Measurement Techniques
– methods meters & monitoring

IOSH – Shake Rattle & Roll
16th May 2019

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Who are you listening to?

- Consultant & Director at the Industrial Noise & Vibration Centre. c5yrs Years
- Business Owner of Noise & Vibration Solutions.
- Previous UK Sales Manager Cirrus Research Plc c8yrs

m 07837 385 248
The **Control** of Noise at Work Regulations 2005
Our ears do not perceive 3dBA to be ‘TWICE AS LOUD’
Measurement: Common Errors

- Not knowing how to use your equipment
- Not knowing what data you need
- Not taking readings in the correct location
- Not calculating the exposure properly
- Stopping there...
- Jumping to Conclusions
  - Not identifying the correct noise sources & Ranking them
- Using the wrong noise control techniques
Incomplete noise Risk Assessments

1. Air Chiller Fans
Typical current noise level below:
- Despatch area: 83 - 85 dB(A) $L_{eq}$
- Admin area: 84 - 85 dB(A) $L_{eq}$
- Admin area: 85 dB(A) $L_{eq}$

Estimated practical target for this source: $< 75$ dB(A) $L_{eq}$

Diagnosis and comments
The noise from these fans is being radiated into the surrounding area. Forklift drivers are the only employees in these areas and the fan noise levels in the 'Admin area' do make the computer/admin area directly below the fans, a compulsory hearing protection zone. All other chiller fans around the site should also be silenced.

Figure 5 showing silencer in intake area

Noise control options
Fit cylindrical silencers (minimum length should be 1 x diameter) as shown in the figure 6 above. The silencers already present on the fans in this area may require servicing as they could be clogged or damaged as the noise level in the area was $< 75$ dB(A) in the previous 2007 assessment and no other machines have been introduced since.

The noise may be radiating from the panels surrounding the silencers if the noise has been knocked or damaged so should also be checked.
Incorrect diagnosis of source

Remember the 3dB(A) Rule
-You must rank the noise sources and start with the highest source first.

E.G 2 noise sources are 93dBA (90+90)
If you control noise by switching one off, reduction of 3,
maximum level reduced to 90dBA

If you have 2 noise sources where 1 is less than the loudest noise source SAY 90dBA + 88dBA and you tackle this one 1st you are going to get less than 3 dBA reduction
Controlling the Noise at Source

Maintenance
Engineering the Noise at source
Damping
Isolation
Absorption & Insulation
Silencers
Enclosures (absorption & insulation)
Incorrect noise control recommendation:
Not selecting the Correct Hearing Protection
The **Control** of Vibration at Work Regulations 2005
Hand Arm Vibration
A(8) Daily Dose

<table>
<thead>
<tr>
<th>Exposure Limit Value - ELV</th>
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<tbody>
<tr>
<td>5 m/s²</td>
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<td>Exposure must be kept below this Limit Value</td>
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<table>
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<tr>
<th>Exposure Action Value - EAV</th>
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<tr>
<td>2.5m/s²</td>
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<tr>
<td>Where exposure is likely to exceed this Action Value:-</td>
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<tr>
<td>Implement a HAV management programme to reduce exposure and risks</td>
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<td>Provide appropriate health surveillance</td>
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Tools & Risky Operations Include ....
Sensitivity of Hand to Vibration

![Graph showing sensitivity of hand to vibration against frequency (Hz)].

The graph plots relative sensitivity on the y-axis against frequency (Hz) on the x-axis. Key points such as slow hand movement, rapid hand movement, engine idle speed, mains hum, and time pips are marked along the frequency axis.

- **Relative Sensitivity**
  - 0
  - 0.2
  - 0.4
  - 0.6
  - 0.8
  - 1
  - 1.2

- **Frequency (Hz)**
  - 2
  - 4
  - 6
  - 8
  - 10
  - 16
  - 32
  - 64
  - 125
  - 250
  - 500
  - 1k

The graph indicates that sensitivity to vibration peaks at certain frequencies, notably at slow hand movement and rapid hand movement, and decreases at higher frequencies like mains hum and time pips.
A Complete Set of PPE ...

Hard hat, safety glasses, masks, earmuffs ..... 

But for Hand-Arm vibration .....................
All anti vibration gloves have sweet spots and areas of harmful resonance

Get your Tool - Anti Vibration glove matching right!

- Slow rotating tools
  ART. NO: IMPVIBFLEXI
- Rotating tools
  ART. NO: IMPVIBAMP
- Fastest rotating and impact tools
  ART. NO: IMPVIBWIN
- Impact tools
  ART. NO: 15-TVIB

All Eureka products have a name to carry its purpose, go to www.eurekasafety.se and see if you can figure it out. eureka@berger.se +46 31 75 10 850
There are no such thing as anti-vibration Gloves that work..
Must I continually monitor workers’ exposure to vibration?
No. No legal requirement; probably not good use of your or your employees’ time except for very specific circumstances.

Once you know enough about the work to say what the exposure is likely to be ...your focus can shift to investigating, and taking, practical steps to reduce the exposure and the risks. Take positive action to reduce the exposure and the risks... Make sure the action you take results in real changes – monitor your systems and make sure work instructions are being followed.

I’m using monitoring to make sure my workers keep below the Exposure Limit. Isn’t that sensible?
Just because your workers’ exposure is below the Limit, it doesn’t mean you have complied with the law, or done enough to protect workers’ health. A fundamental requirement under the regulations is that exposure is reduced to ‘as low as reasonably practicable’.
All the data / statistics used to estimate the relationship between vibration dose and damage risk were based on hard-mounted transducers. If you get a different value, your measurement is wrong by definition. Period.
Vibration Measurement – to no standards

Hand-held or glove mounted

Hand-held accelerometer measurements.

wrist mounted

Wrist mounted accelerometer measurements. Even fewer than no standards involved...

Simple dynamic model

Mhand

all k-low
all c-high
all highly variable

Mtool

tool handle

Arm Wrist

Simple dynamic model

Ma

tool handle

Mhand

all k-low
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Arm Wrist
None of these alternative measurement techniques can be used for a reliable assessment (re BS5349) of the levels of vibration to which operators are exposed. Period. Very simples...

HSE Guidance 2017
“Hand-arm vibration measurements should be made with the transducer firmly attached to the vibrating surface... There is currently no wrist or glove mounted device which measures vibration suitable for use in a vibration risk assessment.”

Continuous Monitoring
Don’t unless you can prove that the cost is justified, especially on lower risk activities. Assess if circumstances warrant the usefulness of collecting monitoring data re reduced exposure.

Will additional measurements affect your risk reduction actions?

HAV measurement white paper via www.invc.com/wrist-mounted-vibration-transducers-not-again/
None of these alternative measurement techniques can be used for a reliable assessment (re BS5349) of the levels of vibration to which operators are exposed. Period. Very simples… For example…
ASA Ruling: We considered that because we had seen evidence that wrist mounted transducers did not measure hand-arm vibration in accordance with the Standard, did not provide ELV or EAV data that was required by the Regulations and were not therefore suitable for risk assessments of hand-arm vibration as set out by the Regulations... Full ruling at: www.asa.org.uk
Manufacturers are under increasing pressure to develop low vibration plant. In the case of Dennis, our prototype re-designed low vibration handle reduced operator exposure during simulated cutting from 5 - 6m/s\(^2\) down to 1 - 2m/s\(^2\) without affecting mower control.
The **Control** of Vibration at Work Regulations 2005
Whole Body Vibration
Exposure Action Value (EAV) 0.5 m/s$^2$
Will apply to most vehicles/mobile machinery users but actions will be just good practice

Exposure Limit Value (ELV) 1.15 m/s$^2$
Some activities in some industries

These are not triaxial measurements
ISO 2631: 1997 (Parts 1 and 2)
- Part 1: covers general requirements including the defined weighting curves for measurements
  - 0.5Hz - 80Hz for health, comfort and perception
  - 0.1Hz - 0.5Hz for motion sickness
- Part 2: concerned with vibration in buildings (1Hz - 80Hz)

This standard excludes the hazardous effects of vibration transmitted directly to the limbs i.e. Hand-Arm Vibration)

BS 6841: 1987
- Measurement and evaluation of human exposure to whole body mechanical vibration and repeated shock (similar to ISO 2631 Part 1)
In Summary

• Look at what needs to be achieved by the assessment & select correct measurement parameters and locations for that job – No measurements for measurements sake.

• Present report that provides not just the HAV/WBV/Noise levels but recommendations for Action. Most companies know they have a problem and while a report confirms this, the job should not stop there.
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