St Mary's University Twickenham London

Noise

Further Information and Guidance

HSGN 17a

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Introduction and Health Information

Noise Induced Hearing Loss (NIHL) can be caused by a single exposure to a very loud noise, or by exposure to raised levels of noise over a prolonged period of time.

Short-term hearing loss can be experienced as a Temporary Threshold Shift (TTS). Most people have experienced this at some point in their lives, for example, coming out of a noisy club and being partially deaf. This usually disappears within a few hours, although it can take over 24 hours to disappear completely.

There is evidence to suggest that TTS can lead to Permanent Threshold Shift (PTS). This is more likely to occur where there is insufficient recovery time between incidents of TTS, or where the circumstances causing TTS occur regularly.

Tinnitus is a continual ringing in the ear, causing disruption to sleep and affecting speech. It may be the result (among other things) of extended exposure to excessive noise levels and can be temporary or permanent.

Presbyacusis – this is the loss of hearing as a result of growing old. The hearing loss is progressive, with the high frequencies being affected first. While the process begins after the age of 20, it is often between the ages of 55 and 65 that the high frequencies in the speech range begin to be noticeably affected.

Trauma damage to the ear – examples of this include fractures of the temporal bone, puncture of the eardrum by foreign objects and sudden changes in air pressure.

Exposure to noise is not the only factor which causes hearing to deteriorate – certain drugs and medications or chemical agents used in the workplace can cause damage to the hair cells in the inner ear. These are called ototoxic chemicals, over 200 of them have been identified and their effects may be temporary or permanent. Examples of ototoxic chemicals include – antibiotics, salicylates, loop diruretics, chemotherapy drugs, quinine, solvents (e.g. Benzene, toluene, butanol and trichloroethylene, as well as certain metals, such as arsenic, lead, cobalt, mercury and lithium).

Some of these agents are synergistic with noise exposure. In certain circumstances where neither the agent nor the noise exposure alone causes the hearing loss, the combined occurrence will. Or, in some circumstances, the extent of hearing damage by noise is magnified by the effect of these ototoxic chemicals. In compensation cases is it vital to distinguish whether hearing loss was caused by these other factors (some of which may also be work-related).

Persistent high noise levels can contribute to stress levels at work. Noise levels which interfere with communication at work can contribute to accidents – verbal warnings, alarms may not be as effective if they are harder to hear. The effect on staff of having to raise their voice continually to make themselves heard, and straining to make out what others are saying, may also contribute to stress levels at work. There is also strong evidence to suggest that excessive noise levels can interfere with task performance, thus affecting productivity.

Because individuals are affected by noise differently, it is difficult to specify what level of noise is absolutely safe. What we can say is that damage to hearing has been recorded at noise levels above 75-80 dBA. With varying proportions of the population being potentially affected at different noise levels, there is no clear boundary between "safe" and "unsafe". For example, after 15 years of exposure to 85 dBA for 8 hours a day, 5% of workers will show hearing loss. 15 years of exposure to 90 dBA will damage the hearing of

14% of workers. Finally, 15 years exposure to 95 dBA will damage the hearing of 24% of workers.

Risk assessment

Risk Assessment requires :·

- assessment of the level and type of noise; this may come from manufacturer's data for individual pieces of equipment, or from sound level measurement, especially where multiple pieces of equipment operate in an area simultaneously. Additional noise e.g. from background music should also be included;
- identification of who might be affected;
- the likely exposure time of those individuals, taking into account working patterns, noise exposure during breaks etc;
- assessment of indirect risk e.g. the risk of individuals not hearing warning alarms due to the noise level;
- consideration of additional risk factors such as the presence of vibration or solvents.

The risk assessment should include an action plan which documents the measures already in place to reduce the risk from noise exposure and any further measures planned.

The noise risk assessment can be a standalone document, or can be incorporated into the overall risk assessment document for a department or process where this is more appropriate.

The risk assessment should be reviewed if there is any change in noise exposure; and at least every year otherwise.

a) Reducing Noise Exposure

Measures should be put in place to reduce risks from noise exposure to as low a level as is reasonably practicable – even if noise levels are below the lower exposure action value, consideration should be give as to whether further reduction is practical.

Formal measures to reduce noise exposure must be introduced if the upper exposure action value is exceeded i.e. personal exposure above 85dB. Provision of hearing protection is not an adequate sole solution in these circumstances.

Personal noise exposure **MUST NOT** exceed the exposure limit value of 87 dB (this measurement can take into account the effect of hearing protection).

Measures to reduce noise exposure may include:

- replacing tools and equipment with alternatives which create lower levels of noise
- ensuring all equipment is properly maintained
- reducing exposure by reducing time exposed to noise
- shielding or enclosure (of either a piece of equipment or the operator).

Detailed guidance on ways of reducing noise exposure can be found in "Controlling Noise at work – Guidance on Regulations" (HSE 2005)

b) Workplace Noise Control Techniques

Where a risk assessment identifies that employees are exposed to noise at work the ideal scenario would be to remove the noise problem, and thus remove exposure, altogether. This being impractical in most cases, the next step should be to look at ways of reducing noise and noise exposure. This will often involve a combination of methods, such as controlling the noise at source, redesigning the workplace or re-organising work patterns. Both the source of noise and the transmission pathway will need to be considered. Personal protective equipment should never be considered as the primary control measure, because it relies heavily on it being worn correctly, and at all relevant times. Possible noise exposure control measures can include the following:-

i) Planning the Location of Noise Sources

Machines and processes can be sited away from workplaces where employees are constantly present. Where workplaces are divided into noisy and quiet areas, the separation should be as complete as possible, and this may involve extending the partitions to the walls, ceilings or roof. The walls and ceiling may also require the attachment of sound-absorbing material to prevent increases in sound levels due to reflections. Other ideas for planning the location of noise sources include :-

- specify quieter machines or processes when designing a new production process. When purchasing new machines, the contract specification should stipulate low noise generation. Suppliers and manufacturers must provide details of the potential noise to be produced but it must be noted that the levels quoted are those generated under test conditions and when installed, the noise levels may be greater. Reasons for the increases include reflections from walls, floor and ceilings, difference in mounting and loading conditions, and the additive effect of noise from adjacent machines
- rearrange the workflow so that part of the job may be carried out in a quiet area
- reduce the duration of individual exposure by rotating jobs between quiet and noisy areas
- run machines at lower speeds
- use low-noise air nozzles, pneumatic ejector and cleaning guns designed on effective aerodynamic principles
- matching air-supply pressure to the needs of the equipment and operation, and avoid jet noise from leaks.

ii) Change Process or Activity

The best control strategy is to substitute a quieter process or machine, this may include changing the :-

- process – squeeze riveting instead of percussion riveting etc
- noisy machine – manual-turning lathes may be replaced with automatic computer-controlled lathes
- activity – compressed air tools may be replaced with quieter hydraulic alternatives
- maintenance – poor maintenance may lead to more noise from gears, bearings etc than is necessary.

iii) Damping

Avoid impact noises by cushioning conveyor panels, cyclones etc with buffers, rubber/plastic surface coatings etc. Modifying the motion of the contacting surfaces may reduce impact sound, or the surface shape may be altered or softer surfaces, such as resilient pads, used.

Provide vibration damping. Energy is dissipated in a soft, resilient material, reducing the energy available for noise generation (panels, chutes, fan ducts, machinery guards, ducting etc). Vibration isolation ensures movement is not transmitted to surfaces, which then radiate noise (fans, power presses, engines, pumps, guillotines, ventilation equipment etc).

iv) Acoustic Barriers/Enclosures

Barriers and enclosures can be applied in three ways :-

- enclose the machine (i.e. the noise source). This introduces a barrier to noise transmission (machinery, generators, compressors, pumps, engines, transformers, quiet work stations etc.). The employee should not enter the enclosure
- enclose the operator (i.e. the receiver of the noise). The comfort of the operator should be considered, and the enclosure should provide adequate ventilation and temperature control. If this is not practicable, it may be practicable to provide a noise refuge for use when the operator is not actually operating the machine. This may be of particular use where an operator moves around the plant
- fit silencers (mufflers) to exhaust systems (i.e. control a significant aspect of the noise source). These only work on noise sources where the rapid movement of air or gas is a factor (fans, blowers, compressed air, combustion noise, exhaust gases etc.). However, their effectiveness is limited to a fairly small frequency range, and the silencer must be selected following frequency analysis – tuned to the most annoying frequencies

If an enclosure is built, consideration should be given to the following:-

- absorbent linings should never be made of flammable materials. If liquid fuels, cutting oils, solvents or other flammable liquids are present, it may be preferable not to use sound-absorbent lining but to construct the enclosure from a material with increased sound-insulating properties. If water sprays are used, the internal lining should be water-resistant, and in dusty environments, the lining surfaces should be regularly cleaned
- doors and removable panels must have efficient seals
- enclosures should be ventilated to discharge heat generated by machinery. If forced ventilation is used, consideration must be given to the noise generated by the fans, blowers etc
- windows – large windows are generally not needed, although vision windows may be required to check processes. If small, windows may be constructed of single sections of shatterproof plate glass or plastic. Larger areas may need to be double-glazed
- other apertures, such as cable holes, leads etc should be led through oversized holes and then packed with sound-resistant and vibration-decoupling grommets or glands.

Key Terms

"A" weighting – a frequency weighting devised to attempt to take into account the fact that human response to sound is not equally sensitive to all frequencies ; it consists of an electronic filter in a sound level meter, which attempts to build in this variability into the indicated noise level reading so that it will correlate, approximately, with human response. It is expressed as dB(A).

Continuous equivalent noise level, L_{Aeq} – of a time-varying noise – the steady noise level (usually in dB(A)) which, over the period of time under consideration, contains the same amount of (A-weighted) sound energy as the time-varying noise, over the same period of time.

Daily personal noise exposure – the level of daily personal noise exposure of an employee as ascertained in accordance with Schedule 1 Part 1 of the Control of Noise at Work Regulations 2005, taking account of the level of noise and duration of exposure, covering all noise.

Enforcing authority – Health and Safety Executive, or Local Authority, as determined by the Health and Safety (Enforcing Authority) Regulations 1998.

Exposure limit value – means the level of daily or weekly personal noise exposure or of peak sound pressure which must not be exceeded.

Lower exposure action value – means the lower of two levels of daily or weekly personal noise exposure or of peak sound pressure which, if reached or exceeded, require specified action to be taken to reduce risk.

Music and entertainment sectors – this is taken to mean all workplaces where live music is played or recorded music is played in a restaurant, bar, public house, discotheque or nightclub, or alongside live music or a live dramatic or dance performance.

Noise – any audible unwanted sound.

Peak sound pressure – means the maximum sound pressure to which an employee is exposed.

Risk assessment – the assessment of risk in terms of exposure to noise.

Sound level meter – an instrument for measuring sound pressure levels.

Upper exposure action value – means the higher of the two levels of daily or weekly personal noise exposure or of peak sound pressure set out in the Control of Noise at Work Regulations 2005, which, if reached or exceeded require specified action to be taken to reduce risk.

Weekly personal noise exposure – this means the level of weekly personal noise exposure as ascertained in accordance with Schedule 1 Part 2 of the Control of Noise at Work Regulation 2005, taking into account the level of noise and the duration of exposure and covers all noise.

Working day – means a daily working period, irrespective of the time of day when it begins or ends, and of whether it begins or ends on the same calendar day.

References and further reading

Controlling Noise at work The Control of Noise at Work Regulations, 2005. Guidance on Regulations L108 HSE Books

Worried about your hearing?

Protect your hearing or lose it, HSE Guidance for employees INDG 363, also available online

http://www.hse.gov.uk/pubns/indg363.pdf

Management of Health and Safety at Work Regulations (1999)

https://www.hse.gov.uk/pubns/hsc13.pdf

A number of documents exist in relation to the exposure of noise at work and useful sources of information may be found at :-

Health and Safety Executive - http://www.hse.gov.uk/noise

Institute of Acoustics - http://www.ioa.org.uk

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