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ASSESSMENT OF WORKPLACE NOISE IN ORDER TO PREVENT THE RISKS OF EXPOSURE

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Abstract: *The first key step to prevent risks of noise exposure at work is the risk assessment. It consists of several actions aimed to identify the various risks related to exposure to noise for a given workplace. The paper presents the content of a questionnaire, which helps the collection of information on noise at work in an efficient and unified form that allows further processing of data. The questionnaire was applied during noise assessments conducted in 15 workplaces, grouped in 6 working fields. The paper presents and analyzes the responses obtained during these studies from a total of 253 surveyed employees.*
Key words: *workplace noise, risk assessment, noise exposure, survey on noise, noise questionnaire*

1. INTRODUCTION

In the industrial areas noise is generally complex due to the superposition of many sources in a certain workplace. Sounds emitted by each machine or equipment have different composition in frequencies and tones, continuous or intermittent expression and are disposed on different time intervals during the working period [1], [5]. The cumulative noise affects not only people working with machines or equipment that produce excessive noise, but also affects people who work nearby.

In the current modern industry, aimed at increasing productivity and efficiency, the workplace noise tends to become one of the main causes of occupational diseases [2], [4], [6]. The general rules of labor protection stipulate the need for regular assessment of noise, in order to identify jobs and workplaces that do not meet the regulated noise limits and also employees exposed to excessive noise. This is a component of the noise exposure risk prevention, action in which the involvement should be both of the employer and employees.

2. THE RISKS OF NOISE EXPOSURE

Depending on the approach to the subject, there are several definitions for risk in the literature. A concise and clear one is given by [6]: "The **risk** is the chance, high or low, that somebody could be harmed by hazards, together with an indicator of how serious the harm could be." There are four major components of risk [4]: hazard, consequence, likelihood and perception.

The risk of noise exposure was a concern at the international level since an early stage of the development of occupational health and safety policy. The main characteristics of risk prevention strategy are given by the Noise Directive 2003/10/EC, regarding the exposure of workers to the risk arising from physical agents (noise), transposed in Romanian legislation by H.G. 493/2006.

The excessive noise at work alters the health and comfort of people exposed [2], [4], but also has some collateral effects on the work process and enterprise that the employer must consider:
- Noise has effects on company's competitiveness (long term noise produces hearing loss and professional deafness; noise degrades interpersonal relationships and so the working climate);
- Noise reduces concentration, negatively influencing the quality of work;
- Noise favors the occurrence of incidents and accidents at work (it may cover alert messages or it may produce traumatic deafness);

- Noise favors absenteeism and increases costs due to the health alteration of workers;

There are three key steps to prevent risks of noise exposure at work: risk assessment; taking action to prevent or control risks; regular monitoring and review of implemented measures in terms of efficiency.

3. RISK ASSESSMENT

The first of these steps - risk assessment - consists of several actions aimed to identify the various risks related to exposure to noise for a given workplace. According to [6]: "A **risk assessment** is simply a careful examination of what, in your work, could cause harm to people, so that you can weigh up whether you have taken enough precautions or should do more to prevent harm".

A check-list may be useful as a guide to identify different risks related to noise exposure at work. It may contain identifiers such as:

- Generates noise difficulties of communications between workers involved in specific tasks, increasing the risk of injury?
- Are there workers exposed to loud noise, with the potential risk of noise induced hearing loss?
- Are there workers from specific risk groups such as pregnant women and young people?
- Is the level of noise that contributes to stress at work within the company?
- Are hazardous substances that may increase the risk of hearing problems used at the workplace?
- Are there some available results of previous noise monitoring and/or noise reduction measures?

Another issue to be cleared in the stage of risk assessment is related to awareness of employees: knowledge of reality of noise situation at their workplace, their ability to recognize and refer to the risk of exposure to noise, knowledge of basic principles that enable them to understand and choose appropriate solutions, knowledge of legal provisions and professional obligations and rights, understanding their role and responsibilities in the noise control program.

The risk assessment should be carried out in an efficient and accurate manner. It consists of the following types of activities: gathering of information, observation, noise measurements (not mandatory) and analysis of available data (from previous noise assessments, data provided by the manufacturers of the equipment, previous medical examinations of employees).

It is desirable that the information to be collected through direct discussions with employees and managers, during a visit at their workplace. The visit might be a good opportunity to make observations regarding the working conditions and routine in different departments and divisions.

4. QUESTIONNAIRE ON NOISE

A short questionnaire was developed to be used for collecting information during the risk assessment of noise exposure at work. Its aim is to detect awareness of employees, as described in the previous section, and to identify risks. It offers the following advantages:

- Reduces the time associated with the collection of information, allowing the addressing to a large number of employees.
- Because they are not directly addressed, employees can express their opinions without restraint and without being influenced by the attitude of the person conducting the survey. The questionnaire can even be anonymous.
- If the questionnaire is simultaneously applied to all employees, they can not influence each other in expressing opinions.
- Gives a pattern for data collection, allowing their comparison between successive assessments within the same workplace or for compare noise situations of similar workplaces or companies.
- Allows easily data storage and insertion in reports and analyzes.

The questionnaire contains twelve questions, which enable the identification of potential risks of noise exposure. The possible answers are Yes or No, but there are two questions which ask for detail information (Q6 and Q10). In addition, it contains some fields that require identification data: name and address of the company, field of activity, number of employees, etc. Questions:

Q1: Do you consider that the noise from your workplace exceeds 85 dB?

Q2: Is the acoustic power of the machines and equipment at your workplace explicitly indicated by the manufacturer?
Q3: Is it necessary to raise your voice to cover background noise, when communicate with colleagues at work?
Q4: Are you exposed to impact noise or explosive type noise during the work?
Q5: Do you consider that the employer must take measures to reduce the noise at your workplace?
Q6: Have been taken actions to reduce and control the noise at your workplace? If yes, please mention them.
Q7: Have you noticed, lately, one of the following hearing problems: buzzing in the ears, different tones of the same sound in the left and right ear?
Q8: Have you noticed lately a decrease in the auditory perception during the day?
Q9: Do you consider that you should protect yourself in order to prevent occupational diseases caused by the noise at work?
Q10: Employer has provided you with hearing protection equipment? If yes, please describe the equipment you use.
Q11: Based on work safety rules, are you required to use hearing protection equipment at work?
Q12: Do you think that a noise assessment should be carried out, by an authorized person, at your workplace?

5. SURVEYS ON NOISE EXPOSURE

The questionnaire was applied in several companies which have made case studies for risk assessment of exposure to noise. What follows are the results obtained for 15 such noise surveys. Taking into account the specificity of their activity, the analyzed workplaces were included in six groups: carpentry, car repair workshops, metal processing, textile fabrics, heating stations and rolled products. They are presented in Table 1, in which the successive columns contain: the group number, the workplace number and type of activity, the number of questionnaires filled by the employees and the level of daily nose exposure, in dB (only where measured values were available).

Table 1

Workplaces, number of filled questionnaires and daily noise exposure

Group	Wp Nr.	Type of activity	Nr. quest	Daily exp. [dB]
1	F1	Carpentry 1	15	
	F2	Carpentry 2	10	90,0
2	F3	Car body repair	10	
	F4	Car service	10	82,3
3	F5	Metal processing 1	10	85,0
	F6	Metal processing 2	20	
4	F7	Textile manufacturing 1	40	80,5
	F8	Textile manufacturing 2	30	79,5
	F9	Textile - tailoring	20	81,7
	F10	Textile – sewing 1	20	78,5
	F11	Textile - sewing 2	20	80,5
5	F12	Zonal heating station 1	8	89,0
	F13	Zonal heating station 2	10	86,0
6	F14	Wire milling	20	
	F15	Bar rolling	10	

Questions Q1, Q2 and Q4 (Figure 1) verify if the workers can estimate the type and level of noise at work. Analysis of the answers shows that in the case of textile workshops (F7 – F11) less than 30% of respondents feel that workplace noise exceeds 85 dB. In consequence more than 70% of them made a correct estimation of noise, as shown by the last column of Table 1. They also say that the producers of the equipments in use did not indicate their acoustic power emission and workers are not exposed to impact noise.

The impact noise is reported in carpentry (F1), car body repair (F3), metal processing (F6) and rolling (F14, F15). Daily exposure values from Table 1 that exceed 85 dB are confirmed by responses to question Q1 (for F2, F5, F12 and F13). Overall, it can be concluded that the respondents have made a good estimation of the noise at work.

Questions Q3, Q7 and Q8 (Figure 2) test the ability of employees to recognize the signs that indicate the presence of excessive noise and the appearance of its effects on the health of exposed persons.

Is to be noted that from the total respondents: 39,13% have to raise the voice to cover the background noise at work (Q3),

22,53% have noticed hearing problems such as buzzing in the ears (Q7) and 23,72% of them reported decrease in the auditory perception during the day (Q8). Most hearing problems were reported in the following groups of activity: carpentry, metal processing and rolling.

Another observation is that the comparison of figures 1 and 2 shows that the answers to questions Q1 and Q3 are in agreement.

Questions Q5, Q6 and Q12 (Figure 3) verify if the employees were informed and involved in the control and reduction of noise within the company and if they know the requirements of the specific legislation.

The diagram shows that the answers to these three questions were mostly YES, with the following observations:

- At F3 responses are contradictory. All employees said that measures to reduce noise at work have not been taken (Q6) and are not necessary (Q5), but they consider that a noise assessment should be carried out, by an authorized person (Q12).

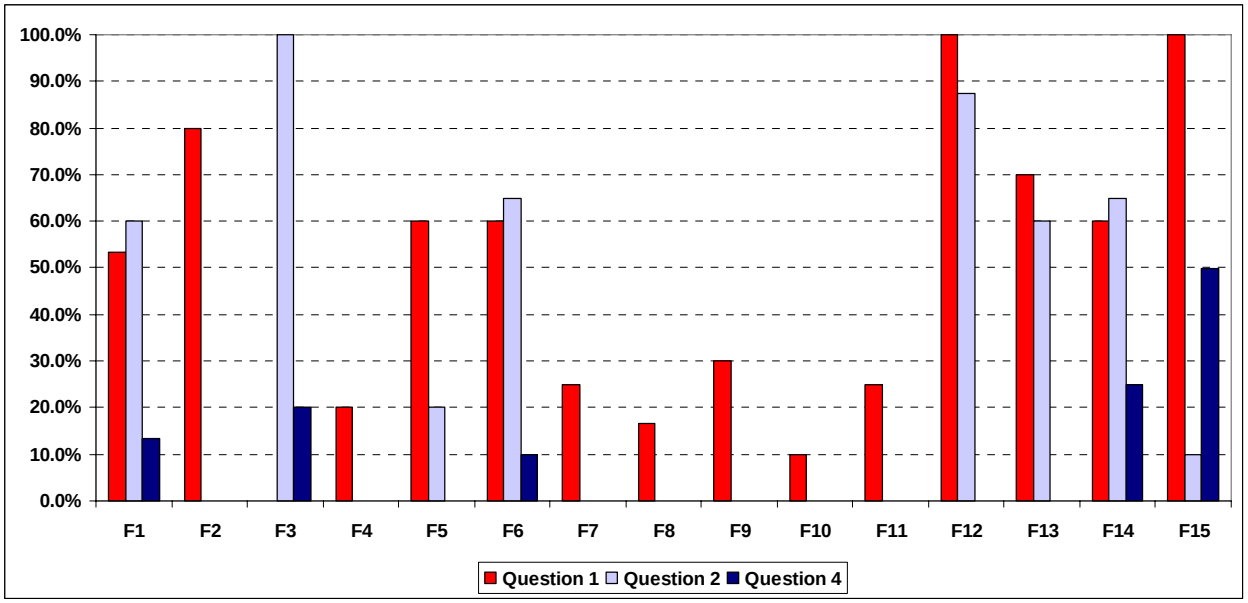

Fig. 1 Percentage of YES answers for questions Q1, Q2 and Q4

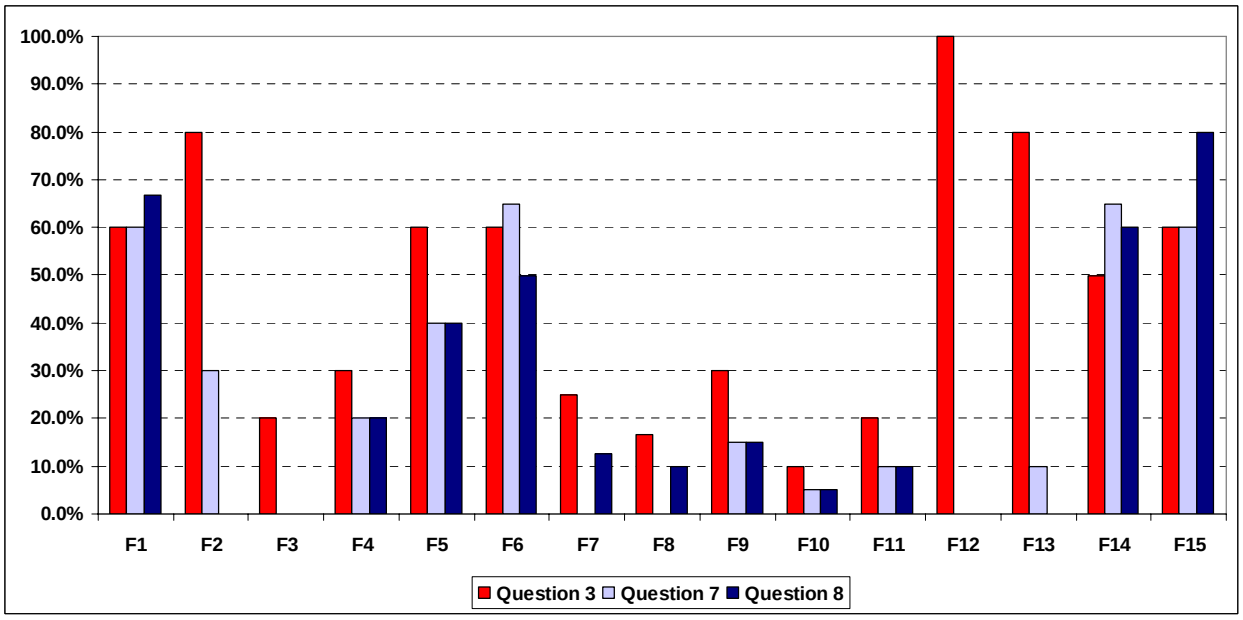

Fig. 2 Percentage of YES answers for questions Q3, Q7 and Q8

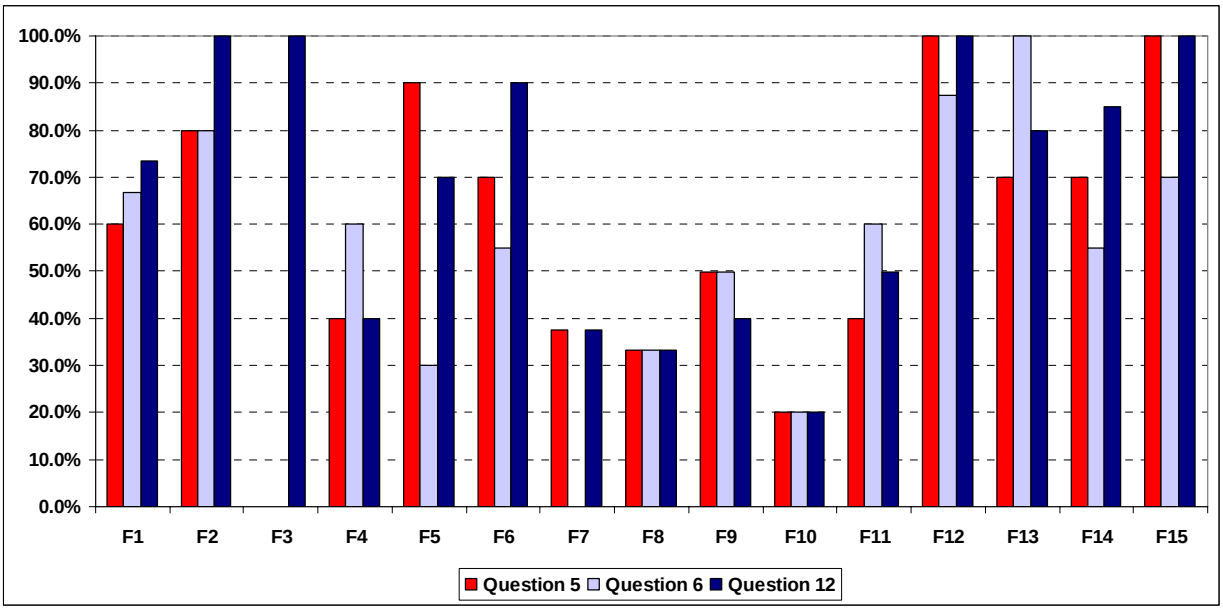

Fig. 3 Percentage of YES answers for questions Q5, Q6 and Q12

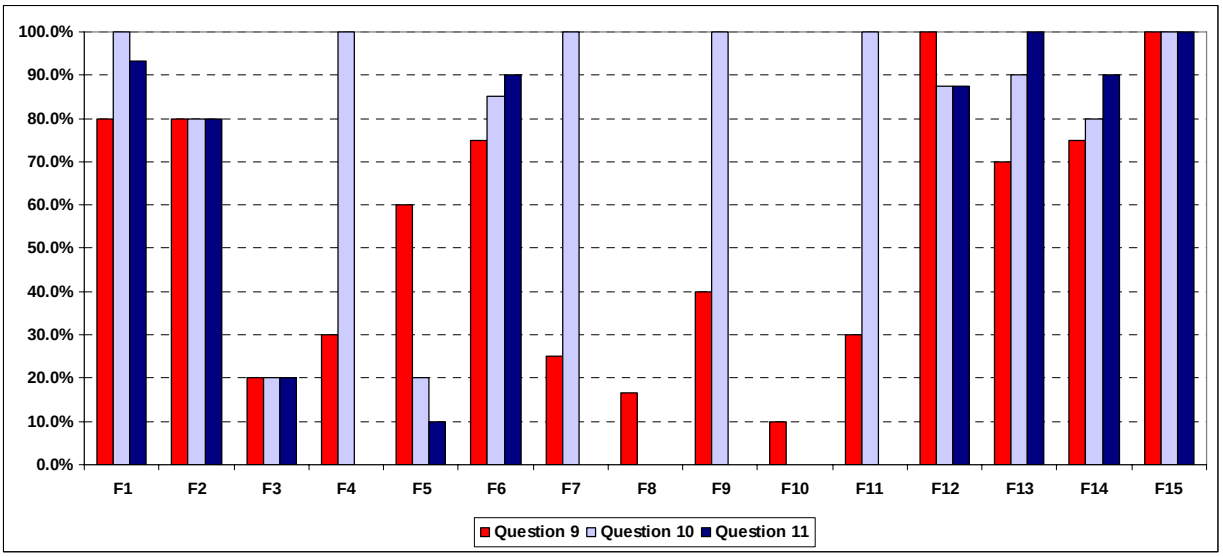

Fig. 4 Percentage of YES answers for questions Q9, Q10 and Q11

- At F4, 60% of respondents believe that actions have been taken to control noise and 40% of respondents believe that other measures are necessary. The answers are in agreement with those given to the questions previously discussed.
- Answers for workplaces F7 to F11 are also in agreement with those presented in the diagrams in figures 1 and 2.

Questions Q9, Q10 and Q11 (Figure 4) are related to the use of individual protection equipment against noise and knowledge of the related legislation, of rights and obligations of the employees.

The answers show that in 13 of the total 15 analyzed workplaces the employer has provided workers with hearing protection equipment (Q10).

A rate of 46,25% of total respondents believe that they should protect themselves in order to prevent occupational diseases caused by the noise at work (Q9). This means that they have recognized the risk of exposure to noise and are concerned for their health and safety.

A situation to be monitored is at F5, where the daily exposure is 85dB (Table 1) but only 10% of respondents know that the legislation imposes the use of noise protection equipment.

Also for F4 (car service) the daily exposure level exceeds 80 dB, the employer has provided individual equipment for protection against noise (100% of answers), but all respondents say that they are not required to use it (question Q11).

6. CONCLUSIONS

Workers' exposure to noise must be assessed to detect, control and reduce risks for health, emphasizing the following key issues:
- The level, type and duration of noise exposure, taking into account the presence of impulsive noise and paying attention to workers with high risk;
- The health effects, including data from the regular medical controls;
- The measures and solutions applied to reduce noise and the use of individual hearing protection equipment.

A survey on noise exposure conducted at the workplace may be of great help in order to obtain information in an efficient, realistic and complete manner. The surveyor can use a short questionnaire, identical with that one presented in the paper, or supplemented with additional questions depending on the workplace specificity. The results will be more conclusive if more employees will be surveyed.

In most cases, exposed workers can solve the noise problem themselves, once they realize the risk, they understand the principles of risk management, they assume the role and responsibilities as individuals and group and once they acquire the necessary knowledge in a proper legal framework.

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Evaluarea zgomotului de la locul de muncă în vederea prevenirii riscurilor de expunere

Prima etapă a prevenirii riscurilor de expunere la zgomot profesional este evaluarea riscurilor. Aceasta constă într-o serie de acțiuni menite să identifice riscurile legate de expunerea lucrătorilor la zgomot într-un anumit loc de muncă. Lucrarea propune utilizarea unui chestionar pentru colectarea eficienta a informațiilor necesare acestei etape, într-o formă unitară, care să permită prelucrarea ulterioară a datelor. Sunt prezentate răspunsurile obținute prin aplicarea chestionarului în 15 organizații, grupate pe 6 domenii de activitate şi însumând un total de 253 de persoane intervievate.

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