

Atelier : Comment impliquer le personnel concerné ?

Participative strategy of risk management applied to the problems of noise at work

Jacques Malchaire

Université catholique de Louvain
Unité HYTR

Clos Chapelle-aux-Champs 3038

B-1200 Bruxelles

Belgique

E-mail : malchaire@hytr.ucl.ac.be

Summary

The paper proposes a strategy for progressively control as much as possible the noise exposure in industry. The procedure can, at the two first stages, be used by the workers and their management themselves to reduce some noises and improve the working situation by reviewing the work procedures, checking the machines and tools, reduce the number of people exposed... At later stages, when necessary, it calls in progressively the assistance of specialists and experts to identify more sophisticated solutions and organise personal protection and medical surveillance.

Résumé

Cet article propose une stratégie progressive de contrôle de l'exposition au bruit dans l'industrie. Cette procédure peut, dans ses deux premiers stades, être utilisée par les travailleurs et la direction pour réduire le bruit et améliorer les conditions de travail en analysant les procédures de travail, en contrôlant les machines et les outils, en réduisant le nombre de personnes exposées au bruit, etc. Aux stades les plus avancés, si nécessaire, cette procédure prévoit l'intervention de spécialistes et d'experts pour offrir des solutions plus sophistiquées et mettre en place un dispositif de protection personnelle et de surveillance médicale.



any books, papers, documents are describing the criteria for hearing conservation programmes (HCP) [1-7]. Unfortunately, many industries fail to take action to avoid noise induced hearing losses (NIHL). The reasons are multiple [8]: noise at work taken for granted and not perceived as a serious problem, lack of leadership, no clear allocation of operational responsibilities, lack of technical competence, presumption that control measures are expensive, over-reliance on contractors to provide hearing conservation programme (HCP) services [9].

A different approach is to develop and propose a simple method that can be understood and used by all companies whatever their size and their health and safety management, in order to, at least, become aware of the problem and bring some straightforward solutions. Occupational health specialists would be called in at later stages of the procedure, if and when needed, to assist finding more sophisticated solutions and organise personal protection and medical surveillance programmes.

A strategy in four stages is described hereunder. Its ambition is to make it possible to initiate and conduct a policy of prevention in any company of any size or type, based on the expertise available inside and outside this company.

The basic principles

This strategy is based on some fundamental principles that need to be underlined.

The qualifications available are complementary

Knowledge about what really occurs in the work situation is decreasing from the employee, who knows exactly what he does and lives everyday, to the expert, who, in a very limited time usually, collects only the information he needs for the specific problem for which he was called in.

On the other hand, qualification in health, safety, wellbeing increases in the opposite direction, from the employees, foremen, direction... who are often little aware of the risks they incur, to the expert very specialized in a single field.

It is thus logical to consider that the two sets of knowledge – about the work situation and about the principles of health, safety and wellbeing – are complementary. It remains to organize the cooperation in an interdisciplinary way between the workers, their local management, the occupational physicians, the OHS practitioners, the experts.

The workers must be the main actor of risk prevention and wellbeing at work

Insofar as the goal of an OHS intervention in the work environment is the maintenance or the improvement of the wellbeing of the employees, no relevant action can be taken without the knowledge of the work situation that only the employees hold. The employees must thus be the main actors - and not only the objects - of prevention and must be regarded as such by all the OHS practitioners or others.

All the problems are related

The employee 'lives' his work situation as a whole and not as a set of distinct and independent facts: he is 'being well' or not, he likes his job overall or not... In addition, all aspects of the work situation are interrelated. This is particularly true in the field of musculoskeletal disorders as most epidemiological studies demonstrated that they do not have a single cause but are linked to almost all aspects of the work situation [10]. A comprehensive approach is therefore required.

The small and medium-sized enterprises (SME)

In the western countries, less than 40% of the employees work in companies employing more than 250 people. Usually, in these large companies, a well trained OHS practitioner is present, competences are available, consultation bodies function rather well, problems are dealt with and the frequency and severity rates of accidents and occupational diseases are lower. The majority of the employees work in SME where the situation is much more variable. The methods must therefore be addressed in priority at these SME, by taking account of the limited means and competences that are there available.

The SOBANE strategy

The philosophy of the strategy is not specific to the problems of noise [11]. Strategies with similar objectives were developed and validated in the fields of heat stress [12, 13], hand arm vibration [14] musculoskeletal disorders [15], and other fields (safety, fire and explosion, work on VDUs, chemical and biological agents...: see the web site www.sobane.be).

It includes 4 stages whose characteristics are summarized in table 1.

At stage 1, Screening, all the aspects of the work situation are quickly reviewed and obvious solutions are implemented immediately. This stage is performed by the persons who are directly concerned and who know the working conditions of yesterday, today and tomorrow, that is the workers and their technical management. A guide is used, named Déparis (Dépistage participatif des risques, participative screening of the risks). This Déparis guide is short, simple to understand and to use and attractive. It is not time consuming in order to be used systematically as soon as a «problem» is suspected. It is then decided whether some risk factors need to be investigated more in detail in order to determine means to avoid them and make the work situation as comfortable as possible.

For these risk factors, **a stage 2, Observation**, is started by the same people: a meeting is generally organized to brainstorm on the problems and determine what can be done in the short term. Still, the procedure is simple and straightforward to review systematically more in depth, one by one, the aspects of the work situation directly or indirectly related to the noise exposure, trying to find for each of them the optimum condition. At the end, all the information is put together, reviewed as a whole and decisions are taken about preventive actions.

If these persons are not able to define satisfactory solutions or if, after implementation of the technical or organizational solutions identified at this stage, the problem remains, the assistance of an OHS practitioner (physician, nurse, ergonomist, hygienist, engineer...) becomes indispensable and a more detailed **stage 3, Analysis**, is performed on the problematic aspects, again to better determine where the problems are and how to avoid them.

When their qualifications or means are exceeded or when this **Analysis** does not still make it possible to finalize the solutions, the complementary assistance of an expert might be required for **a stage 4, Expertise**, oriented towards a very specific aspect of the working conditions, in order to single out final control solutions. These experts should have extensive qualifications and means not only to assess the specific risk, but to bring about the most cost-effective solutions. Often, however, their **Expertise** will be limited to this field. The proposed solutions must therefore be integrated in the whole context of the working conditions in order not to lead to other problems of a different nature.

Stage 1, Screening

The Déparis guide is intended to be used collectively, by the workers, their technical management and people from

	Stage 1 SCREENING	Stage 2 OBSERVATION	Stage 3 ANALYSIS	Stage 4 EXPERTISE
When ?	All cases	If problem	Difficult cases	Complex cases
How ?	Simple observations	Qualitative observations	Quantitative observations	Specialised techniques
Cost ?	Very low 10 minutes	Low 2 hours	Average 2 days	High 2 weeks
By whom ?	Workers and people of the company	Workers and people of the company	Workers and people of the company + Specialists	Workers and people of the company + Specialists + Experts
Expertise work ergonomics	Very high Low	High average	Average High	Low Very high

Table 1 : Characteristics of the 4 stages of the strategy

the maintenance, the purchase and/or the engineering department, when possible. The guide was prepared to consider, in a 2-h meeting, all the aspects of the working situations. Recommendations are made about who the coordinator should be and how to organize the meeting. The guide includes 18 tables (table 2) considering successively the following aspects:

Working areas

Work organization

Accidents

Electricity, and of fire

Commands and signals

Work material, tools, machines

Work postures

Efforts and handling operations

Lighting

Noise

Atmospheric hygiene

Thermal environments

Vibrations

Autonomy and responsibilities

Work content

Time constraints

Relationships personnel-hierarchy

Psychosocial environment

have encountered repetitively in their daily life. From this voice level, a rough estimation of the noise level and the severity of this particular situation are deduced.

The users are then invited to observe carefully each source and look for straightforward control measures. As these users are the workers themselves and their technical management,

it can be expected that they know in detail their equipment and can, more easily than a specialist, identify efficient control measures that will not interfere with the tasks. They do know in general what types of gears are used, what parts vibrate, what can be enclosed...

The document suggests a series of possible actions but mainly draws the attention on the different aspects to be considered. It mentions also solutions that cannot be implemented without the assistance of specialists: equilibration of parts, duct

silencers, absorbing materials ... These were included deliberately in order to help these users to recognize when

Table 2 gives the different aspects dealt with in the table related to the noise aspects.

Noise	
To be discussed	Who can do what and when ?
In the workshops - The ease to speak at a distance of 1 meter - Personal protective equipments (ear plugs, ear muffs...) available and used when necessary	
In the offices - No discomfort, nor lapse of concentration - Traffic, telephones, air conditioning, photocopiers, conversations...	
Location of the workstations - As far as possible from the noise sources	
Means of communication - The ambient noise is taken into account	
Noisy machines or installations - Well maintained, equipped with hood	
Holes, openings - In the walls between the premises, slots around doors	
Aspects to study more in details :	

Table 2: Table of the Déparis guide concerning the exposure to noise

Stage 2, Observation

Stage 2, **Observation**, concentrates on the identification of the noise sources. It starts by asking to make a drawing of the working area, with the exact location of the sources and the workers, in order to invite the partners to realize how they are working day after day and decide perhaps appropriate modifications. Then, for each workplace, it relies on the voice level that has to be exerted in order to be understood at a distance of 0.5 meter, to assess the severity of the «problem». This was chosen as it avoids the problem of measurements and corresponds to problems people might

they need this assistance and to call in these specialists with specific objectives.

The procedure ends up by inviting the users to determine who will do what and when and deciding whether a specialist must be called in to help perform a more detailed **Analysis**.

Stage 3, Analysis

Stage 3, **Analysis** grossly follows the same procedure, this time going in detail in the particular situations that were identified as unsatisfactory at the end of stage 2, **Observation**.

First, an attempt is made to assess the personal noise exposure level of the workers. A trained occupational health specialist is invited to determine the appropriate time and duration of the measurements, to control the validity of the measuring technique, to perform the measurements and estimate the exposure duration at each measured level, if different conditions exist.

The measurements are restricted to A-weighted noise levels. They should preferably be performed using a calibrated exposimeter recording, for instance, the equivalent noise level every 15 seconds. From the equivalent noise levels LAeq and exposure durations, it is recommended to compute for the different noise sources the partial personal noise exposure levels LPE_i, that is, the personal noise exposure level if all other noise exposures were insignificant. These partial LPE_i levels make it possible to determine what work sequences, what situations or what noise sources are the most responsible for the risk of discomfort or hearing impairment.

The total personal noise exposure level (LPE) is estimated as usual by the addition of the partial exposure levels.

The interpretation scale is more quantitative than in stage 2, **Observation**, from light discomfort, to a probability of 75% to suffer from a NIHL at the age of 55 years in case of an exposure to these conditions during 35 years.

Discomfort is linked not to the personal noise exposure level but rather to the equivalent level in the short term. The risk of hearing impairment on the contrary is in relation to the LPE.

The users are then invited to go through the list of possible solutions and identify what could be done to reduce the risk of discomfort or hearing impairment.

As in stage 2, **Observation**, they are invited to estimate what the situation might be if these solutions were implemented and to estimate the residual risk. If this risk is unacceptable, additional efforts and information are required: a stage 4, **Expertise**, must be undertaken with the further assistance of an expert.

They will finally draw up the inventory of the technical measures, define deadlines and allocate responsibilities for actions.

At this stage, more than in stage 2, **Observation**, the users have adequate training and enough information to determine :

- Whether personal protection must be worn;
- What protection should be carried on, by whom, when and for how long;
- Who should participate in the audiometric programme and when.

The document draws the attention on some main aspects of the personal protection. These recommendations are based on the fact that the best protective device is the one that is worn during the longest period of time [16, 17].

Emphasis is therefore placed on convenience to use, comfort, aesthetics, rather than on the intrinsic attenuation capacity.

Stage 4, Expertise

At this stage, the overall situation should be known and attention will concentrate on very specific items such as the reverberation of the hall, the damping of a vibrating structure, the silencing of a resonating structure... This will involve specific, highly sophisticated measurements and the experts should know what to do in a given case.

The only aspect to stress is the absolute necessity to assist this expert. Much too often, the problem is transferred to the expert and he is expected to solve it by himself.

As underlined in table 1, this strategy is based on the complementarity between the **Expertise** of the workers and the **Expertise** of the specialists.

Validation

The strategy was validated in ten SME of various industrial sectors. It proved to be understood, accepted and used and showed its effectiveness to improve the working conditions, to train the operators, to support the use of personal protective equipments and the adoption of adequate procedures of work.

Conclusion

The strategy has three major characteristics:

First, it is realistic: noise regulations exist for decades. Still, many workers are exposed to harmful noise. Motivation is limited in industry, since time, budget, technical resources and competence in acoustics are limited. The assessment and prevention procedures is optimised, starting from what industry is willing and able to do.

Second, it is participative: the workers and their management play the essential role in the dynamics of the improvement of the working conditions. Occupational health specialists and experts are there to assist, in order to identify the most adequate technical and organisational control measures.

Third, it is structured in 4 stages that require complementary knowledge and competencies:

At the two first stages, **Screening** and **Observation**: knowledge of the industrial process, the machines and the working procedures.

At the **Analysis** stage: assistance of specialists with education and training about the general methodological aspects, the common measuring and evaluation techniques, the main technical solutions;

At the **Expertise** stage: when it is absolutely necessary, assistance of highly trained experts who will bring their specific knowledge for the identification of particular solutions.

The strategy is not designed for experts but for the industry, calling in experts when needed. This itself might be utopian in many industrial settings, at least at the present time. Specialists can still use the strategy directly to initiate the procedure, demonstrate its simplicity and usability. Contrary to what is done too often, the experts are not called in to be responsible for finding the solutions, but the whole process of searching for solutions is carried out in full partnership.

The strategy does not therefore exclude the participation of a specialist from the start. Simply, it does not rely on this.

Bibliography

- [1]. S. Pell - An evaluation of a hearing conservation program. American Industrial Hygiene Association Journal 1972;33:60-70.
- [2]. W.L. Hager, E.R. Hoyle, E.R. Hermann - Efficacy of enforcement in an industrial hearing conservation program. American Industrial Hygiene Association Journal 1982;43:455-465.
- [3]. W. Melnick - Evaluation of industrial hearing conservation programs: a review and Analysis. American Industrial Hygiene Association Journal 1984;45:459-467.
- [4]. L.H. Royster and J.D. Royster - Education and motivation. In: E.H. Berger, W.D. Ward, I.C. Morrill, L.H. Royster (eds) Noise and hearing conservation manual. Fairfax, Virginia, USA, American Industrial Hygiene Association, 1986:383-416.
- [5]. R.K. Harrison - Hearing conservation: implementing and evaluating a program. AAOHN Journal 1989;37:107-111.
- [6]. J.L. Reynolds, L.H. Royster, R.G. Pearson - Hearing conservation programs (HCPs): the effectiveness of one company's HCP in a 12Hr work shift environment. American Industrial Hygiene Association Journal 1990;51:437-446.
- [7]. J. Starck - Noise and vibration. In: D. Brune, G. Gerhardsson, G.W. Crockford, D. D'Auria (eds) The workplace. Vol. 1 - Fundamentals of health, safety and welfare. International Labour Office, Geneva, International Occupational Safety and Health Information Centre (CIS), Geneva, and Scandinavian Science Publisher as. Oslo, 1997
- [8]. R. Leinster, J. Baum, D. Rong, C. Whitehead - Management and motivational factors in the control of noise-induced hearing-loss. Annals of Occupational Hygiene 1994;38:649-662.
- [9]. J.D. Royster et L.H. Royster - Hearing conservation programs - Practical guidelines for success. Chelsea, Michigan, USA, Lewis Publishers Inc., 1990.
- [10]. J. Malchaire, N. Cock, S. Vergracht - Review of the factors associated with musculoskeletal problems in epidemiological studies. International Archives of Occupational and Environmental Health. 2001;74, 2, 79-90.
- [11]. J. Malchaire - Strategy for prevention and control of the risk due do noise. Occupational and Environmental Medicine 2000;57: 361-369.
- [12]. ISO/CD 15265 - Ergonomics of the thermal environment: risk assessment strategy for the prevention of stress or discomfort in thermal working. International Standard Organization, Geneva, Working document of working group ISO/TC159/SC 5.2000
- [13]. J. Malchaire, H. Gebhardt, A. Piette - Strategy for evaluation and prevention of risk due to work in thermal environment. The Annals of Occupational Hygiene 1999;43,5:367-376.
- [14]. J. Malchaire, A. Piette - Stratégie de prévention des risques dus à l'utilisation de machines vibrantes. Recueil des résumés du 9ème congrès international sur les vibrations mains-bras, Nancy, France, 2001,5-8 juin.
- [15]. J. Malchaire, A. Piette - Co-ordinated strategy of prevention and control of the biomechanical factors associated with the risk of musculoskeletal disorders. International Archives of Occupational and Environmental Health, 2002, 75, 459 - 467.
- [16]. J.R. Franks, M.R. Stephenson, C.J. Merry (eds). Preventing occupational hearing loss - a practical guide. National Institute for Occupational Safety and Health, 1996:pp. 92.
- [17]. E.H. Berger, J.R. Franks, F. Lindgren F. International review of field studies of hearing protector attenuation. Proceedings of the 5th International Symposium on the Effects of Noise on Hearing. Gothenburg, Sweden.