

## THE NOISE AT WORK AND THE PROFESSIONAL DISEASES

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### ABSTRACT

*This article describes the effects of workplace noise and outlines the main steps that should be taken to reduce and control noise at work.*

*Exposure to noise at work can harm workers' health. The most well-known effect of noise at work is loss of hearing, a problem observed among coppersmiths since XVIII-th century. However, it can also ex-acerbate stress and increase the risk of accidents. Eliminating or reducing excessive noise at work is not simply a legal responsibility for employers; it is also in an organization's commercial interests. The safer and healthier the working environment, the lower the probability of costly absenteeism, accidents and under-performance.*

### 1. Noise-related diseases in Romania

There are the statistic figures and the conclusion about noise-related diseases at work in Romania from 1995 to 2004 [1].

Noise can cause damage to the hair cells in the cochlea, part of the inner ear, or even can affect the auditory centers of the brain. The symptoms of noise-induced hearing loss can be caused by exposure to a noise level higher than 87 dB(A), daily personal exposure.

Some dangerous substances such as toluene, styrene and carbon disulphide, lead, mercury, manganese, arsenic, westrosol can affect the hearing. The combined exposure to some of these substances and to loud noise appears to cause a greater risk of hearing damage than the exposure to either noise or the substances separately.

Romanian legislation makes reference to assessment, admissible limits and prevention measures for the protection of exposed workers to noise [2] (Title VI, Chapter VII - Noise). Annex 2 contains the list of professional diseases requiring mandatory declaration (pos. 28 - hypoacusis, deafness by exposure to a noise higher than the maximum admissible limit and to ototoxic substances). Professional diseases connected with the exposure to noise at workplace are: high blood pressure, digestive

diseases, neurosis and other neuropsychic disturbances.

The employers obligation regarding the health of the workers are:

► *on hiring personnel* – to order the general clinic examination to otorhinolaryngology specialist and, eventually an audiometric diagram (limital tonal audiometry). Contraindications for hiring in work places exposed to noise are: chronic diseases of internal and medium ear, psychosis, manifest neurosis and medium blood pressure, severe, associated with risk factors, stage II and III.

► *on annual medical examination* – audiometric diagram (3 months after hiring date then yearly), otorhinolaryngology specialist whenever required by audiometric examination, psychologist examination (at every 3 years)

**Professional Hypoacusis** represents the permanent hearing diminution of professional etiology of the auditory threshold (definitive auditory impairment) at 4000 Hz frequency, of more than 30dB inclusive of perception type (after applying the presbycusis correction) in general occurring in both ears and symmetrically, not affecting the conversational frequency; usually this is a slightly diminished auditory sensitivity. **Professional Deafness** represents the permanent hearing diminution of professional etiology of the auditory threshold

(definitive auditory impairment) at conversational frequency, of more than 25dB inclusive (the arithmetic average of values at 500, 1000 and 2000 Hz) after applying the presbycusis correction of perception, in general occurring in both ears and symmetrically. The noise is the main etiologic factor responsible for hypoacusis and professional deafness if exceeds the maximum admissible limit for daily professional exposure to noise of 87 dB(A), admissible in Romania according to [1] and [3]. The professional exposure to noise is established on the basis of professional anamnesis, proved with official records on years of service in noisy environment and by noise assessment at workplace. Anamnesis provides information regarding the application of personal protective equipment (e.g. earmuffs) and collective equipment (sound absorbing cabins, sound absorbing materials). The bulletins of sound intensity determination at work are useful in setting the diagnosis of professional character of hypoacusis and deafness, as well as the audiometric diagram/examination on employment.

**Table 1.** The evolution of the new cases of hypoacusis and deafness in period 1995-2004

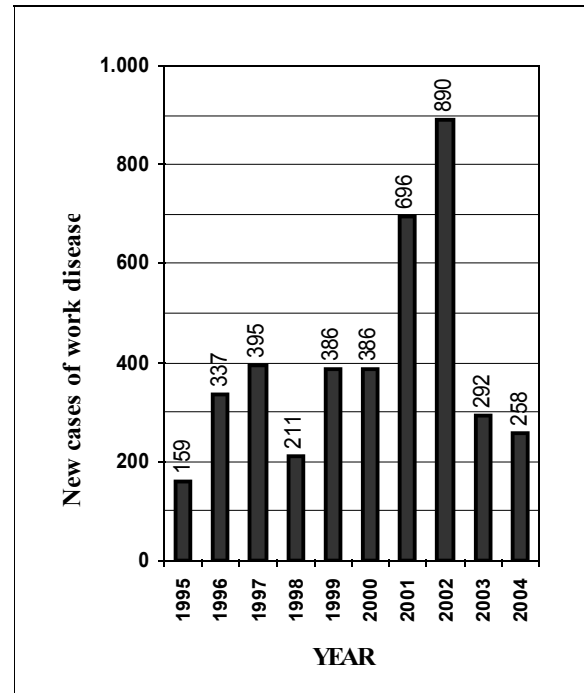
Year	New cases of noise-related professional diseases
1995	159
1996	337
1997	395
1998	211
1999	386
2000	386
2001	696
2002	890
2003	292
2004	258

In Romania, there are more than 300.000 workers exposed to noise according to statistical records (321.611 employees in 2004). The new cases declared as professional diseases caused by exposure to noise have registered a continuous increase over the last 10 years (table 1, figure 1).

The high number of cases recorded in 2004 includes professional deafness 73 cases as well as professional hypoacusis 185 cases. In 2004, hypoacusis cases occurred after a period of average professional exposure of 21,48 years and professional deafness after 23,27 years. The most frequent cases of hypoacusis and deafness caused by exposure to noise are recorded in the next counties: Alba, Brăila, Harghita and Cluj (table 2).

**Table 2.** Distribution of new cases of deafness and hypoacusis on counties of Romania in 2004 and average length of service till the onset of disease

County	No. of new cases	Average length of service [yrs]
Alba	39	16,5±7,1
Brăila	30	23,3±5,6
Harghita	24	21,8±7,3
Cluj	23	26,0±8,9



**Fig. 1** The evolution of the new cases of hypoacusis and deafness in the period 1995-2004

**Table 3.** The evolution of the new cases of professional diseases 1995-2004

Year	New cases of professional diseases		
	Total cases	Noise-related diseases	
		No. of cases	% of total cases
1995	2.031	159	7,83
1996	2.015	337	16,72
1997	2.060	395	19,17
1998	1.828	211	11,54
1999	1.802	386	21,42
2000	1.572	386	24,49
2001	2.238	696	31,10
2002	2.508	890	35,49
2003	1.376	292	21,22
2004	990	258	26,06

According to the statistic figures [4], professional diseases caused by exposure to noise represents 26% of the total of new cases of professional diseases recorded in 2004. Despite the total number of reported professional diseases which is approximately constant, professional diseases caused by exposure to noise have registered a continuous increase for the period 1995-2000 (table 3).

The figure 2 shows the evolution of percentage of the new cases of hypoacusis and deafness in total professional diseases in Romania for the period 1995-2004. It's obvious the increasing of the noise-related professional diseases in the total reported number of work illness.

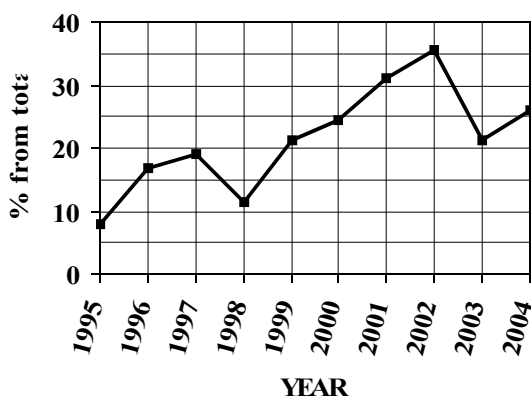


Fig. 2 The evolution of percentage of the new cases of hypoacusis and deafness in total professional diseases for the period 1995-2004

**2. Noise-related diseases in workshops**

According to World Health Organization [5] and some EU statistics and studies [2]-[4], occupational hearing diseases are very important, anyway the most reported

by the workers. The most frequent noise work-related diseases are:

1. Hearingimpairment
2. Noise-induced hearingloss
3. Tinnitus

**1.Hearingimpairment.** Hearingimpairment can be due to a mechanical blockage in the transmission of sound to the inner ear (conductive hearingloss) or damage to the haircells in the cochlea, part of the inner ear (sensorineural hearingloss). Rarely, hearingimpairment may also be caused by central auditory processing disorders (when the auditory centers of the brain are affected).

**2.Noise-induced hearingloss.** Noise-induced hearingloss is the most common occupational disease in Europe, accounting for about one third of all work-related diseases, ahead of skin and respiratory problems [9]. Noise-induced hearing loss is usually caused by prolonged exposure to loud noise. The first symptom is normally the inability to hear high frequency sounds. Unless the problem of excessive noise is addressed, a person’s hearing will deteriorate further, including difficulties detecting lower frequency sounds. This will normally occur in both ears. The damage of noise-induced hearingloss is permanent. Hearingloss can occur without long-term exposures. Brief exposure to impulsive noises (even a single strong impulse), such as from gunshots or nail or rivet guns can have permanent effects, including loss of hearing and continuous tinnitus. Impulses can also split the ear drum membrane. This is painful but the damage is healable.

**3.Tinnitus.** Tinnitus is a ringing, hissing or booming sensation in the ears. Excessive exposure to noise increases the risk of tinnitus. If the noise is impulsive (e.g. blasting), the risk can rise substantially. Tinnitus can be the first sign that the worker’s hearing has been damaged by noise.

**3. The risks of occupational noise**

The occupational noise is a hazard and can induce some risks in workshops leading to work-related accidents or/and professional diseases.

**a.Work-related accidents.** A high level of noise in the workshops can lead to occupational accidents or may increase the risks of accidents. This link between noise and accidents is recognised in the “Noise directive” [10], where there is a requirement for it to be considered specifically in the risk assessment for noise. **Noise can lead to accidents by:**

- making it harder for workers to hear and correctly understand speech and signals

- ▶distracting workers, such as drivers
- ▶masking the sound of approaching danger or warning signals (e.g. reversing signals on vehicles)

- ▶contributing to work-related stress that increases the cognitive load, increasing the likelihood of errors

**b. Disturbance of speech communication.** Effective communication is essential in the workplace, whether it is a factory, building site, call center, hospital or school. Good speech communication (where the listener gets 90% of syllables and 97% of sentences) requires a speech level at the ear of the listener that is at least 10dB higher than the surrounding noise. Surrounding noise is very often felt as a distinct disturbance of speech communication, especially if:

- there is often surrounding noise
- the listener has already a slight hearing loss
- the speech is in a language that is not the listener's mother language
- the listener's physical or mental condition is affected by ill health, tiredness, or increased workload under time pressure

The impact of disturbance of speech communication for occupational safety and health will vary depending upon the work environment. For example:

→surrounding noise may force teachers to raise their voices, leading to vocal problems

→a verbal instruction may be misunderstood by a driver or mobile plant operator on a construction site due to background noise, leading to an accident.

**c. Stress.** Work-related stress occurs when the demands of the work environment exceed the workers' ability to cope with (or control) them [11]. There are many contributors (stressors) to work-related stress, and it is rare that a single causal factor leads to work-related stress. The physical workenvironment can be a source of stress for workers. Occupational noise, even when it is not at a level that requires action to prevent hearing loss, can be a stressor (e.g. the frequent ringing of a telephone or the persistent hum of an air-conditioning unit), although its impact is usually in combination with other factors.

How noise affects workers' stress levels depends on a complex mix of factors including:

- the nature of the noise, including its volume, tone and predictability
- the worker's occupation (e.g. musicians can suffer work-related stress as a result of concert over hearing loss)
- the complexity of the task performed by the worker, for example, other people talking

can be a stressor when tasks require concentration

- the worker him/herself; noise levels that in some circumstances may be a contributor to stress, especially when that person is tired, can at other times be harmless.

**d. Noise and chemicals.** Some dangerous substances are ototoxic (literally "ear poisoning"). Workers exposed to some of these substances and to loud noise appear to be at greater risk of hearing damage than those exposed to either noise or the substances separately. This synergy has been particularly noted between noise and some organic solvents, including toluene, styrene, and carbon disulphide. These substances may be used in noisy environments in sectors such as the plastics and printing industries, and paint and lacquer manufacturing.

#### 4. The noise management at work

Noise can be a problem in many workplaces, not just on construction sites and in factories, but anywhere from farms to bars, schools to concert halls or in hospitals. Whatever the workplace, there are three **key steps to preventing harm to workers**:

1. assess the risks
2. take steps to prevent or control the risks (based on the assessment)
3. regularly monitor and review the effectiveness of the measures in place

**ASSESSING THE RISKS.** The degree and type of assessment will depend upon the scope and extent of the problem in the workplace, but all the risks arising from noise should be considered. For example, the ways in which noise may increase the risk of accidents in a factory should be considered along with the risk of noise-induced hearing loss.

There are **the key points in a risk assessment**:

√identification of the different noise-related risks in the organization, for example:

Are some workers exposed to loud noises, with the potential risk of noise-induced hearing loss?

Are there dangerous substances present that may increase the risk of hearing damage?

Does noise in certain work tasks make it more difficult to communicate, increasing the risk of accidents?

Is the nature of the noise contributing to the work-related stress within the organization?

√Taking into consideration the workers which may be harmed and how, including temporary and part-time staff, as well as workers in specific risk groups such as employees who are pregnant

√Evaluating measures that are already in place to control noise levels and decide what further action needs to be taken

√Recording all the findings and share them with workers and their representatives

**PREVENTING AND CONTROLLING THE RISKS.** There is a hierarchy of control measures that can be followed to ensure the health and safety of workers:

- ① elimination of noise sources
- ② control of noise at source
- ③ collective control measures through work organization and workplace layout
- ④ personal protective equipment

**1. Elimination the noise source.** The elimination of a source of noise is the most effective way to prevent risks to workers and should always be considered when new work equipment or workplaces are planned. A “*no noise or low noise*” procurement policy is usually the most cost-effective way to prevent or control noise. Several EU member states have databases to help enterprises in the selection of work equipment.

**2. Control of noise at source.** The reduction of noise, either at its source or in its path should be a major focus of noise management programmes, considering both equipment and workplace design and maintenance. A range of engineering controls can achieve this, including:

- isolation of the source, via location, enclosure, or vibration damping using metal or air springs or elastomer supports
- reduction at the source or in the path using enclosures and barriers, mufflers or silencers on exhausts, or by reducing cutting, fan, or impact speeds
- replacement or alteration of machines including beltdrives as opposed to noisier gears, or electrical rather than pneumatic tools
- application of quieter materials such as rubber liners in bins, conveyors, and vibrators
- active noise reduction (“anti-noise”), in certain circumstances
- carrying out preventive maintenance: as parts become worn, noise levels can change

**3. Collective control measures.** Where noise cannot be adequately controlled at source, further steps should be taken to reduce the exposure of workers to noise. These can include **changing the:**

- workplace - sound absorption in a room (e.g. a sound absorbing ceiling) can have a significant effect on reducing workers’ exposure to noise
- work organization (e.g. using working methods that require less exposure to noise)

■ work equipment - how work equipment is installed and where it is located, can make a big difference to workers’ noise exposure

The ergonomics of any noise control measure should be considered. When noise control measures create difficulties for workers to carry out their jobs, they may be modified or removed, rendering them ineffective.

**4. Personal protective equipment.** Personal protective equipment, such as earplugs and earmuffs, should be used as a last resort after all efforts to eliminate or reduce the source of the noise have been exhausted!

There are some issues to take into account when using personal protective equipment:

- making sure the personal protective equipment chosen is appropriate for the type and duration of the noise
- the personal protective equipment against the noise have to be compatible with other protective equipment
- employees should have a choice of suitable hearing protection so they can select the most comfortable solution
- many workers, such as drivers, police officers, pilots, and camera operators, need communication earmuffs or headsets, often with active noise cancellation to ensure clear communication and minimize accident risks
- the personal protective equipment should be correctly stored and maintained
- training should be given on why the personal protective equipment is necessary, how it should be used and how to store and maintain it

**MONITORING THE RISKS AND CONTROL MEASURES.** Employers should check regularly that the measures in place to prevent or control noise are still working effectively. Depending on their noise exposure, workers have a right to appropriate health surveillance. Where this occurs, individual health records must be kept and information provided to the employees. The knowledge gained from the surveillance should be used to review the risks and control measures.

## 5. The noise - the management’s and the workers’ obligations

**Employers** have a legal duty to protect the health and safety of staff from all noise-related risks at work.

**Employee involvement.** Consulting the workforce is a legal requirement, and helps to ensure that the workers are committed to safety and health procedures and improvements. Using their knowledge helps to ensure hazards are correctly spotted and workable solutions

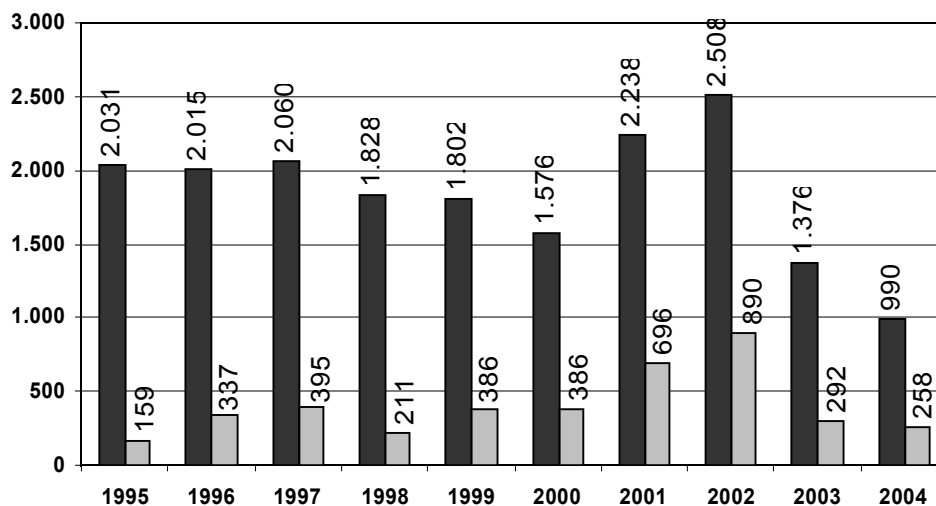
implemented. Worker representatives have an important role in this process. Employees must be consulted on health and safety measures before the introduction of new technology or products.

**Information and training.** Workers should receive information and training to help them understand and deal with the noise-related risks. This should cover:

- ▶ the risks faced, as well as the measures taken to eliminate or reduce them
- ▶ the results of the risk assessment and any noise measurements, including an explanation of their significance
- ▶ noise control and hearing protection measures, including personal protective equipment
- ▶ why and how to detect and report signs of hearing damage
- ▶ when workers are entitled to health surveillance, and its purpose

**Noise and pregnant workers.** Exposure of pregnant workers to high noise levels at work can affect the unborn child. *“Prolonged exposure to loud noise may lead to increased blood pressure and tiredness. Experimental evidence suggests that prolonged exposure of the unborn child to loud noise during pregnancy may have an effect on later hearing and that low frequencies have a greater potential for causing harm”* [12].

Employers are required to assess the nature, degree, and duration of exposure of pregnant workers to noise [13] and, where there is a risk to the safety and health of the worker or of an effect on the pregnancy, the employer must adjust the working conditions of the pregnant woman to avoid exposure. It should be recognized that the use of personal protective equipment by the mother will not protect the unborn child from physical hazard (noise).



## 6. Conclusions

Regarding the noise-related diseases there are some conclusions to be done:

- ▶ the irreversible loss of hearing through exposure to a noise exceeding the admissible level at work impairs the workers' quality of life and those affected are "condemned" to a life style impeding the communication
- ▶ prevention is the only method of treatment! and can be achieved by applying technical and organization measures to reduce the noise

▶ the health and work safety of the person exposed to professional noise is/have to be an actual priority

▶ the importance of EU and Romanian legislation and the application of them at the workplaces are illustrated by the decrease in last years of work diseases including noise-related diseases; the **figure 3** shows this decreasing.

## 7. References