



## Ergo Tip of the Month - January 2008

### Hand-Arm Vibration : What are the Standards and How is it Measured?

When operating hand-held equipment such as a chainsaw, grinder or jackhammer, vibration can be transmitted from the equipment, to the hands and arms of the worker. If the intensity and duration of vibration exposure is excessive, it is possible to damage nerves, blood vessels and joints of the hand. The most common injury attributed to excessive vibration exposure is Raynaud's phenomenon. The primary sign of this condition is reduced blood flow to the fingers when exposed to cold temperature, causing the fingers to become pale (white) or purple with a sensation of numbness or tingling. Severe cases can cause workers to become disabled and unable to complete their regular job duties.



Hand on right showing signs of Raynaud's phenomenon

#### **Standards**

In the United States, there is no legislation, or law, dictating what the maximum acceptable level of vibration exposure is. There are, however, 2 generally accepted standards which recommend a maximum exposure limit. The American Conference of Government Industrial Hygienists (ACGIH) recommends a threshold limit value (TLV), or total daily exposure limit, of no greater than  $4 \text{ m/s}^2$ , for durations of 4 to 8 hours per day. The European Directive (2002/44/EC) and the American National Standards Institute (ANSI) both advocate a maximum Exposure Limit Value (ELV) of  $5 \text{ m/s}^2$ , as measured over the course of an 8 hour day. The European Directive and ANSI have also published an Exposure Action Value (EAV), which can be described as a daily amount of vibration above which intervention is required to control exposure. The EAV is a daily exposure of  $2.5 \text{ m/s}^2$ , as measured over an 8 hour day.

Your geographical location and company policies may effect which standards will apply to your organization. It is therefore recommended to review your company, municipal, and/or state legislations before determining which limit value to use.

#### **Assessing the risk**



Measuring hand-arm vibration levels with a datalogger

You can determine through review of Physical Demands Analyses (PDAs), employee questionnaires, or injury/medical data, which operations/jobs/tools expose a worker to hand-arm vibration. Some jobs may include, but are not limited to, mechanics, electricians, pipe fitters, boilermakers, construction workers, general contractors, carpenters, miners, and/or millwrights. Typical equipment that may expose a worker to vibration may include, but are not limited to, chainsaw, circular saw, jack hammer, impact tools, grinder, power mower, polisher, nut runner, drill, and/or string trimmer.

### **Quantifying hand-arm vibration levels**

Once the operations, tooling, and/or individuals are identified as potential risk for hand-arm vibration exposure, it is time to measure the level of vibration. This may initially seem to be an overwhelming feat, however it is not! The key is finding the best equipment and software for your needs. Proper measurement requires a tri-axial accelerometer connected to a datalogger monitor. Ideally this measurement process should meet the requirements dictated in ISO-5349-1:2001. Each measurement tool varies slightly in the way in which data is obtained and analyzed, and further each standards association or governing body has established their own protocol for how to compare the measured exposure to the limit value. It is therefore essential to understand where the output numbers are coming from, and which limit(s) apply to your organization.

After identifying those jobs which are exposed to excessive vibration levels, an action plan to reduce, or control, the vibration levels must be initiated. Intervention may include providing anti-vibration gloves, shock absorbing covers for tools, anti-vibration sockets and drill bits, reducing exposure to the cold while using vibration tools, or decreased exposure time throughout the day. Also, health surveillance of all individuals exposed to these jobs, or tools, should be part of the action plan.

Vibration levels should continue to be monitored on a regular basis, to ensure compliance, or identify need for intervention, thus reducing the risk of injury.

### **Additional Resources and Links**

ACGIH Publication #7 DOC-647. Hand-arm vibration: TLV physical agents 7<sup>th</sup> edition documentation. Available at: <http://www.acgih.org/Store/ProductDetail.cfm?id=1350>.

ANSI S2.70-2006. *Guide for the measurement and evaluation of human exposure to vibration transmitted to the hand*. Available at: <http://webstore.ansi.org/RecordDetail.aspx?sku=ANSI+S2.70-2006>

ISO 5349-1:2001. *Mechanical vibration – Measurement and evaluation of human exposure to hand transmitted vibration- Part 1: General requirements*. Available at:  
[http://www.iso.org/iso/iso\\_catalogue/catalogue\\_tc/catalogue\\_detail.htm?csnumber=32355](http://www.iso.org/iso/iso_catalogue/catalogue_tc/catalogue_detail.htm?csnumber=32355)  
<http://www.havsrn.com/Legislation>

Hand Arm Vibration Syndrome (HAVS). Risk Management and Legislation in the EU. Available at: <http://www.havsrn.com/Legislation>

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