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Hearing Protection

Most hearing conservation programmes are ineffective



Most of the workers expected to use hearing protection either get no protection whatsoever or the performance of their PPE is inadequate. The implications of these findings published in the UK in a recent HSE report are far reaching.

The common assumption that PPE is a reliable solution to hearing damage risk problems is simply untrue, leaving many personnel still at risk and many companies open to claims. Peter Wilson of the INVC summarises the results of the research and outlines the key factors required to make hearing conservation programmes as effective as possible.

The research - most hearing protection is inadequate

Despite the emphasis on noise control in the new noise regulations, hearing protection is often (wrongly) considered to be the first and only line of defence against the risks of hearing damage.

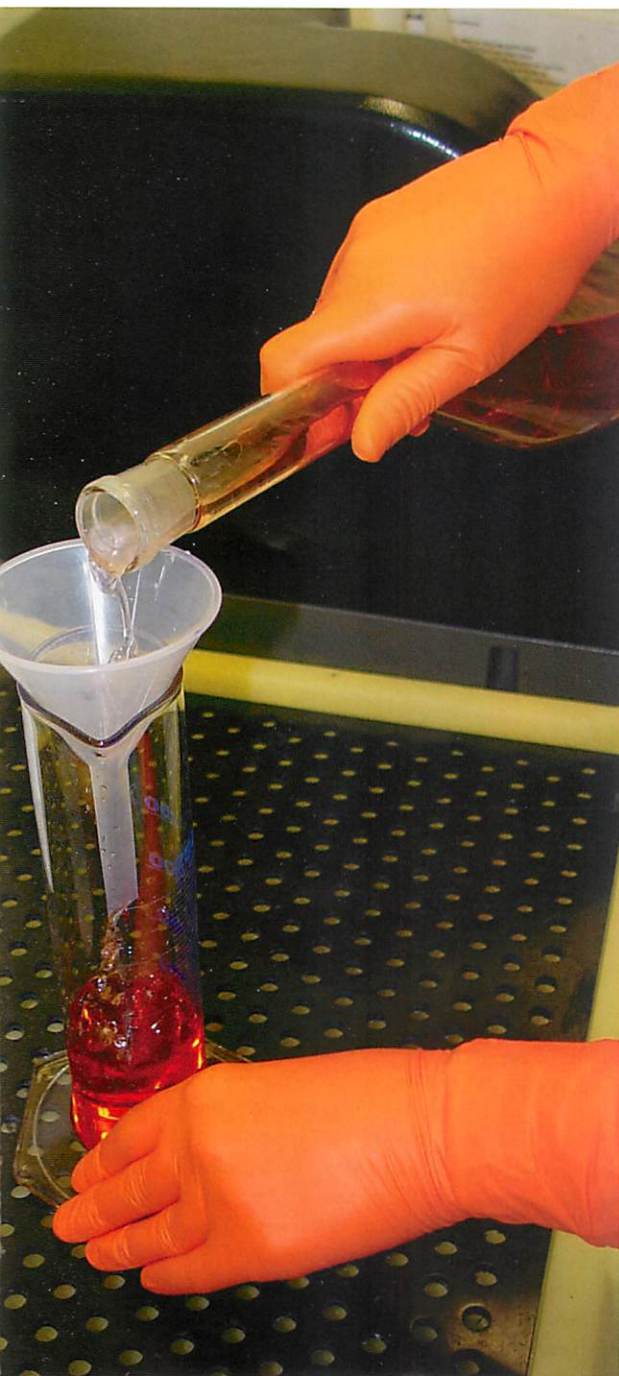
Noise problem? Issue PPE. Problem solved.

New research published in the UK by the HSE (RR720 2009), however, indicates that only 40% of PPE users get any protection whatsoever and that the real world performance of a substantial proportion of the remaining 60% is inadequate. Companies must become aware that issuing PPE is not a simple or reliable solution.

The following is a summary of the main findings of the research based on both company visits and on laboratory testing.

No protection

- *The use of PPE in 25% of the companies visited was so ineffective that it was likely to result in negligible or no protection for most users*
- *Even in companies with generally effective hearing protector use, 14% of the workers did not wear protectors when and where it was required*
- *Overall, 40% of the workers who should have been wearing protectors got no protection at all*



“glove choice may well have become over simplified, so that you just purchase on the basis of it being latex or nitrile”

gloves and to emphasise that these gloves are designed only for incidental exposure to chemical splashes, EN374: 2003 has given us a new pictogram.

The question mark in the middle of the square-shaped glass beaker reminds those of us engaged in risk assessments that we are referring to ‘low chemical resistant’ or ‘waterproof’ gloves. Significantly, there is no obligation for the manufacturer to undertake any testing on the 12 listed chemicals and the new pictogram only tells us that the gloves have fulfilled the penetration test (EN374-2: 2003).

While it is prudent to seek advice from the manufacturer on actual breakthrough times with a particular chemical, we should not forget that this test data will often be based on deep immersion of the glove into the chemical and therefore may not offer a realistic representation of a work situation where the focus is on splash protection.

Also, it should be noted that any test data is likely to be done on an unused glove and does not reflect the actual workplace situation, where the used glove is subjected to many other stresses that are beyond the scope of a simple laboratory test.

EN374-2: 2003 (determination of resistance to penetration by chemical and/or micro-organisms through porous material). An important test for those using disposable gloves to protect themselves from micro-organisms, as it gives us an indication of the barrier properties of the glove to liquid-borne biohazards.

For most disposable gloves, the water leak test is used, where according to the inspection level based on ISO 2859 a specified number of gloves from every batch are filled with water to assess the levels of pinholes. Levels of pinholes are measured in terms of AQL or Acceptable Quality Level, with an AQL of 0.65 having a lower level of acceptable pinholes than 4.0. To display the pictogram and as part of the process for

satisfying a Complex Design registration, gloves must have a minimum AQL of 1.5. EN374-2: 2003 describes the levels, which are often displayed underneath the pictogram (Table 3).

Conclusions

As you will have already appreciated, choosing a glove is difficult when there is such a vast jungle of available products. Glove choice may well have become over simplified, so that you just purchase on the basis of it being latex or nitrile, powdered or powder-free and depending on price.

For practical and economic reasons, often the users select just one glove. A better strategy might be to use two or three different gloves to cover all the needs you are likely to encounter in the workplace. This approach is likely to better optimise the balance between protection and cost – or comfort and cost. ■

Bibliography

EN374-1:2003 Protective gloves against chemicals and micro-organisms – Part 1: Terminology and performance requirements

EN374-2:2003 Protective gloves against chemicals and micro-organisms – Part 2: Determination of resistance to penetration

EN374-3:2003 Protective gloves against chemicals and micro-organisms – Part 3: Determination of resistance to permeation by chemicals

EN420:2003 + A1:2009 Protective gloves – General requirements and test methods

Author Details:

Nick Gardner, MBA
 E: nick.gardner@shieldscientific.com
 M: 07917 332249
 T: 020 8647 8418
 W: www.shieldscientific.com



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The main factors implicated in these results were:

- Peer group pressure and group behaviour plus reluctance of supervisors to enforce wear
- The need to hear traffic, radios and difficulties in communicating
- Attitude - viewing PPE as an imposition without adequate consultation
- Incorrect fitting (e.g. foam plugs)
- Use of PPE as the sole control measure without a comprehensive noise control programme
- Inadequate protector provision

Thinking beyond PPE

Companies must become aware that issuing PPE is not a simple or reliable solution.

Inadequate protection

- Less than 50% of companies had selected PPE based on the attenuation actually required; consequently, about half of these had specified PPE that over-protected
- There was ignorance of the need to provide a choice of PPE in a number of cases

Adequate protection

- Hearing protection was effective for most workers in the 40% of companies who used PPE within a comprehensive noise control programme (noise control measures and 'Buy Quiet' policy)
- PPE was most effective in companies who combined training with appropriate supervision and employee cooperation

Unnecessary protection

- Making whole buildings or sites hearing protection zones when only limited areas are noisy
- Requiring the use of PPE everywhere rather than assessing the actual risk

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PPE field performance issues

Earmuffs - The standard HSE recommendation has been to de-rate the manufacturers' attenuation data by 4dB to account for 'real world' performance. The laboratory testing, however, showed an additional 6dB loss after a simulated month of normal use, primarily caused by stretching of the headband which is invisible to the user. This means that nearly a third of the earmuff users seen would have been under-protected.

Damage to earmuff seals is more obvious, but removing an eighth of the seal showed a drop in attenuation of only 2dB. The effectiveness of the seal is also compromised by glasses, goggles and dust masks. The less bulky versions reduce the attenuation by around 2dB, the bulkier versions by up to 10dB. Moreover, wearing earmuffs over clothing (e.g. hoods in cold weather), reduced the performance by 14 - 21dB.

Earplugs - Proper fitting is the key factor. Just over 50% of the compressed foam earplug users seen had not inserted the plugs properly and most of them were ignorant of the correct fitting procedure. Simulated tests showed that the attenuation could fall to as low as 9dB if not properly fitted. Users generally preferred push-in plugs (foam or flange), as they are easier to

fit and were usually inserted deeper into the ear canal. Banded ear canal caps gave negligible protection under band pressure - they have to be inserted into the ear canal entrance.

While custom moulded earplugs were generally considered by companies and users to be the best available, not all users found them comfortable. While not included in the laboratory testing for the report, previously published information has indicated that the attenuation can fall by up to 6dB over the first hour of use due to temperature effects changing the shape of the ear canal.

Hearing conservation programme - best practice

The following is a pragmatic guide to the key features that should be included in order to minimise the risks to staff and potential future claims.

1 Noise control programme

The HSE research showed that hearing protection was most effective in those companies where it was implemented as part of a comprehensive noise control programme. This is largely due to the cultural and management attitude engendered by the process - an unwillingness simply to try to offload responsibility (in the form of PPE) onto the workforce. In ▶

addition, PPE cannot be used for long term risk management unless you can prove that noise control is not practical.

Consequently, companies must assess the costs and benefits associated with implementing an effective control programme based on the best of current technology. This requires a noise control audit. This is an engineering evaluation of the noise control options, costs and benefits carried out either as part of a Noise Management Assessment, or as an add-on to an existing assessment where the competent person does not possess the required specialist engineering expertise. In many cases, low cost engineering noise control techniques are available that can provide the bonus of a potential pay-back due to reduced costs.

PPE cannot be used for long term risk management unless you can prove that noise control is not practical. Despite the regulatory requirement to reduce noise levels as far as reasonably practical, the following are the three key target noise levels which trigger particular benefits:

<95dB(A) - PPE programmes can be made to work reliably

<85dB(A) - PPE becomes only advisory; no Health Surveillance; reduced training and management

<80dB(A) - complete deregulation

Where PPE can be made advisory or unnecessary, there are substantial direct and indirect cost savings. Depending on the type of protection used and the conditions, typical cost savings on PPE can be £30 - £200 per head, per annum, with additional savings relating to improved communications, reduced management resources and absenteeism.

Moreover, a simple, well policed 'Buy Quiet' purchasing policy is probably the most cost effective long term noise control measure that a company can take. It is

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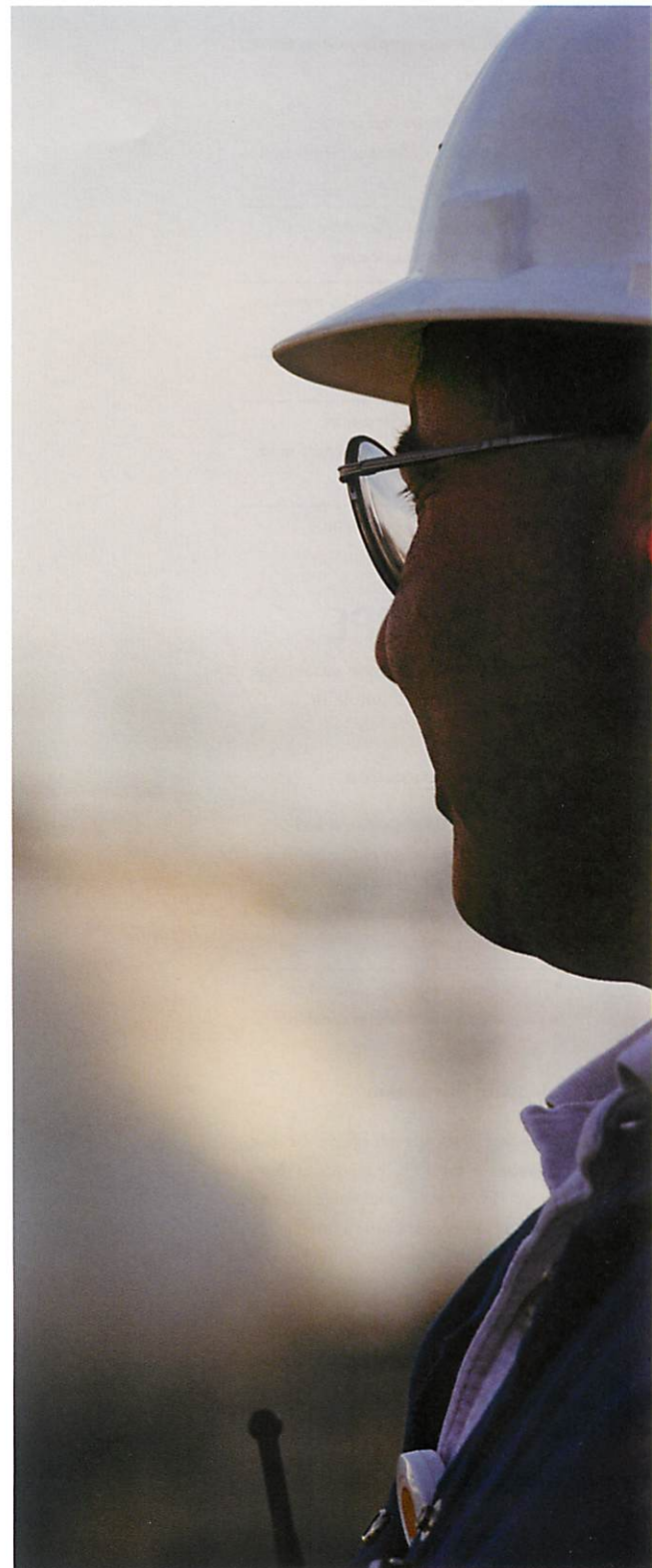
important, however, that you do not allow your suppliers to spend your money on control measures that are not best practice.

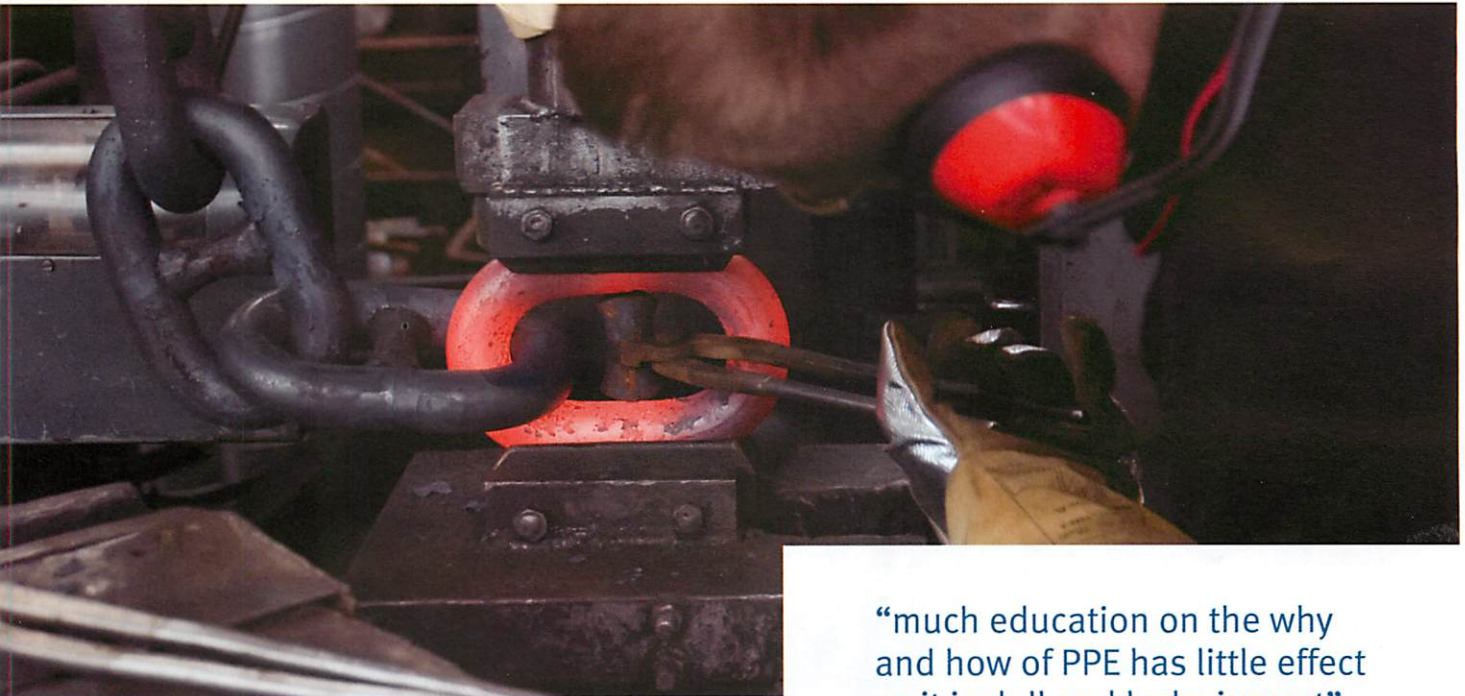
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2 Management practices

The findings in the HSE report highlight a few key management practices that should be in place in order to make hearing conservation programmes as effective as practical. These are:

- *Assessment – report quality is a big issue; most reports are not of 'merchantable' quality. You must be able to identify personnel at risk and the assessment must include a specific programme of action*
- *Hearing conservation programmes should be implemented as part of a comprehensive noise control and management programme and efforts should be focused on higher risk areas and activities*
- *Do not issue edicts making whole sites or departments mandatory hearing protection zones when a significant proportion of the workforce is not at risk. This is poor management and can also be counter-productive, as workers tend not to take the risks seriously, knowing that there is no risk in some of the areas where they are required to wear PPE*
- *Where health surveillance (audiometry) is required, do not skimp on the process. Allow for a little more time over and above the minimum to discuss hearing damage, PPE selection and fitting. This is an opportunity for one-on-one education and motivation*
- *Managers and supervisors must set an example and companies must have a procedure in place to police the use of PPE - including enforcement and disciplinary procedures ▶*





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3 Training and motivation

Personal motivation, company culture and supervision are key factors in operating a successful programme. Motivation is particularly important for remote workers where direct supervision is not practical. Much education on the why and how of PPE has little effect as it is dull and lacks impact. The best approach is to use brief, graphic material that workers will remember and to apply this to home life situations (such as DIY or noisy hobbies) to avoid accusations of ‘imposition’. Link this to the free issue of earplugs for home use plus other positive incentives. Supervisors and managers must also be trained in their responsibilities.

Training should also be given in correct use and communication while wearing PPE. Users will often remove a protector and lean close in order to hear speech. This is unnecessary: when you don protectors, you hear your own voice more clearly and tend to speak too quietly. If you shout at the same volume as you would while not wearing PPE, other people will be able to hear your

speech (and warning signals) better with PPE than without in high noise areas.

4 Choice of protectors

Offering a choice of suitable protectors in noise hazard areas is a mandatory requirement. Suitability is based on three criteria: field attenuation of the protectors; physical suitability for the circumstances; comfort or wear rate.

Attenuation

There are a number of broad PPE categories based on area noise levels as follows:

- 80-85 – *Hearing protection advised. Low performance protectors must be available - beware of over-protection*
- 85-95 – *Hearing protection mandatory. Most protectors from reputable suppliers provide adequate or over-protection*
- 95-105 – *High risk. Only high quality protectors, very carefully controlled and used, can provide sufficient protection*
- 105 plus – *Very high risk. Adequate protection cannot be guaranteed without very stringent controls and checks*

Use the UK HSE website calculator to estimate the protection provided by PPE at www.hse.gov.uk/noise/calculator.htm. Suitability is based on a calculated effective noise level inside the PPE with a rating of ‘good’ or ‘acceptable’ as shown in the following table. Note that you should make an allowance for de-rating the protector performance according to the new research and the wear-rate trade-off.

Effective Noise Level dB(A) (mean - 1 SD)	Protector Rating
Over 85	Insufficient
>80 to 85	Acceptable
>75 to 80	Good
70 to 75	Acceptable
Below 70	Overprotection*

*The issue with overprotection is that the wearer may feel isolated and may miss warnings

Physical Suitability

The following are the main physical factors that govern the selection of suitable PPE: safety glasses, hard hats, other safety equipment, clothing, earrings, ▶

turbans, hairstyle, temperature, dust, hygiene, confined spaces, fitting difficulties (plugs) and physical factors (size of ears, skin disorders). All of these will factor into your choice of suitable ear protection.

Wear rate

If you consistently achieved a 99% PPE wear rate in noise hazard areas, you would feel that you had an effective hearing conservation programme in operation. At a 99% wear rate, however, (doffing protectors for a cumulative total of only five minutes over an eight hour shift), the maximum real-world attenuation is approximately 17dB for earmuffs and 10dB for earplugs as shown in the graphic.

If staff only wear PPE for seven out of eight hours, then protection is limited to around 7dB for earplugs and 9dB for earmuffs - no matter what the theoretical performance. Consequently, comfort, motivation and supervision are the paramount factors that determine the wear rate and therefore the protection that is achieved in practice.

A very effective, but often overlooked, option to improve the performance of hearing conservation programmes is to encourage the use of different protectors at different times during the day. ■

Reference: HSE Research Report RR720; Real World use and performance of hearing protection. www.hse.gov.uk/research/rrhtm/rr720.htm

Author Details:

Peter Wilson BSc; MSc; M.I.O.A.

Peter Wilson is the director of the Industrial Noise and Vibration Centre, or INVC.

In addition to a mechanical engineering degree and an MSC in Acoustics and Vibration, Peter has spent many years honing his practical skills in the field of noise and vibration engineering – initially in the automotive industry (solving problems on both products and for customers). He has not only been involved in the development of a number of unique and

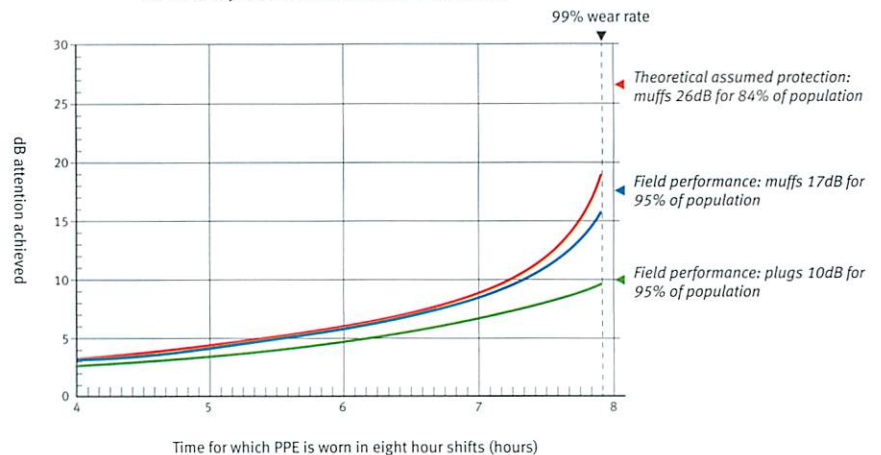
innovative noise and vibration control techniques, but he also developed the IOSH competency training courses in both noise and vibration. An entertaining and sometimes controversial speaker, he has a refreshingly pragmatic and practical approach to the subject of industrial noise and vibration management.

About Industrial Noise and Vibration Centre

The INVC is an award winning engineering consultancy and one of the leading organisations in the fields of noise and vibration management and control. The company has been widely recognised by public bodies and by industry as one of the premiere sources of best practice in the fields of noise and vibration management and control – largely because the INVC has been responsible for developing a number of the innovations in techniques and technology that constitute current best practice.

The engineering approach is evident in the wide range of elegant source control solutions to noise and vibration that the company has developed. It is also very evident in the benchmark noise and vibration management programmes and risk assessment techniques that have been widely adopted. The latter includes the largest database of accurate field HAV (Hand-Arm Vibration) data available in

Protector performance versus wear time



Europe, which represents current 'best practice' in virtual risk assessment by email.

In a similar vein, it is also possible to implement some of the innovative noise control technology anywhere in the world via internet links.

The company is also the major provider of noise and HAV training in the UK, having developed the IOSH competency courses for both Noise and HAV.

INVC Ltd
889 Plymouth Road
Slough
Berks
SL1 4LP
United Kingdom

T: +44 1753 698800

E: consult@invc.co.uk



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