

APPLICATION OF VIBRATION DIRECTIVE IN 6 EUROPEAN COUNTRIES

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Abstract

The Vibration Directive 2002/44/EC [1] seeks to introduce minimum protection requirements for workers when they are exposed to risks arising from vibration. It has been implemented in most European countries since July 2005. Although it is a well known risk, it is of increased importance since the application of the directive and there are important new challenges for enterprises, regulators and legislators. Measurement is complicated and risk assessment and reduction not simple. The objective of this article is to provide an overview on the application of the Directive in 6 European countries, this to assist head staff of occupational prevention organizations to develop management procedures for the prevention of hand arm transmitted vibration hazards. For that purpose, nine questionnaires on the different aspects of vibration prevention were elaborated and completed by experts from these countries.

1. Introduction

The vibration Directive 2002/44/EC of the European Parliament and of the Council on the exposure of workers to the risks arising from physical agents (vibration) [1] has been implemented in most European countries since July 2005. It results in many questions from employers, hygienists and exposed persons on how to evaluate vibration, what are situations at risk, what are the effects of vibration, how to reduce vibration, how to develop an action plan for prevention...?

Therefore the European Agency for safety and Health at Work has ordered a report to get an overview on human vibration hazard prevention in Europe [2]. This

report is mainly written to assist head staff of occupational prevention organizations to develop management procedures for the prevention of vibration hazards. It shows the ways in which they are being addressed across Europe (overview of policies and practices in the different EU member countries in relation to vibration diseases and recognition, assessment and control of exposure). In particular it emphasizes how the vibration directive is applied by the different European countries and the different strategies developed. It examines initiatives, providing a representative coverage of activities across the EU and to identify success factors that can be reported. These will include solutions, guides, actions and strategies at national and sector levels, including actions by social partners.

A redactional group composed of half a dozen of European vibration or hygienist experts was created. Apart from limited resources, it was not considered useful to make a comprehensive overview of the situation in all 25 member states, but rather to present the variety of situations. It was thought that the distribution of selected countries was such it may be representative of all the rest of Europe with one country (Germany) very active in the field of vibration reduction, one Scandinavian country (Finland), one member of Benelux (Belgium), one representing East Europe (Poland) and two Latin countries (France and Spain).

2. Methods

To get the needed information nine questionnaires on national practices were elaborated by the group and completed by experts from the 6 countries. The main questions cover the following topics:

- main sources of vibration and percentage of exposed workers;
- main groups at risk with regard to European Directive;
- application of European vibration directive in national regulations;
- evaluation of vibration at work;
- control of application of vibration directive;
- policies and practices in the different European countries;
- assistances provided by insurance, social partners, research organizations, manufacturers, states;
- success of the actions described above;
- challenges for the future researches.

3. Results

3.1 Who is at risk?

The percentage of “recognized” workers exposed to vibration varies widely between countries: 5 to 11 % are exposed to HAV from hand tools. According to the third European Working Conditions Surveys 2005 (EWCS), exposure to vibration is much more common among men than women (the ratio exceeds 5 to 1).

About 24% of all European workers interviewed during the EWCS survey reported being exposed to mechanical vibration in the workplaces of the European Union. Construction (23% of workers), mining and manufacturing (20%), agriculture (18% of workers), transport and communication (14%), electricity, gas and water

supply (13%) were the main sectors with the greatest exposure to vibration from hand tools, machinery, and vehicles.

It is difficult to get national numbers for tools. There are mainly rotative tools (grinders, saws...) which are estimated to be 4,5 millions in Germany and 200 thousands in Finland. Percussive (chipping hammers, breakers...) and rotopercussive tools (perforators..) are 3 to 5 times less numerous. The estimations are respectively 600 and 70 thousands for the above countries.

All the interviewed experts agreed that operators of most main percussive and rotopercussive tools (such as chipping hammer, demolition hammer, rock drill, breaker, impact drill, scabler, rammer, vibratory rammer), of main rotative tools (e.g. grinder, impact wrench, sander...) and main alternative tools (jig saw, file...) will be likely exposed to vibration above action level. In addition if percussive and rotopercussive tools are used more than 1 or 2 hours a day the limit value may be exceeded. This might also be the case for rotative tools such as grinders if used more than 4 hours.

3.2 What say the national regulations?

The directive 2002/44/EC is today implemented in the 6 European countries which took part in the survey. Policies in some countries include additional or stricter requirements in comparison with the Directive's provisions: e.g. Finland (35 m/s^2) and Poland have fixed short-term exposure limit value.

The control of the application of the Directive is generally done by factory inspectors who check work stands and minimal fulfillment of requirements concerning workers health and safety. Inspectors analyze measurement reports which are required by regulations. If there are no such report they order to perform risk assessment. But due to recently transposition into legislation on vibration, labour inspectorate has done few activities related to the application of action and limit levels.

3.3 Who is doing vibration measurements at work?

Vibration directive requires firstly vibration assessment from employers. Directive opponents claim this was impossible because of measurement high cost and small number of laboratories able to make them. In fact the Directive does not ask explicitly employers to measure vibrations but to assess them.

However direct measurements are often a necessity and it is of interest to know how countries solve the problem of multiplying organizations able to make this job. Some governments (e. g. Poland, Spain) seem to have decided to assist directly companies by equipping a large number of health and safety organization with vibrometers (see table 1). Other countries (e. g. France) considers that these organisms should not interfere with private business. Companies have to manage by themselves for assessing vibration or pay some private laboratories to make the measurements.

The development of many new places for the measurement of vibration represents a real challenge. Generally metrology technicians have previous experience in noise. If whole body vibration measurements are relatively simple to be done, this is

not the case for hand arm vibration especially when percussive tools are instrumented. Large errors are common.

Many companies do not apply the Directive because they do not feel able to assess vibration exposure. Their vibration assessment is based on figures given by manufacturers and standardized technical report [3], guides of good practices [4], or data banks [5] (<http://vibration.arbetslivsinstitutet.se/eng/wbvhome.lasso>, <http://www.las-bb.de/karla/index.htm>, <http://www.hvbg.de/d/bia/pub/ada/index.html>) as reported in table 2.

Table 1 - Organisations doing human vibration measurements

	Belgium	Finland	France	Germany	Poland	Spain
Employers	Survey: 55%, employers assess the risk of vibrations (n=56).	5% with a subcontractor	Very few	By using emission values measurements	yes	no
Laboratories	Universities ¹	2 health & safety organizations	9 health & safety organizations, consultants (5 to 10)	20 to 30 +8 health & safety organizations	4 Health and safety organisations, national labour inspectorate (50 laboratories),- 100 groups of occupational physicians,-150 laboratories, 50 Consultants	139 health and safety organizations
Accredited organization	Laboratories certified by the Ministry of Labour Noise and vibrations specialists certified by the Flemish government, Fund of Occupational Diseases: measurements requested by companies	None	None today but some in preparation	Technical surveillance association, German institutions for statutory accident insurance and prevention, Consulting engineers		Health and safety organization

Table 2 - Strategy used by employers to assess vibration exposure

	Belgium	Finland	France	Germany	Poland	Spain
Declaration of manufacturers	Some. Based on figures given by manufacturers	Using manufacturer's guide and CEN/TR 15350:2005 [3]	Idem	Using a German standard similar to CEN/TR 15350: 2005	Idem. Just to compare devices to buy better and cheaper.	Idem
EC guide of good practice [4]	Yes. Information passed through articles in e-magazines, seminars, websites	No	Yes but INRS guide in preparation	Yes predominantly. Information passed through internet	No	No but NSHT guide in preparation
Data bank on Internet [5]	Employers are using all kind of information sources: website of the Swedish National Institute for Working Life, legislative texts, guides of manufacturers	Yes FIOH web site including good practices.	Yes	Yes Several data banks developed	Yes but just for comparisons	No

3.4 Can we successfully reduce vibration?

Controlling the risks from hand arm vibration requires a set of prevention measures. The European Directive 2002/44/EC sets out the measures that have to be taken by employers to reduce and avoid exposure to vibration based on a risk assessment. The question arises how enterprises can deal with these issues in practice.

Prevention measures can be taken at three levels of the process starting by preference at the most early stage (see figure 1): elimination of vibration at its source, development of vibration reduced machines and devices, action on the effects of vibration. Low vibration tools have successfully reduced workers' exposures to hand-arm vibration in the last decades. Nevertheless, the market shares of certain machines and devices should be further increased. In addition to technical solutions, organizational means such as work automation, job rotation, temporarily limited exposures as well as systematic medical check-ups were implemented at work, in order to further improve the working conditions of employees exposed to vibrations.

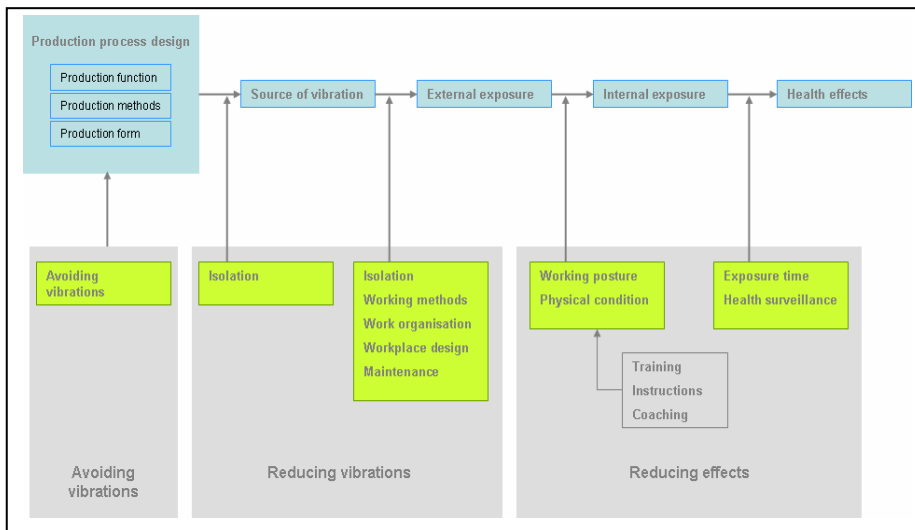


Figure 1 - Categorising control measures

Apart from problems with regard to the handling of vibration reduced machines and devices, higher costs can be seen as an other relevant factor which sometimes leads to the ignorance of such engineered solutions. In fact, vibration reduced machines and devices are sometimes considered as luxury comfort which is not to be related with work. However, most of the time, technical solutions are ignored due to the lack of awareness and knowledge. In operational instructions, for example, warnings related to risks due to vibration can hardly be found. Therefore and in order to prevent workers from ill health, more information on occupational safety and health should be passed on to workers in guides of good practices, awareness raising campaigns as well as in practical trainings. Especially in small and medium enterprises (SMEs), the lack of know-how, the lack of training, but also the lack of measuring equipment can be seen as main deficits with regard to users not adopting successful solutions. Moreover, many companies still tend to tackle risks which may lead to severe accidents at first place, neglecting occupational health issues.

However the market share of hand-arm vibration reduced machines such as chain saws / saws lies between 50% and 70%. But regarding road breakers, vibratory rams, drills, sanders as well as chipping hammers and grinders the market share can be found only in between 30% and 50%. Moreover, machines such as demolition hammers and rock drills only consist of a market share below 30%.

3.5 How to assist employers in the application of Directive?

The innovative approach on vibration is wide and different in each country. The assessment of risks without measurement which does not require the use of specific

apparatus and appropriate methodology, is an innovative approach that must be more developed using interactive web sites for example.

Most of software tools are related to exposure vibrations which are based on two main factors; equivalent vibration value and time exposure. There are several and similar kinds of computer tools to evaluate the vibration risk and it's a field well developed. Nevertheless there is a need of low cost and easy to use dosimeter for hand arm and whole body vibration. The spread of information about the technological trends to control the vibration is an important action to be considered to assist the employers in selecting low vibration equipments. For example: web sites are needed where one can check the latest novelties to control the exposure vibrations and its effectiveness.

Updating activities on vibration is important and will need the elaboration of clear national strategies, policies, action plans or campaigns. Thus in Belgium the effort concentrates on the development of overall risk assessment procedures (the SOBANE risk management strategy) [6]. SOBANE consists of four levels: screening, observation, analysis and expertise. In the screening level are the risk factors detected by the workers and their management, and obvious solutions are implemented. In the observation level the remaining problems are studied in more detail and the reasons and the solutions are discussed in detail. In the analysis level, an OH practitioner is called upon to carry out appropriate measurements to develop specific solutions when necessary. In the expertise level, the assistance of an expert is called upon to solve a particular problem.

3.6 What kind of research is needed?

A questionnaire was sent by BAUA to all European countries regarding their recently finished, current or planned research in the field of human exposure to vibration. Twenty out of 25 Member States have answered. Table 3 categorizes the main responses.

In many countries there seems to be an insufficient data base concerning vibration exposure at different branches and machinery under several working conditions considering maintenance and age of machinery. Obviously, measurements in field studies are required, which contribute to the identification of branches, machines and conditions with the most detrimental effects. Concerning the hand arm vibration, some countries advocate the development of standardized and reproducible measurement methods for several classes of machines and working conditions. In particular, the effectiveness of anti-vibration gloves should be determined with standardized methods. More research is needed to check the validity of the frequency weighting network and take into account co factors such the coupling between the hand and tool.

Joint projects of EU Member States should be encouraged to bundle the scientific resources in this field.

Table 3 - Categorized responses regarding needed hand-arm vibration research

Field studies HAV	
Exposure measurements; data base; identification of problem branches, machines and conditions (including age of machines, effects of anti-vibration gloves)	Austria, Denmark, Germany, Slovenia
Comparison of measured and predicted A(8)	France
Testing of new measurement equipment (dosimeter)	France, Germany, Poland
Laboratory studies HAV	
Anti-vibration gloves (effectiveness, eligibility criteria), effects of HAV reduction techniques	Germany, The Netherlands
Cold water provocation test	Austria
X Determination of evaluation values (aside from acceleration)	Italy
Epidemiological studies HAV	
Association between HAV and health effects considering HAV-frequency, coupling forces, age, length of rest periods, repeated shocks, intervention studies	Germany, The Netherlands
Modelling HAV	
Modelling the effects of vibration on cells (muscle, blood, neuronal) by means of animal studies	Finland
Measurement methods HAV	
Standardisation, reproducibility (classes of machines, working conditions, anti-vibration gloves), measuring uncertainty (incertitude)	Czechia, France, Greece, Ireland, Spain, UK
Measurement of coupling forces	France
Reduction techniques / measures HAV	
Active attenuation, wireless data transfer, fast hydraulic valves?	Finland
Development of low vibration tools	France

4. Conclusion: is vibration an increasingly important hazards?

Certainly not if we consider the risk by itself and number of persons exposed to high level. The number of persons exposed to hand arm transmitted vibration considerably increases with the development of mechanism. Vibration syndrome (Raynaud vascular disease) was firstly described at the beginning of XX century. Vibration exposure is always coupled with efforts needed to operate the tools, or poor posture imposed by the tasks. Today machines are less vibrating but they are also less heavy and generally better designed for the ergonomics. Therefore it is likely that the number of exposed persons to severe magnitude of vibration is decreasing as well as the number of workers who are demanded to exert great physical efforts to operate tools and machines.

Certainly yes if we consider the total number of persons exposed (according to the country between 5 and 11 % are exposed to HAV from hand tools). More people are concerned because of the systematic replacement of manual tasks by machines. In addition this population is aging i.e. more susceptible to complain of vibration exposure and suffer from musculo skeletal or neuro vascular problem.

Certainly yes if we consider law requirements. The EC vibration directive has boosted the demand of information from employers who have up to now generally neglected vibration hazards. In many cases the vibration level is above the action values. So employers have to develop a control strategy which will often consist in phoning to the machine manufacturers to get low vibration equipment. This in turn boosted the concern of these latter (the demand of a buyer is a priority). Manufacturers needed the help of vibration consultants to improve their machines. They all needed measuring instruments and new tools and standards for better assessment of vibration at the workplace or to evaluate the performance of a device to cut vibration emission... So new instruments appeared on the market. In parallel more researches are done by organizations. Recent technologies open or facilitate new areas of research e.g. dynamic modelling of human or machine responses to vibration excitation.

So if we cannot said that vibration is an increasing hazards it is definitely an increasing preoccupation for deciders and today an emerging business. Hoping this will significantly improve the machine operator conditions of work.

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