

# Noise exposure in the balance: Managing occupational and leisure risks to hearing health

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## **When Workplace Risks are also Leisure Risks**

Health and safety risks that are present in both occupational and home/leisure environments can pose difficulties for health and safety professionals when determining risk mitigation responsibilities. Where work is defined as the time spent in paid employment (usually at a specified location), risks or costs associated with activities undertaken on “work time”, are thought to be the responsibility of the employer. Leisure, defined as time free from work commitments, is under the control of the individual, and associated risks may be considered the individual’s responsibility.

Such simplistic distinctions generally guide the way workplace regulations are developed and applied, and shape the way we think about workplace safety and risk management. They work well when discussing discrete risks where health impacts may result from a specific event isolated in time (e.g. fractures, head injuries) with obvious resultant responsibilities. However for risks that pose a continuous or additive threat to health, such as noise exposure, the story may not be so clear, and methods of apportioning responsibility require deeper examination. The aim of this paper is to look more closely how responsibility is often defined (explicitly or implicitly) in the way regulations are interpreted and implemented. It focuses on noise exposure as an example, but the underlying reasoning has relevance to other additive threats that exist in workplace and leisure environments. In particular, it provides an example from which to examine the likely unintended consequences resulting from assumptions underpinning existing approaches to workplace risk-management strategies, specifically noise reduction.

## **Hearing Health and Noise Exposure Guidelines**

The effect of noise on hearing is well recognised. Excess exposure results in irreversible damage to the hearing system with related difficulties in perceiving and processing speech and other sounds. The problem is not insignificant, nor is it inevitable. Despite its preventable status, hearing loss as the result of excessive noise exposure continues to be a significant problem. Estimates of prevalence

vary, although a much-cited Australian population-based study reported 37% of participants over the age of 15 years showing hearing results indicating potential noise induced damage.[1] In general, noise exposure is chronic in nature with cumulative impact only noticeable after the passing of time. For many people, a significant source of excessive noise was (and likely continues to be) occupational in nature. Australian research has found that over 40% of workers reported exposure to loud noise in their workplaces,[2] and that approximately 12% of workers' hearing is at risk from excessive noise exposure[3].

The risk posed in work environments by excessive noise has been widely acknowledged (nationally and internationally) and standards/regulations have been developed specifying "safe" levels of exposure. Whilst it is acknowledged that even "acceptable" level regulatory values are not entirely free of risk – the fact is that such values remain the focus for many noise reduction activities. Regulations vary between (and sometimes within) countries, but all seek to provide employers and employees with clear information about the acceptability of different levels of workplace noise. For noisy workplaces, they can also provide a measureable guideline as to when workplace noise exposure is considered high enough to warrant the introduction of preventative measures such as hearing conservation programmes.

In Australia, for example, workplace guidelines dictate that employers must keep individuals' exposure below an average daily (8hr) exposure of 85dB  $L_{Aeq}$ . For the purposes of this paper we will define this amount of exposure as 1 acceptable daily exposure (ADE) (based on the work of Williams, Beach, & Gilliver).[4] The dB scale is exponential and an increase of 3dB effectively doubles exposure, subsequently requiring a halving of the acceptable exposure time (based on the equal energy principle). Thus an average exposure of 88dB over 8 hours is equivalent to 2ADE, while an exposure of 82dB over 8 hours would be equivalent to 0.5 ADE (or 85dB for 4 hours). Using this terminology, an acceptable weekly exposure (AWE) can also be defined, with any weekly exposure under 1 AWE (i.e., 5 ADEs) considered to carry an acceptable level of risk. The use of ADE/AWEs

allows exposure levels to be represented on a linear scale, providing opportunities to compare and add multiple exposures in a relatively straightforward way. The latter purpose is of immense benefit when discussing individuals' noise exposure patterns with them, particularly when they may come from multiple sources.[5]

### **How should Employers Manage Contributions from Leisure Exposures?**

A growing area of concern for many hearing conservation professionals is employees' exposure to noise outside the workplace. A number of leisure activities have been identified as sufficiently noisy to potentially pose a threat to hearing, and participation rates suggest that a small but significant proportion of individuals are at risk from their leisure noise exposure.[6-8] Further, leisure noise exposure such as that from nightclubs or music events poses a specific difficulty – namely that the source of the exposure in many cases is a welcome one, deemed pleasurable by those participating.

So, what do we do when the hazard we are trying to protect against at work not only exists outside work, but may be a significant and active part of people's lives – one that they seek out? Is all our hard work in the workplace “failing” if the same people go out and voluntarily expose themselves to high levels of noise during their leisure? What can be done if best efforts in the workplace are being undermined by leisure exposure – and should workplaces be protecting themselves against being unfairly blamed for damage to employees' hearing?

These questions can be particularly pertinent in situations where hearing damage as a result of noise is seen as a workplace disease/injury – with associated responsibilities (direct or indirect) for the costs of rehabilitation. The hearing system does not discriminate between damage from occupational or leisure noise exposure –which makes it possible that some organisations may feel vulnerable that they could be held accountable for their employee's leisure exposure along with any occupational exposure.

The quantifiable nature of noise exposure makes it possible (at least in theory if not always in practice) to attempt to calculate the relative contributions of noise and leisure noise to overall exposure. Occupational health and safety practitioners can use these types of calculations for workplace exposures when developing and evaluating hearing conservation programs at work. Workers can use known, quantifiable, safe levels of noise (recognised through noise regulations) to determine when and where noise reduction efforts should be concentrated. By measuring the noise exposure of different activities or work stations, employers are in a good position to identify and address work areas or roles that result in unsafe levels of exposure, and make changes to protect workers. Knowledge of leisure noise levels makes it possible for employers and researcher to also look at patterns of overall noise exposure to estimate the population at risk and groups or activities that may be considered particularly “risky”.

On a group level, such information can be highly valuable for developing and directing appropriate prevention messages/support. On an individual level, workplaces can attempt to quantify the amount of noise exposure individuals receive, and calculate the different contribution from work and leisure activities. This approach attempts to continue the theme of separating organisational and individual responsibilities for work versus leisure time – with workplaces wishing to be responsible only for the proportion of noise exposure received “on their watch”.

In reality, these types of calculations aren’t easy. Difficulties exist in obtaining accurate estimates of individuals’ work and leisure noise exposure sources - particularly historically. Individuals need to be able (and willing) to recall all relevant information about their participation in noisy activities. It is then necessary that this participation information can be linked with noise calculations (e.g. dB levels). Beyond such pragmatic concerns however, are the additional questions regarding how relative responsibility would or should be assigned (for individuals and workplaces) in the event that any such calculations were possible.

## Assigning Responsibility for Risk Management – Case Studies

Consider the following hypothetical examples of individual workplace and leisure noise estimates in relation to noise exposure and resulting AWEs. As an exercise, we ask that you participate by classifying the noise reduction requirements for each case study outlined below as either A, B, C, or D (using the responsibility matrix in table 1 below), where 1 AWE is considered an acceptable weekly dose of noise.

Insert Table 1 about here

Insert Figure 1 about here

It would be unsurprising if many classified the above scenarios with responses such as: 1 =A; 2 = C; 3=A, 4=D. But what are the real consequences of these patterns of exposure and responsibility assignment? The outcome D in itself presents a special case as it implies a shared responsibility, which in turn raises questions. How is the proportional nature of that shared responsibility determined? If Larry's employer can reduce the noise environment so that Larry receives only 0.9 AWE, has the employer done enough to fulfil their responsibility? Is Larry subsequently responsible for cutting back his leisure noise exposure from 0.5 to under 0.1 (i.e., by 80% or more) to remain "safe"?

Consider another case. What if Samantha and Serena were in fact the same person? She works in the office most of the time but has moderate exposure from her visits to work sites to supervise construction. In her leisure time she also receives a moderate level of noise exposure. Neither work nor leisure activities alone (each equivalent to 0.7AWE) are sufficient for hearing conservationists to be concerned about the need for noise reduction in and of themselves. Combined however, these exposures reach 1.4 AWE – a potentially risky level. How do we apportion the responsibility for exposure in this case? Why should a workplace be responsible for exposure that occurs outside of its jurisdiction? Conversely, is it fair for the individual to be expected to curtail their non-work activities

because their workplace exposure places them in a position that gives them a head-start on reaching the recommended acceptable threshold?

### **Re-thinking the Implications of Noise Regulations**

Answering these questions is not straightforward, and the issues raised are not necessarily new or confined to the field of noise reduction. For example, many people may be exposed to ultraviolet sunlight both at work and in leisure time; cigarette smoke (although perhaps on a decreasing scale) can also provide people with different individual and workplace exposures. However, the preventative efforts for these types of risks define acceptable levels of exposure at (or close to) a level of zero exposure. That is, any and all workplace exposure is classified as potentially risky, requiring preventative efforts.

Noise provides a somewhat unusual exposure case because there is a level deemed to be “acceptable”, one considerably higher than zero exposure. Workplace programs are implemented on the basis of keeping occupational noise exposure below the relevant regulatory guideline (e.g. an AWE of 1). The question becomes: Is this really an appropriate use of noise-risk knowledge? Or could it be that focussing on the safety of noise exposure based on regulatory values in a workplaces is potentially hampering the real spirit of hearing conservation messages overall?

Current regulations leave little room to consider non-occupational noise exposures, forcing a potential struggle between competing interests and responsibilities when they occur. Further, the potential for exposure calculations to be used to allocate proportional responsibility (for employers and employees) further complicates matters.

For the foreseeable future, many people will continue to have multiple noise exposures. However we would argue that a significant problem exists when workplace regulations, and their implementation, start from an assumption that leisure exposure is negligible and/or irrelevant to the workplace exposures. Individuals will always have a responsibility to look out for their own health –

but should an individual's workplace exposure impact adversely on participation in activities that would, on their own, otherwise be defined as safe?

It is not (yet) standard/formal practice to try to calculate such relative proportions of exposure for purposes of prevention or subsequent compensation, although it is occasionally attempted in some jurisdictions. Regardless, we suggest that related assumptions already have their place in these kinds of calculations. In effect the regulations start from an assumption that it is up to the workplace to maintain weekly noise exposure levels at or under 1 AWE, and that individuals will maintain their non-occupational exposure at or close to 0 AWE. Workplace regulations effectively allow employers to "use up" the entire safe dose of noise on their employee's behalf.

This is also played out in the way that guidelines are used to determine if noise exposure in the workplace is sufficiently high to require preventative steps, and/or make employees eligible for compensation. If a workplace is not considered "noisy" in its own right there is no onus on the employer to take steps to reduce exposure – regardless of whether the noise levels are putting some individuals at risk overall. Any decisions that rule individuals in moderately noisy environments as ineligible for workplace compensation, also fail to appropriately note that workplace noise may have significantly contributed to their hearing loss.

A related example that this viewpoint is already implicitly applied is the conduct of exit interviews that include a hearing test with the purpose of minimising organisational responsibility for any subsequently diagnosed damage. But what happens in cases where the exposure at work (whilst insufficient on its own to cause damage) left the individual more vulnerable than otherwise to damage from otherwise safe leisure exposures? Such classifications only serve to make individuals solely responsible for both their work and their leisure exposures.

## **Conclusion**



Leisure exposure is currently seen as outside the scope of interest for workplaces –but there is a case to argue that workplaces should acknowledge any exposures that may reasonably be expected to raise individual risk, and take action. In the case of noise exposure, this may mean tailoring noise conservation campaigns to take into account employees' personal exposure outside work. For example, identifying that employees with high leisure exposures may be more in need of noise reduction support at work, or providing PPE to individuals that is appropriate for work *and* leisure activities. It may also mean looking more carefully at lifespan exposures to ensure that any occupational noise is not unduly raising an individual's likelihood of subsequent hearing damage.

Of course, this all leads to another question that may need to be addressed. Are current workplace regulations really appropriate if they assume higher efforts on the part of individuals to maintain low levels of leisure exposure? Perhaps a stronger effort should be made to use the information resulting from research into leisure exposures to re-examine the appropriateness of workplace regulations. Specifically a focus needs to be ensuring that the majority of employees (not just the quiet ones!) are protected.

## References

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Table 1: Responsibility Matrix

		Should this workplace be taking steps to reduce this individual's noise exposure?	
		No	Yes
Should this individual be taking steps to reduce their leisure noise exposure?	No	<b>A</b>	<b>B</b>
	Yes	<b>C</b>	<b>D</b>

1. Samantha	<ul style="list-style-type: none"><li>• Works as an architect in an office, AWE =0.03</li><li>• Attends live gigs on weekends, AWE=0.6</li></ul>
2. Darrin	<ul style="list-style-type: none"><li>• Works in marketing, attends functions, AWE=0.2</li><li>• Plays in a brass band, AWE 1.2</li></ul>
3. Serena	<ul style="list-style-type: none"><li>• Work visits to construction sites, AWE=0.7</li><li>• Plays video games at leisure, 0.1 AWE</li></ul>
4. Larry	<ul style="list-style-type: none"><li>• Works as a club manager, AWE 1.1</li><li>• Races dirtbikes on weekends, AWE 0.5</li></ul>

Figure 1. Case Studies: Noise exposure snapshots