

# OCCUPATIONAL EXPOSURE LIMITS OR ERGONOMICS PROGRAMS – DEVELOPMENTAL TRENDS IN EU AND THE US

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In the European Union emphasis in regulatory efforts to prevent work related musculoskeletal disorders (WMSDs) have changed from a specification approach relying on exposure limits (occupational exposure limits, OEL, or threshold limit values, TLV) to a performance or system approach highlighting dialogue, system monitoring and the implementation of ergonomics programs. The balance between a specification and a performance approach appears to be the basic dilemma in all regulatory efforts, and the events in the US leading to the accept and repeal of the Occupational Safety and Health Administrations (OSHA) ergonomics program standard and the passing of the Washington State ergonomics rule illustrates the inherent conflicts in the issue. Finding a reasonable solution to the dilemma is thus a key question in - but not restricted to - regulatory efforts. Voluntary guidelines, and initiatives aimed at developing company specific tools for the prevention of work related musculoskeletal disorders are equally forced to relate to these issues. This paper presents the background and pro and cons of a specification versus a performance approach.

## HISTORIC BACKGROUND

Quantitative, and highly specific numeric recommendations has traditionally played an important role in the development of industrial production systems, as well as in efforts to promote occupational safety and health. Taylorism and the “scientific management” tradition in the 1920s used work physiology as a base for issuing norms to avoid fatigue and reduction in work output and thus optimizing production: MTM (motion-time-measurements) studies was combined with “fatigue allowances” (Mital et al., 1999) to establish industrial time standards.

In parallel with this development, a regulatory approach, partly driven by labor movement in Europe, focused on workers protection rather than production efficiency, and a large number of international standards and national legislation was issued to define e.g. maximal permissible loads in lifting, maximal energy consumption during work etc. This tradition continued and in the last half of the 20<sup>th</sup> century additional standards were issued to protect workers e.g. the widely used NIOSH lifting guidelines (Waters et al., 1993). Fatigue again was on the agenda, but in this context seen as a precursor for disease, and efforts to avoid fatigue before in intervened with performance constituted the basis for suggested TLVs for

static muscular load (Jonsson, 1978).

In the last decade there has been a swing away from quantitative guidelines and TLVs in the prevention of WMSDs. This development has to at large extent been determined by the lack of scientifically well-founded data allowing numeric limits and TLVs. At the same time, however, a performance approach seemed to be in line with current thinking, considering health and safety at work a developmental resource for the companies, emphasizing functional demands on management activities, and focusing on the overall process of improvement (Gustavsen, 1996). Charles Jeffress, former director of OSHA, expressed this changed attitude in a speech promoting the proposed OSHA ergonomics program standards in 1999.

*“Setting standards is something we must do well. And we must do it differently in the future than we have in the past. It’s impossible to tailor standards to fit every conceivable hazard. Instead we must empower employers and employees to address problems within a practical framework. We must focus on performance rather than specification”.*

This developmental trend is, however, far from unambiguous. Technical standards on ergonomics and physical workloads (e.g. CEN and ISO standards) continue to present very specific exposure limits and equations to

predict acceptable workloads. And at the same time OSHA presented their performance approach, Washington State launched an ergonomics regulation based mainly on exposure limits. (Ironically the Washington State regulation appeared as a direct successor to the previous OSHA draft standard from 1995 that Jeffress opposed in his speech).

The debate and the public hearing following the two proposals from OSHA and Washington State focused to a large extent on the balance between specification and performance. No solution or consensus was reached and the fate of the standards are as follows: the OSHA standard was repelled by the Congress and the Washington State ergonomics rule is having a hard time facing industrial opposition.

### EVALUATING STANDARDS AND GUIDELINES

In 1997 the Nordic Council of Ministers initiated a working group in order to promote a common Nordic view of the large number of regulatory and voluntary standards and guidelines on physical workload. Using a framework of criteria for identifying scientifically “good” and practically efficient standards, more than 25 standards were evaluated according to their scientific coherency, effectiveness and usability. The results were published in *Scandinavian Journal of Work, Environment & Health* 2001 (Fallentin et al.) and the main conclusion favored the performance or process type standards.

The main criticism raised against the quantitative guidelines and the specification approach concerned the paucity of scientifically well-founded data allowing the establishment of numerical accept criteria differentiating between safe and unsafe jobs.

The paucity of scientific data supporting TLVs is evident in the three large epidemiological reviews from the National Institute of Occupational Health (NIOSH) and the National Research Council (NRC) in the US published between 1997 and 2001. The three studies are unanimous and clear in their conclusion: there is a clear relationship between certain physical work factors and musculoskeletal disorders, but especially “when there are high levels of exposure” (Bernard, 1997). This last reservation serves to illustrate that the current scientific “state of the art” allows the identification of high risk and clearly hazardous jobs and – to a certain extent - jobs with minimal risk. In between there is a large “gray zone” of uncertainty, derived from the fact that the dose-response data required to determine TLVs

are simply not available.

Basically, this lack of dose-response data can be referred to a number of underlying deficits in the scientific data at hand -

1. The use of gross categorical exposure measurements in most epidemiological studies. Often exposures are dichotomized in e.g. yes/no, high or low, hand forces above or below 4 kg. This is sufficient for etiologic causation but insufficient for TLVs or quantitative guidelines that require knowledge of the complete exposure (dose)-response curve i.e. exposure measurements on a continuous scale. This has unfortunately not always been recognized by the standard makers. E.g. guidelines for hand forces are often referred to the study by Silverstein et al (1987) showing an increased risk of carpal tunnel syndrome at hand forces above 6 kg. This cut point was however never intended to signify an increased risk and only chosen to divide the material into homogenous groups and measurements indicated that the high hand force was actually 14.5 kg.
2. Secondly, the choice of exposure-metric represents a major problem. The exposure metric always carries an implicit assumption about dose (Smith, 1996). As uncertainties of exposure-dose relationships are the rule rather than the exception in the field of WMSDs, it means that the exposure metric chosen as a proxy for dose may be misleading. We do not know if cumulative, average or peak exposure is the right one to choose. If the biological effect of different compositions of duration and intensity differs markedly, there is a clear risk of presenting a misleading impression of dose-response data (Rothman and Greenland, 1998).

The practical implications of this are numerous: The possibility of identifying high risk jobs means that effective interventions can and should be implemented. The lack of dose response data on the other hand implies that risk assessment for the large number of jobs “in between” – with moderate exposures - are inflicted with very high uncertainty. This uncertainty in risk assessment was clearly seen when Marras et al (1999) conducted a study on the ability of the NIOSH 1993 lifting guideline to classify jobs

according to their risk of low-back disorders. This frequently used guideline identified high-risk jobs with a reasonable sensitivity, while a large proportion of low- and medium risk jobs were misidentified. The lack of specificity was apparently the result of the fact that the guideline seemed to identify most jobs as being risky.

## **THE PERFORMANCE APPROACH**

Partly due to the problems with setting exposure limits, and supported by reports on the successful effects of ergonomics programs, but also influenced by a strong industry opposition against mandatory occupational exposure limits, there has been an increased demand on initiatives based on a performance approach. The Nordic document partly supported this development and found “some support for the view that regulatory actions against work-related musculoskeletal disorders will be most successful if an integrated ergonomic program approach is adapted”.

### **Problems**

Performance or program-based approaches are, however, not without problems. Evidence of the efficiency of ergonomics programs is mainly circumstantial and based on individual case stories. The case study review published by the US General Accounting Office (GAO, 1997) describes a reduction in exposure and adverse health effects in five companies implementing core elements in an ergonomics program (i.e., management commitment and employees involvement, hazard identification, job hazard analysis and control, training and medical management). However, the data in this report and other studies are mainly from large companies with well functioning health and safety system, internal expertise and ample resources and on a societal level the positive effects of a performance based regulation are difficult to demonstrate.

In the EU, the framework directive and its individual directives (e.g. the manual handling directive) established a performance based approach focusing on measures to encourage improvements in the safety and health of workers, but without clearly identifiable effects on either exposure or health effect. Results from the “Second European survey on working conditions” (Paoli, 1996) indicated that the percentage of the workforce exposed to the handling of heavy loads increased from 31% to 33% in the same period that the Manual Handling directive was implemented in the EU countries.

In general, the impact of a regulatory performance based approach is difficult to monitor and only recently initiatives have been taken in order to evaluate the effect of performance based regulation in the EU and examine country specific differences in transposition and implementation of directives.

Compliance is another potential problem in a performance-based approach and - as indicated in the public hearing of the OSHA proposed ergonomics rule - the lack of specific numerical criteria could be characterized as a “compliance nightmare for employers and an enforcement nightmare for OSHA”.

Especially small and medium sized enterprises (SMEs) expressed their concern about the lack of specific instructions, and, in the final rule OSHA responded to this criticism by including specific compliance endpoints. The inclusion of specific exposure limits was clearly inspired by the Washington States ergonomics rule, and ironically OSHA in this way reintroduced some of the approach from the original OSHA standard from 1995 to which they had repeatedly expressed their denial. In this form the standard was subsequently passed and repelled within a short period of time.

## **EXPOSURE LIMITS IN FUTURE REGULATORY EFFORTS?**

The current regulatory efforts in EU and the US strongly rely on a performance-based approach. The EU regulation on occupational health issues are based on the Framework directive, which specifies a system/performance approach for the implementation of preventive measures to guard against accidents at work and occupational diseases. Employers and workers obligations are specified, and special emphasis is put on the employers’ obligation to evaluate occupational risks, and to make provision for adequate protective and preventive services. This approach is further refined and developed in the new strategy for health and safety at work recently published by the Commission of the European Communities. The strategy, which comprises the period from 2002 to 2006 emphasises a “holistic approach” aimed at establishing a preventive safety and health culture, promote well-being at work and “going beyond the mere prevention of specific risks”. The same picture is seen in the US: the “post standard era” is characterised by an OSHA ergonomics strategy with a strong emphasis on developing voluntary industry-specific guidelines and compliance assistance instead of a formal rule. The main objection against a formal rule being the

inability “ to make a scientific valid determination regarding the degree of risk from various levels of activity”. (Elaine Chao, Secretary of Labor, 2002).

Since we have argued that scientific evidence does not allow TLVs it could be said that there are no place for exposure limits in regulatory efforts to prevent WMSDs. And there are a number of good reasons to suggest that this may be the case.

There are however two aspects that needs consideration:

Evidence based information tells us that high level of exposure to certain physical work place factors increases the risk of WMSDs to a level that may be considered unacceptable. It could be argued that government regulation is essential to ensure a minimum level of workers protection. A policy relying exclusively on a performance approach without specific numeric limits may be on the expense of the protection of the most exposed and most vulnerable part of the workforce.

Secondly, the risk assessment of moderate levels of exposure becomes difficult in the absence of threshold limit values. Regulatory or voluntary guidelines become difficult to implant and tend to appear diluted without numerical recommendations. The answer is not to approach unsupported recommendations, but rather to promote research into the mechanism of disorders and the use of biomarkers in order to establish valid dose-response data (Forde et al., 2002).

### *Conclusion and future*

The current situation appears rather paradoxical: Legislative and regulatory approaches to prevent of WMSDs are dominated by deregulation, dialogue, performance approach and the absence of exposure limits. Voluntary and technical standards - with limited legal implications - are, on the other hand, “allowed” to present very specific and rather unsupported limits.

In order to accomplish a more consistent approach, the promotion of the following elements could be discussed

1. Regulatory efforts based on sound scientific evidence. This would imply a performance based approach, but supported by legally binding maximum permissible limits for a number of physical work place factors.
2. Voluntary – probably – industry-specific guidelines combining a performance based approach with practical, numerical recommendations clearly acknowledging the limited knowledge base.

3. Research into the mechanisms of disorders with a view to establish TLVs.

## REFERENCES

- Bernard, B.P., 1997. Musculoskeletal disorders and workplace factors. A critical review of epidemiologic evidence for work-related musculoskeletal disorders of the neck, upper extremity, and low back. Cincinnati, USA: U.S. Department of Health and Human Services, NIOSH.
- Fallentin, N., Viikari-Juntura, E., Wærsted, M., Kilbom, Å., 2001. Evaluation of physical workload standards and guidelines from a Nordic perspective Scand j Work Environ Health 27: Suppl 2.
- Forde, MS., Punnet, L., Wegman, D.H., (2002) Pathomechanisms of work-related musculoskeletal disorders: conceptual issues. Ergonomics 45(9):619-30
- General Accounting Office, 1997. Worker Protection: Private Sector Ergonomics Programs Yield Positive Results. Washington, DC: GAO/HEHS-97-163
- Gustavsen, B., 1996. Health and safety as a development resource. In: 25<sup>th</sup> International Congress on Occupational Health. Key-note Addresses. Stockholm, pp. 63-67.
- Jonsson, B., 1978. Kinesiology. With special reference to electromyographic kinesiology. In: Cobb, W.A., Van Duijn, H (Eds.), Contemporary Clinical Neurophysiology. Elsevier Scientific Publishing Company, Amsterdam, pp. 417-428.
- Marras, W.S., Fine, L.J., Ferguson, S.A., Waters, T.R., 1999. The effectiveness of commonly used lifting assessment methods to identify industrial jobs associated with elevated risk of low-back disorders. Ergonomics 42:229-245.
- Mital, A., Bishu, R.R., Manjunath, S.G., 1991. Review and evaluation of techniques for determining fatigue allowances. Int J Ind Erg 8:165-178.
- Paoli, P., 1996. Second European Survey on Working Conditions. European Foundation for the Improvement of Living and Working Conditions, Dublin.
- Rothman, K.J. and Greenland, S., 1998. Modern epidemiology (Second edition). Lippincot-Raven, Philadelphia, US.
- Silverstein, B.A., Fine, L.J., Armstrong, T.J., 1987. Occupational factors and the carpal tunnel syndrome. Am J Ind Med 11(3):343-358.
- Smith, T.J., 1996. Dose concepts in Occupational Exposure Assessment. In: 25<sup>th</sup> International Congress on Occupational Health. Key-note Addresses. Stockholm, pp. 19-24.
- Waters, T.R., Putz-Anderson, V., Garg, A., Fine, L.J., 1993. Revised NIOSH equation for the design and evaluation of manual lifting tasks. Ergonomics 36:749-776.

### *Rules and directives:*

- Council Directive 89/391 of 12 June 1989 on the introduction of measures to encourage improvements in the safety and health of workers at work. Official Journal L 183, 29/06/1989 p. 0001-0008.
- Council Directive 90/269/EEC of 29 May 1990 on the minimum health and safety requirements for the manual handling of loads where there is a risk particularly of back injury to workers (fourth individual Directive within the meaning of article 16(1) of directive 89/391/EEC). Official Journal L 156, 21/06/1990 p. 0000-0013.
- Occupational Safety and Health Administration (OSHA), 1995. Proposed ergonomics protection standard. USA: Occupational Safety and Health Administration.
- Occupational Safety and Health Administration (OSHA), 2000. Ergonomics Program: Final Rule. Federal Register 65(220): 68262-68870.
- Washington State Department of Labor and Industries, 2000. WAC 296-62-051, Ergonomics. Olympia, Washington.