May 2003

Presentation on "Hand-Arm Vibration Syndrome (HAVS), Risk Identification, Measurement and Surveillance Programmes"

By Dr. Ian Lawson, Chief Medical Officer, Rolls-Royce plc.

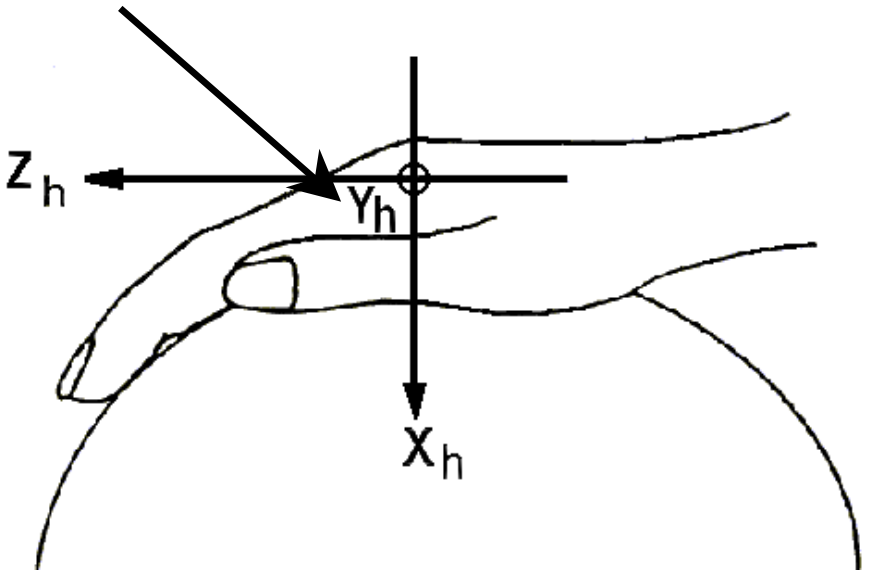
Ian introduced his presentation with a reference to the **EC Physical Agents (Vibration) Directive (PAVD),** which came into force in July 2002. Following the usual consultation and revision of guidelines, the new regulations are due to be laid before Parliament in December 2004. Guidance in HSG88, Hand-Arm Vibration, is to be revised and republished by January 2005, prior to the Regulations coming into force in July 2005. The Faculty of Occupational Medicine are planning to issue their own guidelines in Spring 2004 and these will be mirrored by supporting measures from DTI.

Ian went on to explain that many people did not seem to appreciate that HAVS was one of the most common Occupational Diseases, with about 4 million workers exposed to this risk. Of these, 1 million were thought to be exposed to more than the HSE Action Level, resulting in about 200,000 known cases. About 12,000 sufferers were still, employed and Employers' Liability claims ranged from £2,000 to £200,000.

One of the most obvious signs of HAVS, commonly called Vibration White Finger (VWF), is blanching of the flesh which starts distally, with the nails becoming white and sharply demarcated. In addition to this **Vascular Component**, there are the **Sensorineural Component (Carpal Tunnel), Musculo-sleletal (Pain, Stiffness, Arthritis, Bone Cysts) and Central Nervous System Components.**

In developing a management strategy to control HAVS risks, Ian added, employers must first develop a distinct policy. This must include provision for **Risk Identification, Assessment, Health Surveillance, Case Management, Information and Training and Exposure Control.**

One of the most obvious starting points in any strategy is to obtain manufacturer's data on **Vibration Magnitude,** expressed as the **Average Acceleration over an 8 Hour Day (A8), as the Vector Sum or on the Dominant Axis (Y_h).** The units of measurement are **Metres/sec/sec (m/sec^2).** This should indicate whether a piece of equipment is likely to pose a risk.



Ian then went on to say that the following factors influenced the severity f the biological effects due to HAV in working conditions: -

- Magnitude of vibration
- Frequency spectrum of vibration
- Temporal exposure pattern and working method (i.e. length and frequency at work and rest spells)
- Duration of exposure per working day
- Cumulative exposure to date
- Direction of vibration transmitted into the hand
- Magnitude and direction of forces applied by the operator through the hands into the tool or workpiece
- Posture of the hand, arm and body during exposure (i.e. the angles of fingers, wrist, elbow and shoulder)

Regarding the identification of sources of potential risk, Ian said that experience had enabled the compilation of a list of likely suspects, or **Atlas**, in the following categories: -

Percussive Metal Working Tools

- Fettling tools
- Needle guns
- Percussive chisels
- Pneumatic clinching & flanging
- Nibblers
- Impact wrenches
- Hammer drills
- Chipping hammers
- Riveting tools
- Nut runners

Grinders and other Rotary Tools

- And held polishers, sanders & grinders
- Flex-driven grinders and polishers
- Pedestal grinders
- Rotary burring tools

Percussive Hammers and Drills used in mining

- Jack Hammers
- Rock (etc.) Drills
- Rammers

Forest & Garden Machinery

- Chain saws
- Anti-vibration chain saws
- Brush Saws/Strimmers
- Hedge trimmers
- Barking machines/shredders
- Mowers

Other processes and tools

- Shoe-pounding-up machines
- Concrete vibro-thickeners
- Concrete levelling vibrotables

- Motorcycle handlebars

In considering the biological effects of HAV, Ian firstly looked at the Vascular Component. HAVS could be confused with **Raynaud's Disease (RD)**, but he emphasised that this is a primary disorder usually affecting women (4:1), rather than men, who start with episodes of finger whiteness during their teens and twenties. The symptoms are usually bilateral and symmetrical, with possible effects in the feet. RD is possibly not triggered by cold and maybe the blanching is more diffuse, patchy.

If **RD** *can be discounted*, therefore, the practical signs of **VWF** to look for are: -

- For a diagnosis of VWF there needs to be a history of significant vibration exposure and the occurrence of **well demarcated finger blanching**
- Attacks of blanching normally **commence in the distal phalanges** and extend **proximally,** before receding distally with recovery
- Mottling is physiological
- Generally triggered by cold, or dampness
- Some subjects feel fingers to be abnormally cold without blanching (could this be a 'pre-blanching' stage?)

There is a **Latent Interval** between first exposure and the onset of blanching can extend from 6 months to more than 20 years, until up to 1 year after the last exposure.

Regarding the **Sensorineural Component,** the practical points to note are: -

- **Numbness** and **Tingling** should be treated **synonymously**
- Numbness may be poorly described as **"Fingers feel fat"**
- Numbness and/or Tingling in **Warmth** is more indicative
- **Dexterity loss in Warmth** is required for severe staging (3SN)

Referring to the **PAVD,** Ian said that the **Exposure Action Value (EAV) A(8) of 2.8 m/sec^2** indicated the level above which Health Surveillance should be introduced. The current version of **HSG88** implies that this is so and **Annex C, ISO 5349,2001** has this to say on the subject: -

> **"Studies suggest that symptoms of the hand-arm vibration syndrome are *rare* in persons exposed with an 8-h energy-equivalent vibration total value, A(8), at a surface in contact with the hand, of less than *2m/sec^2* and *unreported for* A(8) values of less than *1m/sec^2*"**

The Health Surveillance options start with the **Short Survey.** If n symptoms occur, repeat within one year. The next stage is the **Full Symptom Questionnaire** which looks at: -

- Past Medical history

- Full Occupational history

Vascular Component (V)

Stage	Grade	VWF Symptoms
0	**-**	Nil
1V	**Mild**	Tips only, winter
2V	**Moderate**	Distal middle phalanges (occasionally proximal)
3V	**Severe**	Whole finger, most digits
4V	**Very Severe**	Trophic skin changes

Grade indicated by stage and number of affected fingers on each hand
e.g. 2VR(2) : 1VL(1)

- Examination and diagnosis

Where employment decisions have to be made, a **Full Assessment** has to be made with **Standardised Tests; -**

- Thermal Aesthesiometry (TA) – on Index and Little Fingers to test depth sense perception
- Vibrotacile Thresholds (VTT) – on Index and Little Fingers to test sensitivity of skin receptors to vibration stimulus.
- Cold Water Provocation Test (CPT) – All fingers tested at 15°C for 5 minutes to monitor temperature fall and recovery patterns. Although blanching may occur during this test it is not a reliable indicator of disease.
- Finger Systolic Blood Pressure (FSBP) – on all fingers. Transducer flows measured against falling pressure in a restrictive cuff. Where the transducer signal starts to rise, that point is taken as the FSBP.

Other HAVS screening tests are: -

- Dexterity – Manipulative dexterity tests done on a Purdue Pegboard.
- Musculo-skeletal -Grip strength measured on a Jamar dynamometer.

In taking remedial action to prevent or treat the risks from HAV, it is important to assess the progression of the symptoms of the sufferer. Some years ago a system was developed by Taylor and Pelmear, but this was subjective, relied on seasonal factors and could not accommodate the separate rates of progress made by the vascular and neurological components. So a new classification scheme, called the Stockholm Workshop scales, for the Vascular and Sensorineural Components, respectively.

Sensorineural Component (SN)

Stage	Symptoms
0_{SN}	Nil
1_{SN}	Intermittent numbness with, or without, tingling
2_{SN}	Intermittent or persistent numbness, with or without tingling. Reduced sensory perception

3_{SN} Reduced tactile discrimination and/or manipulative dexterity.+**2_{SN}**

This systematic approach to identify the extent of the biological risk and plan a strategy to manage it. As far as the individual case is concerned, the advice in HSG88 is: -

"Workers should be advised as individuals about the likely effects of their continuing to work with hand transmitted vibration once symptoms have begun. Whether an individual should stop work entailing exposure to hand transmitted vibration will depend on the progression of symptoms and their functional effect. It is considered *inadvisable for workers to continue exposure if this is likely to result in disease progressing to Stockholm Stage 3"*

Ian commented "But what do I do with the Stage 2 cases at this point?" and "What do I do with Carpal Tunnel Syndrome cases, post surgical release?"

Ian concluded by showing some of the Engineering solutions adopted to control the HAV risk in factories.

Presentation By Dr. Paul Langford, Marketing Director, Hilti GB

In his introduction, Paul referred briefly to the background surrounding the incidence of HAVS, the rising numbers of compensation claims and the consequent rocketing of insurance premiums. It is no surprise, he added, that Noise and Vibration are high on the HSE list of priority actions in the Construction Industry. Their simple aims are to design out risk, control exposure and to conduct health surveillance. In support of this they had issued advice on management strategies (HSG88 and a CD-ROM), Practical Solutions (HSG170) and free leaflets for employers and employees.

Focussing on INDG3368, Power tools: how to reduce vibration health risk (Free), Paul quoted an extract from Page 7 which emphasised the benefits, and pitfalls, when selecting a healthier design of tool: -
"…..internationally agreed test codes exist which set out specific methods for vibration testing. These allow you to compare the vibration performance of different brands and models of the same type of tools. Unfortunately, many of these test codes do not represent the way the tools perform at work and vibration levels in workplaces may be much higher than those occurring in this type of 'laboratory' test."

Paul then showed us a chart which demonstrated how the exposure time had to be controlled, relative to the magnitude of vibration, in order to stay below the action level of **2.8 m/sec^2.** Although this is of crucial importance, Paul went on, there are other significant factors that employers should consider: -

- Could the work be done more safely and effectively without using hand held power tools?
  IF NOT,
- Is the tool suitable for the task?

- Ask about **vibration reduction features.** Do they need maintenance to remain effective? Do they reduce tool efficiency?
- Can the supplier offer **technical support.** E.g. Advice on using the tool for specific tasks, using it safely and maintaining it in good condition?
- Consider the ergonomic factors such as weight, handle design and comfort, grip force needed and ease of handling.

Paul then went on to list some other measures: -

- Take care to select low vibration, high performance tools and accessories.
- Use job rotation and alternative methods when the action levels go above the Action Level.
- Adopt effective maintenance systems to ensure that vibration is minimised.
- Train operatives in tool selection, handling and other factors to keep below the action levels.
- Be aware of the difference between **Laboratory and Site** values for magnitude of vibration and the variable conditions which may increase risks.

He added that the Kier Group had asked Hilti GB to join their tool supplier in developing a partnership to reduce HAVS by using these principles. The programme also included toolbox talks, tool selection charts and awareness posters (even on the back of toilet doors!). Tool design looked at factor such as cut-outs to reduce twisting from Re-Bar hits, Damping Systems and self sharpening chisels to minimise vibration arising from tool wear. As part of this package, maintenance was 'free' for two years in order to encourage good practice to demonstrate the benefits.

Paul concluded by showing some alternatives to drilling which eliminated the hazard and lead nicely into the next presentation!

Presentation on by Max Ulanowski, Contracts Director and Safety Advisor, East Midlands Diamond Drilling (EMDD)

Max's presentation went under the title of **"Solutions for Avoiding Hand-Arm Vibration"**, which put him right at the top of the tree when it comes to Risk Control Measures!

Starting with the traditional approach of using conventional breakers and percussive tools, Max said EMDD used a proactive route to new methods and techniques that removed the operator from the hazard. One of their best products was the **"Concrete Buster"** that not only eliminated the HAV Risk but also had the added benefit of remote operation in demolition operations. It is agile and can gain access to buildings through conventional door openings and is quieter than other machines. It can also be used to form floor openings and removal of lift shafts with no risk of falls, or falling objects!

Paul went on to describe the considerable benefits of even using **hand-held** diamond drills over conventional percussive drills by this comparison: -

Calculation of exposure time based upon an average working day of 8 hours.

	Percussive Drills	**Diamond Drills**
Weighted Acceleration	11 m/s^2	2.5 m/s^2
Permitted Exposure Time	25 mins	**7 Hours**

Paul concluded that their techniques brought all-round benefits: -

- Contracts were completed more quickly
- The machines were cost effective
- They were safer for operatives
- Overall contracts were more efficient

Members' Questions

Warwick Adams opened questions by asking about the measurement of vibration on tools. Ian replied that all tools were surveyed to identify potential problems.

David Elliott of Clydesdale Forge asked what frequency of surveillance was advisable. Ian answered that this could take the form of a pre-employment screening, 6-monthly or annual examination.

David Hughes asked about the setting up of medical testing at just 17 centres across the UK. Ian said that the reason was historical in that they were originally located to provide facilities for miners.

As there were no more questions, the Chairman thanked all three speakers for an excellent, complementary set of presentations on very different aspects of this important issue and the members joined in his thanks in the traditional manner.