Pergamon

Ann occup Hyg, Vol 38 No 5, pp 649–662, 1994
Elsevier Science Ltd
British Occupational Hygiene Society
Printed in Great Britain
0003–4878/94 $7.00+0.00

0003–4878(94)E0044–Z

MANAGEMENT AND MOTIVATIONAL FACTORS IN THE CONTROL OF NOISE INDUCED HEARING LOSS (NIHL)

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(*Received* 10 *August* 1993 *and in final form* 6 *January* 1994)

Abstract—This paper describes a study investigating attitudes to noise as an occupational hazard. The objectives of the study were to understand the individual and organizational factors which affect attitudes towards noise induced hearing loss (NIHL) and to relate these to the standards of hearing conservation achieved in industry as demonstrated by compliance with the Noise at Work Regulations.

The study comprised a survey of 48 organizations across Britain, and a more detailed examination of 10 of these as case studies. Methods used included desk research, audits of hearing conservation programmes, questionnaires and interviews.

Whilst there is widespread acceptance that industrial noise is a hazard, it is one that is frequently taken for granted, and measures to deal with it are often inadequate. Most organizations place the onus on the workforce to protect their own hearing through the use of personal hearing protectors Workers reactions to noise tended however to be passive and much of the time neither managers nor the workforce are concious of the noise hazard. This is the case even where some managers are committed to good industrial housekeeping and accident prevention.

An effective hearing conservation programme requires three management attributes: leadership from senior management, the ability of middle management (particularly in production and engineering) to put hearing conservation measures into practice, and specialist technical knowledge of noise and of the legislation The study points to the need for more education and motivation of senior managers as the priority in improving standards of hearing conservation and noise control.

NOISE IN INDUSTRY

NOISE in industry is widespread even though there are indications from the Industrial Injuries Scheme that cases of occupational deafness have peaked (HSC, 1992). NIHL (noise induced hearing loss) and other ear disorders constitute the second most frequent category in the Prescribed Diseases Statistics in the U.K. with 1041 assessed claims in 1990–1991 (EMPLOYMENT GAZETTE, 1992). In addition, in the 1990 Labour Force Survey 100 000 respondents reported that they suffered from deafness or other ear disorders 'caused' by work, the second in the league table of such complaints. In 1987 the Health and Safety Executive estimated that in the U.K. about 17 million people were exposed to 85 dB(A) or over in their normal work (HSE, 1987), a level equivalent to the First Action Level given in the Noise at Work Regulations which were introduced on 1 January 1990.

THIS STUDY

This study investigated the management, organizational and psychological factors which are involved in the limitation of NIHL in the workplace. The overall purpose

was to improve the understanding of why people in industry fail to take action to avoid NIHL.

The study assessed the degree of compliance with the Noise at Work Regulations and evaluated other actions taken to reduce NIHL in a range of organizations. At work, both management and the workforce have responsibilities with regard to health and safety but the degree to which these are fulfilled is affected by the attitudes of both groups and by the organizational arrangements which are in place to promote action. The study therefore examined attitudes to noise at work among managers and the workforce and explored the organizational factors which affected the level of actions taken to reduce the risk of NIHL.

RESEARCH DESIGN

The study had two elements.

(1) *A survey of* 48 *organizations*

This was carried out to obtain quantitative information about the attitudes held and actions taken regarding hearing conservation programmes and compliance with the Noise at Work Regulations in a broad range of organizations.

The 48 organizations covered a variety of small and large, public and private sector organizations: heavy and light engineering, 'high tech' organizations, agriculture, foundries, metal fabrication, manufacturing, wool and textiles, oil and petrochemical industries, and local authorities. In each case a proportion of the workforce was regularly exposed to noise levels greater than 85 dB(A), indicating the likely potential for individuals to have daily exposures exceeding the first action level of the Noise at Work Regulations. Whilst the sample was not statistically representative of British workplaces as a whole, the consistency of the findings across the organizations surveyed suggests that the findings are reliable and that general conclusions can be drawn.

(2) *Detailed case studies of* 10 *organizations chosen from the original* 48

These case studies explored in greater depth the processes involved in the responses of the organizations and individuals.

Participant organizations were selected to include some which scored well in the audit in the first part of the study and some which scored badly. Organizations were also chosen to include those whose employees showed high and low levels of awareness of the risks of NIHL.

The case study organizations came from the following industry sectors: Utilities; Foundries; Textiles ($\times 2$); Chemicals ($\times 2$); Quarrying; Ceramics; and Heavy Engineering ($\times 2$).

The workforces at the sites ranged from 150 employees to over 1000. The number of employees exposed to daily noise doses at or above 85 dB(A) ranged from 30 to several hundred.

METHODS

Both stages of the research involved noise audits undertaken by professional occupational hygienists from Thomson-MTS Ltd and human factors studies by

psychologists from Building Use Studies Ltd. The audits assessed the organization's hearing conservation programme, focusing on issues such as:

—the noise measurements and documentation that were available;
—training related to noise exposure and hearing conservation;
—other measures taken by the organization, including engineering changes and audiometry.

During the case studies, noise dosimetry was carried out in organizations where exposure data was not available for certain areas.

In the survey of 48 organizations, a questionnaire was used to measure workers' knowledge and attitudes relating to noise hazards. A total of 1514 questionnaires were completed by people who reported that they worked in a noisy environment. This represents a response rate of at least 69%. The exact response rate is unknown because it is possible that some of the questionnaires issued to an organization were not distributed to the workforce.

Attitudinal information was gathered in the case studies by means of interviews. These were conducted with senior managers, middle managers, personnel with managerial responsibility for health and safety, shop floor supervisors and the workforce.

FINDINGS

The findings from the survey of 48 organizations and from the case studies will be described together, since the latter complement and build on the former. The findings are presented in three main sections:

—1.0. Compliance with the Noise at Work Regulations.
—2.0. Management and workforce attitudes to noise at work.
—3.0. Organizational and procedural issues.

The division of findings between the three sections is not entirely mutually exclusive. For example, some attitudinal information is included, where appropriate, in sub-sections which relate to regulatory compliance.

1.0. COMPLIANCE WITH THE NOISE AT WORK REGULATIONS

The audit assessed organizations' compliance with each aspect of the Noise at Work Regulations. Ratings were calculated for individual aspects of the Regulations such as noise assessments, display of signs for areas, training, engineering control and personal hearing protection. In addition an overall audit score for each workplace was calculated. More details are contained in the full report of this study (HSE, 1993). The distribution across the sample of these overall audit scores, expressed as percentages, is shown in Fig. 1.

This shows that over half of the organizations had an audit score of 60% or less. These organizations had addressed inadequately, or had failed to address at all, major sections of the Regulations. The score obtained in the audit relates directly to the compliance effort required so that even organizations scoring between 60 and 80% still

need to undertake a significant amount of work in certain areas if they are to comply with the Noise at Work Regulations.

Each aspect of the Regulations is discussed separately.

1.1. *Noise assessment*

Of the 48 organizations in the survey, 40% had carried out assessments which were adequate to comply with the legislation and which included written conclusions and recommendations. Overall, documentation of assessments was poor, frequently lacking information such as the work activity and machine loading at the time measurements were taken. All 10 of the case study organizations had carried out some noise measurements and nine claimed that they had carried out a noise assessment as required by the Regulations. In only four of these was the assessment considered to have met the requirements of the Approved Code of Practice. In the other six organizations there was a misconception that their noise measurements constituted an assessment. Six of the 10 organizations had carried out some personal dosimetry measurements. However, even when extensive records of these measurements were held, the data were not always used to highlight areas where engineering controls should be considered.

A few workers said that seeing noise measurements being taken had raised their consciousness about the hearing conservation programme, and reinforced their training. However, this process was not supported by giving workers' feedback about the noise levels and the consequent risk in their work area. This lack of information

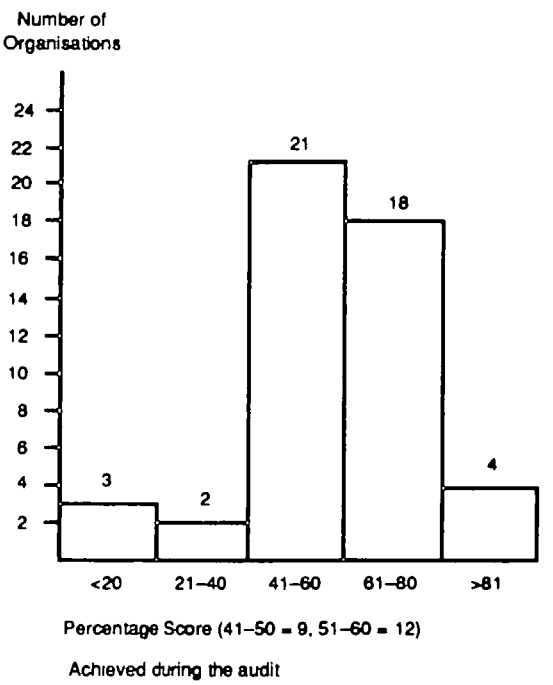

FIG 1. Frequency distribution of overall noise audit scores obtained by 48 individual organizations.

about the noise risk meant that workers felt they had little control over the noise situation and helped engender passivity and a lack of initiative in protecting themselves.

1.2. *Engineering control of noise*

Of the 48 organizations in the survey 60% had introduced some engineering control of noise before the Regulations came into force, but most had not developed these measures as far as they might.

There was a presumption among managers in the case studies that engineering controls are expensive, but there was little evidence of their having thoroughly investigated suitable control measures. There was often a reluctance to segregate or enclose noisy equipment, in some cases, because of shortage of space, but in others because segregation or enclosures might impede the efficient flow of work.

In spite of this, some engineering controls, involving varying degrees of capital expenditure, had been introduced in all but one of the case study organizations, mainly by in-house engineering departments. The degree of success was variable but some organizations showed ingenuity in reducing sound levels. Many of those interviewed commented that better information about suitable sound insulating materials and designs was needed.

There were some complaints from the workforce that engineering measures to control noise levels made their work more difficult. These complaints generally concerned difficulty in gaining access to soundproofed machinery for cleaning and maintenance, lack of working space due to soundproofing, and overheating and poor ventilation in soundproofed cabs and noise havens.

1.3. *Identification of hearing protection zones*

Among the 48 organizations 45 (94%) had identified hearing protection zones using appropriate warning signs, and in addition 35 (73%) had placed signs on tools and equipment, but in several instances the number and location of signs could have been improved.

A number of problems were encountered regarding hearing protection zones:

—scepticism that hearing damage will occur if you stand on one side of a line marked on the floor, but not if you stand on the other, with a resulting loss in credibility of the whole notion of hearing protection;

—difficulty in identifying hearing-protection areas based on dose levels rather than actual noise levels, especially near machinery which is operated only intermittently;

—confusion amongst the workforce about the organization's current rules on hearing protection; and

—a failure to understand the need for warning signs on individual noise sources such as powered hand tools.

1.4. *Hearing protection—provision and selection*

In all 48 of the organizations participating in the survey hearing protection was available, but only 50% of them gave the workforce instructions in how to use and fit protection. Fewer gave elementary maintenance instructions and only 25% took the noise frequency analysis and levels into account when selecting hearing protectors.

Nine of the 10 case study organizations provided a choice of hearing protector types. In the tenth, they were unable to offer earplugs because of the risk of chemical

contamination. There was a wide range of personal preferences in workers' selection of hearing protectors. Given that workers find some protectors more comfortable than others it is important to give them choice, since other research (HENDERSON and SALVI, 1982; TENGLING and LUNDIN, 1982) has shown that workers failed to wear high attenuation protectors in the recommended manner if they were uncomfortable.

There were a number of common complaints about hearing protectors:
—they cause discomfort (including sweating with ear muffs);
—they cause disorientation and loss of balance;
—they cause ear infections;
—they cut you off from social contact with others;
—if the wearer needs to hear whether or not machinery is running correctly they make working impossible;
—they make team work difficult, whether communication is direct or via radio;
—ear muffs cannot be worn with welder's helmets;
—ear muffs are awkward when working in confined spaces;
—hearing protectors are dangerous as the wearer cannot hear traffic or warnings.

Whilst none of these complaints should be ignored, it is noteworthy that there were considerably fewer complaints in those organizations where wearing hearing protectors had become established as the norm. This indicates that workers can become accustomed to wearing hearing protection in spite of initial intolerance.

1.5. *Recording of issue of hearing protection*

In several of the case studies a record was kept of the issue of non-disposable hearing protectors and, in at least one organization, of the first issue of disposable protection. The reasons for keeping records of protectors issued were not understood by some workforces who viewed this as a sign of management "keeping a check on them". Another concern among workers was that when a record of issue is kept, lost or damaged hearing protectors would not be replaced or that the worker would be reprimanded or even charged for replacements. In contrast to such beliefs, management in all the case studies indicated that replacement protection was readily available and was issued without any restrictions. It thus appears that, in some cases, workers perceived restrictions on the availability of protection which did not exist. These findings indicate the need for better management–worker communication.

1.6. *Maintenance of hearing protectors*

None of the case study organizations had a clearly-specified and well-understood maintenance programme for reusable hearing protection, though two were introducing an inspection programme in response to the Noise at Work Regulations. Most of the workforces were not aware of any need for maintenance of ear muffs and some workers interviewed were ignorant of the procedure for having their hearing protectors checked or replaced, which raises questions about the effectiveness of their training. In most of the workplaces where oil or dust were widespread non-disposable protectors were typically kept in an unhygienic state.

1.7. *Enforcement of wearing of hearing protection*

Twenty-one of the 48 organizations (44%) reported trying to enforce the use of hearing protection by means of disciplinary procedures. Among the individual

respondents in the workforces, 43% said they 'always' wear hearing protectors in noisy areas, 41% claimed they 'sometimes' wear them and 16% stated that they 'never' wear them. The most common reason for failing to wear protection was discomfort, which was mentioned by 36% of questionnaire respondents.

Comparison of the case study organizations suggests that a number of factors are involved in persuading a high proportion of the workforce to wear hearing protectors. These include:

—consistently high noise levels;
—organization norms of wearing hearing protection (including wearing by managers and supervisors);
—supervisors who enforce the wearing of hearing protectors;
—adequate training of the workforce about the noise hazard;
—having a parent suffering from noise induced hearing loss, or having a severe hearing problem oneself.

Enforcing the use of hearing protection by temporary contract staff was found to be relatively more difficult than with permanent staff.

In one or more of the case study organizations a number of factors which might be thought important in achieving high levels of hearing protection wearing were found *not* to be decisive. These factors include:

—whether other safety equipment is normally worn;
—whether there are people in the workplace who suffer from NIHL.

There was no evidence of people being ridiculed or teased for wearing hearing protectors, even in workplaces where they were not normally worn. This does not mean that there were no peer pressures at all but that they operate in a subtle manner. The workforce will informally develop shared beliefs about the use and value of hearing protection which creates a non-specific pressure to conform. It was found though that anyone dissenting from the norm would not be ridiculed.

None of the organizations with disciplinary procedures for failure to wear hearing protection had resorted to any penalty harsher than verbal warnings. It was generally considered by management that the best way to promote the use of hearing protection was persuasion. This is in contrast to the view of a considerable number of workers: 41% of those responding to the questionnaire were in favour of rules to enforce its use.

Overall, the most important factor in establishing a norm of hearing protection wearing appeared to be clear rules from senior management, supported by good shop-floor supervision, maintained over time.

1.8. *Training*

In the survey, many workers pointed to the need for more education and training: 15% of all criticisms of hearing conservation programmes mentioned a lack of education, training and information. Only 26% of organizations had a specific noise training programme, less than half of which involved plans for repeat or refresher training and in only 16% of organizations was training for senior management planned. One problem which emerged in the case studies was the difficulty of making refresher training interesting. Eight of the 10 case studies included training on noise as part of their induction programme, although in two this was little more than a passing mention that there were noisy areas on site. In these two cases managers tended to be dismissive of the value of training, and argued that it was too expensive. The

inadequacy of training and supervision was graphically illustrated by the degree of ignorance found amongst workers about the correct wearing of hearing protectors: abuses included wearing a personal stereo underneath or even instead of ear muffs, using cotton wool instead of ear plugs, only pushing ear plugs half way in becausee they felt more comfortable like that, and cutting ear plugs in half because they felt too big.

Those workforces which had undergone training were consistently more rigorous in their use of hearing protection than those who had not. However, the data suggested that this was not merely a function of the knowledge gained changing attitudes and behaviour, but also, and perhaps more importantly, a function of indirect effects: the information given making management rules comprehensible and realistic and, more generally, the provision of training convincing the workforce that management considered noise to be a serious issue. For managers, professional training in industrial management which includes a component about noise appeared to achieve positive attitudes and behaviour towards noise problems.

1.9. *Audiometry*

Audiometry is not mandatory under the Noise at Work Regulations. However, it was included in the audit as a further indicator of management response to hearing conservation. The interviews revealed that it was a valuable tool in raising workers' awareness of the potential damage to their hearing and in encouraging workers to protect themselves. Such benefits of audiometry are documented elsewhere; for example, KARMY and MARTIN (1982) found regular hearing tests are probably the most effective way of maintaining the use of hearing protectors. In the survey of 48 organizations, 22% carried out some audiometry, although there was often little analysis of the audiometric data and workers were frequently ill-informed about the availability of and reasons for audiometry. Many complained that the results of their own tests were inadequately explained. Again, this provoked feelings of lack of involvement and passivity regarding the noise problem.

In many cases, audiometry was routinely conducted only for new workers; it was rarely explained why this had been done, which tended to engender the belief among the workforce that audiometry was carried out only to enable the organization to protect itself from claims for compensation. This directly contrasted with the view of some managers who felt that audiometry would encourage workers to make compensation claims or to demand noise reduction measures.

There were mixed views amongst senior management about the usefulness of audiometry. Some saw it as a good educational device, raising people's consciousness about noise, others mistrusted it and felt that the results were open to 'influence' by the person having the test.

2.0. ATTITUDES TO NOISE AT WORK

The overall picture which emerged from the study was one of patchy compliance with the Noise at Work Regulations, with only a small proportion of organizations demonstrating a positive and comprehensive approach to the control of noise and hearing conservation. The study showed that noise at work is widely taken for granted. People adapt to it and many consider that it is inevitable in their type of work. Workers

pointed out that hearing damage is neither shocking nor life-threatening, it is delayed in onset and it does not involve time off work. It is therefore not generally perceived as serious, either by management or the workforce, nor are they conscious of it much of the time.

2.1. *Management attitudes*

Management views on the Noise at Work Regulations. In half of the case study organizations, managers (other than health and safety specialists) had little knowledge of the Regulations. In three cases, managers specifically sought advice from the research team on matters relating to implementation. Generally, managers expressed no strong views about the Regulations and tended to accept them as reasonable, although there was some concern that other organizations or even other countries in the European Community will gain an unfair business advantage by failing to comply with them.

Four main criticisms of the Noise at Work Regulations emerged:

(1) organizations encounter difficulty in managing the distinction between the First [85 dB(A)] and Second [90 dB(A)] Action Levels;
(2) there are problems in conforming with the Regulations when noise levels are intermittent and only occasionally exceed the relevant Action Levels;
(3) the Noise at Work Regulations were introduced at the same time as other demanding legislation, making it difficult to devote sufficient resources to them all; and
(4) it was felt that the Noise at Work Regulations focus unfairly on industrial noise, when leisure noise may well have as great a potential for damage as noise at work.

Noise policies, purchasing policies and budgets. This aspect of organizational arrangements was investigated in case studies as an indicator of management attitudes. Four of the 10 organizations had a written policy on noise and a strong, co-ordinated scheme for hearing conservation. These organizations performed consistently better than the others in most aspects of hearing conservation. The policies acted as a foundation and catalyst to the organizations' activities but did not determine them: policies not supported by management commitment were less effective.

The other six case studies had no policy and little or no available documentation about noise control measures which had been introduced or which were planned for the future. The absence of a co-ordinated approach and of a written statement of policy meant that there was no standard by which the management or workforce could evaluate their organization's performance which resulted in *ad hoc* measures and a piece-meal approach. It is likely that documentation of the actions taken would, with little additional cost, have had the effect of demonstrating concern about noise and would have promoted more positive attitudes.

In the survey of 48 organizations, less than half had written guidance specifying maximum noise levels for new equipment being purchased. Eight of the case study organizations lacked equipment purchasing policies, but most gave examples of purchases where noise levels had been seriously considered. Managers made it clear though that performance or costs factors would usually predominate over considerations of noise.

None of the organizations had a specific, annual budget for noise-control measures, although health and safety budgets usually included provision for expenditure on hearing protectors. Depending on the scale of investment required for noise control measures, finance normally came out of engineering budgets and the measures would be considered on their merits relative to other engineering proposals.

Motivation behind management action. The case studies indicated that public relations concerns were likely to have the strongest bearing on management's approach to noise. A few of the organizations were trying to establish good public relations and they developed a sensitivity to health, safety and environmental issues to avoid bad publicity both in the long and in the short term. Two of these organizations were in the chemical industry, and management indicated that after major incidents such as the Flixborough disaster improvements in the chemical industry were not confined to the prevention of explosions, but that all aspects of health and safety management were treated with greater rigour. Thus, the higher health and safety standards were found to have been automatically applied to noise control and hearing protection even though these have a low public profile.

Among senior managers there were differing attitudes to cost control and productivity. One group held that productivity or quality of output could be improved in quieter, less stressful conditions, and felt that minimizing claims for compensation for hearing damage and fines for non-compliance with the Regulations were a sensible way to control their cost base, but most perceived the risk of prosecution to be low. Others argued that noise reduction measures slowed down the production and required large capital expenditure.

In most of the case studies, the organization's performance on hearing conservation directly matched the attitudes of senior management. Where senior managers had treated noise as an important issue for some time, the organization was controlling the risks effectively. In general, middle management in production functions tended to be reactive in their management role: they addressed the agenda set by senior management. However, an exception to this was found in one case study organization, in which a middle manager was trying to implement a hearing conservation programme in the face of indifference or hostility from most of the senior managers. He had however, received the production director's support since the Factory Inspector had criticized the organization's performance on health and safety generally.

Relationship between management attitudes to health and safety and hearing conservation. As noted above there was a group of case study organizations, motivated by public relations concerns, which took health and safety issues seriously. They developed a strategic management approach to deal with all aspects of health and safety, and so hearing conservation efforts were well organized and effectively implemented. In these organizations, performance on health and safety matters was an important component of people's work appraisal.

In another sub-set of the case study organizations management also professed to take health and safety seriously and the workers in these organizations confirmed this view. The managers maintained a high profile interest in housekeeping and 'hazard spotting' with daily site tours. However, this concern was independent of attitudes to

and actions about noise: senior managers neglected or were unaware of the noise problem. It was clear that steps to improve cleanliness, reduce accidents or win safety competitions did not necessarily have a positive influence on hearing conservation, rather it created a false impression among the workforce that health and safety was being effectively managed, which lowered the profile of noise risks.

Middle management was generally relaxed about their organizations' attitude to health and safety. They considered that everything would be done to alleviate a health and safety problem: the unwillingness to use disciplinary procedures to enforce the use of hearing protection and the unsatisfactory level of noise control measures taken in many organizations indicate that this positive attitude was seldom justified with respect to hearing conservation.

2.2. *Workforce attitudes*

Over half of the respondents considered that they were at risk of suffering from NIHL if they were to work in their current noise levels for 10 years: 54% believed that the noise levels in their workplace would definitely or probably damage their hearing but only 19% described themselves as 'very worried' that they might become hard of hearing. Many people put greater emphasis on other workplace risks, or on the possibility of unemployment, than on the possibility of going deaf. Where workers did express a view about workplace noise, this tended to focus on the immediate annoyance, stress and disturbance of concentration which it caused, rather than the long-term risk to hearing. Some suffered from headaches and the inability to sleep because of the noise and a number of others reported experiencing temporary threshold shift effects.

This lack of concern about the possibility of suffering NIHL is surprising considering the large number of people interviewed whose hearing had deteriorated. About one quarter of the workforce interviewed described themselves as suffering some sort of hearing loss. Most were passive about this, some regarding it as inevitable as one gets older.

Workers were more sceptical about their management's commitment to hearing conservation in organizations in which the staff responsible for implementing the noise policy were at a low level in the management structure. The findings of this study suggest that, although most workers interviewed knew that noise can damage hearing, many do not act on this because:

—they have become accustomed to working in noise;
—there is no norm of wearing hearing protection in their area;
—they behave passively at work—they wait for instructions from management and management has not told them to wear hearing protection;
—they cannot discern any immediate effect of not wearing hearing protection;
—for a number of reasons, they dislike wearing hearing protectors.

The survey identified a widespread feeling that protecting workers' hearing is ultimately the responsibility of management. This feeling appeared to lead to workers relying on management to take the initiative. This is seen as one of the central findings of the research, since it suggests that resources should be directed towards convincing management rather than workers of the need to give more attention to hearing conservation.

3.0. ORGANIZATIONAL AND PROCEDURAL ISSUES

3.1. *Structure of health and safety management*

The results of the study indicate that in order to deal with the Noise at Work Regulations, a triumvirate of management attributes is needed: leadership from senior managers; clear allocation of relevant operational responsibilities among middle managers in production areas; and technical competence. Usually these are shared between two or three individuals. If any one of these three attributes is missing, compliance with the Noise at Work Regulations will be partial and perhaps ineffective. In the worst case study organizations, the people responsible for carrying out duties under the Noise at Work Regulations were not aware of the extent of their legal duties, and delegated *de facto* responsibility to a lower level manager who was usually ill-equipped to respond because of a lack of technical knowledge about noise or insufficient authority within the organization.

Eight of the organizations had some form of health and safety adviser, either on-site or off-site professional advisers, the latter sometimes supplemented by on-site non-professional personnel. The effectiveness of these health and safety advisers varied depending on their personal competence and commitment, their status, and the priority given by the organization to the noise hazard. Where there was a professional health and safety team on-site, noise issues were generally dealt with effectively, particularly regarding implementation of the hearing protection aspects of the Noise at Work Regulations. In contrast, in most of the case study organizations where there were no on-site, professional health and safety advisers, managers had little expertise in relation to noise and poor knowledge of the Noise at Work Regulations, even where the factory or site was part of a larger group with access to central health and safety personnel.

One exception to this was an organization which benefited from a new, energetic management team who had received professional industry-specific management training including a component on health and safety. This organization illustrates that professional, on-site health and safety advice is not essential to achieving good hearing conservation. One manager felt that the structure of health and safety management was less important than commitment to the issue, although he still felt that the structure was beneficial in that "recalcitrant people find themselves being brought into the company safety ethos".

3.2. *Organizational culture*

Organizational culture was recognized by progressive managers as an important factor in achieving high standards on health and safety issues. The two chemical organizations which had a positive and effective approach to the Noise at Work Regulations had a very strong organizational culture which emphasized individual responsibility and initiative, as well as having a marked emphasis on health and safety. Some of those interviewed commented how surprising the organizational culture had been initially, in comparison with other organizations. Much of the culture focused on a positive attitude to the workforce and their requests and suggestions.

It is worth noting that two of the other organizations which had a good hearing conservation programme, the quarry and the utility, had relatively new management teams who were making deliberate efforts to change the organizational culture. In the quarry, the need to set higher standards, and a more active and committed attitude to

the whole operation, including health and safety, was driven by the managers adopting a thorough, professional approach and being aware of the noise hazard as a result of their management training. They also had a heightened concern for the environment and for good public relations, in order to obtain planning permission to extend the quarry, and their rigour in managing this aspect of their operation encompassed their actions with regard to health and safety.

The benefits of linking concern for health and safety with concern for environmental issues was supported by another health and safety manager, who is attempting to change senior management's attitudes in his organization. He believed that the co-ordination of these areas of concern helps to develop a nucleus of activities and expertise, makes it more likely that high quality management personnel can be afforded, and thus, overall, can lead to more effective management of all the issues. Another of the organizations whose hearing conservation and safety record in the past had been poor was attempting to improve their entire approach to health and safety by means of a culture-change programme.

CONCLUSIONS

The majority of organizations participating in this study had addressed inadequately, or had failed to address at all, major sections of the Noise at Work Regulations. Although difficulties were found by all organizations in implementing parts of the Regulations, those committed to the process had found practical solutions.

Great reliance was placed in most organizations on the use of personal hearing protectors as the principal means of preventing NIHL, with managers often feeling that engineering noise control measures would be costly and difficult and that insufficient practical guidance and information was available. The emphasis on the use of hearing protectors tends to place the onus on the workforce to take action to limit NIHL. Workers reactions to noise tended however to be passive and frequently focused on the immediate annoyance, stress and disturbance of concentration which it caused, rather than the long-term risk to hearing. From the management perspective, despite the emphasis on the use of hearing protection, enforcing the wearing of protectors and appropriate training were often inadequate.

The study showed that noise at work is widely taken for granted both by managers and by the workforce. People adapt to it and many consider that it is inevitable in their type of work, so that it is not generally perceived as serious, either by management or the workforce, nor are they conscious of it much of the time, even where some managers are committed to good industrial housekeeping and accident prevention.

The most important factor governing an organization's achievements in hearing conservation was found to be senior management commitment. Middle management attitudes tended to follow senior management's priorities. Senior management commitment ensures that sufficient resources are available for hearing conservation measures; this in itself demonstrates to the workforce that the organization takes this issue seriously. The findings suggest that a triumvirate of management attributes are needed to ensure good compliance with the Noise at Work Regulations. These are: leadership from senior managers; clear allocation of relevant operational responsibilities to middle management in production areas; and technical competence. If hearing conservation is to be improved then senior management as well as the

workforce needs to be educated and motivated. Perhaps surprisingly this study indicates that the emphasis should be on generating senior management commitment, without which knowledge about noise hazards amongst the workforce will not necessarily result in good hearing conservation behaviour. Training is therefore important, not so much for the knowledge which it imparts but for the attitudes and cultural norms which it develops. This is true for managers and for the workforce. Those organizations which have responded most positively to the need for hearing conservation measures had good training practices and had developed strong organizational cultures with clear leadership, professional values and a co-ordinated strategic approach.

Acknowledgements—This report and the work it describes were funded by the Health and Safety Executive; however, its contents, including any opinions or conclusions expressed, are those of the authors alone and do not necessarily reflect HSE views or policy

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