th>
<th>Partial exposure points</th>
<th>Daily exposure m/s² A(8)</th>
<th>Total exposure points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grinder</td>
<td>6</td>
<td>72</td>
<td>1</td>
<td>23</td>
<td>5</td>
<td>33</td>
<td>1.25</td>
<td>2.4</td>
<td>90</td>
</tr>
<tr>
<td>Sander</td>
<td>5</td>
<td>50</td>
<td>2</td>
<td>8</td>
<td>2</td>
<td>10</td>
<td>2.6</td>
<td>108</td>
<td></td>
</tr>
<tr>
<td>Cut-off saw</td>
<td>8</td>
<td>128</td>
<td>47</td>
<td>8</td>
<td>3</td>
<td>8</td>
<td>1.6</td>
<td>43</td>
<td></td>
</tr>
</tbody>
</table>

### Priorities:

- **WARNING:** Exposure at or above 2.5m/s²A(8) EAV (100 points)

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[www.hse.gov.uk/vibration](http://www.hse.gov.uk/vibration)
1. HSE’s “Sources of vibration magnitude”

<table>
<thead>
<tr>
<th>Industry</th>
<th>Tool type</th>
<th>Tool characteristic, inserted tool, size, process</th>
<th>Notes</th>
<th>Range lower (10%ile) (m/s²)</th>
<th>Range upper (90%ile) (m/s²)</th>
<th>Recommended initial value (75%ile) (m/s²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>General</td>
<td>Drills</td>
<td>Standard drill bit</td>
<td>Vibration values can vary across the many sub-categories (e.g. small to large) and different materials being worked. Larger drills tend to give higher vibration values. Maintaining sharp drill bits is important.</td>
<td>2</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>General</td>
<td>Drills</td>
<td>Hole saw</td>
<td></td>
<td>4</td>
<td>12</td>
<td>10</td>
</tr>
<tr>
<td>General</td>
<td>Drills – Core</td>
<td>78–107 mm masonry bit</td>
<td>Can give very high vibrations if operators push too hard. Maintaining sharp drill bits is important.</td>
<td>6</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>General</td>
<td>Drills – Impact</td>
<td>5 and 8 mm masonry bit</td>
<td>Can give very high vibrations if operators push too hard. Maintaining sharp drill bits is important.</td>
<td>7</td>
<td>13</td>
<td>11</td>
</tr>
<tr>
<td>General</td>
<td>Grinders – Angle</td>
<td>100–180 mm</td>
<td>Vibration values will depend on force being applied and different materials being worked. Selecting the right grade of abrasive and applying the right forces.</td>
<td>3</td>
<td>10</td>
<td>7</td>
</tr>
</tbody>
</table>
Vibration magnitude data sources

1. HSE’s “sources of vibration magnitude” *(or EU guide)*
2. Trade associations, consultants, research
3. Manufacturer/supplier data *(Machinery Directive)*
4. Workplace vibration measurements
Manufacturer/supplier data

Suppliers must (Machinery Directive):

- Design and construct to minimise vibration risks
- Provide instructions to reduce vibration exposure
- Warn of (residual) vibration risk
- Declare vibration emission (or state that it is below 2.5 m/s²)
Manufacturer/supplier data: lab tests

- Vibration emission tests are:
  - Designed to be repeatable and reproducible (artificial?)
  - Mainly for comparison of tools of the same type
Measurement

Relevant Standards:

- **Measurement** - ISO 5349 Parts 1 & 2
  - Part 1: General requirements
  - Part 2: Practical guidance for measurement at the workplace

- **Instrumentation** - ISO 8041-1
Workplace vibration measurements

Continuous monitoring is **not** a requirement of the CVAWR regulations.
- Assess risk to health
- **Control of risk**
- Provide information, instruction and training
- Health surveillance
- Record & monitor
Risk Control Hierarchy

Elimination
- Change the process

Substitution
- Change the machinery

Engineering
- Modify the process or machinery
- Train people
- Maintain equipment
- Manage exposure times

Administration

PPE (?)
- AV gloves
Anti-vibration gloves are available, **but:**

- Unlikely to reduce HAV exposure
  - AV gloves reduce vibration at > 300 Hz
  - Most power tools operate at 30 - 150 Hz (1800 – 9000 rpm)
- Also, may make grip/control difficult

**DO NOT** rely on gloves to control vibration exposure
**DO** keep operators warm and dry
Maintenance of tools

- Regular maintenance programme
- Return tool policy
- Raise awareness of the risks from poorly maintained tools
- Attachments (suitability, sharp, properly fitted, replacements available)

Poorly maintained machines produce higher vibration

Worn and ill-fitting attachments produce higher vibration
- Assess risk to health
- Elimination or control risk
- **Provide information, instruction and training**
- Health surveillance
- Record & monitor
Training on appropriate tool use

- Follow the instructions for safe use
- Plan the job
- Avoid actions that raise exposure unnecessarily
- Use aids to reduce applied forces
  
  *e.g.* *tool tensioners and jigs*

- Apply appropriate force (let the tool do the work)
  - often more force produces higher vibration
  - Vibration-reduced machines only give lower vibration when operated correctly

- Make use of training from tool suppliers or manufacturers
Information, instruction and training

Includes:

- Best practices for low-vibration exposure
- The importance of vibration control
- Reporting of problems:
  - Tools, accessories, processes …
- Reporting of symptoms:
  - Numbness, tingling, whitening of the fingers, …
- Assess risk to health
- Elimination or control risk
- Provide information, instruction and training
- **Health surveillance**
- Record & monitor
Health Surveillance: HSE tiered approach

Tier 1
Initial assessment
Questionnaire-based

Tier 2
Annual screening
Nurse-led

Tier 3
Clinical assessment
Doctor-led

Tier 4
Diagnosis
Doctor-requested

Tier 5
standardised testing

Diagnosis
Staging
Fitness for work
Reporting (RIDDOR)
Tier 4: RIDDOR 2013 requirements

*Employers and self-employed people* – Report cases of certain diagnosed* reportable diseases linked with occupational exposure to specified hazards:

- **Carpal Tunnel Syndrome:**
  where the person’s work involves regular use of percussive or vibrating tools

- **Hand-Arm Vibration Syndrome:**
  where the person’s work involves regular use of percussive or vibrating tools, or holding materials subject to percussive processes, or processes causing vibration

*must be diagnosed by a doctor*
- Assess risk to health
- Elimination or control risk
- Provide information, instruction and training
- Health surveillance
- **Record & monitor**
What does the inspector look for?

- Tasks assessed
- Risk of HAVS for employees
- Likelihood of exposures above EAV & ELV ("exposure assessment")
- Control measures (current & future plans)
- Information, instruction and training
- Scheme of health surveillance
- Assess risk to health
- Elimination or control risk
- Provide information, instruction and training
- Health surveillance
- Record & monitor

The End
Any Questions?
Thank you
HAV / HAVS issues

- Frequency
- Weighting(s)
- Coupling Force
- r.m.s. and shock
- Energy transfer
- Damage mechanisms
- Dose-response
- Health Outcome
- Vascular
- Musculo-skeletal
- Neurosensory

HAV / HAVS issues

- Input

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