

Occupational Noise Surveys – Making a Difference

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ABSTRACT

Occupational noise survey reports should provide the first step towards reducing exposure but often fail to initiate change. Engineering noise controls may be given only a cursory examination or, more commonly, noise control recommendations are not focused on the equipment and activities that result in excessive noise exposure. Consequently there is no persuasive argument for implementing noise control and this can lead to over-reliance on hearing protection. This paper outlines an approach to compiling occupational noise survey reports that is more likely to achieve success in reducing noise exposure for workers. This approach relies on answering three fundamental questions: Who is exposed? What is causing the exposure? What can be done to reduce the exposure?

INTRODUCTION

Part 1 of AS/NZS 1269 describes the measurement and analysis techniques for assessing noise in the workplace. It also provides examples of proformas for reporting the results of noise assessments. However, it does not provide guidance on how to write a noise report in a way that is most likely to initiate positive changes in the workplace.

Workplace managers are unlikely to commit to potentially costly noise reduction initiatives unless it is clear that they will actually be effective, i.e. they will actually reduce noise exposure. Therefore, an effective noise survey report should provide compelling evidence to support the case for noise reduction. Part 2 of AS/NZS 1269 provides valuable advice on development of an evidence-based noise control plan and should be considered when preparing occupational noise survey reports.

RANKING OF NOISE PROBLEMS

Consider the example exposure evaluation provided in AS/NZS 1269.1. This example describes a worker exposed to the following noise hazards:

Table 1. Noise hazards

Noise hazard	Measured noise level, $L_{Aeq,T}$ dB(A)
Planer	102
Circular saw	98
Hammering	92
Power drill	89

Based on this information alone, it may seem appropriate to concentrate any noise mitigation efforts on the planer since it is the noisiest item. However, noise levels alone do not allow noise reduction efforts to be prioritized. The fundamental objective of noise reduction should be to reduce daily noise exposure. Therefore, an understanding of how the worker interacts with these hazards and consideration of the exposure duration is required. The example in AS/NZS 1269.1 provides the following information:

Table 2. Noise exposure details

Noise hazard	Measured noise level, L_{Aeq,T_i} dB(A)	Duration of exposure, T_i h
Planer	102	0.5
Circular saw	98	4.0
Hammering	92	2.0
Power drill	89	2.5

With this additional information the partial noise exposure for each hazard can be determined using:

$$E_{A,T_i} = T \times 10^{(L_{Aeq,T_i}/10)} \times 4 \times 10^{-10} \quad (1)$$

where E_{A,T_i} is partial exposure in Pa²h.

Table 3. Partial exposure evaluation

Noise hazard	Measured noise level, L_{Aeq,T_i} dB(A)	Duration of exposure, T_i h	Partial Exposure, E_{A,T_i} Pa ² h
Planer	102	0.5	3.17
Circular saw	98	4.0	10.1
Hammering	92	2.0	1.27
Power drill	89	2.5	0.79

The worker's total daily exposure, $E_{A,T}$, is calculated by summing these partial exposures: $E_{A,T} = 15.3$ Pa²h.

Table 3 allows each noise hazard to be ranked by contribution to the worker's daily exposure:

Table 4. Ranking of noise hazards

Noise hazard	Noise hazard ranking
Circular saw	1
Planer	2
Hammering	3
Power drill	4

It now becomes evident that the partial exposure associated with the circular saw has a dominating influence on the worker's overall daily exposure. Therefore, the most effective way to reduce overall daily exposure must be to reduce the partial exposure from the circular saw. Starting at the top

of the hierarchy of controls, if the hazard could be eliminated the worker's overall daily exposure would reduce from 15.3 Pa²h to 5.2 Pa²h. This represents a 66% reduction in sound energy received by the worker. If elimination were not feasible, but engineering controls could be used to reduce the noise level of the saw by 5 dB to 93 dB(A), then the worker's daily exposure would reduce to 8.4 Pa²h; a 45% reduction.

However, if efforts were focused on the noisiest item, the planer, then even if this hazard were eliminated the worker's daily exposure would only reduce to 12.2 Pa²h (20% reduction). Reducing the noise level of the planer by 5 dB to 97 dB(A) would reduce the worker's exposure by only 14% to 13.2 Pa²h.

Even elimination of the planer, drill and hammer from the worker's daily activities would only reduce the worker's overall daily exposure by 34% to 10.1 Pa²h. So in this example, elimination of all hazards except for the dominating circular saw is less effective than a modest reduction in noise levels from the saw.

It is clear, then, that we must start from the top of the ranked list of noise hazards and work down in order to achieve the most effective reduction in exposure.

EXPOSURE REDUCTION STRATEGIES

The example above demonstrates the importance of prioritizing noise controls in order to reduce exposure. However, not all scenarios are so simple. In many workplaces there are multiple noise hazards and multiple workers with varied work patterns that expose them differently to the various noise sources. In such cases it is still important to prioritize noise control efforts. However this prioritization must now be considered in the context of the workplace's strategy for exposure reduction.

Exposure reduction strategies include:

- 1) reducing exposure for those people at greatest risk (ie those with the highest noise exposures);
- 2) reducing the cumulative exposure for the entire workforce; and
- 3) reducing the number of people at risk irrespective of the magnitude of their exposure (i.e. bringing as many people as possible below the exposure standard).

In the first case, the approach described above for a single worker can be applied to the occupations with the highest exposures. In the second case it is necessary to evaluate the effect that each hazard has on the cumulative exposure of the workforce by summing the partial exposures to each hazard for all workers. In the third case, it is necessary to determine which hazards contribute to the exposure of the greatest number of people.

THE NOISE SURVEY REPORT

An effective noise survey report should initiate a process of exposure reduction. This can only happen if the recommendations can clearly demonstrate to the employer that the suggested noise controls will affect exposure. It is vital, therefore, that a noise assessor not only quantifies noise hazards but investigates the activities that workers undertake which expose them to the hazards. The noise assessor must also be aware of any exposure reduction strategy implemented in the workplace.

A typical report will contain a description of the workplace being surveyed, noise measurement results including exposure evaluations, and a summary of actions or recommendations. These sections of the report must be connected. The description of the workplace must include a description of the activities that expose people to noise. The results should clearly show how these activities contribute to exposure, and the recommendations must focus on actions that would demonstrably reduce personnel noise exposure.

Consider the following recommendations, which could conceivably be included in a noise survey report for the worker described in the previous examples.

Table 5. Example recommendations

<i>Item no</i>	<i>Recommendation</i>
1	Use noise barriers to protect bystanders from exposure
2	Apply absorbent materials to reduce reverberant noise in the workplace
3	Provide class 4 hearing protectors to the worker

At first glance these may seem like reasonable recommendations. However, closer examination shows that implementation of the recommendations would not produce the desired result.

In order to judge the efficacy of item 1, an understanding of how the various noise hazards contribute to the exposure of any bystanders would be needed. Also, there is the potential that introducing noise barriers may introduce sound reflections that would increase the noise levels received by the worker.

In order to judge the efficacy of item 2, an understanding of how the noise levels received by the worker are influenced by reverberant sound in the workshop is required. For the particular hazards in the example, it is likely that direct sound from the noise hazard dominates over reverberant sound. Sound absorption would not reduce the direct sound received by the worker and as a result the recommendation would not be effective.

Provision of hearing protection (item 3) is clearly required in situations where the worker's exposure exceeds the relevant exposure standard.

Of the three example recommendations above, items 1 and 2 cannot be justified based on the details provided in the worker's exposure evaluation. Therefore, the most likely recommendation to be implemented is item 3, provision of hearing protection. However, noise exposure is evaluated without taking into account any protection that may be provided by hearing protectors. Therefore, although provision of hearing protection may be necessary, it does not reduce exposure (only the risk from that exposure). Thus, while there may potentially be some merit in the recommendations, none demonstrably reduces the exposure of the worker.

Contrast the recommendations in table 5 with the following recommendation:

“Replace the circular saw blade with a low noise saw blade providing a 5 dB reduction in noise levels.”

This is an effective recommendation because it can readily be shown to provide a 45% reduction in the worker's daily exposure.

CONCLUSIONS

In order to write noise assessment reports that initiate positive change in the work place it is necessary to:

- A. Find out what people do and find out what noise hazards they encounter when doing what they do. Include this information in the description of the workplace section of the noise assessment report.
- B. Determine how these hazards contribute to daily exposures. Prioritise them based on their contribution to daily exposures and take into account any existing workplace exposure reduction strategy. Include this analysis in the results section of the report.
- C. Provide noise reduction recommendations for the top ranked noise hazards that can be demonstrated to reduce noise exposure.

REFERENCES

- Standards Australia and Standards New Zealand 2005, *Occupational noise management - part 1: measurement and assessment of noise immission and exposure*, AS/NZS 1269-1:2005, Standards Australia and Standards New Zealand, Homebush and Wellington.
- Standards Australia and Standards New Zealand 2005, *Occupational noise management - part 2: noise control management*, AS/NZS 1269-1:2005, Standards Australia and Standards New Zealand, Homebush and Wellington.