Recommending Noise Control in Place of Ineffective PPE

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Industrial Noise and Vibration Centre: www.invc.com
Industrial Noise and Vibration Centre

- Award winning noise control technology for fans
  £800k capital and £250k / p.a. running cost savings for Corus

- The major provider of engineering noise control case studies to the HSE
  the largest database of engineering source control examples available

- Developers of current “BAT” noise control -
  food and drink, pharmaceutical and electronics industries…

- Buy Quiet Policy
  de-facto UK standard noise purchasing policy

- Presentations and Training
  Noise regs. Launch - HSE UK road-shows; developed and run IOSH and
  BOHS competency courses; Plastics Federation; Hygiene industries…

- Noise Training for English, Scottish, Irish Environment Agencies
Noise Control Instead of Ineffective PPE…

PPE does not work well in the real world
HSE research proving that hearing protection is not effective across most industrial applications provides a gold plated opportunity for the legal profession to drive a coach and horses through hearing damage claim defences based on PPE use.

Minimising Hearing Damage Risk
Consequently, as real-world PPE performance is so compromised, the best way to guarantee low levels of risk at low cost is to reduce noise levels as far as practical.

How to Recommend Self-financing Noise Control
The Noise Control Audit Process
A guide that demonstrates how occupational health and other professionals can add value to noise risk assessments by linking to best practice in engineering noise control to reduce the risks of hearing damage dramatically.
How Ineffective is PPE – insurance costs

Total NIHL costs incurred by notification year

(Source: Institute and Faculty of Actuaries UK deafness working party)
Issuing PPE is not a simple or reliable solution...

No Protection
- 40% of PPE users got no protection whatsoever
- performance of much of the remaining 60% was inadequate
- even with generally effective PPE use, 14% did not wear them

Muffs – additional losses in performance…
- 6dB loss after 1 month of use (headband stretch)
- 2 - 10dB due to glasses, goggles, dust masks
- 14 - 21dB worn over clothing (hoods etc)

Plugs
- >50% of compressed foam plugs not inserted correctly
- attenuation as low as 9dB if not properly fitted
- banded ear-canal caps - negligible protection under band pressure

HSE Research Report RR720:
INVC summary: [www.invc.co.uk/profile/resources/technical-notes/#hseppe](www.invc.co.uk/profile/resources/technical-notes/#hseppe)
"Write only" Noise Assessments…

Factory assessment by consultants. This much report - the rest is a library of octave bands, dose logs and other padding.

No Action Plan, no noise control options - and no-one has ever read it! Imagine trying to extract useful information in 5 years time to defend a hearing damage claim ....

2002 HSE figures
63% of noise assessments were deemed "inadequate" i.e. a reassessment would be required to bring them up to the necessary standard
Use assessment data to create a register of noisy plant on each site.

Our open source DNA template documentation is available free at:–
The “You must control Noise at Work Regulations”

HSE “…these regulations are concerned with controlling noise, not measuring it …”

- Hearing protection **cannot** be used for long term risk management unless it can be **proved** that noise control is impractical
- Companies should not repeat risk assessments that do not include useful and practical information on noise control

Paraphrasing HSE research: “*most noise assessments aren’t worth the paper they are written on…”*

- Companies should carry out a Noise Control Audit
  - *assess the noise control options using the best of current technology*
  - *generate cost v noise reduction trade-offs for each item of noisy plant’*
  - *plan the most practical and cost effective noise control programme*
Noise Management - Best Practice

Noise Control - Attitude!

Industrial Noise and Vibration Centre: www.invc.co.uk/noise/noise-control/occupational-noise-control/
Placebo Noise Control
The Noise Control Audit

The audit is available as an add-on to conventional risk assessments.

Objectives

• generate cost v noise reduction trade-offs for each item of noisy plant using the best of current technology

• use results to plan the most practical and cost effective noise control programme possible across the company

The results of the Audit also take into account factors such as:-

• hygiene; access; maintenance; productivity

Where the audit proves that control is impractical, it also provides certification so that PPE can be used for long term risk control.
Cadbury conservatively estimate that the noise control programme will pay for itself within 7 years......
Self-Financing Noise Control

Acoustic enclosures
- £1,600,000 spent on acoustic enclosures. Noise Control Audit: BPM saved over £1million + much lower noise levels and operating costs.

Chocolate vibrators
- Enrober - re-design eliminated fatigue cracking; improved control of coating thickness – 10% chocolate savings…
- Chocolate weight s.d. across moulds reduced from 1.2gms to 0.2gms/sweet

Vibratory Feeders
- Food: noise control project doubled throughput and eliminated blockage issues
- Pharma plastics: 27dB(A) reduction plus elimination of fatigue cracking and blockages
Quiet Tape

- quiet tape uses stronger glue - generating more tension
- may have to adjust machines to use the new tape
Top 10 Noise Control Solutions
Simple solutions to common problems

INVC Top 10 Noise Control Solutions available free at:-
www.invc.com/profile/resources/top-10-noise-control-solutions/
Top 10 Noise Control Solutions

Vibration Control
1. Vibration damping
2. Vibration isolation pads

Fans
3. Fan installation / efficiency
4. Aerodynamic noise control – Quiet Fan technology

Pneumatics
5. Pneumatic exhausts
6. Pneumatic nozzles

Machines
7. Chains and timing belts
8. Electric motors
9. Hydraulic power packs

Existing machine guards
10. Convert to acoustically effective guards

www.invc.com/profile/resources/top-10-noise-control-solutions/
1 - Damping Thin Plates

unconstrained layer of damping material

damping material in sandwich construction

damping material

sheet metal

damping material deforms only near bends

damping material made to shear over whole area

www.invc.com/profile/resources/top-10-noise-control-solutions/
Weighing Machine Enclosures

Problem
- typically 87-98B(A) - high hygiene

Conventionally: Enclosure
- Enclosures – c 5dB(A) reduction
  - usually increases operator noise level by c 3dB(A) under platform!
  - c£8000+ capital + access /
  - hygiene / maintenance problems

BPM - engineering control
- engineering source modifications
- 10 - 12dB(A) at <=50% of the cost
- x4 performance + no effect on access or hygiene
- maintenance and cleaning simplified

- 94dB(A) with enclosure
- 82dB(A) with enclosure removed
- PPE unnecessary; improved productivity, cleaning, access, maintenance ...
2 - Vibration Isolation

m/c foot

Tico pad

bolt

load-spreading steel washer

NO ISOLATION

EFFECTIVE ISOLATION

www.invc.com/profile/resources/top-10-noise-control-solutions/
**Problem**
High speed strip fed press at 101dB(A) in a quiet area.

**Conventional**
Manufacturer supplied "acoustic guards" gave only 3dB(A) reduction. Full enclosure suggested.

**BPM**
Noise Control Audit - dominant source = fabricated press legs.
Tuned isolation fitted between frame and legs.
9dB(A) noise reduction at operator
£45 materials, 1 man day to fit
Fan System Noise Control Options

Aerodynamic Noise Control at Source
- award winning Quiet Fan technology
- *cf F1 / aerospace CFD - design retro-fit aerodynamic aids*
- reduce noise and increase efficiency
- *improves efficiency by c 20% over many conventional silencers*
- self financing, green, highly profitable…

Only if the above is not practical should you consider…
- Silencing
- Enclosures
- Lagging
- Barriers
- Building modifications

Conventionally, these high cost palliative techniques have been the only measures that are considered…

www.invc.com/noise/noise-control/fan-noise-reduction/#qft
Centrifugal Fan Installation

NOISY

QUIET

high pressure

low pressure

www.invc.com/profile/resources/top-10-noise-control-solutions/
Axial Fan Installations

NOISY

QUIETER

www.invc.com/profile/resources/top-10-noise-control-solutions/
Axial Fan Installations

>2-3 duct diameters

NOISY

QUIETER

www.invc.com/profile/resources/top-10-noise-control-solutions/
Fan: Outlet dampers

www.invc.com/profile/resources/top-10-noise-control-solutions/
4 - Aerodynamic Efficiency: Fan Speed v Noise

- Variable speed drives
- Two speed motors (day and night)
- Proportional control systems

<table>
<thead>
<tr>
<th>speed reduction</th>
<th>noise reduction dB</th>
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<tbody>
<tr>
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<td>2</td>
</tr>
<tr>
<td>20%</td>
<td>5</td>
</tr>
<tr>
<td>30%</td>
<td>8</td>
</tr>
<tr>
<td>40%</td>
<td>11</td>
</tr>
<tr>
<td>50%</td>
<td>15</td>
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4 - Aerodynamic Fan Noise Control

Problem
Occupational + environmental tonal noise

Conventional
• silencers, lagging and enclosures
• capital cost > c£35000 + maintenance costs

Aerodynamic Noise Control
• internal fan modification reduced tones by 23dB and overall noise by 22dB(A) using Quiet fan technology
• cost c £3000 - no maintenance costs (lasts the lifetime of the fans despite passage of cans)

modified fan

www.invc.com/noise/noise-control/fan-noise-reduction/#qft
Yoghurt-Based Noise Control - Boiler Burner

16dB tonal noise reduction
Silencer Solutions

- zero back-pressure silencers
- standardise on 3 sizes
- fix piped silencers to machine and manifold multiple exhausts

Entraining Nozzles

- c10dB quieter for the same thrust
- use c 20% less air
- pay for themselves very quickly
- intrinsically "safe"
- reduce air pressure....

www.invc.com/profile/resources/top-10-noise-control-solutions/
Problem
• 94dB(A) from cooling pipes for sealed tube ends - rapid cooling a necessity

Conventional Solution
• enclosure - high cost with hygiene and productivity issues

BPM Solution
• Coanda effect linear nozzles
  ▪ 12dB(A) noise reduction (82dB(A))
  ▪ improved performance (less turbulence disturbing tubes)
  ▪ 20% less air consumption - pay for themselves very quickly
  ▪ no effect on access or operation
7 - Chains and Timing Belts

- replace noisy chains with belts
- use quiet tooth profiles on toothed belts
- chevron tooth pattern – ultra quiet
- replace wide toothed belts with a par of narrower belts
- toothed belt noise is very sensitive to belt tension

5 – 20dB noise reductions are possible

Timing belt drives

www.invc.com/profile/resources/top-10-noise-control-solutions/
8 - Motor Noise

GEC motor: 104dB(A)

Brook Hansen motor: 92dB(A)
9 - Hydraulic Power Packs

Pump isolation
- 10 – 20dB(A) noise reductions
- no heat, visibility, or leakage issues

www.invc.com/profile/resources/top-10-noise-control-solutions/
10 - Existing Guards

Minimise gaps
- halving the open area will reduce the noise radiated by 3dB
- reduce opening by 90% - 10dB noise reduction

Acoustic Absorbent
- fitting an appreciable area of acoustic absorbent inside the guards will reduce the noise within by 5dB or more...

Guard Vibration
- radiated as noise – use damping...

Test mock-ups

www.invc.com/profile/resources/top-10-noise-control-solutions/
Effect of Leaks on Transmission Loss

Transmission loss achieved dB

% open

Potential Transmission Loss dB
Common Enclosure Problems

Enclosure issues [https://youtu.be/2T4XBxyOIIB4](https://youtu.be/2T4XBxyOIIB4)

Buy Quiet Noise Control

Probably the single most cost effective long term noise control measure that a company can take.

BUT - attitude....

Do not allow your suppliers to spend your money on noise control without close scrutiny and written evidence that they have followed diagnostic best practice. Also applies to post installation retro-fit when you didn’t have a policy...

Most suppliers do not have technical expertise in engineering noise control and usually buy-in proprietary materials, enclosures, silencers etc as palliatives with no guarantee that they constitute Best Practicable Means with current technology.
2\textsuperscript{nd} Opinion: Remote Control of Noise

- Video
- Sound
- Photos

Specialised analysis

- BPM
- BAT
- Costs

Database

Experience

Email - Internet

www.invc.co.uk/noise/noise-control/remote-control-of-noise/
Noise Control Best Practice Elements

- Attitude
- Noise Control Audit
  - based on detailed diagnosis and costing of the options and benefits using the best of current technology
- Develop detailed noise control recommendations for each category of occupational plant
  - implement as retro-fit on the first of each type of machine/plant
- Implement Noise Control Programme
  - based on the results of the audit
- Update Noise Assessment
  - de-regulate areas; reduced PPE costs...
- Buy Quiet purchasing policy

This approach can produce noise control measures that actually improve productivity and reduce costs - in contrast to reliance on conventional enclosures and acoustic guarding.
Contact us for copies of:-
Top 10 Noise Control Solutions Guide
Digital Noise Assessment (DNA) template

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