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A SAFE SOUND ENVIRONMENT - NOISE AS A CONTRIBUTORY FACTOR IN INDUSTRIAL ACCIDENTS

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Introduction

The Introduction to the 1972 Code of Practice for reducing the exposure of employed persons to Noise states that "By hindering communications and by masking warning signals noise may be the cause of accidents." As implied by the title of the 1981 Consultative Document "Protection of Hearing at Work", the proposed Regulations will not encompass effects of noise other than damage to hearing. It might therefore be wondered whether research over the past decade has established that there are no grounds for concern regarding a relationship between noise and industrial accidents.

There exists a wide body of anecdotal evidence implicating noise as the cause of accidents (1). However, these claims have not been adequately documented, and thus in each case the link between the noise and the accident is questionable. This paper considers the possible causal mechanisms for such a relationship, and reviews the scientific evidence available to test the assertion that noise can cause accidents.

Possible Causal Mechanisms

The masking effect of noise may impair the perception of verbal communications, warning shouts, warning sounds such as sirens and bells, and the sounds of machinery which may warn of impending danger. As a consequence of exposure to noise, the temporary and permanent elevations of the threshold of hearing could similarly degrade the perception of such sounds. Under some circumstances, the wearing of personal hearing protection could also impair the perception of warning sounds (2), so that this method of limiting noise exposure must be employed with considerable care. In general, the failure to perceive such sounds would not be the essential cause of an accident, although their perception could have played an important role in preventing it. A more general effect of noise on people's level of arousal could give rise to accidents by causing inattention, carelessness and mistakes; however, there is no direct evidence of this result of changes in human performance.

Accident Statistics and Noise

Five studies which have attempted to relate the occurrence of accidents to noise levels are summarised in Table 1. The two experimental methods employed are comparisons between groups exposed to different noise levels (Studies 1, 2 and 4), and within group longitudinal studies for periods before and after the introduction of hearing conservation programmes (Studies 3 and 5).

All of the studies use reported accidental injuries as their prime measure, and Studies 1 and 4 also provide some assessment of the severity of these injuries. Whilst these statistics are often accessible, they provide a relatively small

Study	Industrial Activity	Accidents (range of rates per employee per annum)	Noise	Study period (years)	Population (No. employees involved)	Statistical tests
1. Kerr (1950)	Various in Radio Corp. of America	All reported accidents (0-0.23) and severity rating	Mean noise level (unspecified)	1	53 departments in 1 plant (12,060)	Correlations across depts. $p < 0.05$
2. Cohen (1973)	Metal work and electronics	Accidental injuries requiring visit to the dispensary (low noise group 0.08, high noise group 1.8)	High and low noise groups (specified)	5	2 groups in each of 2 plants (1034)	Unspecified test(s)
3. Cohen (1976)	Metal work as in 2.	As for 2. (High noise group: 1st period 1.9 2nd period 1.2)	As for 2, the 2nd period with a hearing cons. prog.	2 + 2	2 groups in 1 plant (866)	Wilcoxon Test $p < 0.01$
4. Jessel (1977)	All documented occupational activities	Accidents involving "interruption to work" (0.03-0.17); plus 2 more serious categories	Inferred from occupational activity	2	French national statistics (13.6 million)	None
5. Schmidt et al (1982)	Cotton yarn plant	All injuries reported to supervisors (continuous service group: 1st period 0.4 2nd period 0.2)	92-96 dB(A), the 2nd period with a hearing cons. prog.	5 + 5	Group with continuous service (47) and others (103 average)	Wilcoxon Test $p < 0.001$

Table 1. Summary of studies of accident statistics and noise.

number of events when the population under study for a few years is approximately 1000 or less. Relatively small studies of this scale would benefit considerably from the collection of data on the larger categories of all minor injuries and near-miss incidents.

The early study by Kerr (1950) has the advantage of a large experimental population. However, no details of the noise levels or the accident rates are reported (3). This study found that of the 40 variables investigated, noise showed the second highest correlation with the rate of accidents across the 53 departments concerned.

More recently, Cohen (1973) found significant differences in the accident rates between high and low noise areas in two separate plants (4). For instance, in the plant manufacturing boilers, 35% of the group exposed to levels of 95 dB(A) or above had 15 or more injuries over the 5 year study period, but only 5% of the group exposed to less than 80 dB(A) had a similar injury rate. Similarly, the study of French industry statistics by Jessel (1977) reported that "noisy activities are twice, or even three or four times, more dangerous than quiet ones" (5).

The most important criticism of all three of these studies is that the various groups are not matched for all factors other than noise, so that it cannot be concluded that noise was the causative factor in any differences observed. For example, in the data of Jessel it is unlikely that (the inferred) noise was the primary cause of accident rates five times as large in the construction industry as in clothing manufacture. Although the study of Cohen roughly matched the two groups for age and work experience, it was not possible to match the work tasks, work environments or other pre-disposing factors amongst the employees.

In an attempt to overcome the confounding by uncontrolled variables such as these, Cohen (1976) continued his study to investigate the influence of a hearing conservation programme involving the use of personal hearing protection (6). In the high noise group there was a significant reduction in the number of injuries in equal periods before and after the introduction of the programme, the median injury rate per employee per annum having decreased from 1.9 to 1.2. By contrast, there was no corresponding change in the injury rate of the low noise group, so it could be argued by the authors that the reduction in accidents in the high noise group was not due to plant-wide improvements in general morale or awareness of safety. However, this is not entirely valid since the hearing conservation programme was applied differently to the two groups, and thus could have resulted in a differential effect.

Similar evidence of a significant reduction in the rate of injuries after the introduction of a hearing conservation programme was obtained by Schmidt et al (1980). However, this study did not include a control group over the same time period, or any information on the actual use of the personal hearing protectors provided (7).Unlike the studies of Cohen, it did include analyses of two groups; those who remained in continuous employment throughout the period of the study and those others who were only employed for part of that period. The similar result for both groups of a reduced injury rate after the introduction of the hearing conservation programme indicates that self-selection out of the job was not important to the overall conclusion in this case.

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Conclusion

Whilst none of the studies individually establishes a link between noise and accidents, their combined evidence provides a strong suggestion of such an association. The deficiencies of the studies reviewed have indicated a need for considerable care in the design and execution of future research.

A new approach to the investigation of this topic would be a longitudinal study to cover periods before and after reductions in noise levels achieved by noise control which did not otherwise change the work environment or the work task. This would provide a more reliable means of noise reduction for the purposes of this research than can be achieved by the introduction of personal hearing protection. In addition, detailed investigations of accidents in noisy and quiet areas could help to determine the role of noise in causing accidents.

Reference

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