IMPROVED NOISE MANAGEMENT FOR THE BUILDING INDUSTRY

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ABSTRACT: There is great potential for excessive noise exposure for workers in the general building industry as not only can the individual tools and equipment produce high noise levels but also the worker is usually close to the source of the noise. Effective noise management procedures are required to minimise the loss of hearing of workers on building sites. This paper reports on a project sponsored by WorkCover NSW for which the aims included identification of a baseline of current noise exposure levels on a representative range of building sites, assessment of the extent of the implementation of noise management codes on building sites and suggestions for strategies for improved implementation.

1. INTRODUCTION

Exposure to high levels of noise is common in the building industry as almost all the activities are noise producing. The statistics from around Australia for the building industry show that the high number of compensation claims for hearing loss, approximately 7%, is exceeded only by claims for sprains, strains, fractures, wounds etc [1]. The types of noises that construction workers are exposed to include those which are almost constant in sound level, such as from pumping, those which are intermittent such as grinding and sawing etc and those which comprise many short impact noises, such as from hammering, compacting etc. The worker is usually close to the machine or to the tool which is the source of the noise so the potential for excessive noise exposure is great. The nature of employment in the industry is quite different from most other industries. Only a small proportion of the workers are employed by a construction company and most of the workers on the sites are self-employed contractors or sub-contractors.

The general consensus is that there is an ongoing problem with the implementation of occupational health and safety (OHS) in general on building sites. Even basic safety precautions, such as the wearing of hard hats and safety boots, are sometimes overlooked in order to get the job completed quickly. Protection of hearing is low on the priority list particularly as hearing loss does not become noticeable in the immediate short term. Australian National and State Codes of Practice for Noise Management [2,3] and Standards [4] have goals to minimise occupational noise-induced hearing loss and tinnitus and include sections on Noise Control Planning, Engineering Noise Control Measures, Administrative Noise Control Measures, Personal Hearing Protectors, Training and Education, Noise Assessments and Audiometric Testing. It is obvious from the high number of compensation claims that these codes are not being adequately implemented on building sites. The aims of this project, sponsored by WorkCover NSW, included identification of a baseline of current noise exposure levels on a representative range of building sites, assessment of the extent of the implementation of noise management codes on building sites and recommendations for strategies for improved implementation. The full and condensed versions of this study report are available from the internet [5,6].

2. BACKGROUND

A literature search showed that only limited information was available on the noise exposure levels for the range of tasks on building sites. Many of the reports dealing with noise on building sites were focussed on the control of environmental noise for the nearby residents and not on the control of the noise for the workers on the sites.

One study from Australia was that by Milhinch and Dineen [7] which investigated workers views on noise and risk on a building site in Victoria. This study, funded by Incolink, the consortium responsible for workers compensation payments, sought to assess the noise hazards and the views of the individual workers on a major building site. Dosimeters were used to determine the noise exposures for a range of workers. Many of the workers were found to be exposed to high occupational noise levels but also there was great variability in the exposures for different workers in the one trade. For example, the noise exposure for plumbers ranged from 81 to 99 dB(A). The views of the individual workers indicated that the workers understood the importance of hearing but that they were more concerned about safety on site than hearing damage. In the second stage of this study, Dineen et al [8] investigated the efficacy of a hearing education program "Knock out Noise Injury" in modifying the beliefs of workers and their use of hearing protectors. The workers responded well to the education program which was based on examples of situations on building sites. They reported significant changes in their beliefs about hearing hazards. Those supplied with custom-made uniform-attenuation earplugs reported using the plugs more frequently than those provided with conventional hearing protection.

Another Australian study was that by Savage [9] who undertook a comprehensive investigation of noise exposures for workers on three high-rise building sites in Brisbane. The dosimeter data from 238 workers from 20 occupational groups showed 8-hour noise exposures greater than 85 dB(A)

for all groups except the electricians and the plumbers, but only those work groups likely to be exposed to excessive noise were chosen for the study. Savage also found that the peak levels for seven of the 20 groups exceeded the limit with the highest being 146 dB(lin) for a formworker. These results must be considered with some caution as there is the possibility that the dosimeter data may include peak levels which were not directly related to the work.

3. NOISE EXPOSURE LEVELS

The limits for an unacceptable risk of hearing loss are specified in the various State and Territory legislation. Over recent years these have been changed to conform to the standard for occupational noise in the National Standard [2]. Thus in Australia the exposure to noise in the workplace should not exceed an 8 hour noise level equivalent of 85 dB(A) or a peak level of more than 140 dB(C). At the time the measurements were commenced this latter criterion was expressed in terms of dB(lin).

The determination of the 8 hour noise level equivalent is based on both the noise level and time duration for each activity during the day. For a structured working environment where the activities are regular and predictable, the determination is reasonably straightforward for either a daily assessment or for an average over a week. For a building site where the activities can vary greatly throughout the day and from one day to another, the determination is far more complex.

The first step was to obtain data on the noise levels for a range of activities and on a range of building sites. Four different types of building sites were identified: large city sites; large rural sites; small city sites; and small rural sites. Many tools and procedures are common to all sites but others are only used on larger sites. Visiting a range of sites also enabled assessment of any differences in work practices and in implementation of noise management procedures. Details of the sites and the noise levels for a range of activities are listed in the full report [5] and these are compared with and supplemented by published information from Australia and overseas.

The aim of the project was not to determine the noise exposure for any particular worker but to assess the potential noise exposure for the industry as a whole, and for particular parts within the industry. The goal was to identify and rank those areas of the industry that are at greatest risk of excessive noise exposure. This meant the data had to be consolidated while still being meaningful.

As described above the noise exposure is based on the noise level and the time, so both these aspects needed to be consolidated. Different tools are used for different time periods and even the same tool may be used for different periods for different tasks. Observations and discussions with those in the industry led to the use of three categories for the typical usage times:

long	2 hours or more per day
medium	30 mins to 2 hours per day
short	less than 30 minutes per day

The noise level for any particular task can vary with the actual job and with the workplace. A convenient method for categorising the noise levels was to use overlapping 10 dB noise level ranges with an additional category of less than 85 dB(A).

Table 1. Ranking of tasks by noise exposure based on the types of tasks

Range for $L_{Aeq,8h}$	Tasks	Comment
100 to 110 dB(A)	Work involving cutting into concrete, such as wall chasing.	On large sites this could be done by one person for most of the day with the only breaks being the time necessary to move and set up at the next wall.
95 to 105 dB(A)	Work involving cutting and chipping concrete, such as use of Kanga Hammer	On large sites it is quite common for this task to be undertaken by one person for most of the day with the only breaks being the time necessary to move and set up at the next location.
90 to 100 dB(A)	Work involving cutting and sawing timber Work involving a considerable amount of metal grinding	Even on the smaller sites it is possible for one person to spend most of the day using power tools for cutting and sawing of timber. Metal grinding is usually for lesser time periods.
85 to 95 dB(A)	Work involving cutting of concrete blocks and bricks Work involving mechanical rollers	The operator could spend about half the day actually cutting with the remainder of the day spent measuring, stacking etc. These can operate continuously throughout the day.
80 to 90 dB(A)	Use of most power tools Work such as driving excavators	While many of the noise levels for individual tasks may be high, the time duration for these tasks can be quite short and the noise exposure depends on the number of times they are repeated during the day.
less than 85 dB(A)	Most general labouring work	Main risk is the proximity of other noisy activities.

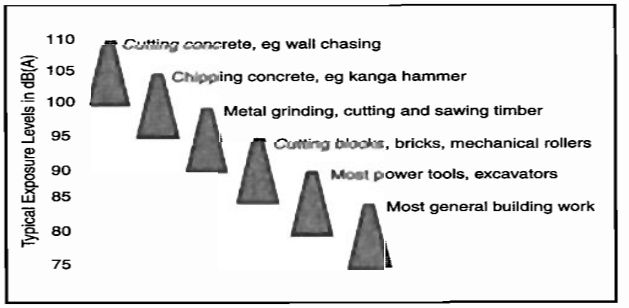

Figure 1. Ranking of tasks by noise exposure based on the types of tasks. The triangular shape indicates that the number exposed to the higher end of each range is less than the number at the lower end of the range

Comparing the types of activities, the noise level category and the time period category a ranking of the tasks in terms of noise exposure was attempted. The ranking which eventuated from this analysis is shown in Table 1 and summarised in Figure 1. It is important to note that this ranking does not allow for the additional contribution to the noise exposure from other activities in the vicinity of the worker.

In order to gain an indication of the noise exposure for various trades, they were categorised into four main groups commonly used in the industry, namely:

Plant includes excavation, bobcats, backhoes etc

Materials Handling includes rigging, dogging, fork lifts, cranes, scaffolding etc

Construction includes concreting, bricklaying, external carpentry etc

Fitout and Finish includes plastering, tiling, painting, internal carpentry, etc

The noise exposures were estimated from the typical tasks undertaken by the various trades and are shown in Fig 2. This type of analysis shows that a large proportion of the workers on building sites are likely to have noise exposures greater than 85 dB(A) with a smaller proportion having much higher exposures. This emphasises that there is clearly a need for effective noise management programs for building sites.

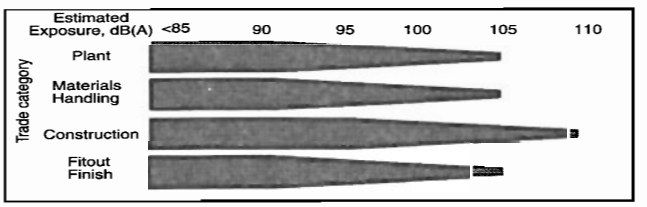

Figure 2. Estimation of noise exposure for different trades. About 50% of the workers in each trade would be within the rectangular area

The other important criterion for assessment of excessive noise is that the peak noise level should not exceed 140 dB(C). In this study the use of explosive tools was the only event found to produce levels above 140 dB. The level depended on the charge used and for the most commonly used size the measured value of 155 dB agrees well with the 150 dB measured by Savage [9] for a ramset gun. The hammering for the erection of the scaffolding was next in ranking of impulsive noise with peak levels in the range 130-140 dB.

4. IMPLEMENTATION OF THE CODE OF PRACTICE

There is a similarity between the codes of practice for noise management for each of the States as they rely on the same basic principles. Following is a summary of the assessment of the extent of implementation of each part of the code on the building sites visited in NSW. This assessment was based on discussions with the various representatives from the industry and site inspections.

Noise control planning – the essence of this section of the code is that a written noise control policy and program of action should be developed in consultation with employees and employee representatives. There was no evidence that planning for noise control was considered except where there were environmental noise constraints.

Engineering noise control measures – an important objective of the code is the requirement to minimise noise exposure by engineering noise control measures. Essentially this involves two options: noise control at the source and control of the spread of noise. The only evidence noted was the use of low noise blades in brick saws, of placement of generator away from the workers on the site perimeter and improved design of the cabs of earth moving equipment.

Administrative noise control measures – these measures generally involve job rotation to reduce the time of exposure to the higher noise levels. There was no evidence that these measures were considered.

Personal hearing protectors – the code states that personal hearing protectors should only be regarded as an interim measure while the control of noise by other measures is being implemented. On most building sites this appears to be the only approach to the management of noise exposure. While the protectors were available they were usually not personally issued nor was their use enforced. Effective use of personal hearing protectors also requires adequate consideration of a number of aspects including indication signs, selections of suitable protectors, inspection, maintenance, clean storage and instructions for use. Commonly these aspects were not catered for.

Training and education – this should be considered to be an integral part of a preventive strategy. General OHS training usually includes some reference to use of hearing protectors but this had clearly not been adequate.

Noise assessment – this is required in all workplaces where it is considered that the noise levels may be excessive and the reports on assessments should be available to management, worker representatives and relevant authorities. There was no evidence that such occupational noise assessments had been undertaken.

Audiometric testing – audiometric testing alone does little to reduce on- going hearing loss but a comprehensive noise management program should include comparison of audiograms and investigations when hearing loss is

identified. While ad hoc audiometric testing was available for the employees of the larger companies or by the Union, there was no evidence of regular audiometric testing programs.

5. STRATEGIES FOR IMPROVED IMPLEMENTATION

Government agencies faced with the task of improving noise management programs need to consider the actions which will be most effective for that particular industry while conforming to the government policies. For example, regular inspections and substantial fines for infringements may be effective but may not be in accordance with current policies. There are two main considerations within agencies regarding implementing policies and procedures:

priority in taking action — ie high, medium and low priority
time to implement strategy — ie short , medium or long time

Based on the findings from this particular study, over 24 strategies were recommended with almost half being in the highest priority suggesting immediate action. It was estimated that some strategies would only need a few months for implementation while others may take around two years. The issues addressed by the strategies for the main areas of the code of practice are summarised below.

Noise control planning

A major limitation in adequate planning to minimise noise exposure is a lack of knowledge of the noise levels for plant and noise exposures for various activities. Legislation in some States includes requirements for the provision of noise level data for plant and equipment. Enforcement is needed to ensure that suppliers do in fact provide this noise level information as part of the technical data.

Many of the codes of practice for various trades, trade courses and OHS inductions include general advice about noise levels but this is not sufficient for adequate noise control planning. Information is available to update and revise these documents to assist adequate noise control planning.

The implementation of work methods statements which are being required for construction projects should encourage planning but they need to be checked for adequate inclusion of noise management.

Engineering noise control measures

Australia imports most of the items of plant and equipment used on building sites. Thus the focus should be on encouraging the purchase or hire of those items with lower noise levels. The provision of noise data in specifications and promotional material is essential to encourage selections of items with low noise output.

Promotional material from the suppliers and the government agencies should include examples of the use of noise enclosures and simple screening as well as the importance of maintaining these noise control elements.

Administrative noise control measures, job rotation etc

The encouragement of multiskilling in the building industry effectively leads to job rotation which has great benefits in many aspects of OHS including opportunities for reducing noise exposure. There does need to be an effective plan and appropriate record keeping to achieve the reduction in noise exposure. Again promotional material and codes of practice can be used to encourage this aspect of noise management.

Personal hearing protectors

Undoubtedly these will continue to be the major form of noise management on building sites. Therefore high priority should be given to this part of the noise management program.

Unlike other protective equipment, such as hard hats and safety boots, hearing protectors are only required at specific locations on building sites so the placement of warning signs at the entry of the site is not appropriate and they are usually ignored. The warning signs should be placed at the location of the noisy activity as well as on the individual items of equipment for which typical use could lead to excessive noise exposure.

Hearing protectors should be part of the personal safety issue to each worker and not just available from a common store area. They should be readily available so that the worker does not have to travel across the site for issue of disposable plugs.

All aspects of selection, use and care of the protectors should be an important part of the OHS induction training. Building sites can be particularly dirty environments so special attention to cleanliness and care is essential. Promotional material for the various trades should emphasise that other methods of noise control should be considered. When personal protectors are required they must be selected for personal issue in consultation with the employee to ensure comfort and suitability and to encourage consistent and correct use.

Training and education

Training programs need to be targeted specifically at the building industry. A well presented training package which caters for the differing backgrounds of those working in the industry should include examples specific to the building sites. An effective mechanism would require visual presentation such as a video. Such a training package has been developed by Comet Training in NSW and was reviewed in a recent issue of this journal [10].

Regular items submitted to trade journals, newsletters and the general public media should increase the awareness of and maintain the emphasis on noise management.

Noise assessment

Government inspectors and union officers should be encouraged to undertake noise measurements as part of their visits to sites. These assessments should be primarily used for guidance to those on site for identifying potential excessive noise levels. Quantifying the noise levels would increase the general knowledge on typical noise levels and provide the opportunity to reinforce the education and training programs.

Audiometric testing

While it is not a control measure itself, regular audiometric testing is an important tool for a noise management program. In particular it can be used to identify early loss of hearing and to reinforce the other aspects of the noise management program. For many jurisdictions in Australia such testing cannot be enforced nor made a pre-requisite for continued

employment or insurance cover. Under these circumstances encouragement may be provided with an incentive, such as a reduced insurance premium for regular testing.

6. CONCLUSIONS

This study has shown that the noise exposure for many on building sites can be excessive. Those trades involved with cutting and chipping concrete experience the higher noise exposures. The high number of claims for compensation for hearing loss indicates ineffective noise management on building sites. The study of practices on a range of sites showed that the implementation of codes of practice for noise management is still far from satisfactory.

Strategies for encouraging improved implementation of the requirements of the codes of practice for noise management have been suggested. There is a need for greater emphasis on education and training which is focussed for those in the building industry. Also promotion of the noise levels for different tools should encourage selection of low noise items. Personal hearing protectors are likely to continue to be the main method of noise management and greater attention should be given to selection, care and maintenance.

It is rewarding to note that the sponsors of this project, WorkCover NSW, accepted that actions were required to improve the implementation of noise management on construction sites. It was identified as a key issue and a group of inspectors have received additional training in effective noise management as it could be applied to construction sites. As well as focussing on noise issues during their inspections these officers participated in a series of seminars held by WorkCover for the industry. It is early days yet but there is optimism that improved implementation of noise management will be eventually achieved.

Around the time this project was being undertaken, there was some relevant action in the USA driven by the Labourers' Health and Safety Fund of North America. The Construction Noise Control Partnership has been established. This is a coalition of unions, contractor associations, insurance companies, universities and government agencies dedicated to promoting quieter construction sites. Updates on progress with a best practice guide for noise control can be found on the website [11]. This working group has also been involved with the United States Occupational Safety and Health Administration, OSHA, seeking rulemaking to revise the construction noise standards. This revision is aimed at including a hearing conservation component for the construction industry that provides a similar level of protection to that afforded to workers in general industry. The proposal [12] was released in August 2002 for a 4 month public comment period.

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