Workers' exposure to vibrations : Council common position

Following the political agreement achieved under the French Presidency at the end of 2000, the Council of Ministers reached a common position in June on the proposal for a directive concerning the protection of workers from the risks of mechanical vibrations. The directive will be the first separate directive after the splitting in 1999 of the Commission's original proposal from 1993 covering all types of physical agents (mechanical vibrations, noise, optical radiation and electromagnetic fields and waves). The June 2001 Social Affairs Council also reached a political agreement on the proposal for a new Noise Directive (see article over).

Introduction

The new Directive on protection against vibrations will plug a large loophole in European health and safety legislation.

It is estimated that 1.7 - 3.6% of the European workforce is exposed to potentially harmful hand-transmitted vibration. A recent survey in Great Britain estimated that over 1,000,000 workers were exposed to vibration levels above the national action level of 2.8 m/s^2[1] . Estimates in the Netherlands suggest that 4 - 7% of the workforce is exposed to whole-body vibration. The 3rd European Survey on working conditions carried out by the Dublin Foundation (Merlie and Paoli, 2000) confirms that exposure to vibrations remains widespread in Europe.

Vibration - whether whole-body, or hand-arm - has many effects on humans including vascular, musculoskeletal, neurological effects. NIOSH[2] found strong evidence for a relationship between Hand-Arm Vibration (HAV) and Whole-Body Vibration (WBV) and relevant musculoskeletal disorders. The Eurostat study launched by the Commission to achieve comparability of data on recognized occupational diseases in Member States in 1995 (EODS)[3] indicates that diseases caused by mechanical vibration were among the 10 most frequent diseases in the EU.

The Vibration Directive was the focus of one of the most long drawn-out legislation adoption procedures ever, taking 8 years and still counting. This is because the debate was not just about vibration issues, but whether a joint Directive should be passed on the basic physical agents within the meaning of Article 16 of the Framework Directive.

The Vibration Directive is what emerged from the initial proposal for a general Directive on physical agents in 1993. That proposal would have wrapped all physical agents - noise, mechanical vibration, optical radiation, electromagnetic fields and waves - together in a single instrument. The Commission decided in 1999 to concentrate on mechanical vibration, where the state of scientific knowledge was considered sufficiently advanced and for which the link between exposure to vibration and some occupational diseases could be established. The European Council reached a unanimous common position on the Vibration Directive on 25 June 2001. The Directive is now with the European Parliament for its second reading.

General issues

There is no doubt that the Vibration Directive will significantly help improve working conditions in Europe. It is an entirely new directive that will for the first time get to grips with a particularly hazardous physical agent. But there are some points of concern that should be further addressed. The vexed issues centre on the Directive's basic provisions, namely the proposed limit values, risk assessment method, health surveillance, derogation and transitional periods.

Proposed values

The TUTB greatly welcomes the introduction of action and limit values in the Directive, which will contribute enormously to the prevention of vibration-induced diseases in Europe. At the same time, it will give impetus to manufacturers to produce lower emission machines and vehicles at lower cost. Even so, the proposed limit values of 5 m/s^2 for HAV and 1.15 m/s^2 for WBV and their corresponding action values of 2.5 m/s^2 and 0.6 m/s^2 are high. There is solid scientific evidence of dose-effect relationships for lower magnitudes of vibration of less than 3 m/s^2 for HAV and 0.5 m/s^2 for WBV.

Common position on a vibration directive

Hand-arm vibration
Action value : 2.5 m/s^2 - Limit value : 5 m/s^2
Whole-body vibration
Action value : 0.6 m/s^2 - Limit value : 1.15 m/s^2

[1] Keith T. Palmer, M. Griffin, H. Bendall, B. Pannett, D. Coggon, "Prevalence and pattern of occupational exposure to hand transmitted vibration in Great Britain: findings from a national survey", *Occup Environ Med*, 2000.

[2] *Musculoskeletal Disorders and workplace factors*, NIOSH, 1997.

[3] Antti Karjalainen and Simon Virtanen, *European Statistics on Occupational Diseases, Evaluation of the 1995 pilot data* (EODS), 1999.

■ **Limit values for Hand-Arm Vibration**

There is a statistically significant positive correlation between the prevalence of Raynaud's syndrome and the measured vibration magnitude. Wasserman (1998) reports that after 8 years of 8 hours exposure to 2.8 m/s^2, or 2 hours of 5.6 m/s^2, at least 10% of the exposed population may develop Hand-Arm Vibration Syndrome. Bovenzi *et al*, (1995) found a significant correlation for a HAV > 2.5 m/s^2 and 20 years exposure. A study by S.M. Mirbod, R. Inaba, H. Iwata, M. Jamali (Gifu University School of Medicine, Japan, 1998), suggests that 2.2 m/s^2 would be a permissible vibration exposure for an 8 hour working period.

Furthermore ISO 5349-1:2001 - the reference standard that the Directive proposes for exposure assessment - shows in Figure C.1. that with an exposure of 5 m/s^2 (i.e., the Directive's proposed limit value of 8 hours exposure), 10% of the population will develop vibration-induced white finger in **6 years** - in other words, by working with vibrating tools within the limit values set by the Directive.

Pelmear and Leong (2000) reviewed the literature and concluded that existing standards and guidelines provide inadequate protection for impact vibration. They recommended a more stringent level to lower the prevalence of Raynaud's phenomenon, namely, 1.8 m/s^2 for 8 hours or less, and under 5 m/s^2 for 1 hour's exposure. Bovenzi recommended tougher criteria for exposure than in the present ISO HAV standard. National regulations in Denmark set a limit value of 3 m/s^2 and a non-mandatory target for firms to reduce vibration exposure to 1m/s^2. In the amended proposal for the Directive on physical agents (1994), a threshold level for health risk alert and the need for preventive measures including training was set at 1m/s^2 for HAV exposure.

To conclude we believe that lowering the action value to 1m/s^2[4] and the limit value to 3m/s^2, in the proposal, will reduce the number of workers likely to contract HAV-related occupational diseases during their working life.

■ **Limit values for Whole-Body Vibration**

Epidemiological studies by Bongers *et al* (1990), Boshuizen, Bongers and Hulsdhof (1990), Bovenzi and Zanini (1992), Bozenzi and Betta (1994) found a significant association between exposure to WBV > 0,5 m/s^2 and Low Back Pain among groups of workers. Also Depuis and Zerlett (1987), Musch (1987), Schwarze (1999) found a significantly higher risk of lumbar problems in workers exposed to WBV. Ergonomic requirements suggest that tractors, heavy vehicles and construction machinery with frequencies most often between 1 and 5 Hz and operating for 8 hours a day, require a limit of oscillation acceleration of 0.3 - 0.45 m/s^2. These limits can be achieved technically by jointly engineering the suspension of the vehicles' axles and the driver's and passengers' seats (Kroemer and Grandjean,1997).

In many studies investigating the relationship between low back disorders and whole body vibration, a level of 0.5 m/s^2 is often cited (Hulshof, 1998).

The prevalence of low back disorders is also high among operators of rail vehicles with relatively low vertical but high lateral vibration. The highest levels of vertical vibration were found in off-road vehicles and forklifts (Johanning, 2000)[5].

Also in ISO 2631-1:1997 (the Directive's proposed benchmark standard for exposure assessment), Figure B.1 shows a health caution zone for 8 hours exposure between 0.45–0.8 m/s^2. This means that, for the proposed limit value of 1.15 m/s^2, **there are certain health risks** for workers exposed according to the Directive's suggested evaluation method. In a simplified model of the ISO figure on vibration evaluation used in the Danish regulations, the limit value is between 0.6–0.8 m/s^2.

The Commission's initial proposal on the general Directive for physical agents in 1994 and for WBV exposure set values considerably lower than the current proposal - specifically, an action value of 0.5 m/s^2 and a limit value of 0.7 m/s^2. Also it included a threshold level for health risk alert and the need for preventive measures at 0.25 m/s^2 for WBV exposure.

The European Parliament accepted these values in the first reading of that general proposal. In the forthcoming second reading, it is expected to put up amendments to the common position on a Vibration Directive recently adopted by the Council.

To conclude we believe that lowering the action value to 0.45 m/s^2 and the limit value to 0.6 m/s^2 in the proposal will reduce the numbers of workers likely to contract WBV-related occupational diseases during their working life.

Risk assessment and measurements

The Directive requires employers to perform a risk assessment on vibration exposure. Although relevant standards for concrete measurement are suggested, they are given a let-out to perform the risk assessment by "observation". Risk assessment is extremely

[4] Bear in mind that as the action value in most cases triggers health surveillance, it must be low enough to prevent the development of diseases.

[5] Lic. Rip Op de Beeck, *Research on work-related low back disorders*, European Agency for Safety and Health at Work, 2000.

important because it determines prevention measures and health surveillance of workers. It can only be considered reliable if appropriate measurement techniques are applied. The aim is to determine whether the action values - not to say the limit values - set in the Directive have been reached or exceeded. It is difficult or impossible to gain any meaningful measure of exposure to or the characteristics of vibration through observational methods[6]. Permitting observational evaluation undermines the whole concept of the limit values in the Directive. Limit values in the European Directives were always followed by reliable measurement methods.

The manufacturer's declared vibration emissions alone cannot be used to describe the actual vibration levels to which workers are subjected in practice. It is often not possible to establish exposure levels based on emission data[7]. These values are likely to underestimate the true exposures, since standardized operating conditions for measurement do not always represent the actual conditions in which the machine is used. Other aspects, including equipment maintenance, the workpiece and surface on which a tool is used can aggravate the exposure. Therefore, measured values of the vibration on the actual work environment and real tasks to be performed are required. Although measurements of vibration are considered complicated and expensive it must be borne in mind that advances in equipment are demand-driven. Vibration measurement equipment is now significantly lighter and cheaper than 10 years ago. So, the next generation of measurement equipment is expected to develop to meet the new market demands.

The option of observational evaluation must be dropped from the Directive, therefore. Should the observational approach be maintained, it should be allowed only for machinery with declared vibration emissions considerably below the Directive's action value. It should also be mandatory for such evaluations to be performed only by qualified OHS personnel. Moreover information from relevant databases[8] on ***measured*** vibration values for the specific equipment if available should be taken into account.

Health surveillance

The Directive requires appropriate health surveillance to be ensured when the outcomes of the risk assessment indicate a danger to workers' health. Whatever else, workers exposed to vibration exceeding the action value are entitled to "appropriate" health surveillance. This is a general wording which applies more to the kind of examinations, and does not categorically require periodic examinations. The amended proposal for a Directive on physical agents (1994) specified that workers exposed above the action values shall have the right to ***regular*** health surveillance aiming at early detection of health impairment. It is also not clear whether and in what circumstances workers exposed to vibration lower than or equal to the action limits are entitled to health surveillance. In Great Britain, the recommendation is that it would be prudent to conduct health surveillance on all regularly exposed workers[9].

Prevention measures (PPE)

Annex A, paragraph 5 "Individual protectors", provides that personal protective equipment (PPE) against hand-arm vibration can contribute to the programme of preventive measures. **It must be clear that PPEs can only make a limited contribution to prevention**. ISO 5349-1:2001, Annex E: "Preventive measures", states that anti-vibration gloves should not be expected to provide a sufficient means of protection from hand-transmitted vibration.

Derogations

For vibration exposures that can vary across the day, Article 10.2 provides a derogation from the obligation not to exceed limit values if the 40-hour average exposure does not exceed the limit value. As a result, workers can be exposed to very high vibrations over shorter periods. But for prevention purposes, the magnitude of vibration is more significant than the duration of exposure. Reducing the magnitude of vibration reduces exposure more effectively than reducing the duration. The difficulty of controlling the frequency and duration of exposure to vibration could also lead to abuse of this provision.

Transitional periods

This Directive sets significantly long transition periods for compliance with the limit values. Member States can make use of a maximum transitional period of 6 years from the implementation date (i.e., 3 years from the adoption of the Directive) for firms using older equipment. Employers can claim this transposition period if they bought and gave to workers equipment which exceeds the limit value before **3 years after the implementation** of the Directive. If such a transitional period has to stay in, it should at least apply to employers that gave equipment to workers before the adoption of the Directive. For agriculture and forestry, this transition period can be extended to **9 years**. That said, even longer transition periods are preferable to exempting certain high-vibration sectors. ■

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[6] P. Buckle and J. Devereaux, *Research on work Neck and Upper Limb Musculoskeletal Disorders*, European Agency for Health and Safety at work, 1999.

[7] *Ermittlung des Normungsbedarfs zur festlegung von kennwerten fur Vibrationene*, Kommission Arbeitsschutz and Normung (KAN), Report 3, 1996.

[8] Examples of such Databases exist in KAN (St. Augustin, Germany) and the National Institute of working Life (Umea, Sweden).

[9] *Vibration solutions: practical ways to reduce the risk of hand-arm vibration industry*, Health and Safety Executive, 1997.