

The EU directive 90/270 on VDU-work

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**Workshop at the XI th Annual International Occupational Ergonomics
and Safety Conference '96**

The EU Directive 90/270 on VDU-Work a State of the Art Seminar

The EU Directive on the Minimum Health and Safety Requirements for Work with
Display Screen Equipment in Practice - a European Overview

Booklet of Abstracts

******* CONFIDENTIAL: ONLY for INTERNAL USE *******

July 12th, 1996

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**The EU Directive 90/270 on VDU-Work – a State of the Art Seminar
an European Overview**

******* CONFIDENTIAL: ONLY for INTERNAL USE *******

This booklet can be bought at 'Institut für Hygiene und Arbeitsphysiologie' at the Eidgenössische Technische Hochschule (ETH), Clausiusstr. 25, ETH-Zentrum, CH-8092 Zurich, Switzerland, Fax: +41-1-632 1173

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Workshop: The EU Directive on VDU-Work - a State of the Art Seminar

"The EU Directive on the Minimum Health and Safety Requirements for Work with Display Screen Equipment in Practice - a European Overview"

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In Co-operation with:

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SANUS Project at University of Stuttgart (Germany)
SIG CHI of Gesellschaft für Informatik (GI)
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The EU Directive 90/270/EEC on the minimum health and safety requirements for work with display screen equipment gives general guidelines on responsibilities and identifies areas for legislation. It does not provide measurable ergonomic standards. These values are being identified in standards such as ISO 9241 and EN 29241.

The International Standards Organisation (ISO) has announced a set of standards called ISO 9241 which provide specific values on which legislation may be based. It also provides system manufacturers, employers and employees with a scientific basis for planning ergonomic working environments. The standard currently comprises 17 parts: Part 1 General Introduction, Part 2 Task design (the way jobs are designed for people working

with display equipment), Parts 3-9 Hardware and physical environment, Parts 10-17 Software and usability.

The European Committee for Standardisation (CEN) has decided to issue its own standard, EN 29241, which will be virtually identical to ISO 9241. In this context EN standards are particularly relevant because CEN member countries, which include both EEC and EFTA, have jointly decided that EN standards will replace national standards (e.g. BS 7179) as soon as they are published. ISO-standards are not always introduced as national standards.

Of course, the Directive outlines minimum standards. Many countries will have existing legislation that already meets or exceeds the proposals.

Each member country will review the Directive and having interpreted it to suit local conditions, they will create new legislation. The new ergonomic laws should be in place as soon as possible. Local legislation will refer to local standards bodies' interpretation of ISO 9241 and EN 29241.

The principles behind ergonomic legislation are simple and founded in common sense. However, far reaching implications for manufacturers and employers ensure that their implementation is complex.

The aims of this Workshop are threefold:

- (1) to present the actual state of the national legislation from a theoretical, political and a practical point of view,
- (2) to discuss the range of possible evaluation criteria,

- (3) to give an overview of the methods and tools in practice.

For each country a representative will give an overview of the national activities and forthcomings of the legislation process (20 min). The discussant will introduce the strength and weaknesses of the presented approach (20 min). This input should lead to a short discussion (10 min).

Publication:

The results of this meeting will be published after the workshop as an edited book by an international publisher (e.g., Francis & Taylor) or as a special issue of an international journal. In preparation for this meeting a four-page abstract of each presenter will be distributed to all participants as a booklet.

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Safety and Health when Working with Display Units: Challenges of the Directive 90/270/EEC from a German Perspective

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ABSTRACT

This paper is about the current situation of German legislation regarding the European Directive on safety and health when working with display screen equipment. After a brief review of the main points and implications of the directive in general, its challenges from a German perspective are described. In the second part of this paper the SANUS initiative of the Ministry of Education, Science, Research and Technology is presented. This initiative is aimed at broad information dissemination and concrete support of organisations which want to start up work place assessments according to the European Directive 90/270/EEC.

KEYWORDS

work requirements, work environment, work organisation, health and safety protection, satisfaction and productivity, hardware, software, German legislation, SANUS initiative

THE DIRECTIVE IN A NUTSHELL

The EU Council Directive 90/270/EEC of 29 May 1990 "on the minimum safety and health requirements for work with display screen equipment" is the fifth individual directive within the meaning of Article 16 (1) of directive 87/391/EEC. By adopting this directive, the member states of the European Union have obliged themselves to "bring into force the laws, regulations and administrative provisions to comply with this Directive" in their respective countries. They shall also "report to the Commission every four years on the practical implementation of the provisions of this Directive, indicating the points of view of employers and workers". Approaching the end of the first four-year reporting period, this workshop may be considered as an informal get-together of national representatives who are in one way or another strongly involved with the practical implementation meant above. Of course, the workshop can not and will not replace each nation's formal reporting obligations and procedures, it may however indirectly contribute to this activity by the public presentation, discussion and comparison of the different imple-

mentation policies and practices in European countries. This paper is about the current situation in Germany.

Initially, ambiguity and vagueness in the directive - either real or in the eyes of the beholder [8] - caused a lot of uncertainty and confusion within the responsible bodies as well as among employers and employees. In the meantime however, many constructive discussions, proposals and activities have aimed at implementing the directive in legislation, in administration, in organisations as well as in industry and have thereby done much to reduce, if not eliminate, these feelings of uncertainty and confusion.

The directive sets lower bounds on safety and health conditions at work places with VDU's and formulates procedures to guarantee that violations of these requirements are either prevented or else systematically detected and removed. When an employer "habitually uses display screen equipment as a significant part of his normal work" (Article 2, c), then the employer is obliged to perform an analysis of the work place, "particularly as regards possible risks to eyesight, physical problems and problems of mental stress" (Article 3, 1). Also they will have to "take appropriate measures to remedy the risks found" (Article 3, 1). Furthermore workers at VDU's shall get appropriate information, instruction and training in order to be able to satisfy the minimal requirements on safety and health conditions (Article 6). They shall also be involved in the design or redesign of VDU work places in accordance with the requirements of the directive (Article 3) [5].

In view of the above listing of requirements it is important to recall, that according to article 118a of the Treaty of the EEC, no directive may impose legal, administrative or financial obligations, which will counteract the founding or existence of small and medium-sized companies. This ground rule should of course be taken seriously while implementing the present EU directive into practice.

The fifth directive 90/270/EEC should have been transferred in national German law before January 1, 1993. Initially it was planned to implement the enabling directive 87/391/EEC through the so-called *Arbeitsschutzrahmengesetz* (Enabling Act of Workers' Protection) and the individual sub-directives through so-called *Verordnungen* (Regulations).

Unfortunately, up to now the German federal diet has not passed this *Arbeitsschutzrahmengesetz*. Consequently, there does not yet exist a legal base for the implementation of the individual sub-directives [6].

Currently it is being examined, whether the enabling directive 87/391/EEC may be transferred in national German law as the *Gesetz zur Umsetzung der EG-Rahmenrichtlinie und weiterer Arbeitsschutzrichtlinien* [7]. The fifth directive will then presumably be taken over one-to-one in a *Bildschirmarbeitverordnung* ("Regulation of Work with Display Units"). It is still unclear, even controversial, whether the *Bildschirmarbeitverordnung* will be worked out in a so-called *Unfallverhütungsvorschrift* (Directive to Prevent Accidents at Work). See the figure below.

In summary, it is not known at the moment, how long it will take to transfer these EU Council Directives in national German law. However, as the transfer is mandatory on the basis of the EEC Treaty, it is officially ad-

vised not to postpone the practical implementation of the implications of the directive [1]. It should particularly be noted, that - irrespective of current German legislation - the directive has already force of law at the level of governmental administrations insofar as they are employers [6].

CHALLENGES OF THE DIRECTIVE

In Germany, general regulations and directives for safety and health at work have already been in place for many years [9]. Even for work at display units there are special regulations and directives [10]. These rules however relate almost exclusively to office furniture, hardware equipment and the immediate working environment of the VDU worker. Testing of eyes and eyesight has also been introduced in Germany in the beginning of the eighties [6]. In the following we will discuss some of the requirements of the directive which are rather new for Germany.

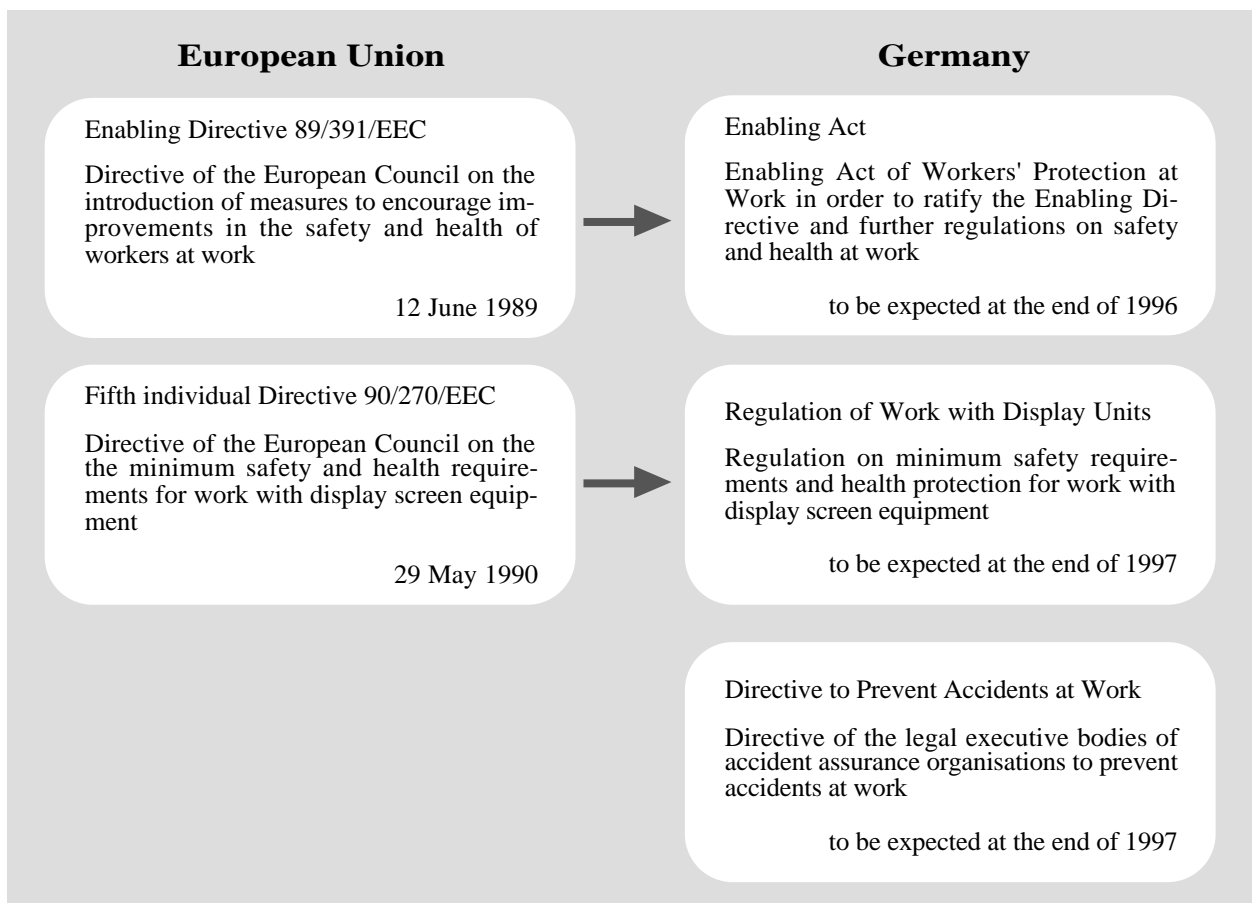


Figure 1: Anticipated Implementation of the EU Council Directives in German Legislation

Obligations and responsibilities of employers

The directive obliges employers to assess and adapt VDU work places in accordance with its technical annex, taking account of "technical progress, developments in international regulations and specifications and

knowledge in the field of display screen equipment" (Article 10). Employers are thus responsible for implementation of the requirements for safety and health at VDU workstations. The analysis of work places shall deal with four aspects: work environment and work organisation, hardware (furniture, equipment) and software (more generally: the man-machine-interface). Com-

panies may perform the analyses themselves or they may consult and hire special service providers. This allows for adaptations of the analyses to the special characteristics and local circumstances of a company [3].

Consultation, participation, instruction and training of employees

Employees shall be instructed and trained in working with their VDU workstations, so that they will be able to act in accordance with the minimum requirements for health and safety. It is not enough to equip the work places with ergonomically adequate hard- and software: the workers should also know how to use it in order to fully profit from its ergonomic features (e.g. taking an adequate posture on ergonomically designed chairs [2]). Employees shall furthermore be consulted during design or redesign of work places so as to allow them to express requirements or recommendations. This is especially important in the case of development or improvement of user-interface software, i.e. functionality and usability of the man-machine-interface.

Requirements on work organisation

The directive contains two references to work organisation and mental stress at VDU work places. Article 3 requires that potentially dangerous mental load be identified and eliminated. Furthermore, in article 7 it is stipulated that measures regarding the structuring of work (e.g., breaks, mixing activities) be taken in order to avoid excessive physical or psychic load (caused e.g. by boredom or satiation).

Requirements on the man-machine-interface

In the appendix of the directive one also finds minimum requirements on the man-machine-interface and on the operating and application software running on the machine. These requirements have been formulated at a rather high level of abstraction in five paragraphs, which however may be made more concrete by reference to existing national (DIN 66234), European (EN 29241) or international (ISO 9241) standards [4] (except for the stated principle that "no quantitative or qualitative checking facility may be used without the knowledge of the workers", which is rather an issue of privacy regulations, not human factors of software).



THE "SANUS" INITIATIVE

The European directive on work with visual display units should be implemented in a effective and - very important! - (time and cost) efficient way. It should therefore be noted that the obligatory work place assessments do not have to have a thoroughly scientific character. It shall however be possible for practitioners in office, industry and other organisations to perform those assessments themselves.

Starting from these premises, an initiative was taken by the Ministry of Education, Science, Research and Technology (BMBF) to establish a consortium and fund a project called SANUS (a German acronym for "Safety and Health Protection of Work with VDU's on the basis of national and international Norms and Standards"). The project has started in 1994 and will last until the end of 1997. The consortium has set itself the following goals:

- To develop and evaluate a strategic procedure for work place assessment and improvement in industrial and administrative settings

- To compile and critically review methods of work place design and assessment covering all furniture and hardware, application software and the man-machine interface, working environment and work organisation

- To act as an intermediary for providers and users of all kinds of methods and tools for the practical implementation of the directive. Relevant methods and tools will be catalogued in the so-called SANUS-Handbook

- To perform pilot implementations of the directive in designated organisations which are co-operating partners in the project

- To prepare and disseminate information, on request as well as on its own initiative, about all issues and aspects concerning the practical implementation of the directive by means of conferences and workshops, seminars and tutorials, a project-specific hands-on work group for practitioners, publications and newsletters, both in paper and in electronic form

The consortium consists of the following partners: the Institute of General Psychology and Methodology of the University of Dresden, the Department of Ergonomics and Human Factors of the University of Ilmenau, the Research Group MenBIT of the University of Wuppertal and the Institute of Industrial Ergonomics and Technology Management of the University of Stuttgart (the last one being the consortium leader). These four institutes work in close cooperation with the software house ISA (Stuttgart), the engineering company ELK (Krefeld), the counseling companies and training experts ATB (Chemnitz), ibek (Karlsruhe) and GSM (Stuttgart).

INFORMATION DISSEMINATION

Project SANUS promotes the communication and transfer of experiences between stake-holders in the field. Several national and international conferences and workshops for experts and practitioners have been held. Discussions at these meetings showed clearly, that issues like the development of user-centred software, the assessment of the ergonomic quality of those software as well as the measurement and analysis of mental workload receive a lot of interest both from practitioners and from tool designers.

In order to facilitate the transfer of experiences with the implementation of the directive between practitioners in industry and the researchers of project SANUS, the consortium has established a so-called industrial workshop.

The workshop provides participants an opportunity to learn more about implementation methods and tools and their practical application. Topics for discussion may further be proposed by the participants themselves. Up to now four successful workshops have been held.

Latest news about the progress of the political debates and the legal implementation, about pilot implementations in several companies as well as about the ongoing work in the project will also be published in the project's newsletter. Finally, facts about work place assessments, methods and tools for assessment, and more general information about the European directive in Germany are made available through the world wide web [12].

ASSESSMENT OF WORK PLACES

Whereas adequate requirements and criteria, norms and standards, methods and tools for the assessment of furniture, hardware and environment at the work place have already been around for many years, this is not yet true for the assessment of mental workload and stress at screen-based workstations, for the evaluation of graphical interfaces and for the development of user-friendly application software. We will now present some of the recommendations proposed by project SANUS with respect to assessment.

Assessment of physical ergonomics aspects

As far as furniture, equipment and working environment is concerned, 19 assessment procedures were reviewed and evaluated by project SANUS on their relevance for the directive on VDU equipment. Based on this review a new, quick and easy procedure was derived:

SAHIB (University of Ilmenau), which is a screening questionnaire, particularly suited for use by non-experts and taking not more than 20 minutes to complete

Assessment of mental load and stress

Project SANUS offers two methods and related tools for the assessment and evaluation of psychologically well-defined workload at visual display equipment. These methods and tools can at least partially be handled by non-experts and do not require too much effort on part of them:

BEBA (University of Dresden), which is particularly suited for use by small and medium-sized companies, enables the assessment of workload caused by or related to features of the work organisation or task structure

SynBA (University of Wuppertal), which has mainly been tested in large and medium-sized companies, is used to assess whether and, if so, to what extent the workload at a given work place departs from its optimal level, for which it depends upon computer-supported analysis and interpretation.

Assessment and improvement of the quality of software

A mayor goal of project SANUS has also been advice, training and further development of practical tools for the evaluation and design of directive-compliant soft-

ware. Thus, many existing methods and tools for software evaluation were reviewed and tested as to their relevance for the directive and two new tools are under development:

QS2, a software screening procedure based on a questionnaire developed by Prümper and Anft, is particularly suited for non-experts and will take not more than one hour per work place

SHIVA is a computer-aided tool for detailed analysis of application software on the basis of screen shots and dialogue flow diagrams. It can be applied by human factors experts, e.g. as member of a design team

Both procedures allow a conformance check of the tested software with ISO 9241, parts 10 to 17 [11].

To encourage the development of user-friendly and user-centred software as required by the directive it is necessary to provide developers with more adequate tools than exist today. To this end, dialogue modules have been designed and (partly) implemented, and will be tested for compliance with the directive. These dialogue modules go well beyond the dialogue elements as they exist in current industrial standards like MS WINDOWS, OSF Motif, CUA, etc. and will be made available to developers through an on-line style guide as well as a User Interface Management System.

GUIDELINES FOR PRACTITIONERS

One of the main goals of project SANUS is to iteratively develop and test a practical procedure for the implementation of the European directive. Constant feedback on the procedure from the pilot implementations (see below) is considered very important. The procedure itself will be documented in a so-called SANUS-Handbook, which will also describe the methods and offers the tools to perform work place assessments in all four areas: work environment and work organisation, physical and mental workload, hardware and software at the workplace. The first version will be shipped by the midst of July this year.

Much emphasis will be put on the practicality and efficiency of the SANUS procedure, i.e. it should be easy to implement by those responsible within the organisations and it should not put an undue economical burden on those organisations. The procedure will of course differ for organisations of different sizes, e.g., because work place assessments in small companies will most often be done by the owners themselves, whereas - as a rule - large companies in Germany have their own department for safety and health protection at work.

PILOT IMPLEMENTATIONS

A number of public and private organisations cooperate with the main partners of the consortium of project SANUS. These very diverse organisations are setting up projects to implement the European directive, are already running work place assessments or plan to improve working conditions and thereby workers' productivity in accordance with the directive. They are being supported by members of the SANUS consortium in a number of different ways, from the supply of infor-

mation and documentation about all aspects of the directive and its implementation in Germany up to the planning and execution of complete pilot work place assessments by means of the SANUS toolkit.

Up to now 17 medium-sized or large administrative and industrial organisations have profited from this co-operation with project SANUS. The following is only a partial listing: public services and institutions like a state office of safety and health protection, a state library, a state university, the large office GEZ in Cologne (responsible for collecting the broadcasting contributions), the multinational SIEMENS in Munich, and a number of counseling and engineering companies in the fields of data processing, architectural planning and construction. Apart from large and medium-sized companies, project SANUS is also involved in work place assessments in small companies, which partially require another approach. For instance, organisations having from only one up to 17 VDU workstations like city works, a theatre, an optician's shop, a car dealer and a service bureau for gardening or interior design have been successfully supported. New co-operating partners are steadily looked for and invited to join the SANUS consortium.

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Analysis of Workplaces with Display Screen Equipment Based on the EU-Directive Developed by the Technology Consulting Office Oberhausen (ABETO)

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ABSTRACT

One main point of discussion in implementing the VDU Directive 90/270/EEC is the workplace analysis. A procedure is introduced to this end.

KEYWORDS

Workplace analysis, psychic stress

INTRODUCTION

Article 3 of the EU-Directive on VDU-work obliges employers to perform an analysis of workplaces with display screen equipment.

The Technology Consulting Office (TBS) is an institution which, when new technology is being introduced, advises works and personnel councils on questions of health and safety requirements as well as questions of re-organisation and quality management systems.

ABETO

ABETO has been developed by the Technology Consulting Office as a practical instrument for the analysis of workplaces with display screen equipment.

This instrument has been tested in several cases where questions of health and safety requirement as well as questions of design were raised. It basically consists of 4 steps:

Step 1: Setting up a project group,

Step 2: Selection of special workplaces with display screen equipment,

Step 3: Analysis,

Step 4: Development of action.

Step 1: Setting up a project group

The first step is to form a project group to oversee and carry out the complete ABETO process. Its main tasks are the organization of the following steps and the solution of ergonomic problems.

Depending on the size of the firm, the members could come from the following groups:

- users
- responsible managers
- representatives from the administration department
- industrial safety officer
- work doctor
- external consultant (e.g., technology advisor or business consultants).

Step 2: Selection of special workplaces with display screen equipment

A complete analysis of all workplaces with display screen equipment is often neither possible nor necessary. The project group thus needs to be selective. This can be done in various ways, or these can be combined with each other: the Employee survey.

Questionnaires are used to find out which problems employees do have in terms of working environment, health conditions, display equipment such as hardware and software as well as task design. Those workplaces with specific problems are selected to groups, so that single workplaces can be analysed as representative for a whole set of problems.

The employees or members of the project group then carry out short testing using easy-to-use checklists [1]. The checklists cover items such as working environment, health conditions, hardware and software conditions and task design. If serious problems occur, pro-found checklists may be used.

Step 3: Analysis

At this stage workplaces with special problems are investigated in detail. This is done by members of the project group with appropriate qualifications. If necessary, external specialists may need to be called on to perform measurement work, for example. The analysis is based on standards of the International Standards Organisation (ISO) such as parts from ISO 9241 or German Standard Organisation (DIN). Any deviation from these guidelines is a defect, so that step 4 is primarily concerned with rectifying these.

ABETO follows the assumptions that stress on employees working with display screen equipment basically comes from 3 sources:

- environment conditions
- usability of software
- task design.

One further source may be the organisation of work in general. Environment conditions include problems with hardware and physical environment. Software problems include all problems of usability or much rather unusability. A questionnaire based on the standards of ISO 9241/10 is used here. Employees can evaluate the software by themselves [2].

Problems with task design include problems employees do have with the way jobs are designed for those who work with display screen equipment. Cause of stress may be all "Kinds of restrictions employees have to face in order to carry out their job properly" [3].

Interviews on this item are performed by external specialists or by trained members of the project group. Training for the latter is possible at no great time or expense. DIN EN 29241/2 is the standard on which psychic stress is evaluated. The outcome of step 3 ist a report on defects [4, 5].

Step 4: Development of action

The task of step 4 is to rectify any defects found. This may be a change of hardware conditions or a reprogramming of software in cases where the defects are serious and numerous [6]. Where suggestions for improvement are put forward, it is recommendable to involve the em-

ployees as the users of display screen equipment. ABETO offers a good instrument for workplace analysis and improvement. One means of improvement may as well be a reorganisation of those workplaces with display screen equipment. In this field further efforts have to be made. On the whole, ABETO can be seen as a practice guide for analysis of workplaces based on the EU-Directive.

INFORMATION AND QUESTIONS

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The EU-Directive 90/270/EWG in Austria

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The EC-Directive 90/270/EWG of May 1990 requires companies to provide several features of interactive software systems that are used for task accomplishment and user adaptation. The directive has been developed in order to increase productivity at VDU-workplaces as well as to increase human comfort and safety when tasks are accomplished through interactive computer systems. The directive should have been transformed to national law of all member states of the EU until 1993. Although not all of the EU-member states have achieved this goal by now, Austria has included the entire directive into the Austrian Law for Occupational Health and Safety (ALHS, 1993). In order to develop an EU-conform instrument two projects have been launched in sequence: Scientific Foundations for a EU-Conform Instrument, and a Prototypical Instrument for Evaluation. In the following we summarize the objectives and (intermediate) results of these projects.

In the project Scientific Foundations, several aspects of operationalizing the directive have been investigated:

1. In how far has the directive been incorporated into national law in the EU-member states?
2. How are existing criteria from cognitive ergonomics related to statements of the directive?
3. How can existing instruments and criteria be evaluated to contribute to the development of an instrument for evaluating VDU-workplaces according to the EC-Directive?
4. How can the findings of 2. and 3. be integrated to proceed in the development of a proper instrument for evaluating VDU-workplaces according to the EC-Directive?

For the first question the responses to a request to the corresponding institutions of each EU-member state have been evaluated: there are only 8 out of 12 EC-states that have met the deadline and incorporated the directive into national law by 1993. Moreover, all of the members fail in providing a methodology for evaluating VDU-workplaces according to the directive. We rather find a demand for developing such kind of instruments.

Table 1:

Statements in the Directive

Cluster of Criteria stemming from Cognitive Ergonomics	1.	2.	3.	4.	5.
Task Appropriateness	x	x	o	x	x
Self-Explanation	o	x	x	o	x
Controllability	x	x	x	x	x
Conformity	x	x	x	o	x
Robustness	o	x	x	o	x
Adaptivity	x	x	x	x	x
Learnability	x	x	x	o	x
Support for Cooperation & Communication	o	o	o	o	o
Integrity & Security of Data	x	x	x	o	x

x criterion concerns the directive;

o criterion concerns the directive partially

The statements of the directive are related to the clustered criteria identified in cognitive ergonomics (as given, e.g. in [2, 3]) as shown in Table 1.

- All of the clustered criteria with the exception of 'Support for Cooperation and Communication' are directly related to at least three of the statements of the directive.
- Controllability and adaptivity are crucial issues, followed by task appropriateness, conformity, learnability, data integrity and security.
- Support for cooperation and communication is of minor importance, due to its strong relation to a certain organization of work, namely group work.
- The statements concerning user friendliness, adaptivity, controllability and principles of ergonomics are related to 7 out of 8 clustered criteria, since they are located at a high level of abstraction.

After having identified the relationships between traditionally identified criteria and the statements of the directive, the next investigation has been focussed on existing techniques to evaluate VDU-workplaces.

REVIEWING INSTRUMENTS

In order to evaluate existing approaches for checking criteria from cognitive ergonomics a scheme has been developed. The scheme is based on:

- 11 domains describing the fundamental review criteria, such as the set of criteria.
- Each domain comprises several items for description, such as references for the domain 'identification'.
- For each criterion of an evaluation technique several characteristic items have been acquired: name, definition, usability for quantitative or qualitative measuring, domain, and use for the analyzed technique.

The domains were:

- ◆ **IDENTIFICATION** of the evaluation technique, containing the authors, state of origin, date of origin, references.
- ◆ **FUNDAMENTALS** for the development and the application of the evaluation technique, such as the DIN-norm [4].
- ◆ **SCIENTIFIC DISCIPLINES** that have contributed to the development of the evaluation technique, such as cognitive psychology.
- ◆ **GOALS OF EVALUATION**, including the motivation and the domain(s) of application, organizational roles that are affected through the evaluation, and the type of business the technique may be used in.
- ◆ **CRITERIA FOR EVALUATION** that constitute the technique, such as task appropriateness.
- ◆ **PROCEDURE OF EVALUATION**, containing the steps and tools, in order to apply the technique.
- ◆ **VALIDATION OF THE TECHNIQUE**, i.e. what kind of studies and verification procedures the technique has already undergone, in order to determine

ist dependability. It includes business domains, experiments, states and references.

- ◆ **EXPENSES FOR APPLICATION** concerning the time, budget and people who perform the preparation, the measurement, and the evaluation of the results. It also comprises the degree of participation for the involved end users, and the qualification of the persons performing the evaluation.
- ◆ **LEVEL OF DETAIL OF EVALUATION** addresses several layers of organization: individual task layer, global work organization, social behaviour, and enabling cooperation through the VDU-workplace.
- ◆ **RELATIONSHIPS TO CONCEPTS FOR DIALOGUE DESIGN** provides knowledge about in how far existing dialogue concepts and models, such as reviewed in [5], have influenced the development of the evaluation technique.
- ◆ **OVERALL BENEFITS:** analyzing this aspect provides insights into several issues:
 1. In how far have the goals been achieved the developers intended to achieve?
 2. How easy and straightforward can the technique be used?
 3. Are there indicators to use the techniques for developing an instrument for the directive?

Although there exist several studies reviewing existing evaluation techniques, e.g. [6,7,8,9,10] our approach is the first comprehensive one. It does not only take into account the criteria of a technique but also its orientation and context of application. Hence, the usability of techniques for developing a technique in compliance with the directive can easily be determined by the performed analysis.

INTEGRATION OF FINDINGS

For the development of a compliant evaluation technique we can identify several layers of evaluation:

- *organization of work*: at this layer the global as well as the individual organization of work is concerned.
- *technology*: at this layer all devices and software functions used for task accomplishment have to be considered for evaluation.
- *social aspects*: besides the organizational context the social one, comprising cooperation and communication, have to be taken into account in the course of evaluation.

The Table 2 shows the relationships of the addressed layers to the statements of the directive. Since all criteria and methodological proposals can be assigned to one of the addressed layers, the development of a proper instrument can be performed in a structured way.

The Table 3 gives an overview of the analyzed evaluation techniques according to the domains and items discussed in the previous section. Highly developed techniques are EVADIS II [2], MUSIC [11], KABA [12], ABETO [13] and TCO [14]. However, most of them are

either product-oriented, such as EVADIS or completely user-oriented, such as MUSIC. For the development of an EU-compliant instrument, both aspects will have to be integrated according to the directive.

We have shown in our case study how difficult it is to evaluate interactive technology at the workplace ac-

ording to EC-Directive for interactive systems. Up to now, there exists no comprehensive instrument for this type of evaluation. We have given an overview of several problems involved and introduced our proposals to solve particular problems arising in the accomplishment of (the complex task of) putting a directive to work.

Table 2:

Statement in the Directive

Dimension of Evaluation	1.	2.	3.	4.	5.
Task / Organization	x				
Software / Devices			x	x	x
Individual / Society		x		x	x

Table 3:

Statements in the Directive

Dimension of Evaluation	1.	2.	3.	4.	5.
Task / Organization of Work	EVADIS II MUSiC DRUM SUMI Workload PROKUS E-Prüfer AN-Sicht				
Task / Organization of Work	1. Layout Appr. Job C. Model Checklist SW-Checker KO-Kriterien ABETO KABA RHIA/VERA	2.	3.	4.	5.
Software/ Devices			EVADIS II MUSIC DRUM SUMI KO-Kriterien	Workload PROKUS ABETO E-Prüfer AN-Sicht	Layout. Appr. Checklist PROTOS
Individual/ Society		(*)		* EVADIS II Usa-testing MUSIC DRUM SUMI ABETO KO-Kriterien SW-Checker	Workload PROKUS E-Prüfer AN-Sicht Layout Appr. Job C. Model Checklist

PRELIMINARY RESULTS FROM PROJECT II

Empirical Data about handing the directive

In the following four different aspects of evaluation are handled. For each of the aspects we have defined concluding results, in order to reflect the main issues in the implementation of the directive. In case there are different interpretations we have also categorized the statements according to their origins: enterprises, consulting companies, unions and government. In the course of the investigation the following issues have been addressed:

1. How important are statements concerning cognitive ergonomics that are handled within issues concerning occupational health and safety?

According to this question it had to be found out in which way the governmental regulations on occupational health and safety are actually implemented and how the particular statements are interpreted by responsible staff.

2. How is the evaluation of workplaces where software is used actually performed?

It should be identified which measurements and instruments are applied in order to implement the relevant aspects for further development of an evaluation instrument.

3. Who is responsible for evaluation and what kind of external organizations or experts have to be involved for execution?

In this context the roles of people directly or indirectly involved in evaluating software have to be acquired.

4. What happens with the results of an evaluation?

Similarly to the question how government regulations are interpreted for each evaluation it has to be clarified how the results can be used for improvements in quality management and work conditions.

HANDLING SOFTWARE EVALUATION IN THE CONTEXT OF OCCUPATIONAL HELP AND SAFETY

- (a) *The statements of the governmental regulations are considered to be important. However, the implementation of the governmental regulations as well as experiences of enterprises in handling cognitive ergonomic criteria is missing.*

Although the number of workplaces where interactive software solutions are increasing the governmental regulations have not been implemented in most of the cases. All of the statements in the governmental regulations are considered to be important since they are a first step towards improvements at the workplaces. There is more engagement in implementing the regulations as soon as the responsible staff members consider software as implementing a model of the organization of work.

Within enterprises the statements of the governmental regulations are considered to be redundant and fuzzy. In addition, additional regulations for the statements are missing, in order to implement the entire set of regulations. There are no indications on how to develop a proper instrument or which instrument could be used

within an enterprise. Finally, issues concerning criteria of cognitive ergonomics are rarely discussed within enterprises since software is still considered to be just another tool for task accomplishment. In most of the cases it is still neglected that software allows to adapt to individual user needs and particular tasks.

One problem in the context of finding instruments for evaluation is the actual measurement of psychological criteria. However, this criteria could be addressed due to the regular use of software in a particular context. Staff members from the industry council do not identify the possible threat towards the safety and health of working people since they stick to criteria from hardware ergonomics that are measurable in a quantitative way easily. Staff members from trade unions on the other hand stress out the particular importance of reducing health risks and psychological stress caused by software.

Consulting agencies have already identified the importance of implementing the criteria of governmental regulations in the area of cognitive ergonomics. However, they also identified a lack of understanding and misconceptions when dealing with regulations concerning cognitive ergonomics. They also expect from the government additional regulations in order to find out certain weights for the criteria as well as a limitation of issues important for interacting with software at the workplace. However, it has to be stated that the governmental regulations for handling software in an enterprise context is of high importance due to several reasons:

1. Software is not just another tool

First, software is a vital factor for all the processes occurring in an enterprise. It is not only the reliability of software for a workplace, but also the pre-programmed structure of data and processes that actually influence the daily work within an enterprise. As soon as the management as well as software developers are committing themselves to model the organization and the flow of work when implementing software solutions the criteria from cognitive ergonomics come into playing and are discussed within the design process. As a consequence, software can be adapted towards actual enterprise tasks as well as user needs when users are participating in the development process.

Secondly, as long as software is developed by technology-driven aspects there will be no inclusion of human criteria when interacting with software. In the case of technology-driven software development user needs as well as tasks actually to be performed are not the starting point for software development. The starting point is a set of functions that are implemented with the help of certain platforms and development environments. However, following this strategy the likelihood for acceptable products is decreasing the more technology-driven development is performed.

As a consequence the requirements set up by user needs and enterprise processes should be acquired very early in the development process and should be the starting point for further decisions in the area of technology. In the cases process models are neglected software is developed just like another tool for task accomplishment.

Finally, all the benefits that could have been achieved through the appropriate application of technology can not be achieved and the intended business strategy fails.

2. From the point of view of the health of working people missing implementation of criteria from cognitive ergonomics may lead to damages of the individual health that may be not removable.

Furthermore, stress, for instance through hindrances in the workflow according to software functions may influence the quality of work results. This fact becomes even more important as soon as different processes are nested within each other.

The motivation for improving performance at a workplace is actually decreasing as soon as basic ergonomical principles are neglected in the course of software development. In contrast, as soon as basic ergonomic principles are handled in a proper way in most of the cases software leads to higher productivity and improvements in quality management.

- (b) *The evaluation of software at workplaces may lead to improvements in quality management as well as reducing failures.*

Enterprises indeed implementing the governmental regulations do not only meet legal requirements, they also try to improve their internal quality management as well individual health conditions. However, when it comes to mental overload and stress there are no instruments that could be applied in order to improve work conditions. Consultant agents provide some instruments to indicate psychological hindrances for the successful use of software. However, they fail in providing concrete measurements and qualifications, e.g. for the medical staff employed by the enterprises.

- (c) *Standard software has to be treated isolated and can not be adapted towards the needs of enterprises. This is not the intended use of standard software.*

Investigated enterprises as well as the consultant agencies and governmental responsables consider standard software to be more or less inflexible. This type of software is considered not to be adaptable very easily to individual user needs and processes of an enterprise. The responsables would like to have some quality checks that are performed outside of the enterprise in order to rely on criteria that can be met objectively. However, software developers are not very interested in aspects of cognitive ergonomics since some human measurements can not be performed. In addition, as soon as software can be evaluated objectively there is still an open question concerning in how far the software should be flexible and adaptable to individual needs and work processes of an enterprise.

First experiments with evaluations of standard software have led to results that show the required adaptation of standard software as well as the possibility of such a process. In the cases where standard software has been evaluated and checked for usability the functions not required for the individual workplace have been removed or deactivated. According to this improvements in the course of introducing standard software users tend to use the software in a more natural and acceptable way.

From the technical point of view standard software has the goal to provide a standardized set of functions and data structures that can be applied in many different application domains. However, this goal does not imply that the use of these functions has also to be standardized. Software developers providing standard products have already recognized this need and allow users a lot of adaptations and individual sequences. This process is called customization and allows to adapt to individual user needs and enterprise processes.

- (d) *The governmental regulations are interpreted in relation to the enterprise-wide software. However, the intentions behind the particular statements are not very clear. The governmental regulations are not sufficient for a complete implementation of the statements concerning occupational health and safety. Additional regulations are currently developed and should give indications in how far instruments can be used to check the required standards. Two different aspects have to be improved concerning the implementation of the regulations: redundancy, and level of abstractness. Some of the statements contain redundant information to others. This leads to the same criteria and the same measurement methods, which is not very economically.*

On the other hand, criteria located at different levels of abstraction are not easily to grasp and will lead to inconsistent measurements. The Background for the particular requirements in the regulations is not very transparent. This missing transparency may be included as soon as the criteria addresses by the higher level goals can be refined. It stresses out that the additional regulations should clarify both issues addressed above.

2. How to evaluate Software

We now summarize the main statements concerning the practical approach towards cognitive ergonomic measurements.

- (a) *Enterprises that are evaluating work places according to particular classes of work places often neglect user oriented criteria.*

Since the government does not like to imply certain implementation regulations on the enterprises through the regulations there is a lack of indication on how to perform the measurement of criteria from cognitive ergonomics. If an enterprise is interested in a very effective and fast evaluation it tries to find out particular work places equipped with the particular software product, and then applies a standard procedure for a more or less standardized work place. The responsables expect a reduced the amount of time to be spent for each of the work places as well as a complete meeting of the governmental requirements. However, the people who are actually involved in task accomplishment are not participating in a sufficient way. If only one work place is under consideration in a representative way all the other users who are not participating in an evaluation process have no possibility to deliver their judgments. The trade unions know this dilemma and propose to find out some criteria which can be measured objectively and are oriented towards the functions in an exclusive way, and to measure some subjective measurements, which requires to in-

volve the users. Both the criteria applied for measurements concerning the properties of software as well as judgments of users may involve quantitative as well as qualitative data.

Handling this question and optimizing the effectiveness and effectivity will lead to a strategy that allows to deliver the judgment of each user as well as to find out in the planning phase in how far a particular software actually meets the minimal requirements for the user of the software in the enterprise. Actually, all different factors are concerned at the use interface:

- Individual needs of users: skills, experiences, preferences and intentions.
- Factors of work: reliability of data, timeliness of results, integration of tools, different types of tasks, etc.
- Functionality: robustness, conformity, explainability, adaptivity and support of group work, if required.

As a consequence, any instrument measuring occupational health and safety has to take into account that the main topic of interest is the user interface, and all of the factors have to be measured in an integrative way instead of measuring them isolated. The latter requirement is also stated in the planned additional regulations of the government.

(b) In order to evaluate software within an enterprise particular strategies and instruments are developed.

The reason for this development is the lack of existing instruments that can be easily used and adapted towards enterprise processes. Although there exist some approaches for measuring occupational health and safety at a work place for the implementation of the criteria in cognitive ergonomics there is almost no indication how to handle the results. But actually the results of the measurements are the interesting input that may need enterprises to improve the work conditions.

As soon as the results of measurements do not lead to direct advice and regulations that may be implemented effectively any offered instruments will not be used in the intended way. The existing approaches for measurements do not give any information about the efficiency of the instrument since empirical data are missing. The reason for these missing empirical investigations is that the government did only implement the directive in the national law without thinking about any further activities to put these regulations to practice.

(c) Help should be available in the course of evaluation. This help should be easy to handle, understandable, easy to use and efficient.

Since there is no instrument in the moment that can be applied directly in the context of business processes help is required from responsible government institutions as well as consultancy agents. On one hand the reasons for hindrances at the work place should become evident in the course of measuring, on the other direct user support to remove hindrances should also be available. In acquisition of requirements for an instrument has led to the following list:

An evaluation instrument should

- allow quick evaluation
- lead to automatical analysis of the result
- implement the governmental regulations in a straightforward way
- be comfortable and complete
- allow easy recognition of hindrances in the course of interaction
- provide direct feedback about the required changes to remove hindrances.

The efforts related to an evaluation should be minimized for enterprises. For each evaluation not more than one hour should be spent for.

3. Role assignments and requirements for qualification

In this context the requirements for experience and skills have been analyzed and acquired. Governmental regulations require that enterprises are obliged to assure health and safety at a work place through the acquisition of possible risks. In addition, at workplaces where software is used ergonomical design has to be achieved.

(a) Evaluation has to be initiated from the management.

The initiative should come from the enterprises management. Responsible roles are physicians, security staff members and ergonomists. Middle management or top management should assign evaluation tasks to the security staff members who are responsible for the implementation of the guide lines and principles from the governmental regulations. Unfortunately, in most of the enterprises criteria and techniques from cognitive ergonomics have never been applied. As such, staff members from the security department are not educated and skilled in using qualitative measurements. However, first results are available from the development of particular instruments. The more basic ergonomic knowledge has been integrated into the instrument the more likely are improvements at the work place.

Medical staff members have been handling physical needs of employees up to now. They are not prepared to evaluate criteria from cognitive ergonomics. They involve mostly psychological criteria. Particular education for these people is required. However, medical staff members are those persons to whom employees could indicate some hindrances and cognitive overloads.

People from technical departments, such as computer specialists, are usually responsible to install software and to control their production. They are actually not interested in implementing particular criteria, in particular when standard software is used in an enterprise. They only feel responsible for the technical background and error free execution of functions.

People representing staff members at the work place are also not educated very well in the field of cognitive ergonomics. Although these people should represent the entire number of employees they can not control and monitor the process of software installation and planning in a proper way. They are rather kept busy through other tasks, such as the loss of work places due to the recession. However, they have identified cognitive ergo-

conomic criteria to be important for the use of software at the work place and have committed themselves to be educated in this field.

External experts are usually called to verify evaluation results or to perform evaluation additionally if there is absolutely no knowledge available within an enterprise. In addition, external experts are required for particular problems that do not involve technical, organizational or cognitive problems. For all of the evaluators skills and experiences in cognitive ergonomics are required. The main goal is to improve the work conditions in the enterprise.

(b) *The cooperation with the people from the government is highly appreciated.*

All of the investigated enterprises uttered their interest in cooperating with the government for implementing the statements of governmental regulations. They also complained about the missing support coming from these institutions. Some consultancy agencies proposed an outsourcing scheme for governmental institutions that are responsible for implementation of laws. As such people from the government would become consultants for enterprises. At the moment these people fail to provide the required information to implement regulations.

(c) *The participation of employees in the course of evaluation is stressed out differently.*

The role of employees working with software for the evaluation is handled differently. On one hand, participation is considered to be a means for more democracy within an enterprise that finally leads to higher productivity. On the other hand, participation is considered not to be required, since the users are considered to be not capable to handle such a complex procedure. The trade unions consider participation as a useful means, although they would like to have a particular set of criteria that could be measured without involving end users. Consultants consider the participation of end users to be required in the beginning in order to find out hindrances for higher productivity. In a second step they consider experts to remove the hindrances to be essential for improvements.

From the point of view of cognitive ergonomic measurements the participation of users is required. The reason for this involvement is given through the orientation of the governmental regulations towards user criteria. Only the users can give information about the capabilities of the system provided for each user. For instance, if a user has problems with spatial relationships to be handled at the graphical user interface, it could be an individual problem that essentially requires modifications at the user interface. However, improvement of health and safety should focus on those people who have difficulties in interacting with computer technology.

4. Handling the results of the evaluation

The last step of each evaluation procedure is the interpretation of the results and the consequences related to the results. Besides meeting ergonomental requirements improvements in the quality management and safety of people at work places are considered to be the major targets of software evaluation.

(a) *Results from evaluations have not to explain the reasons for difficulties, they rather should give practical tips and procedures to be followed for the removal of hindrances.*

(b) *Enterprises are in particular interested in results of evaluation procedures that can be implemented directly. Besides meeting the ergonomental requirements potential improvements should be able to be implemented immediately. If possible, external consultants should have the possibility according to the results to optimize the application of software. Improvements are considered to be possible in the organization of work as well in technical belongings.*

A major requirement to handle results effectively is the possibility to actually introduce new concepts in an organization. In order to succeed in the implementation of improvement the reasons for hindrances should also become evident. From the point of view of cognitive ergonomics it is not so efficient to have a list of activities in order to remove possible hindrances, it is rather required to know why certain improvements have to be performed.

(c) *The qualification and education of software users is considered to be a means to reduce hindrances and problems in the course of interaction.*

In enterprises sometimes people are educated in order to use software without failures. However, the technical possibilities should be explored extensively before education programs are developed. It could be cheaper to adapt existing software to user needs instead of trying to adapt people to software functions. Only those cases should be handled through skill management and education that can not be solved through technology. In particular, the use of standard software allows a wide range of adaptation to individual skills and needs. However, responsible persons in the enterprises tend to provide additional education in case of problems, instead of investigating adaptation features.

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The implementation of the display screen directive (90/270/EEC) in the UK

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ABSTRACT

The Health and Safety Commission (a tri-partite body including government, employers and trades unions) decided to transpose the Directive as Regulations under the Health and Safety at Work etc Act 1974 (specifically "under section 15(1), (2), (5)(b) and (9) of, and paragraphs 1(1)(a) and (2), 7, 8(1) and 14 of Schedule to" that act).

The original Directive contained a number of obligations which, although generally quite straightforward, were formulated in language which was sometimes unclear, having lost something in translation from the original French. Unfortunately, on the advice of the Government Solicitors, the HSC retained much of the original wording of the Directive and included the technical annex as a Schedule to the Regulations.

1. OVERVIEW

The Health and Safety (Display Screen Equipment) Regulations 1992 set out six main obligations on employers of those who work with display screen equipment. Employers are required to:

- analyse workstations and reduce health and safety risks
- ensure workstations meet minimum ergonomic requirements
- provide information about risks and measures
- plan daily work routine for users
- offer eyetests and special glasses if necessary
- provide health and safety training

The Regulations only apply where there are 'users' or 'operators'. Although both these terms are common in the computer industry, the Health and Safety Executive chose to give them specific meanings under the Regulations. A 'user', in terms of the Regulations, is an employee who habitually uses display screen equipment as a significant part of his normal work. Some of the em-

ployer's responsibilities extend to users employed by others (eg Temp agency staff) who are working on the employers premises or equipment.

The Regulations also apply to the self-employed. An 'operator' in terms of the Regulations, is any self-employed person who habitually uses display screen equipment as a significant part of his normal work. As a self employed person, some of the obligations are their own responsibility eg training. However, other responsibilities fall on the employer who has hired them for display screen work.

For each user and operator working in his undertaking, the employer must:

a. assess the risks arising from their use of display screen workstations and take steps to reduce any risks identified to the 'lowest extent reasonably practicable'

b. ensure that new workstations ('first put into service after 1st January 1993') meet minimum ergonomics standards set out in a schedule to the Regulations. Existing workstations have a further four years to meet the minimum requirements, provided that they are not posing a risk to their users.

c. inform users about the results of the assessments, the actions the employer is taking and the users' entitlements under the Regulations

For each user, whether working for him or another employer (but not each operator)

d. plan display screen work to provide regular breaks or changes of activity

In addition, for his own employees who are users,

e. offer eye tests before display screen use, at regular intervals and if they are experiencing visual problems. If the tests show that they are necessary and normal glasses cannot be used, then special glasses must be provided.

f. provide appropriate health and safety training for users before display screen use or whenever the workstation is 'substantially modified'

Table 1. Summarising employer's obligations towards display screen users and operators

Obligation	towards own employee who is a user	towards other employee (eg works for Temp agency) who is a user	towards self employed person who is an operator
Assess risks at display screen workstation	YES	YES	YES
Ensure workstation meets minimum ergonomics requirements	YES	YES	YES
Inform staff about rights and what has been done	YES	YES	YES
Plan work and provide breaks	YES	YES	NO (individual responsibility)
Offer eyetest and special glasses if necessary	YES	NO (main employer is responsible)	NO (individual responsibility)
Provide training in safe use	YES	NO (main employer is responsible)	NO (individual responsibility)

2. THE MAIN RESPONSIBILITY LIES WITH THE EMPLOYER

The Regulations set out obligations under the Health and Safety at Work Act (1974) for employers responsible for display screen users and operators. As with other aspects of health and safety, many of the duties fall to individual managers. However, the users and operators themselves have a responsibility to co-operate with management on appropriate measures and to play their part in avoiding risks by following safe systems of work, reporting faults and using equipment sensibly.

Under the Management of Health and Safety at Work Regulations (which transposed the Framework Directive), employers must consult with staff and their representatives, especially safety representatives if they exist in the organisation, on matters of health and safety.

3. THE REGULATIONS ARE IMPLEMENTED AND ENFORCED IN GREAT BRITAIN AS PART OF THE HEALTH AND SAFETY AT WORK ETC ACT 1974

The Regulations were made under Section 15 of the Health and Safety at Work Act 1974. Thus they have the full force of the law behind them and are part of the statutory duty of employers to their employees. Enforcement is through the Health and Safety Executive's Factory Inspectorate and Local Authority Environmental Health Officers as appropriate.

The Regulations and the Schedule of minimum requirements for workstations contain little that was not already covered by the existing legislation and guidance. However, in view of the greater level of detail and specification in the Regulations, it is easier for enforcers and others to know exactly what steps should be taken. The full range of penalties associated with the HSAW are available to inspectors including improvement notices,

prohibition orders and legal proceedings, in extreme cases.

4. THE REGULATIONS CAME INTO EFFECT ON 1ST JANUARY 1993

The Regulations came into force on 1st January 1993. From that date, employers have been obliged to assess and reduce risk, provide information and training, plan display screen work for users and offer suitable eye and eyesight tests. They are also obliged to ensure that new workstations meet the minimum ergonomics requirements in the Schedule.

Existing workstations must be assessed for risks to the user's or operator's health. Where this assessment shows no risk, the workstation does not need to be brought into line with the minimum requirements until 1st January 1997. However, if the assessment reveals a risk, then the risk should be reduced to the lowest extent reasonably practicable as soon as possible.

As 1997 approaches, an increasing number of suppliers of computer equipment, furniture and accessories are warning employers about the deadline and urging them to upgrade display screen installations. The Health and Safety Executive has undertaken research into the implementation and the impact of the Regulations in the UK and the results of that research will be published soon.

5. ERGONOMICS STANDARDS ARE RECOMMENDED

The guidance produced by the HSE makes it clear that the requirements in the Schedule can 'be met and in most cases exceeded' by meeting the relevant ergonomic standards BS 7179 or its replacement, the CEN Standard BS EN 29241 which is under development. The relationship between the Schedule and EN 29241 parts are shown below.

Table 2. Showing the relationship between the Schedule and BS EN 29241 parts (when published).

1. EQUIPMENT	BS EN 29241 (parts 1 to 6 will replace BS7179)
(b) Display Screen	3. Visual display requirements 8. Requirements for displayed colours
(c) Keyboard	4. Keyboard requirements
(d) Work desk or work surface	5. Workstation layout and postural requirements
(e) Work chair	5. Workstation layout and postural requirements
2. ENVIRONMENT	
(a) Space requirements	5. Workstation layout and postural requirements
(b) Lighting	6. Environmental requirements
(c) Reflections and glare	7. Display requirements with reflections
(d) Noise	6. Environmental requirements
(e) Heat	6. Environmental requirements
(g) Humidity	6. Environmental requirements
3. HUMAN-COMPUTER INTERFACE	
(a) suitable for the task	2. Guidance on task requirements 11. Guidance on usability specification and measures
(b) easy to use and adaptable to operator	10. Dialogue principles 11. Guidance on usability specification and measures
(c) feedback	10. Dialogue principles 13. User Guidance
(d) format and pace	12. Presentation of information
(e) principles of software ergonomics	parts 10 to 17

Observations on the European Directive on VDU-Work from a UK Perspective

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ABSTRACT

Despite the UK government's clear lack of enthusiasm for the VDU Directive, it was transposed into law, on time, by new regulations which were generally welcomed by trades unions, vehemently criticised by some employers, exploited by a few furniture and equipment suppliers, and which are apparently ignored in many smaller organisations. Some aspects of the UK's transposition of the Directive maybe challenged in the Courts at some time in the future. However, it is argued that the new UK regulations may have their most significant impact by providing assistance to employees bringing civil proceedings against their employers for 'injuries' arising from VDU use, but that problems may result from poor drafting of the Directive and particularly its technical Annex. The VDU Directive and its transposition into UK law became something of a political football (with a slow puncture). It is argued that the VDU Directive has made no significant reduction to the (already very low) health and safety risks to which the vast majority of VDU users in the UK are exposed.

INTRODUCTION

It is probably fair to say that the UK government has not looked favourably upon the European Directive on VDU work ever since the original proposal was presented by the Commission to the Council [11], in March 1988. A Select Committee of the House of Lords conducted an inquiry into the VDU Directive and, in November 1988, published a report [9] suggesting that the scientific evidence that VDUs caused major health hazards was weak and that public concern was not itself a sufficient reason for having a Directive; the Committee concluded that there was inadequate justification for a Directive on VDUs. The UK was the only Member State not to vote in favour of the VDU Directive at the Council of Ministers meeting in Brussels in October 1989. The UK abstained.

The decision to implement Directive 90/270/EEC in the UK as new regulations under the Health and Safety at Work Act 1974 was seen by most commentators, at the time, as the simplest and most appropriate way of complying with the Directive. However, the *Proposals for Regulations and guidance* published by the Health and Safety Commission (HSC) [3], in January 1992, raised

many concerns amongst employers. Most frequently voiced were concerns about: the lack of a simple definition of who would be covered by the new regulations; the requirements for eye testing and the "provision of special corrective appliances"; the requirements for risk assessments; what constitutes the principles of software ergonomics; and the costs involved in complying with the regulations. In contrast, paragraph 12 of the *Proposals for Regulations and guidance* noted that "The TUC [Trades Union Congress] consider that the proposed regulations do not fully implement both the letter and the spirit of the Directive. In particular, they consider that Regulation 3 and the associated minimum requirements in the Schedule should apply to all workstations. The TUC believes that the Directive itself was intended to set minimum requirements for all display screen workstations, not just those in use by a "user" as defined in the proposed regulations".

Guidance on the Health and Safety (Display Screen Equipment) Regulations 1992 was produced by the Health and Safety Executive (HSE) in November 1992 [7], i.e. two months before the new regulations came into force. Paragraph 19 of this guidance suggests that "... research shows that the risk to the individual user from typical display screen work is low". In Annex C of this guidance it is stated that "HSE will also be publishing supplementary practical advice which will be available in 1993". Unfortunately, it was not until July 1994 that the HSE published *VDU User's Easy Guide to the Regulations* [8], which contains a "VDU workstation checklist for risk assessment and complying with the schedule to the regulations". For a period, uncertainty about the precise requirements allowed unscrupulous suppliers of furniture, equipment and services to exploit the new regulations [6].

A *Review of Health and Safety Regulation* published by the HSC in May 1994 [5] highlighted continuing dissatisfaction with the new regulations. For example: in paragraph 9, "The Health and Safety (Display Screen Equipment) Regulations 1992 have, thus far, proved controversial"; in paragraph 43, "Many companies feel that these impose excessive requirements, especially in respect of eye tests for employees"; and in paragraph 145, "There is no evidence of any substantial disagreement over the standards which HSE and other enforcers are trying to enforce, with the single major exception of the Health and Safety (Display Screen Equipment) Re-

gulations 1992". The initial costs of the new regulations were estimated to be £94.9m to £117.2m, with recurring costs of £53m to £64m, set against recurring benefits of £47m to £58m. In other words, the Health and Safety Commission's own estimates appear to suggest that the recurring costs of the Health and Safety (Display Screen Equipment) Regulations 1992 are similar to the recurring benefits. However, these figures should be viewed with caution as the cost benefit analysis from which they are derived made a number of broad assumptions, both with respect to the costs and the benefits.

A government Deregulation Unit published a report [2], in January 1994, entitled *Deregulation Task Forces Proposals for Reform*. With respect to the Health and Safety (Display Screen Equipment) Regulations 1992 this report stated: "HSE guidance states that „medical evidence shows that using display screen equipment is not associated with damage to eyes or eyesight; nor does it make existing defects worse“. The requirement to provide eyesight tests is, therefore, an unjustified burden on business. The Government should review the impact of these regulations as soon as possible with the EC Commission with a view to reducing the burden on business by revoking Regulation 5. If the requirement for eyesight tests remains, bearing in mind HSE's guidance, they should be funded by the State as allowed for in the Directive."

The Deregulation Unit's report goes on: "Review requirements for replacement of equipment by 1996 unless there is a clear need related to recognised hazards. Review the hazards of (for instance) non-swivelling monitors and non-tilting keyboards in view of the burden which replacement would impose on small businesses. The EC product standard should not impose requirements in excess of the current British standard. Given the extent to which DSE work dominates the workplace, it is considered almost inconceivable that an "habitual user" would not use DSE on every workday and the term should be redefined accordingly. Make it clear which injuries are known to affect DSE users and those for which the evidence is patchy or non-existent."

There are no published data on the levels of awareness of and compliance with the Health and Safety (Display Screen Equipment) Regulations 1992. Anecdotal reports [10] suggest that those organisations which conscientiously comply with health and safety legislation have expended considerable time and effort to meet what might be termed the administrative requirements of the new regulations. Meeting the minimum ergonomic requirements for workstations has apparently not posed a significant problem for these organisations simply because most already exceeded many of the minimum requirements. However, there is some evidence (again anecdotal) that many health and safety professionals consider that there are far more pressing and dangerous issues to address than the health and safety risks posed by working with VDUs. Inevitably, risk assessments of VDU workstations are not high on their agenda.

Despite the Health and Safety Executive's substantial efforts to publicise the new regulations, e.g. with advertisements in the national press, it appears that many

small and medium enterprises (SMEs) in the UK have taken little, if any, overt action to comply with the new regulations and no doubt some SMEs remain blissfully unaware of them. Given that no additional resources appear to have been provided by the government for the enforcement of these new regulations, it can be argued that non compliance will probably go largely undetected, except perhaps in organisations which have strong trade union representation or employees who are willing to report their employer to the appropriate enforcement agency. However, many of those responsible for the enforcement of health and safety legislation might also consider that, with limited resources, there are far more pressing and dangerous issues to address than the health and safety risks posed by working with VDUs.

LEGAL CONCERNS

It can be argued that, despite its clear lack of enthusiasm for the VDU Directive, the UK government brought into force "the laws, regulations and administrative provisions" necessary to comply with the Directive by December 1992. However, many of the legal issues here have yet to be explored in the Courts. To understand the nature of these legal issues it is necessary to go back to how the government chose to transpose into UK law what are commonly referred to as the 'six pack' of European Directives and to attempt to explain, briefly, the legal context in the UK.

To transpose the 'six pack' into UK law the government chose to promulgate new regulations under the Health and Safety at Work Act 1974. At the risk of gross oversimplification, the Health and Safety at Work Act 1974 can be viewed as placing certain duties on employers to protect "so far as is reasonably practicable" the health and safety of employees. These duties are enforced by the state, via the criminal law. An individual employee cannot take an employer to Court for failing to comply with some statutory duty laid down in the Health and Safety at Work Act 1974, it is up to the HSE or local authorities' Environmental Health Officers to bring the prosecution. An individual employee can take an employer to Court to claim damages for, say, pain and suffering and loss of earnings, following an accident, but these are civil proceedings. In civil proceedings an employee has to prove, on the balance of probabilities, that a work-related injury was caused by the employer's negligence or a breach of some statutory duty which materially contributed to the injury. Until the Health and Safety (Display Screen Equipment) Regulations 1992 came into force there were no statutory duties specifically related to the use of VDUs.

While the Health and Safety at Work Act 1974 and Regulation 15 of the Management of Health and Safety at Work Regulations 1992 [4] specifically exclude civil liability, historically, regulations made under the Health and Safety at Work Act 1974 do not. Thus, the transposition of the Directive into UK law not only imposes a range of new statutory duties upon employers which, if breached, could lead to criminal prosecution, but also permit these statutory duties to be used to assist an employee bringing civil proceedings against an employer for an 'injury' arising from VDU use. This should not

and would not be a problem, if, and it is a big if, the 'injuries' arising from VDU use were well-defined and if, and it is an even bigger if, it was clear how these statutory duties and in particular the minimum ergonomic requirements prevented these 'injuries'. As the law stands in the UK, it appears likely that these statutory duties will be used to assist employees bringing civil proceedings against their employers for a range of ill-defined 'injuries' allegedly arising from VDU use.

At the time of writing, there are a few anecdotal reports [1 & 10] which suggest that Environmental Health Officers have, on occasions, used their powers to ensure employers comply with the requirements of the Health and Safety (Display Screen Equipment) Regulations 1992. However, there appears to be no record of an employer being prosecuted, under the criminal law, for not complying with the Health and Safety (Display Screen Equipment) Regulations 1992. In the current political climate, many would argue that such a prosecution is extremely unlikely.

At the time of writing, there also appears to be no record of an employee using the Health and Safety (Display Screen Equipment) Regulations 1992 to assist in bringing successful civil proceedings against an employer for an 'injury' arising from VDU use. However, this appears to be more a function of the long delays for such civil proceedings to reach Court rather than a lack of enthusiasm to exploit the opportunities offered by the Health and Safety (Display Screen Equipment) Regulations 1992. Whether such civil proceedings will be successful will depend greatly upon how the Courts interpret the new regulations. The wording of The Schedule to the Health and Safety (Display Screen Equipment) Regulations 1992 is very similar to that in the Annex to the Directive. The Annex (and thus The Schedule) are abizarre mixture of significant and trivial ergonomic issues, expressed very badly. As it is currently worded, meeting the requirements in The Schedule and, therefore, meeting statutory duty is a potential minefield. Will legal interpretation make ergonomic sense?

In general, the wording of the Health and Safety (Display Screen Equipment) Regulations 1992 follows closely the original wording of the VDU Directive. However, there are a number of features of the new regulations which could possibly be challenged in the European Court. For example, in transposing the VDU Directive into UK law those responsible for drafting the new regulations omitted any reference to Article 8 of the Directive concerning 'Worker consultation and participation'. This was perhaps not surprising. A UK government which had so drastically reduced trade union powers and which has long been opposed to the "social dimension of the internal market", was hardly likely to wish to be perceived as conceding novel (to the UK) consultation and participation rights to workers. However, it can be argued that amendments to existing legislation to implement the Framework Directive have met, in a general way, the requirements of Article 8 of the VDU Directive and therefore there was no need to transpose Article 8 in the Health and Safety (Display Screen Equipment) Regulations 1992.

Another feature of the UK's interpretation of the VDU Directive which may find its way into the European Court is the wording of Regulation 2 (3) of the Health and Safety (Display Screen Equipment) Regulations 1992, which states: "The employer shall reduce the risks identified in consequence of an assessment to the lowest extent reasonably practicable". The addition of the phrase *to the lowest extent reasonably practicable* reflects the fact that in UK legislation employers are only required to protect the health and safety of their employees "so far as is reasonably practicable".

CONCLUDING OBSERVATIONS

There continues to be a vociferous minority, some of whom are clearly politically motivated, arguing about the merits of the Directive and its transposition into UK law. However, it appears that the majority of those in the UK who have an interest in health and safety issues remain unconvinced of the need for specific legislation relating to VDU use. Some clearly also hold the (perhaps inaccurate) belief that, as with most other European Directives, the UK has transposed the VDU Directive more faithfully and will enforce the Directive with more rigour than most other Member States.

Currently, there are strong political pressures in the UK for deregulation. However, there are those who would argue that both the Directive and the new regulations should be left to settle down and that strong criticisms of the Directive itself or its transposition into UK law provide unnecessary ammunition for those who want immediate and sweeping changes. Such changes, it is argued, would be unlikely to correct all the imperfections and could result in unnecessary burdens on industry, either from the change process itself or through the nature of any new requirements. The abolition of current requirements or the imposition of further new requirements would, it is argued, be particularly irksome for those employers who have conscientiously taken steps to comply with the requirements of the new regulations. It appears that underlying these arguments is the belief that negotiations were not able to correct all the imperfections of the VDU Directive and that it would be unwise to assume that any future negotiations would fare any better, particularly if the negotiations were provoked by the UK. However, it would appear that Article 10 of the VDU Directive does provide the opportunity, albeit in an unspecified time scale, to correct some of the more serious flaws in the Annex to the Directive.

The fundamental question which surely needs to be addressed is whether the VDU Directive has made any significant reduction to the health and safety risks to which VDU users are exposed in Member States. Although it is possibly too early to provide a definitive response, in the UK, the answer is, in general, probably no. This has little to do with the way in which the Directive was transposed into UK law or the rigour with which the new regulations will be enforced. It has much more to do with the perception of what constitute, and the magnitude of, the health and safety risks to which VDU users are exposed, and the overall level of awareness of ergonomic issues and health and safety matters, which

pre-date the VDU Directive and its transposition into UK law.

The basic problem would appear to be the confusion which exists in the Directive (and therefore in the new UK regulations) between ergonomic issues and health and safety matters. They are not the same. Part of the preamble to the Directive includes the assertion: "[Whereas] compliance with the minimum requirements for ensuring a better level of safety at workstations with display screen is essential for ensuring the safety and health of workers". Is it essential? Many relatively trivial ergonomic recommendations which were originally intended to reduce discomfort and fatigue have been turned into a motley collection of very badly expressed, minimum ergonomic requirements, which are somehow supposed to ensure the health and safety of VDU users. The validity and utility of many of these ergonomic recommendations are open to question.

In many ways, the VDU Directive and its transposition into UK law became something of a political football, reflecting both internal politics and the UK's ambivalence to Europe. While the football is still being kicked around in the UK, it seems to have developed a slow puncture and many of the original players appear to have found other games to play. In years to come, the VDU Directive and its transposition into criminal law will probably be referred to, at least in the UK, as a 'storm in a tea cup'. It is with respect to civil proceedings that the Directive might well have its most significant impact in the UK.

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The Swedish Provisions and the EC Directive on Work with Visual Display Units

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SUMMARY

The first Swedish provisions on work with visual display units came into force on the 1st of January 1986. The Ordinance was amended in 1992 on account of the implementation of the Council Directive of the European Economic Community on the minimum safety and health requirements for work with display screen equipment (90/270/EEC). The new ordinance *Work with Visual Display Units (VDUs)*, AFS 1992:14, came into force on the 1st of January 1993. The main change was the amendment of requirements concerning emissions, the software and the system.

KEYWORDS

Work with visual display units, VDU's, display screen equipment, working environment, legislation, implementation of the EC Directive in Sweden, amendment of previous Swedish provisions

BACKGROUND

The Swedish National Board of Occupational Safety and Health is the central administrative authority for questions relating to the working environment and working hours. The tasks of the Board include issuing Ordinances and General Recommendations and exercising national supervision of compliance with work environment and working hours legislation.

Basic provisions on the working environment are contained in the Work Environment Act, further to which the Board issues Ordinances defining more detailed obligations and requirements. The Work Environment Act applies to all areas of working life - equally to private and public activities. The Ordinances of the National Board of Occupational Safety and Health are published in the series entitled Arbetskyddsstyrelsens firfattningssamling (AFS), as are the Board's General Recommendations.

The ordinances contain sections with mandatory requirements and comments on the individual sections.

Under the direction and supervision of the Board the Labour Inspectorate is responsible at regional level for the enforcement of legislation concerning the working environment. The frames within which the Inspectorate has to operate are mainly defined by the Work Environ-

ment Act. The Labour Inspectorate has the task of adapting supervisory activities to local conditions, subject to guidelines issued by the National Board of Occupational Safety and Health and the Labour Inspection Board.

THE IMPLEMENTATION OF THE EC DIRECTIVE IN SWEDEN

The first provisions on work with visual display units in Sweden came into force the 1st of January 1986 containing requirements for the layout of the workstation, the visual display unit and the keyboard. They laid down demands for the environmental conditions such as the ambient lighting. They also stated that work with VDU's involving severe control or constraint or monotonous routine work shall be avoided or restricted. There were demands for vision test as well. The former Swedish provisions were to a large extent coherent with the EC Directive. It could be argued that the Swedish provisions on work with visual display units served as a model for the EC Directive. However, the implementation of the Directive led to some amendments of the Swedish provisions.

The Swedish Ordinance regarding work with visual display units was amended in 1992 on account of the implementation of the EC Directive 90/270/EEC. The new Ordinance *Work with Visual Display Units* (AFS 1992:14) came into force on the 1st of January 1993.

WORK WITH VISUAL DISPLAY UNITS, AFS 1992:14

The implementation of the EC Directive did not cause an economic or political debate in Sweden, since provisions on work with visual display units already existed. Hence, the amended Swedish provisions do not contain stipulations for workstations put into service for the first time or workstations already put into service, corresponding to articles 4 and 5 of the EU Directive.

The requirements of articles 3, 6 and 8 of the EC Directive - i.e. the employers obligation to analyse the workstations, information for and training of workers and worker consultation and participation - are in addition to the Ordinance AFS 1992:14, implemented by Chapter 3, Section 2a of the Swedish Work Environment Act and the Board's Ordinance Internal Control of the Working Environment (AFS 1992:6). Chapter 3, Section 2a of the Work Environment Act states that the employer

shall systematically plan, direct and inspect activities in a manner which ensures that working environment meets the requirements of the Act and of provisions issued by the authority of the same. He shall investigate work injuries, continuously investigate the hazards of the activity and take the measures thus prompted. Measures which cannot be taken immediately shall be scheduled.

Close to Section 2a the Board has issued an Ordinance; Internal Control of the Working Environment (AFS 1992:6). The provision of this ordinance set a method to ensure the work environment activities to be performed in planning, direction and follow-up as an integral part of other activities in the workplace.

The employer has to see to it that the working environment is in line with the demands of the Act and the Board's provisions.

The mandatory requirements of the Swedish provisions on work with visual display units are not in all detail as the minimum requirements of the EC Directive. However, if the text of the Directive is not to be found in the mandatory requirements, it is written on in the comments on the individual sections.

Section 1: Scope

The provisions apply to work done with a text or visual display screen with appurtenant equipment. The term "visual display screen" denotes an alphanumeric or graphic display screen, regardless of how the image is produced.

The provisions do not apply to work done using an oscilloscope or a digital or text presentation display on a measuring instrument, typewriter, cash register, pocket calculator or suchlike. Nor do they apply to so-called portable systems during brief, non-permanent use at a workplace. There is no exception in the Swedish provisions for drivers' cabs or control cabs for vehicles or machinery as in the EC Directive. Nor is computer systems on board a means of transport excluded. The reason for not making those exceptions is just that they were not excluded in the previous provisions. Pupils from the first grade are comprised by the Swedish work environment legislation, i.e. the provisions on work with VDU's also apply to pupils in school, with the exception of the requirements for vision tests and glasses.

Section 2: The Visual Display Unit and the Keyboard

As a result of the implementation of the EC Directive the requirements on the visual display unit and the keyboard became more detailed but the main content is the same as in the previous Swedish provisions. The visual display unit and the keyboard shall have good readability and be designed in such a way as to facilitate use. The image on the screen shall be free from disturbing flicker and other forms of instability. The characters on the screen and keyboard shall be sufficiently large and distinct and shall have sufficient contrast. The distances between characters and lines shall be sufficient for good readability. The brightness or the contrast between the characters and the background on the screen shall be easily adjustable by the user and shall be adjustable to

ambient conditions. Since the image quality can deteriorate as a screen ages it should be checked at regular intervals.

Section 3: Environmental Conditions

The content of the requirements on environmental conditions, e.g. ambient lighting, glare and reflections, was not changed as a result of the amendment. Some details were added. Ambient lighting shall be sufficient without impeding the reading of the screen. It shall afford an appropriate contrast between the screen and the surrounding environment, taking into account the type of work and the user's vision requirements. Task lighting shall exist if needed. It shall be adjustable and must not dazzle. Rules on lighting conditions at the workplace are contained in the Lighting Ordinance (AFS 1991:8) issued by the National Board of Occupational Safety and Health.

A VDU workstation shall be so designed that disturbing glare and reflections do not occur from the surrounding environment. Factors in the surrounding environment which can cause reflections and glare on the screen, keyboard and worksurface are artificial sources of light, windows and other openings, transparent or translucent walls, and brightly coloured fixtures or walls. Glare and reflections on the screen and keys can often be avoided by suitably adjusting the relative positions of the VDU and light fittings. Particularly important on premises with several workstations are, for example, the light distribution and glare protection of the fittings.

The workstation should be positioned so as to reduce glare and reflections from windows. The screen is best positioned at right-angles to incoming daylight. It is imperative that obtrusive daylight can be screened off, for example, by means of Venetian blinds.

Keyboards and desking surfaces shall have low-reflection surfaces where necessary for the avoidance of disturbing reflections.

A light screen with dark characters (positive polarity) is usually to be preferred in ordinary office conditions. This reduces differences of luminance in the visual field at the workstation, since walls and paper, for example, are usually bright. For work which involves alternating the gaze between a sheet of paper and the screen, a light screen is preferable to a dark one, because this saves the eye from having to adjust from the bright paper to the dark screen, an operation which can be fatiguing to the eye, especially if it occurs frequently, and which can give rise to various disorders, e.g. headache and tiredness.

Visual and lighting conditions may not give rise to unsuitable work postures.

Section 4: The Design of the Workstation

To a large extent the requirements concerning the design and layout of the workstation were contained in the previous Swedish provisions. The workstation shall be dimensioned, designed and equipped in such a way that comfortable and varying work postures and working movements are possible for the operator. The work desk and work surface shall be large enough to allow a flexible arrangement of the screen, keyboard, documents

and related equipment. The Board's Ordinance Work Postures and Working Movements (AFS 1983:6) contains general provisions which also apply to work with VDUs.

The space in front of the keyboard shall be sufficient to provide support for the hands and arms of the operator.

The working height to the keyboard or its equivalent and the viewing angles to the screen shall be adjustable to the body measurements of the operator if the tasks so require. The keyboard and the VDU shall as far as is practically possible be rotatable, adjustable and moveable to suit the needs of the operator. Flexible equipment makes it easier to adjust the workstation to different individuals, different tasks and varying routines without any other inconveniences occurring. If the VDU and the keyboard are separate, work postures can be satisfactory both when reading the screen and using the keyboard.

The work chair shall be stable and allow the operator easy freedom of movement and a comfortable position. The chair shall normally be easy to adjust. For the avoidance of uncomfortable loads and sitting postures, it is important for the chair to be easily adjustable to the operator's body measurements and requirements. Comfortable and variable work postures can be adopted if the chair seat is vertically adjustable, the seat depth variable and the height and angle of the backrest adjustable. It is also important that a person desiring a foot rest should be issued with one.

A low-profile keyboard (max 3 cm from the desktop to the contact surface of the middle row of keys) can usually be placed directly on a vertical adjustable table with a low edge. A high keyboard can be fitted with a wrist support to relieve the strain on the muscles of the forearm, shoulders and neck during micropauses. If a "mouse" is used, the operator must be able to position and use it close to the keyboard, so as to avoid movements with one arm outstretched.

A suitably positioned, stable and adjustable document holder, which is positioned so as to minimize the need for uncomfortable head and eye movements, may be of help to prevent discomfort. When the workstation is used by several persons, ease of adjustment is particularly essential. The Board's Ordinance (AFS 1983:6) Work Postures and Working Movements, for example, requires the employer, where necessary, to ensure that the employee is informed of the best way of working in order to avoid undue strain.

Instruction may be needed on how to use the adjustment devices and technical aids. It is also important for the employee to be offered opportunities of training in proper working techniques.

Section 5: Vision Test

The only amendment on account of the implementation of the EC Directive was the demand for recurrent vision tests. The employer shall ensure that an employee normally having to work with a VDU for more than one hour during the working day undergoes a vision test. In addition, a vision test shall be provided at regular intervals thereafter and if the employee reports discomforts which may be connected with the visual demands of the

work. Complete vision testing includes refraction measurement, determination of visual acuity and suitable correction for close work, with the prescription of glasses where necessary. This testing is done by competent personnel, such as ophthalmologists or authorized opticians. Vision tests are best arranged through occupational health services, if available. Through workstation examinations, the occupational health services can analyse and document the visual requirements of the work and other factors contributing to good vision ergonomics and, competence permitting, take charge of the vision tests.

The employee shall be supplied with special glasses tested for the work if a vision test shows that they are needed and that glasses intended for normal purposes cannot be used.

Measures needing to be taken by virtue of this Section may not involve the employees in any expense.

Sections 6 and 7: Organization of the Work

There were no changes made to the previous provisions regarding the organization of the work. Work with VDUs involving severe control or constraint or monotonous routine work shall be avoided or restricted.

In the event of eye strain or other strain-related disorders resulting from work with VDUs in spite of the measures referred to in Sections 2-6, work shall if possible be arranged in such a way that the operator can switch to other, less strenuous tasks. If this cannot be arranged, the operator shall be given adequate breaks in the course of work.

Section 8: Emissions from the VDU and the Appurtenant Equipment

There were no mandatory requirements concerning emissions from the VDU and the appurtenant equipment in the previous provisions. It was only briefly discussed in the comments on the sections. The implementation of the EC Directive brought about amending a section stating that emissions from the VDU and appurtenant equipment, such as noise, heat and electrical and magnetic fields, may not be disturbing or cause the user discomfort or unpleasantness constituting a risk to his/her safety and health.

The workstation shall have a suitable thermal climate.

In recent years a great deal of attention has come to focus on emissions from VDUs and their possible negative health consequences. The main preoccupation in Sweden has been with electrical and magnetic fields. Problems discussed have included, for example, pregnancy disturbances and "electrical hypersensitivity", i.e. symptoms and subjective discomforts mainly affecting the skin, the nervous system and eyes. Research has not established any clear connection between the various fields surrounding the VDU and other equipment and the symptoms and subjective disorders affecting the individuals concerned. Nor, on the other hand, has it been possible to rule out these fields as one of the underlying factors.

A very extensive research has failed to establish any connection between VDU work and pregnancy disturbances.

If electrical and magnetic fields are connected with "electrical hypersensitivity" disorders, there is a great deal to suggest that they are but one of several causes. Other factors of possible importance include, for example, allergies, sensitivity to light, chemical substances, individual-related factors and work organization. Research continues, but in the meantime greater preparedness is needed for helping and supporting those persons who experience discomforts. If this type of problem occurs at the workplace, it is important that the employer, aided for example by the occupational health service, should carry out an investigation and take steps to help the individual concerned.

Section 9: Software

Requirements on software were amended to the Swedish provisions on account of the implementation of the EC Directive. Software and systems shall be suitably designed with regard to the requirements of the task and the aptitudes and needs of the user. Systems shall as far as possible give the users feedback with regard to the work done. They shall display information in a format and at a pace which are adapted to the operators. In the design and selection of software, special consideration shall be paid to the ergonomic principles applying to human capacity for managing and processing data. If software and system design is guided by human capacity for managing and processing data - that is, human cognitive capacity - opportunities for a good man-machine interface can be created. The man-machine dialogue should be constructed so as to facilitate use, and in a manner appropriate to the tasks for which the system is intended.

The user should be able without difficulty to see how software and system function. To this end, it is important for information to be presented in a manner which is intelligible to the non-specialist and in a language which the user can understand. The information presented on the screen should also be that which the user, on the basis of previous experience, expects to be given. It is also essential for the employee to be given the training and guidance which he or she is in need of.

For the sake of good man-machine interaction, the system should permit a high level of user control. This requires the system and software to be sufficiently flexible to be adapted to the previous knowledge or experience of different users. It is important, for example, that the system should give the user a choice between alternative ways of achieving a certain result. In addition, the user should have the greatest possible liberty to choose and adjust for himself such parameters as when, where and how quickly information is presented and in what format.

For the sake of job satisfaction, the individual needs to be able to influence the quality of his work and to check the result of it. The system, therefore, must give the employee immediate feedback on his performance and actions. Delayed response times, for example, are a potential source of annoyance and stress.

The use of computers at work can imply closer qualitative or quantitative surveillance of the employees. This in turn may be experienced as an encroachment on privacy and may augment burden of work if it takes place without the employees' knowledge. To prevent this, quantitative or qualitative control, through the data system, of the employee's work input must not be undertaken without the employee's knowledge.

EN-ISO 9241 and Directive 90/270/EEC in Sweden, a part of Europe

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ABSTRACT

A close link between the European Directive 90/270/EEC and EN-ISO 9241 is desired but not essential to improve the working conditions for VDU users. Some examples from the Swedish experience have been selected and evaluated.

KEYWORDS

VDU, implementation of 118a directive in Sweden, ergonomics standard.

INTRODUCTION

When we evaluate the today system of the Directive 90/270/EEC with its complementary standards in order to reach a "better" future system we have to select some historic issues and determine its importance for the system. To manipulate the frame of the system will mean a comparison with other similar and ongoing European systems. The first selected issues should not only be easy to cope with in an evaluation process but also be a part of the development that has created the studied system. Shared experience will therefore mean a common base when discussing a future system. The only knowledge that we have for predictions is already history.

Around 1980 international standards in the field of ergonomics seemed to be a powerful way to make the design of VDUs better in terms of users' complaints etc. Image quality was identified as a priority area for Sweden. For the keyboard - another troublesome area for the user - we just follow the German standardisation i.e. the public procurement process (Swedish Agency For Administrative Development, Swedish Telecom and others).

A lack of confidence in the knowledge and in the processing of international standards was the first reason to organise the Work With Display Units (WWDU) Conferences: Stockholm 86, Montréal 89, Berlin 92, Milan 94, and Tokyo 97. The Conferences go back to a working group on image quality. [1] gives an overview of important topic areas.

EVALUATION MODEL

As discussed in sessions at CHI' conferences Stuart Card has sometimes reviewed the presented studies using a simple model of criteria for evaluate the results: A) Replication across labs B) Predict something C) Connected to something D) Unintended consequences to be explain.

This row of basic criteria will cover the purpose of our workshop.

REFERENCE WHITE

For usual office applications a reference white with a colour temperature of 6500 K is suitable. You may argue that you for example prefer 5500 K. If the programmer and the user of the application have monitors with the same reference white the user will get the colours along with what the programmer has expected and the user will not be astonished. Using one reference white for the whole group of applications will mean that the software will give a predictable result that could be repeated with other screens, B) and A). You can also add your experience to an existing system, C). Part 8 of ISO 9241 recommends 6500 k for the majority of applications. For applications that need a more blue reference white 9300 K is advised in the standard. D) is then satisfied too and "reference white" in Part 8 will therefore pass our evaluation. A designer seeking more knowledge will of course make a literature search using key words as "reference white" and "colour usage". A very good advice is also to look up "Derefeldt, Gunilla"!

EUROPE - OUR HOME MARKET

To get rid of the technical trade barriers and create "one single market" stands in the lines of the traditional Swedish trade policy. It is good for the consumers as well as for the producers. A Directive 100a like 89/392/EEC on Safety of Machinery creates a systematic reference system. It makes "reference to standards", standards which often are just produced to fit the system. The work is performed by experts feeling that their task is in a priority area. For the National Board of Occupational Safety and Health (NBOSH) it is obvious that it has to share power also with other interest parties within the standardisation bodies.

The Directive 118a 90/270/EEC is nationally implemented. It is possible to make reference to EN-ISO 9241 (and a few other standards). Deviations in national standards are in practice negligible but you could nationally increase the requirements compared with those in the Directive. A deviation may affect the goal "one single market" which is not the goal of a Directive 118a. The "Directive is a practical contribution towards creating the social dimension of the internal market". (It is obvious that also 89/392/EEC has a social impact. It has its heritage from the days of "free circulation of goods" but now we live under the four freedoms.)

In the Swedish implementation EN-ISO 9241 has the role of interesting reading like some other important documents. It is a conservative approach because you do not the final requirements of the standard. Furthermore the development of this international standard has been classified of no priority for the regulation experts within NIOSH. The Swedish ordinance, AFS 1992:14, and the ongoing European acceptance of EN-ISO 9241 will make enough room for "one single market" with a social dimension from new Europe. So, let's regard AFS 1992:14 and EN-ISO 9241 as they are close connected and creating one system (in parallel with for example the connection in UK).

CONSISTENCY BETWEEN 90/270/EEC AND ALL THE PARTS OF EN-ISO 9241

The development of the Standard started both earlier and for other purpose than to support the goal of the Directive but still both the Standard and the Directive are products to fit the same applications and environments. The requirements that we see in the Directive are stated by none topic specialists with only little experience in standardisation. The experts involved the development of the Standard did not get the chance to participate in the work.

If we do have the same reference system or are able transform the results from one system to the other we will pass criterion C). Let us see the high level principles stated in Part 10 as a more complete version of the statements on software in the Annex of the Directive. (Swedish experts constituted one part of the population in the Beime, Schindler and Wandke study, Understanding and acceptance of ... Part 10 ..., reported elsewhere in the workshop; see [4])

A next step is to request correspondent sets of such high level principles for the hardware, workplace and environment Parts of the Standard. During the development of Part 6 (environment) those principles were referred to. The opinion against became too heavy (probably mostly from some technicians in the related areas). So, "Controllability" is okay as a goal for the software but not for the environment. This is absurd! It seems reasonable to me to use the Parts as different ways (tools) to achieve a "good working life". It is also true that you have to identify additional principles to improve the Standard and the Directive at future revisions. Stimulation could be an example of such a development [2].

If the Parts do not work in co-operation the barriers between the Parts can sometimes cause a solution

within a Part instead of using a better solution recommended in another Part. When trying to blur the reflections caused by sharp pattern in the environment the designer of a CRT believing in Part 7 will make the edge sharpness not so good. It had been better to avoid such pattern in the environment (Part 6).

There is furthermore to develop in order to get a better consistency!

MINIMUM AND OPTIMAL REQUIREMENTS

"Of course, the Directive outlines minimum standards." When the international work with ISO 9241 started at a meeting in Manchester 1983 the Swedish delegation pleaded for optimum requirements. It stressed good working conditions, quality of equipment, workplace etc. It was important to seek knowledge and to speed up the development of good image quality. The other delegations were more or less dominated by producers or careful consultant that sometimes could defend low quality.

What do optimum and minimum requirements mean in practice?

Most of the formulations in the Annex are suitable for optimum requirements, for example "shall be easily adjustable by the operator, and also be easily adjustable to ambient conditions". Also - "The screen must swivel and tilt easily and freely to suit the needs of the operator." - is putting the operator in focus. A good advice by the Standard is therefore to describe the "optimal" conditions to the reader (designer). It is important to state the best conditions for reading a text not only to detect the readability limits for 95 percent of the population. Optimal conditions are very much related to the task, operator and actual work situation but striving towards the objectives in the Directive.

Minimum requirements go often back to a quantitative measurement of a variable. If one variable (or a measure) is monotonous it is in principle easy to predict. If variables will disturb the outcome it will not be so easy to predict. If you only can measure the stimuli and not the response you could be in trouble. Take for example the electromagnetic fields! Some people in Sweden and elsewhere are worried and ask if their equipment is in conformance with MPR (SWEDAC, Swedish Board for Technical Accreditation) or TCO (Swedish Confederation of Professional Employees). This is an important business for the test houses.

Standards depending on measurable variables could sometimes pass criteria A) and B) and fail according to C). Long away from the Standard issued by a standardisation body we have the "de facto standards" which are a sort of functional market standard emanating from a strong or dominating actor on the market. High resolution monitors could even have poor image quality and in fact not correspond to our Directive. Dear employer why should you care if your employees do not!

LONG TERM EVALUATION

Long term consequences are not stated in the Directive or in the standard. Acceptable work load in the long run could mean the complex cognitive aspect of mental

underload and overload as well as physiological strain that will appear. If long term consequences of stimulating work, duration etc. will be taken care of we will have the chance to pass criterion D). Reference to other documents than the Standard is needed.

REVISION OF THE DIRECTIVE

The ICHAC Statement on the Directive [3] emphasizes among other things (from the press release) that "There is little practical guidance for employers on how problems and concerns should be handled." The link from the Directive and the Standard "could provide a much more straightforward route for employers and suppliers to meet their obligations and responsibilities under the Directive". The Commission has turned away this suggestion. It would like to keep the Directive as one under Article 118a.

This evaluation has shown that a group of experts could produce a revised 118a Directive that could be more useful. Such an expert group has even a better chance to make the Directive more consistent than EN-ISO 9241 because it has the possibility to work faster in a common direction and taking in account the acquired experience we have. The Swedish experience with a more

lose connection between Ordinance and Standard tells us that it could work.

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The EU Directive on VDU-work: Theoretical and Practical Implementation in France

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ABSTRACT

This paper describes an investigation of the theoretical and practical implementation of the EU Directive on Visual Display Unit (VDU) Work 90/270/EEC ("EU Directive") in France. The three basic questions posed are: (1) What are the means of verifying the implementation of the EU Directive in France and what are the roles of the key persons associated with the implementation? (2) How are VDU workers in France informed of measures to prevent against health and safety risks associated with the use of display screen equipment? (3) What changes have been observed in the workplace since the legislation was introduced in 1993? The findings suggest that even though there is an implementation infrastructure in France and the EU Directive has been transposed it is neither a priority nor understood well by corporations and the workplace safety regulators.

KEYWORDS

Work Inspectors, Doctors of Work, Safety Controllers, Hygiene and Safety Committee, prevention of risks, Decree.

INTRODUCTION

The information presented in this paper was obtained by two methods: (1) By analyzing the national French legislation and associated application materials pertaining to the EU Directive on VDU-work. (2) Through interviews with Work Inspectors, Medical Doctors of Work, Safety Controllers, and representatives from employee Hygiene and Safety Committees. The French legislation and national application text pertaining to the EU Directive on VDU-work has been summarized herein by the researcher. The legislative summary has been formulated based upon the assumption that the reader is reasonably familiar with the contents and intent of the EU Directive. Following this condensed presentation of French legislation, the results of the interviews with key implementors will be presented.

LEGISLATIVE SUMMARY: FRENCH DECREE

France was one of the first EU member countries to transpose the EU Directive into national law. The transposition came by means of the French Decree n° 91-451

("French Decree") Relative to Visual Display Unit Equipment and Prevention of Risks to Operators. In essence, the French Decree is a direct extraction of the EU Directive. [7]

Summary of French Decree n° 91-451:

- The French Decree is applicable to the establishments mentioned in Article L. 231-1 of the French Labour Code, in which employees regularly work with VDU equipment for a substantial part of their work day.
- Certain equipment mentioned in the French Decree is expressly excluded from its field of application.
- The employer is bound by specific provisions in connection with the analysis and organisation of work.
- Specific provisions are laid down in the French Decree in connection with the information and training for employees that work with VDT equipment.
- Arrangements for special medical supervision are set forth.
- The French Decree includes specific provisions concerning equipment (screen, keyboard, etc.) and the working environment (radiation, humidity, noise, lighting).
- The French Decree came into force 1 January 1993, but in the case of equipment in operation prior to this date, certain provisions will not come into force until 1 January 1997.

In addition to the French Decree, there is an application text associated with the transposition of the EU Directive into French law. This application text is known as Circulaire DRT n° 91-18 of November 1991 ("Circulaire") Relative to the Application of Decree n° 91-451 Concerning the Prevention of Risks Associated with VDU Work. This Circulaire does not appear in the Official Journal, however, it is published in the French Labour Codes [6]. The intent of the present Circulaire is to provide a more precise interpretation of the French Decree. Although new requirements are not introduced in the Circulaire certain provisions of the French Decree are more explicitly described.

The subject matters expanded upon in the Circulaire are fourfold: (1) General Provisions pertaining to the use of

portable equipment, (2) Rest breaks from work with display screens, (3) Conditions of medical surveillance, (4) Equipment and environmental conditions. A summary of points of the French Decree expanded upon in the Circulaire is as follows:

French Decree as elaborated by French Circulaire DRT n° 91-18

Chapter I, General Provisions:

Applicability:

It is the responsibility of the employer, after having consulted with its salaried employees and the Committee of Hygiene and Safety, to determine which jobs and workplaces are subject to the French Decree.

Portable Systems:

Pertaining to portable systems being excluded, the Circulaire clarifies that if a worker uses a portable system for a "non negligible" portion of their work day then the worker is protected by the provisions of the French Decree. N.B. "non negligible" is not defined in the Circulaire.

Chapter II, Workstations and Daily Work Routine:

Activity Changes:

The Circulaire explicitly defines "periodic activity changes". An example given of an activity change is that of performing office tasks instead of work with a display screen. Also, the alternative tasks must be in accordance with the employees normal work responsibilities.

Work Breaks:

The Circulaire further clarifies that "work pauses" are to be breaks from all work activity and that they are to be given in addition to traditional rest breaks. The timing and duration of the recommended work pauses are to be determined as a function of the organisation and characteristics of the work tasks.

Chapter IV, Medical Surveillance

Medical Examinations:

The role of the Doctor of Work and the special examinations for users of VDU equipment is further described in the Circulaire.

Vision Correction:

In the French Decree it is implied that if the results of the worker's visual examination justifies a means of correction then the costs shall be completely borne by the employer. However, in the Circulaire it is clarified that if the correction of a visual dysfunction benefits the worker in his daily life then the costs of correction are to be paid for by the worker.

Chapters V & VI, Equipment and Work Environment:

Chair:

The Circulaire clarifies that the French Decree does not intend to imply that the chair back must move independently from the seat pan nor does it imply that the chair back and seat pan adjustment features be independent of one another. The Circulaire also

notes that "monocoque" (i.e. single shell) type chairs could meet the objectives of the French Decree if the chair back and seat pan are able to incline in a synchronous manner.

Environmental Conditions:

The Circulaire provides examples of how the VDU worker should be protected from temperature changes caused by the equipment. In addition, precise levels of office environment humidity are given.

Electromagnetic Radiation:

The Circulaire prescribes that emissions of ionising radiation shall conform to the French Decree n° 86-1103 of 2 October 1986 Relative to Protecting Workers from Ionising Radiation.

Lighting:

The Circulaire specifies that all disturbing reflections on the display screen should be avoided. In addition, it is noted that the disposition of the natural or artificial lighting must be such as to provide a well distributed and balanced luminance.

MEANS OF VERIFYING IMPLEMENTATION

The implementation verification process of the French Decree on VDU-work is managed by a team of members from various disciplines. This verification team is comprised of a Work Inspector, a Safety at Work Controller, a Medical Doctor of Work, and representatives from the employee Hygiene and Safety Committee. In order to understand better this verification process and the roles each team member plays, the researcher interviewed 25 individuals from the Parisian and South East Regions of France. The information obtained from these interviews and the subsequent perceptions of an implementation verification process are summarized below.

Work Inspector:

In every region within France there are a number of government employed inspectors of work that are responsible for visiting companies in their district and ensuring that all labour codes and decrees are respected by employers. These inspectors provide a liaison role between employees, employers, and the national labour codes. Although the majority of work inspectors are generalists their principal focus is regulating work hours, scrutinizing employee redundancies, and overseeing the general health and safety conditions of the workplace.

In theory, other than the employer, the inspector of work is the team member most responsible for verifying that the minimum requirements of the French Decree on VDU work are followed. In reality, based upon the researchers' interviews with various work inspectors, it does not appear that such compliance verification is a priority when the annual workplace inspections are performed.

From a political perspective, the researcher learned that in 1996 the three national priorities for the work inspectors are: (1) asbestos removal in the workplace, (2) the reduction of risks of falling in the office and

factories, and (3) the improvement of floor surfaces and interior walk-ways. The researcher was given the impression that it is likely that the priority given to verifying the implementation of the French Decree on VDU work would most likely be elevated in 1997 as the entire Decree would be in force at this time following the four year transition period.

Although the French Decree and associated requirements were not always well known by the work inspectors interviewed, the general trend regarding ergonomic health and safety concerns seemed to be that of collective (overhead) lighting, reflections caused by natural light, and collective heating. On a few occasions, the researcher was informed that the most common complaint among workers was in regard to lighting. When queried further about overhead lighting, the inspectors were quick to add that it is the employers' responsibility to provide workers with individual lighting if he/she complained about the overhead lighting as related to their work with a display screen.

Medical Doctors of Work:

While the theoretical role of the Work Inspector, in relation to the French Decree on VDU work, is that of an on-site verifier of regulation implementation, the Doctor of Work's function is one of preventative consultation. [2] Essentially, their role is to consult employers, employees, and Work Inspectors on methods of preventing work related injuries.

The Doctor of Work is an employee of the state and a portion of his/her work time is dedicated to analyzing the workplace conditions and performing periodic general health exams of the employees. For those employees that work with VDUs, the medical examination includes an eye examination and a questionnaire related to the rhythm of work and the general working conditions. The questions pertaining to office ergonomics, and the corresponding interview between the Doctor of Work and employee, are geared towards the general lighting conditions of the workplace and the luminosity of their display screens. If the results of these employee-completed questionnaires indicate that there is a potential health risk in the work area, or with the VDU equipment the Doctor of Work would be obliged to visit the work premises and perform a special surveillance. This type of surveillance by the Doctor of Work is typically performed in conjunction with a Work Inspector and, in larger companies, with employee representatives of the Hygiene and Safety Committee. If the results of this special surveillance indicate that corrective measures must be taken by the employer, it is the Work Inspector and not the Doctor of Work that would assess necessary sanctions.

In contrast to the interviews with the work inspectors, the researcher observed that all of the Doctors of Work questioned were well informed of the French Decree on VDU-work and had taken action to incorporate the essence of this national regulation into their work practices.

In short, the Doctors of Work do not serve as direct verifiers of the French Decree. Instead they attempt to advise employers that by respecting the technical ergonomic

norms - including the physical, organisational and psychosocial factors - the quality of work life can be enhanced and thereby improving the overall performance of the corporation. [2]

Safety Controllers:

The Safety Controllers are government employees who provide support to the government and public sectors. Their function is to monitor and control the occupational health and safety at work and provide means of preventing accidents. In addition, it is their responsibility to both discover the workplace risks and offer improvement solutions for the work posts perceived to be dangerous and to distribute accident prevention documentation to industry. The Safety Controllers play a complementary partner role with the Work Inspectors.

Theoretically, the Safety Controller's principal role is to ensure that the laws and regulations concerning workplace safety are adhered to by industry. Therefore, it would be assumed that they would play a large role in verifying the implementation of the French Decree on VDU-work. Interestingly, the researcher determined that the implementation of the French Decree on VDU-work was not their primary occupation. Instead, the researcher was informed that these controllers are more concerned with preventing traditional "accidents" instead of "professional maladies" that may result from work with VDU equipment.

The Safety Controllers are responsible for periodically visiting companies and ensuring that preventative measures are in place to avoid accidents at work. However, the researcher observed that the Safety Controllers' periodic visits to corporations were more related to heavy industry. They typically only visited companies that employed workers of VDU equipment if there were employee complaints or related injuries.

Hygiene and Safety Committee:

In large companies, that is those with 50 or more employees, it is mandatory in France that there is a Committee of Hygiene and Safety ("C.H.S.C.T."). This group is comprised of elected employee representatives and the president of the company or his representative (i.e. HR Director).

In theory, the role of the C.H.S.C.T. is to contribute to the protection of the health and safety of the employees through the analysis of professional risks and working conditions. They must survey the application of health and safety laws pertaining to corporations. These objectives are theoretically met via regular inspections of the workplace, analyses of professional risks, and investigations following each accident of work. They contribute to the promotion of the prevention of accidents and to providing solutions relative to the organisation of work, the office environment (temperature, humidity, etc.), and the organisation of work equipment. In addition, when a new technology or method is introduced to the workplace, the representatives from the C.H.S.C.T. are required to study the consequences that the new equipment or method may pose to the safety of the workplace.

The C.H.S.C.T. members are advised at their meetings by the Doctor of Work. The C.H.S.C.T. members nor-

mally meet on a quarterly basis. The respective Work Inspector and Safety Controller are systematically invited to meetings of the C.H.S.C.T.. In theory, this group is required to generate a report annually summarizing the general situation of hygiene, safety at work, and working conditions. In companies employing workers that use VDU equipment this annual report on safety and hygiene would reference the French Decree and EU Directive.

In practice, the researcher observed that in very large corporations, i.e. those employing more than 2000 persons, the C.H.S.C.T. committees functioned formally and efficiently. However, it was the observation of the researcher that the smaller companies did not function as formally or efficiently.

In summary, the C.H.S.C.T. committees seem to provide a valuable role in verifying the implementation of the French Decree on VDU-work. However, it is unclear whether the C.H.S.C.T. groups of smaller corporations are adequately informed of the legislation and preventive safety measures.

PREVENTION OF RISKS: METHODS & TOOLS

Per the requirements set forth in the EU Directive and French Decree, the employer is obliged to provide information and training to their employees regarding the prevention of health and safety risks associated with the use of VDU equipment. In France, the source of education materials supporting the application of such health and safety laws is the National Institute of Research and Safety (INRS). This government organization provides occupational safety and prevention support to all industries, the National Body of Health Insurance, and the Corporate Safety & Hygiene Committees. The INRS obtains, elaborates, and diffuses all documentation concerning the hygiene and occupational safety: brochures [3], pamphlets, posters, film, and bibliographic information.

There are a number of publication materials of the INRS concerning specific guidance on the prevention of risks associated with VDU equipment use and the application of the French Decree and EU Directive. A few examples of such recent publications found to be very informative by the researcher are: (unofficial title translations) Visual Display Screens, Methodological Guide for Doctors of Work [2], Better Life With Your Display Screen [4], and Display Screen Work in 50 Questions. [5]

In theory, the educational brochure designated for the VDU workers are to be distributed to employers by the Government Safety Controllers. In practice, the researcher had difficulty ensuring that such educational materials were actually distributed on a consistent basis by the Safety Controllers in all regions as there seemed to be a lack of knowledge within the Safety Prevention bureau as to the materials and risks to safety presented by VDU usage. Regardless, even assuming an ideal situation, the researcher observed, based upon interviews with C.H.S.C.T. members, that corporate management often refused to permit their safety committee to distribute the INRS brochures to the employees because of the fear that it could be incorrectly interpreted: for

example, in one of the educational brochures it is noted that a work pause of 5 to 10 minutes every hour is recommended. In addition, this brochure details that one should leave their work post, move about, and stretch his/her muscles during the hourly breaks. The consequence is that employers fear reduction in productivity would result if the intent is not clearly explained orally to each employee. Unfortunately, in the large companies such specific explanations and associated training is not feasible.

Another method for the employers to receive information concerning risk prevention methods is through the respective Doctors of Work that support their companies. The researcher determined that it is not uncommon for Work Doctors supporting large corporations to offer educational seminars regarding the health and safety associated with VDU equipment work and general office ergonomics.

In summary, the consistent distribution of educational materials and employee training on office ergonomics is limited and often times thwarted due to the direct costs of distribution and training.

WORKPLACE IMPROVEMENTS SINCE 1993

Throughout the investigation and interview process the researcher attempted to gather information regarding the individual's perception of improvements made in the work place since the French Decree and EU Directive were introduced in January of 1993. An overview of the responses to this open ended question is as follows:

In France, it appears that improvements to the office workplace as a result of the implementation of the EU Directive have been slow in coming. However, this does not mean that improvements have not taken place. From a critique standpoint, it has been said that "unlike some of France's neighbors, the French treat the malady instead of preventing it". [1] Perhaps this is the case considering the small number of companies that have taken steps to come into compliance with the French Decree.

Those questioned noted some problems which seem to inhibit the improvements to the quality of the work life. Noted problems include:

- Costs of installing new computers are prohibitive.
- The arrangement of VDU equipment is often determined by the location of the cable hook up points to power and network lines instead of by ergonomic principles.
- Incompatibility between the architecture layout of old offices and placement limitations of VDU equipment.
- The disposition of VDUs with respect to natural and overhead lighting.

In summary, the researcher observed that the general trend in France is neither small nor large companies comply with the French Decree in its entirety at this time. Even though in practice it appears that the French Decree is not yet being applied consistently, those questioned did feel that some general improvements to office ergonomics have resulted since 1993. For example,

there seems to be certain focus areas of the decree that are considered more important to both the users and implementors. Such areas of improvements noted were with respect to the actual display screen equipment and associated software, however, it is unclear as to whether this is a direct result of the legislation or merely the advancement of display screen and computer technology. In addition, those questioned seem to feel that more attention has been given to office lighting conditions, natural light, and window coverings.

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The Italian Visual Display Terminal (VDT) Legislation

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ABSTRACT

This contribution will be focused on the Italian Visual Display Terminal legislation with reference to the European Directive 90/270/EEC. A brief history of its development will be presented with the most recent changes and interpretation issues as well as critical points will also be discussed. Issues related to the introduction of software ergonomics principles as well as referenced technical norms, both at the national and international level, will also be presented and discussed.

KEYWORDS

EU Directives, Ergonomics, Health, Safety, Decrees, Workplace, Workers.

INTRODUCTION

The European Directive 90/270/EEC on the „Minimum Health and Safety Requirements for work with Visual Display Screen equipment“ provides general guidance for applying a comprehensive set of design and use principles and allocates specific responsibilities to those who are involved, both as rulers, providers and users, in guaranteeing health and safety in the workplace.

As far as Italy is concerned, a Legislative Decree has been issued, named „Decreto Legislativo 19 settembre 1994 n. 626“, (Dlgs. 626/94) inspired by European Directives 89/391/CEE, 89/655/CEE, 89/656/CEE, 90/269/CEE, 90/270/CEE, 90/679/CEE with the aim of introducing health, safety and ergonomics principles in the workplaces.

This decree has been recently revised following comments and suggestions arising from both Government, Industry, Academy and Trade Unions, and it has been recently re-issued on March 18th 1996 with several modifications in both definitory and technical aspects.

The decree makes also explicit reference to EN and UNI technical standards, named „norme di buona tecnica“ and the Italian Standardisation Body (UNI) is playing an important role in fostering the adoption of these standards.

THE LEGISLATION

As far as Italy, the European Directives have been introduced in the legislation with a comprehensive and structured law which re-elaborates and up-dates the provisions on Health and Safety contained in the „Decreto del Presidente della Repubblica 19 Marzo 1956 n. 303“ (DPR 303/56). In fact, the new decree consists of 98 articles divided into the following sections and subsections:

TITOLO I:

- Disposizioni Generali (General Provisions);
- Servizio di prevenzione e protezione (Prevention and Protection Services);
- Prevenzione incendi, evacuazione dei lavoratori, pronto soccorso (Fire Emergency and Protection);
- Sorveglianza Sanitaria (Health Surveillance);
- Consultazione e Partecipazione dei lavoratori (Workers Consultation and Participation);
- Informazione e formazione dei lavoratori (Information and Education of Workers);
- Disposizioni concernenti la Pubblica Amministrazione (Provisions for Public Administrations);
- Statistiche degli infortuni e delle malattie professionali (Accident and Professional illness Statistics);

TITOLO II:

- Luoghi di Lavoro (Workplaces);

TITOLO III:

- Uso delle attrezzature di lavoro (Work equipment use);

TITOLO IV

- Uso dei dispositivi di protezione individuale (Individual protection equipment use);

TITOLO V

- Movimentazione manuale dei carichi (Manual movement of burdens)

TITOLO VI

- Uso di attrezzature munite di videoterminali (VDT equipment use);

TITOLO VII: Protezione da agenti cancerogeni (Protection from cancer agents);

- Disposizioni generali (General Provisions)
- Obblighi del datore di lavoro (Employer's Obligations)
- Sorveglianza sanitaria (Health Surveillance)

TITOLO VIII: Protezione da agenti biologici (Protection from biological agents)

- Disposizioni Generali (General Provisions)
- Obblighi del Datore di Lavoro (Employer's Obligations)
- Sorveglianza sanitaria (Health Surveillance)

TITOLO IX: Sanzioni (Sanctions)

TITOLO X: Disposizione transitorie e finali (Transient and Final Provisions)

The amended version of the decree also introduces Annex VII dealing with Environmental and Hardware/Software Ergonomics which was omitted in the first version.

It also includes new definitions and clarifications, such as :

- new figure of Employer who has to be the most prominent figure in the company. i.e. the person responsible for budget planning and spending;
- new figure of Public Administration Employer who has to be any Office Responsible with or without budget responsibilities (Public Administration will identify within a certain timeframe who is the personnel involved);
- exemption for small enterprises with less than 10 workers through self-assessment of potential risks;
- re-introduction of Annex VII on Environmental and Hardware/Software Ergonomics;
- extension of the deadline for VDT equipped workplace: 1/1/1997.

THE INTERPRETATION

Italian legislation, especially Art.3, Art.42, Art.47 and Art.52, makes reference to the fundamentals of ergonomics for optimal design of workplaces.

This implicit as well as explicit reference to the evolutionary character of modern information technology and the fostered adoption of national technical standards somehow shows that what appears to be required in Italian legislation may be more strict than what is required by each individual European directive.

Among the most important points which have been introduced *ex-novo* in Italian legislation are, for instance, postural requirements. In fact, the European directive

never explicitly mentions the potential health risks associated to wrong postural attitudes during working hours, whilst only visual stress was widely considered, notwithstanding the results of an important review of the World Health Organisation of 1987, updated in 1990.

Italian legislation also introduces (Titolo IX) a set of heavy sanctions related to different types of violations.

Besides, severe inspections at workplaces are to be carried out by competent centres, depending on the Ministry of Health (among 200 recognised centres throughout Italy) and these offices have skilled personnel for both sanitary and environmental risk assessment.

Besides good points there are also negative points such as the definition of worker (Art.2) which has been translated from „any worker...who habitually uses display screen equipment as a significant part of his normal work“ in the following: „worker who habitually and systematically uses display screen equipment at least for four hours consecutively detracted the allowed pauses (15 mins every 2 hours) for the entire working week.“.

This is really unfortunate because the pervasive nature of information technology in the modern workplace makes this distinction artificial and inspired by a tayloristic attitude towards workers and workplaces. A related risk is that of excluding 90% of VDT workers from the potential benefits of the modern legislation, although many Employers are expanding the definition to include VDT workers with an average of 20-25 hours of VDT use per week.

A recent resolution of the Italian Ministry of Labour appears to further restrict the scope of the legislation only to those who professionally use VDT such as, for instance, data entry personnel. This interpretation conflicts against the General Provisions (Art.3) where general ergonomic principles in the design and use of modern work equipment should be applied, *irrespective of the duration or typology of VDT work*.

Another interpretation issue arises on Health Surveillance (Titolo I) where the legislation sustains potential discrimination based on the distinction between *fit* and *not fit operators for VDT use* with respect to the visual stress. This approach, in fact, has a high risk to become a sort of discriminatory selection, setting up barriers between young and aged workers, since workers with more than 45 years have to be their sight controlled every two years, even in case of absence of any disturbance. It also seems oriented to exclude from this occupational activity many operators only for minor optical-mological deficiencies and/or for environmental incompatibility.

Moreover no effective distinction has been made in the legislation between different display technologies such as CRT, liquid crystal, etc.

Another definitory issue arises from the specific provisions for Public Administrations, both Central and Local.

In fact for these very large organisations, employing millions of peoples, the legislation handles exceptions at various levels. Public Administrations are free to

adopt different disciplines on the basis of „specific work needs“ and ministerial decrees or regulations may directly rule ergonomic, health and safety requirements and moreover in a different way. Furthermore ergonomic, health and safety requirements are considered met at the time when the Public Employer, who, as already stated, may be an office responsible with no specific responsibilities, issues a specific request to the competent office of the Public Administration, with no actual guarantee whatsoever of this request to be filed, answered and executed.

THE EVALUATION SCHEME

The risk assessment procedure for VDT use is currently inspired by the normative *corpus* on Ergonomics at ISO, CEN and UNI level.

Potential risks concern both visual as well as postural stress and physical as well as mental workload.

Employers will be responsible for evaluating these risks and will also be responsible for the procurement of well-designed workplaces, including all workplace features from tables, chairs to hardware and software, so as to optimise the well-being, health and safety of their employees, even allowing pauses and breaks in-between working hours. Employers are also responsible for medical check-ups, especially those for assessing visual stress.

Since Italian legislation has introduced specific provisions for postural problems, chairs, tables, as well as workstation have also to be checked. Climate, humidity, lighting, reflections and glitterings, noises, radiations are all important ergonomics factors which are to be assessed and constantly monitored by Employers.

According to Italian legislation (Annex VII) the Employer has also the obligation of acquiring interactive software which is adequate to the specific tasks of end-users, easy to use and adaptable to the experience of end-users, which provides feedback at any time to end-users so as guarantee continuous control of the interaction, which works at a pace which is sustainable by end-users, and, generally speaking, which embodies Software Ergonomics principles.

The set of basic criteria for interactive software evaluation which is being identified is the following:

- adequacy to actual tasks performed by end-users;
- adequacy to end-users preferences;
- adequacy to end-users expectations;
- full recoverability from errors;
- self-descriptiveness of dialogue modalities;
- support and help to end-users.

This set of criteria is inspired by the current versions of the ISO 9241, Part1-17.

Since requirements for the VDT equipped workplace includes both hardware and software, conformance to the ISO 9241 may be required.

For this reason the legislation also clarifies that conformance of workplace equipment will always be guaranteed by the conformance to UNI and CEI norms.

Moreover, according to the recent Circular of the Ministry of Labour n. 102/95, although UNI and CEI norms set the minimal level for the requirements of the legislation, no official declaration of conformance is required by providers. Therefore self-certifying the conformance to UNI or CEI norms is enough to sell, distribute and use VDT equipment in Italy.

In a later interpretation, European norms at ISO/CEN level may also be needed for self-certifying conformance since different European countries may have delays in producing national standards.

THE STANDARDS

Application of technical norms and standards therefore is the key for fulfilling ergonomic, health and safety requirements as stated in the current legislation.

The Italian Standardization Body (UNI) Ergonomics Technical Committee, is currently working for updating Italian technical norms and standards and integrating European norms so as to better fulfill the requirements of the new legislation.

Moreover it co-operates with other UNI Technical Committees, such as Safety, Furniture, Lighting, Advanced Production Technology, Transport, etc...

During the last year, ISO/CEN Parallel Enquiry have been launched to speed up the process of voting and confirmation of the ISO 9241 and this is greatly contributing to the cause.

The more relevant UNI norms on Ergonomics and related topics are, amongst others:

- UNI 8459 (83) „Ergonomics of Work Systems: Terminology and Basic Principles“;
- UNI ENV 26385 (90) „Ergonomic Principles in Work Systems Design“;
- UNI EN 614_1 „Ergonomic Principles for Machinery Safety: Terminology and Basic Principles“;
- ISO/CEN 10075 (91) „Ergonomics Principles for Cognitive WorkLoad“;
- UNI EN 29241_1 (93) „Ergonomic Principles for office work with VDT: General Introduction“;
- UNI EN 29241_2 (93) „Ergonomic Principles for office work with VDT: Guidance on Task requirements“;
- UNI EN 29241_3 (93) „Ergonomic Principles for office work with VDT: Visual Display requirements“.

The complete norm ISO 9241 is still under development and consists of 17 parts (including Part 1,2,3 which have already been introduced in Italy), as follows:

a. Visual Requirements

- Part 7: Display requirements with reflections
- Part 8: Requirements for displayed colours

b. Workplace and Environmental Requirements

- Part 4: Keyboard requirements
- Part 5: Workstation and postural requirements

- Part 6: Environmental requirements
- Part 9: Requirements for non-keyboard input devices

c. Software Ergonomics and Man-Machine Dialogue

- Part 10: Dialogue Principles
- Part 11: Guidance to Usability
- Part 12: Presentation of Information
- Part 13: User Guidance
- Part 14: Menu Dialogues
- Part 15: Command Dialogues
- Part 16: Direct Manipulation Dialogues
- Part 17: Form-filling Dialogues.

CONCLUSIONS

Italian legislation based on European Directive 90/270/EEC introduces ergonomic considerations in VDT work, overcoming some of the out-dated requirements which were still in force, as in the DPR 303/ 1956, therefore bridging a legislation gap with respect to modern technologies and this has been extremely valuable for Italy's modernisation.

The authors also share the hope that, in a near future, both the European Directive and the Italian decree might also be reformulated on the basis of experimental both technological and medical data.

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Implementation of the EC-directive 90/270 in the Netherlands

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INTRODUCTION

Just like in any other memberstate of the European Community, the EC-directive 90/270/ EEC on the minimum safety and health requirements for work with display screen equipment, needed to be implemented in the legislation of the Netherlands. On December 30, 1992, - one day before the final date for implementation - this has been achieved with enforcement of a special decree for VDU-work (Besluit Beeldschermwerk), based on the Working Environment Act (Arbeidsomstandighedenwet). The 'VDU-work Order' is founded on most of the articles of the EC-directive. Some smaller alterations have been made because of the general wording in the EC-text. To avoid opinion and interpretation differences, the Dutch Labour Inspectorate published an information sheet (P 184). In this guidebook all articles of the 'VDU-work Order' are clarified and, if possible, attached to a national or international standard (EN or NEN).

1. THE VDU-WORK ORDER

The definition of worker in the EC-directive is: 'any worker (...) who habitually uses display screen equipment as a significant part of his normal work'. In the 'VDU-work Order' of the Netherlands this definition is: 'a worker who in course of this work usually uses display screen equipment for at least two hours per calendar day.' The word 'habitually' is applicable where VDU-work consists of an major component of the employee's function. This definition has been introduced to exclude negligible display screen work. Taken into account the evidence from ergonomic research that indications of injury may significantly arise at sustained VDU-work, a criteria of two hours per calendar day has been adapted. Accordingly, the VDU-Work Order becomes relevant for 1,8 million employees (43% of the total number).

Article 7 of the EC directive contains the requirements on work organisation. The article is relevant because of its impact on the number of hours that people work with Visual Display Units. It states that the employer needs to plan the employee's activities in such a way that daily work on a display screen is intermitted by breaks or changes of activity, reducing the workload. In the 'VDU-work Order' this article is transformed into: 'The employer should plan the employee's activities in

such a way that any work at a display screen for two successive hours or more, will always be alternated by separate tasks or a rest period, reducing the workload'.

The explanatory notes to this article stress the necessity to prevent people from working with VDU's during the entire working time. Interruptions in working with display screen equipment over the working day are essential, at least after every two successive hours. Separate work patterns are preferable during these interruptions. Alternation with work of a different kind, requiring different physical and mental effort, is an appropriate way to relieve the stress due to display screen work. If no other kind of work is available, display screen work must alternate with regular breaks. The duration of the other tasks to be performed or the length of the breaks must be sufficient to reduce stress from VDU-work. The need to relieve the stress of display screen work by alternation with separate working tasks is indicated by evidence from literature that five or six hours of VDU-work is ergonomically inappropriate for a working day of eight hours. This in no way detracts from the requirement that employees should not spend more than two successive hours working without interruption at a display screen. If display screen work alternates with breaks, the breaks should preferably last at least ten minutes.

2. INFORMATION-SHEET 'WORK WITH VDU'S' (P-184)

The information-sheet 'Work with VDU's' of the Labour Inspectorate was published in 1993. In this year almost 11.500 copies of this guidebook were sold. Early 1994 an inquiry has been conducted to evaluate the effects of the VDU-Work Order and the publication of the guidebook. The guidebook P 184 provides useful information about requirements in the annex of the EC-directive. In the subsequent cases it was possible to attach the general wording of the annex-rules to a standard: LET OP: Opmaak! Requirements for the

VDU: NEN ISO 9241/EN 29241 part 3	"	"
chair: NEN (Dutch Standard) 1812	"	"
table: NEN 2449	"	"
lighting situation: NEN 3087	"	"
soft-ware: ISO 9241 part 10-19.		

The guidebook also gives information on health problems related to work with VDU's. Furthermore, many requirements and recommendations are presented - based on legislation of the EC-directive - to avoid health problems due to VDU-work. The guidebook also contains a checklist, that may support the employee to examine one's own workstation according to the requirements and recommendations in P-184.

An inquiry has been conducted in order to evaluate policy outcome. Effects of the widespread publication P-184 on the actual working conditions are discussed. Important questions are:

- Who are the purchasers of P-184?
- Does the content of P-184 meet the expectations of the purchasers?
- Does P-184 have a positive effect on working conditions with Visual Display Units?
- Have VDU-workstations been adapted to the requirements of the Dutch government?
- How does working conditions policy compare with complaints of employees?
- Will these complaints give rise to an overall improvement of workstations?

A questionnaire has been sent to a random sample of 469 purchasers of the guidebook. The response rate turned out to be 43.5 percent. Fairly representative data have been obtained for the total group of buyers, although relatively few reactions were obtained from the category banking, insurance business and commercial services.

3. CONCLUSION

In the Netherlands the implementation of the EC-directive has been implemented with exact definitions of working time and breaks and also with references to standards for the ergonomic aspects of the VDU-work. Generally speaking, the guidebook meets to a large extent the expectations of its purchasers. They appreciate the way the information is presented. Yellow borders in the left margin of the text, demonstrate the difference between requirements and recommendations.

The difficulty level of the guidebook corresponds to the average education level of the readers, which is rather high. The checklist is also of significant value. About one third of the readers uses the checklist to examine the overall quality of VDU-work in the organization. According to the buyers the main deficiencies of the guidebook are the bad binding, the glaze of the paper, the lack of a summary and clear directions for improving the working conditions.

Many Dutch VDU-employees receive information on the VDU-work Order via the guidebook, published by the Labour Inspectorate. However, only a small number of guidebooks have been sold to small companies (1-9 employees), compared to medium sized companies (10-99 employees) and large industrial corporations (100 employees or more). The small organisations might be reached through the overall line organisations. A special manual could be made for this target section, which includes a summary of the requirements and recommenda-

tions next to a checklist and clear instructions about how to improve working conditions.

The buyers of P-184 are very actively engaged in the quality of work with VDU's. The 'VDU-work Order' gives, as the complaints of the employees do, a big impulse towards improvement of the working conditions of VDU-employees. The guidebook has demonstrated its value for remedial purposes. To remedy the complaints of employees by improving the working conditions is seen as more important than solely adjusting the working conditions to the requirements of the Order.

Next to the major concern for furniture, screen, possibilities for interruptions, lighting and guidance, the environmental factors climate, workspace and noises become more important. Improvements that are harder and more expensive to accomplish are easily postponed. About one-third of the users of P-184 give low priority to the improvement of the working conditions. Extensive formal procedures and lack of financial support are the major hindrances for improving the quality of VDU-work.

Ninety percent of the buyers of the guidebook bear in some way responsibility for the working conditions of their colleagues. Generally speaking, they find it hard to estimate the effects of ameliorations. A extensive survey on VDU-work before and after improvements are realized, may demonstrate whether improvements serve the goal to reduce the number of health problems among VDU-employees. These evaluations need to focus on specific shortcomings of VDU-working conditions and complaints of employees. This way the success of pursuing the goal of optimum working conditions may become clear to the users of P-184.

So far the Dutch Labour Inspectorate has spent little attention to the subject of work with VDU's. This is probably a consequence of the fact that all VDU-workstations have to be adapted to the requirements of the Order only by January 1, 1995. In view of the fact that there are 1.8 million VDU-workers in the Netherlands, and the direct relationship between VDU-work characteristics and health problems, the Labour Inspectorate could spend some more time on this subject. During the inspections the features of VDU-work that are hard to improve need to get special attention, because improvements on these features are often delayed.

The guidebook has demonstrated its value for remedial purposes. Nowadays people tend to adapt their work environment to legislation requirements. On the other hand, care for good work conditions in an early stage - the design of offices - may be more beneficial compared with this remedy-approach. Besides, improvement in an early stage is less expensive and easier to accomplish. For that reason prevention of physical and mental health problems need special emphasis in any work environment policy.

The improvement of the working conditions may also result in positive side-effects. The attention for the improvement of working conditions may have a positive effect upon the reduction of sick-leave. Furthermore, it may prevent the loss of skilled and experienced employees who become unfit for the VDU-work. This means that there is a positive effect on the costs of

labour and the productivity, by which the (maintenance of) employment will be stimulated in a durable way.

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The EU Directive and Switzerland

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ABSTRACT

Switzerland's legislation concerning VDU-work is based on its ordinance no. 3 relating to the labor law dating from 1993. This decree holds up the goal of protecting the worker's health.

It's a principle of the Swiss labor legislation, that the employer is responsible for the protection of health of any employee. The employee on the other hand is expected to cooperate with the employer in order to fulfil this demand. To meet these requests the legislation, supplemented with the lately issued handbook and the standards according to CEN are useful instruments in pursuing the goal of protecting health at the workplace.

KEYWORDS

Swiss legislation, VDU-work

INTRODUCTION

In Switzerland an estimated 1.1 million people are working with a VDU. Having refused membership of the European Economic Area (EEA) in 1992, the Swiss made their own contribution to the safety as well as to the health of people working with VDUs. As there was no legal base nor obligation to adopt the EU-directive on VDU-work, the Swiss authority constituted a new legislation that would contribute to a general view relating to health protection at any workplace. The starting point was the common experience that any legalization would not by itself warrant reliably for the assumed implementation.

Swiss legislation concerning VDU-work

Because of their worldwide activities the Swiss companies could hardly afford a legislation being suitable for the specific demands of Switzerland only. Any legislation should therefore be consistent and basically compatible with all other European countries. As for VDU-work any legislation is inevitably interrelated with the normative standards that have to be followed by the producers and by the trade. Switzerland profits from those standards due to its membership in the CEN.

In the aftermath of the refusal of the European Economic Area 1992 the responsible Swiss authority worked out a new legislation for the protection of health and safety at any workplace with a special comment on the VDU-workplace. Lacking a detailed prescription according to the EU-directive 90/270 for VDU-work, in Switzerland the ordinance no. 3 of the Swiss labor law with its respective art. no. 23 (having come into force in 1993 [1]) and the referring handbook „Wegleitung,, (issued in 1996 [2]) comprise the respective guidelines.

Upon the coming into force of the ordinance no. 3 the Swiss legislation finally met with the ILO agreement no. 120 on health protection regarding the sectors trade and administration. The referring handbook does not have any binding character but renders the responsible person or any concerned person the necessary background in order to improve the VDU-work and workplace.

The Swiss legislation differs from the EU-directive mainly in the question of an institutional testing and optimization of a person's visual power as suggested in art. 9 of the EU-directive 90/270. The responsibility for any employee's visual function can not be assigned to his or her employer, but some employers provide screening tests for vision and/or share the expenses for a correction of their employees' eyes. Besides that, the EU-directive 90/270 with its art. no. 3 obliges the employer to provide for an analysis of the VDU-workplace. This decree finds its counterpart to a great extent in the lately introduced guideline on the engagement of specialists for occupational health and safety [3].

Purpose of any directive

There is general consent on the fact that too detailed prescriptions will not contribute to better work and workplaces but to unfavorable applications and misinterpretations of effective rules.

The fact must be stressed moreover, that beyond the rules there exists in our experience an ample scope of deviations from the rules and a host of individual preferences that should be respected as well.

Importance of vocational training and support

We hold the opinion that an adequate formation, training and support will serve the purpose to prevent any health impact, therefore protecting health and improving user comfort and performance. The Swiss National Insurance for Occupational Diseases and Accidents (SUVA) in cooperation with the Swiss Federal Office for Industry, Trade and Labor (BIGA) provides brochures [4,5] and an interactive program for individual training [6]. The Swiss Federal Office for Industry, Trade and Labor (BIGA) disposes of a brochure [7] and a visual instruction for use on PCs [8]. Employers, unions and other concerned institutions provide vocational training by internal or external experts or brochures. The staff of cantonal and federal supervisory boards offer their services.

Importance of work organization

Work contents and work schedule both strongly determine the experience of the persons concerned. Investigations on the main complaints of VDU-workers as on eyestrain and on work related musculoskeletal disorders conducted in the past repeatedly have proven an important contribution of these factors. Therefore any demand for an improvement of VDU-work must include useful measures of work organization that consider the special requests of unusual visual demands and of the fact that a person in many cases keeps seating for too long a time.

Comprehension of VDU-work as an ongoing process

VDU-work and workplaces must not be understood as a static phenomenon but rather as an ongoing and developing process. Besides display technologies, software and workstation design the office environment is in continuous change. A reference must be made to the flat display technology being introduced soon. Any regulation should therefore allow for more flexibility considering the differing user needs. Moreover it is a fact that even valid standards are being criticized and need to be reviewed and revised permanently.

CONCLUSION

Guidelines and regulations - as well as normative standards - allow to meet the users needs in a more specific way. They are of great importance and of valuable support in the process of optimizing the human-machine interface of a complex work situation as it is the case with VDU-work. Nevertheless they can not by themselves prevent any detrimental impact from any

person. We stress the fact that many other factors of the psychological, biological and social background may affect a person's experience at the workplace in a comparatively important way.

The Swiss approach to health protection for people doing VDU-work as well as for other workplaces is as follows: When designing a VDU-office environment the persons concerned must be aware of implementing a whole system and not just of focusing on the singular aspects of the human-machine-interface.

This view allows for concentrating on protective aims rather than on prescriptive requirements and regulations to be adapted in situations where numerous elements in an ergonomic and social setting are present. In our opinion only a system viewpoint allows for meeting the needs of the users and thereby for improving the workplace and work as a whole.

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Appendix: The EU Directive 90/270 on VDU-Work

COUNCIL DIRECTIVE of 29 May 1990 on the minimum safety and health requirements for work with display screen equipment (fifth individual Directive within the meaning of Article 16 (1) of Directive 89/391/EEC).

(90/270/EEC)

THE COUNCIL OF THE EUROPEAN COMMUNITIES,

Having regard to the Treaty establishing the European Economic Community, and in particular Article 118a thereof,

Having regard to the Commission proposal (1) drawn up after consultation with the Advisory Committee on Safety, Hygiene and Health Protection at Work,

In cooperation with the European Parliament(2)

Having regard to the opinion of the Economic and Social Committee(3)

Whereas Article 118a of the Treaty provides that the Council shall adopt, by means of Directives, minimum requirements designed to encourage improvements, especially in the working environment, to ensure a better level of protection of workers' safety and health;

Whereas, under the terms of that Article, those Directives shall avoid imposing administrative, financial and legal constraints, in a way which would hinder the creation and development of small and medium-sized undertakings;

Whereas the communication from the Commission on its programme concerning safety, hygiene and health at work (4) provides for the adoption of measures in respect of new technologies; whereas the Council has taken note thereof in resolution of 21 December 1987 on safety, hygiene and health at work (5);

Whereas compliance with the minimum requirements for ensuring a better level of safety at workstations with display screens is essential for ensuring the safety and health of workers;

Whereas this Directive is an individual Directive within the meaning of Article 16 (1) of Council Directive 89/391/EEC of 12 June 1989 on the introduction of measures to encourage improvements in the safety and health of workers at work (6); whereas the provisions of the latter are therefore fully applicable to the use by workers of display screen equipment, without prejudice to more stringent and/or specific provisions contained in the present Directive;

Whereas employers are obliged to keep themselves informed of the latest advances in technology and scientific findings concerning workstation design so that they can make any changes necessary so as to be able to guarantee a better level of protection of workers' safety and health;

Whereas the ergonomic aspects are of particular importance for a workstation with display screen equipment;

Whereas this Directive is a practical contribution towards creating the social dimension of the internal market;

Whereas, pursuant to Decision 74/325/EEC(7), the Advisory Committee on Safety, Hygiene and Health Protection at Work shall be consulted by the Commission on the drawing-up of proposals in this field,

HAS ADOPTED THIS DIRECTIVE

SECTION I

GENERAL PROVISIONS

ARTICLE 1

SUBJECT

1. This Directive, which is the fifth individual Directive within the meaning of Article 16 (1) of Directive 89/391/EEC, lays down minimum safety and health requirements for work with display screen equipment as defined in Article 2.

2. The provisions of Directive 89/391/EEC are fully applicable to the whole field referred to in paragraph 1, without prejudice to more stringent and/or specific provisions contained in the present Directive.

This directive shall not apply to:

- a) drivers' cabs or control cabs for vehicles or machinery;
- b) computer systems on board a means of transport;
- c) portable systems not in prolonged use at a workstation;
- e) calculators, cash registers and any equipment having a small data or measurement display required for direct use of the equipment;
- f) typewriters of traditional design, of the type known as 'typewriter with window'

ARTICLE 2

Definitions

For the purpose of this Directive, the following terms shall have the following meanings;

- a) display screen equipment; an alphanumeric or graphic display screen, regardless of the display process employed;

b) workstation; an assembly comprising display screen equipment, which may be provided with a keyboard or input device and/or software determining the operator/machine interface, optional accessories, peripherals including the diskette drive, telephone, modem, printer, document holder, work chair and work desk or work surface, and immediate work environment;

c) worker; any worker as defined in Article 3 (a) of Directive 89/391/EEC who habitually uses display screen equipment as a significant part of his normal work.

SECTION II EMPLOYERS OBLIGATIONS

ARTICLE 3

Analysis of workstations

1. Employers shall be obliged to perform an analysis of workstations in order to evaluate the safety and health conditions to which they give rise for their workers, particularly as regards possible risks to eyesight, physical problems and problems of mental stress.
2. Employers shall take appropriate measures to remedy the risks found, on the basis of the evaluation referred to in paragraph 1, taking account of the additional and/or combined effects of the risks so found.

ARTICLE 4

Workstations put into service for the first time

Employers must take the appropriate steps to ensure that workstations first put into service after 31 December 1992, meet the minimum requirements laid down in the Annex.

ARTICLE 5

Workstations already put into service

Employers must take the appropriate steps to ensure that workstations already put into service on or before 31 December 1992 adapted to comply with the minimum requirements laid down in the Annex not later than four years after that date.

ARTICLE 6

Information for, and training of, workers

1. Without prejudice to Article 10 of Directive 89/391/33C, workers shall receive information on all aspects of safety and health relating to their workstations as are implemented under Articles 3, 7 and 9.

In all cases workers or their representatives shall be informed of any health and safety measure taken in compliance with this Directive.

2. Without prejudice to Article 12 of Directive 89/391/EEC, every worker shall also receive training in use of the workstation before commencing this type of work and whenever the organization of the workstation is substantially modified.

ARTICLE 7

Daily work routine

The employer must plan the worker's activities in such a way that daily work on a display screen is periodically interrupted by breaks or changes of activity reducing the workload at the display screen.

ARTICLE 8

Worker consultation and participation

Consultation and participation of workers and/or their representative shall take place in accordance with Article 11 of Directive 89/391/EEC on the matters covered by this Directive, including its Annex.

ARTICLE 9

Protection of workers eyes and eyesight

1. Workers shall be entitled to an appropriate eye and eyesight test carried out by a person with the necessary capabilities:

- before commencing display screen work,
- at regular intervals thereafter, and

- if they experience visual difficulties which may be due to display screen work.
- 2. Workers shall be entitled to an ophthalmological examination if the result of the test referred to in paragraph 1 show that this is necessary.
- 3. If the results of the test referred to in paragraph 1 or of the examination referred to in paragraph 2 show that it is necessary and if normal corrective appliances cannot be used, workers must be provided with special corrective appliances appropriate for the work concerned.
- 4. Measures taken pursuant to this Article may in no circumstances involve workers in additional financial cost.
- 5. Protection of worker's eyes and eyesight may be provided as part of a national health system.

SECTION III MISCELLANEOUS PROVISIONS

ARTICLE 10

Adaptations to the Annex

The strictly technical adaptations to the Annex to take account of technical progress, developments in international regulations and specifications and knowledge in the field of display screen equipment shall be adopted in accordance with the procedure laid down in Article 17 of Directive 89/391/EEC.

ARTICLE 11

Final provisions

1. Member States shall bring into force the laws, regulations and administrative provisions necessary to comply with this Directive by 31 December 1992.
They shall forthwith inform the Commission thereof,
2. Member States shall communicate to the Commission the texts of the provisions of national law which they adopt or have already adopted, in the field covered by this Directive.
3. Member States shall report to the Commission every four years on the practical implementation of the provisions of this Directive, indicating the points of view of employers and workers. The Commission shall inform the European Parliament, the Council, the Economic and Social Committee and the Advisory Committee on Safety, Hygiene and Health Protection at Work.
4. The Commission shall submit a report on the implementation of this Directive at regular intervals to the European Parliament, the Council and the Economic and Social Committee, taking into account paragraphs 1, 2 and 3.

ARTICLE 12

This Directive is addressed to the Member States

Done at Brussels, 29 May 1990. For the Council, The President, B. AHERN

Annex

MINIMUM REQUIREMENTS

(articles 4 and 5)

Preliminary remark

The obligations laid down in this Annex shall apply in order to achieve the objectives of this Directive and to the extent that, firstly, the components concerned are present at the workstation, and secondly, the inherent requirements or characteristics of the task do not preclude it.

1. EQUIPMENT

a) General comment

The use as such of the equipment must not be a source of risk for workers.

b) Display screen

The characters on the screen shall be well-defined and clearly formed, of adequate spacing between the characters and lines. The image on the screen should be stable, with no flickering or other forms of instability. The brightness and/or contrast between the characters and the background shall be easily adjustable by the operator, and also be easily adjustable to ambient conditions. It shall be possible to use a separate base for the screen or an adjustable table. The screen shall be free of reflective glare and reflections liable to cause discomfort to the user.

c) Keyboard

The keyboard shall be tiltable and separate from the screen so as to allow the worker to find a comfortable working position avoiding fatigue in the arms or hands. The space in front of the keyboard shall be sufficient to provide support for the hands and arms of the operator. The keyboard shall have a matt surface to avoid reflective glare. The arrangement

of the keyboard and the characteristics of the keys shall be such as to facilitate the use of the keyboard. The symbols on the keys shall be adequately contrasted and legible from the design working position.

d) Work desks or work surface

The work desk or work surface shall have a sufficiently large, low-reflectance surface and allow a flexible arrangement of the screen, keyboard, documents and related equipment. The document holder shall be stable and adjustable and shall be positioned so as to minimize the need for uncomfortable head and eye movements. There shall be adequate space for workers to find a comfortable position.

e) Work chair

The work chair shall be stable and allow the operator easy freedom of movement and a comfortable position. The seat shall be adjustable in height. The seat back shall be adjustable in both height and tilt. A footrest shall be made available to any one who wishes for one.

2. ENVIRONMENT

a) Space requirements

The workstation shall be dimensioned and designed so as to provide sufficient space for the user to change position and vary movements.

b) Lighting

Room lighting and/or spot lighting (work lamps) shall ensure satisfactory lighting conditions and an appropriate contrast between the screen and the background environment, taking into account the type of work and the user's vision requirements. Possible disturbing glare and reflections on the screen or other equipment shall be prevented by coordinating workplace and workstation layout with the positioning and technical characteristics of the artificial light sources.

c). Reflections and glare

Workstations shall be so designed the sources of light, such as windows and other openings, transparent or translucent walls, and brightly coloured fixtures or walls cause not direct glare and, as far as possible, no reflections on the screen. Windows shall be fitted with a suitable system of adjustable covering to attenuate the daylight that falls on the workstation.

d) Noise

Noise emitted by equipment belonging to workstation(s) shall be taken into account when a workstation is being equipped, in particular so as not to distract attention or disturb speech.

e) Heat

Equipment belonging to workstation(s) shall not produce excess heat which could cause discomfort to workers.

f) Radiation

All radiation with the exception of the visible part of the electromagnetic spectrum shall be reduced to negligible levels from the point of view of the protection of workers safety and health

g) Humidity

An adequate level of humidity shall be established and maintained

3. OPERATOR/COMPUTER

In designing, selecting, commissioning and modifying software, and in designing tasks using display screen equipment, the employer shall take into account the following principles;

a) software must be suitable for the task;

b) software must be easy to use and, where appropriate, adaptable to the operators level of knowledge or experience, no quantitative or qualitative checking facility may be used without the knowledge of the workers;

c) systems must provide feedback to workers on their performance;

d) systems must display information in a format and at a pace which are adapted to operators;

e) the principles of software ergonomics must be applied, in particular to human data processing.

Footnotes

(1) OJ No C 113, 29, 4? 1988? P.7 and OJ No C 130, 26.5. 1989, P.5

(2) OJ No C 12, 16.1. 1989, P.92 and OJ No C 113, 7.5 1990

(3) OJ No C 318, 12, 12, 1988, P.32

(4) OJ No C 28, 3.2. 1988, P.3

(5) OJ No C 28, 3.2. 1988, P.1.

(6) OJ No L 183, 29? 6. 1989? P.1

(7) OJ No L 185, 9.7. 1974, P.15.

Le décret français n° 91-451 du 14 mai 1991 concernant les prescriptions minimales de sécurité relatives au travail sur des équipements à écran de visualisation.

Le premier ministre,

Sur le rapport du ministre de l'agriculture et de la forêt et du ministre du travail, de l'emploi et de la formation professionnelle.

Vu la directive du Conseil des communautés européennes n° 90-270 C.E.E. du 29 mai 1990 concernant les prescriptions minimales de sécurité relatives au travail sur des équipements à écran de visualisation (cinquième directive au sens de l'article 16, paragraphe 1er, de la directive n°89-391 C.E.E.);

Vu le code du travail, et notamment l'article L. 231-2;

Vu le décret n° 82-392 du 11 mai 1982 relatif à l'organisation et au fonctionnement des services médicaux du travail en agriculture;

Vu le décret n° 86-1103 du 2 octobre 1986 relatif à la protection des travailleurs contre les dangers des rayonnements ionisant;

Vu l'avis du Conseil supérieur de la prévention des risques professionnels en date du 26 septembre 1990;

Vu l'avis de la Commission nationale d'hygiène et de sécurité du travail en agriculture en date du 8 novembre 1990;

Le Conseil d'État (section sociale) entendu,

Décète:

Chapitre Ier. Champ d'application

Sont soumis aux dispositions du présent décret les établissements visés à l'article L. 231 du code de travail dans lesquels des travailleurs utilisent de façon habituelle et pendant une partie non négligeable du temps de travail des équipements à écran de visualisation. Toutefois le présent décret ne s'applique pas aux équipements suivants:

- a. Les postes de conduite de véhicules ou d'engins;
- b. Les systèmes informatiques à bord d'un moyen de transport;
- c. Les systèmes informatiques destinés à être utilisés en priorité par le public;
- d. Les systèmes portables dès lors qu'ils ne font pas l'objet d'une utilisation soutenue à un poste de travail;
- e. Les machines à calculer, les caisses enregistreuses et tout équipement possédant un petit dispositif de visualisation de données ou de mesures nécessaires à l'utilisation directe de cet équipement;
- f. Les machines à écriture de conception classique dites "<machines à fenêtre".

Article 2. - Au sens du présent décret on entend par:

Écran de visualisation, un écran alphanumérique ou graphique quel que soit le procédé d'affichage utilisé;

Poste de travail l'ensemble comprenant un équipement à écran de visualisation, le cas échéant, d'un clavier ou d'un dispositif de saisie de données ou d'un logiciel déterminant l'interface homme/machine, d'accessoires optionnels, d'annexes, y compris l'unité de disquettes, d'un téléphone, d'un modem, d'une imprimante, d'un support-documents, d'un siège et d'une table ou d'une surface de travail, ainsi que de l'environnement de travail immédiat.

Chapitre II. Analyse et organisation du travail sur écrans de visualisation

Article 3. - L'employeur est tenu de procéder à une analyse des risques professionnels et des conditions de travail pour tous les postes comportant un écran de visualisation. L'employeur prend toutes les mesures qui s'imposent pour remédier aux risques constatés.

Il est tenu en outre, de concevoir l'activité du travailleur de telle sorte que son temps quotidien de travail sur écran soit périodiquement interrompu par des pauses ou par des changements d'activité réduisant la charge de travail sur écran.

Article 4. - Pour l'élaboration, le choix, l'achat et la modification de logiciels ainsi que pour la définition des tâches impliquant l'utilisation d'écrans de visualisation, l'employeur tiendra compte des facteurs suivants, dans la mesure où les caractéristiques intrinsèques de la tâche ne s'y opposent pas:

- a. Le logiciel doit être adapté à la tâche à exécuter;
- b. Le logiciel doit être d'un usage facile et doit être adapté au niveau de connaissance et d'expérience de l'utilisateur; aucun dispositif de contrôle qualitatif ne peut être utilisé à l'insu des travailleurs;
- c. Les systèmes doivent afficher l'information dans un format et à un rythme adaptés aux opérateurs;
- d. Les principes d'ergonomie doivent être appliqués en particulier au traitement de l'information par l'homme.

Chapitre III. Formation des travailleurs

Article 5 - L'employeur est tenu d'assurer l'information et, dans les conditions de l'article 231-3-1 du code du travail, la formation des travailleurs sur tout ce qui concerne la sécurité et la santé liées à leur poste de travail et notamment sur les modalités d'utilisation de l'écran et de l'équipement dans lequel cet écran est intégré.

Chaque travailleur doit en bénéficier, avant sa première affectation à un travail sur écran de visualisation et chaque fois que l'organisation du poste de travail est modifiée de manière substantielle.

Chapitre IV. Surveillance médicale

Art. 6: Un travailleur ne peut être affecté à des travaux sur écran de visualisation que s'il a fait l'objet d'un examen préalable et approprié des yeux et de la vue par le médecin du travail. Cet examen doit être renouvelé à intervalles réguliers et lors des visites médicales périodiques.

L'employeur est tenu de faire examiner par le médecin du travail tout travailleur se plaignant de troubles pouvant être dus au travail sur écran de visualisation.

Si les résultats des examens médicaux le rendent nécessaire un examen ophtalmologique est pratiqué.

Si les résultats de la surveillance médicale rendent nécessaires, une correction si des dispositifs de peuvent être utilisés les travailleurs sur écran doivent recevoir des dispositifs de correction spéciaux en rapport avec le travail concerné: ceux-ci ne doivent en aucun cas entraîner des charges financières additionnelles pour les travailleurs.

Chapitre V - Équipement

Article 7 Les caractères sur l'écran doivent être d'une bonne définition et formés d'une manière claire, d'une dimension suffisante et avec un espace adéquat entre les caractères et les lignes.

L'image sur l'écran doit être stable.

La luminance ou le contraste entre les caractères et le fond de l'écran doivent être facilement adaptables par l'utilisateur de terminaux à écrans et être également facilement adaptables aux conditions ambiantes.

L'écran doit être orientable et inclinable facilement pour s'adapter aux besoins de l'utilisateur.

Il peut être installé sur un pied séparé ou sur une table réglable.

L'écran doit être exempt de reflets et réverbérations susceptibles de gêner l'utilisateur.

Article 8. - Le clavier être inclinable et dissocié de l'écran pour permettre au travailleur d'avoir une position confortable qui ne provoque pas de fatigue des avant-bras ou des mains.

L'espace devant le clavier et les caractéristiques des touches doivent tendre à faciliter son utilisation.

Les symboles des touches doivent être suffisamment contrastés et lisibles à partir de la position de travail normale.

Article 9. - Le plateau de la table ou de la surface de travail doit avoir une surface peu réfléchissante et de dimensions suffisantes pour permettre de modifier l'emplacement respectif de l'écran, du clavier, des documents et du matériel accessoire.

Le support de documents doit être stable et réglable et se sit

uer de telle façon que les mouvements inconfortables de la tête, du dos et des yeux soient évités au maximum.

L'espace de travail doit être suffisant pour permettre une position confortable pour les travailleurs.

Article 10. - Sans préjudice des dispositions de l'article R. 232-4 du code travail, pour les travailleurs sur écran de visualisation, ses sièges doivent être, s'il y a lieu, adaptables en hauteur et en inclinaison. Un repose-pieds sera mis à la disposition des travailleurs qui en font la demande.

Article 11. - Les dimensions et l'aménagement du poste de travail doivent assurer suffisamment de place pour permettre au travailleur de changer de position et de se déplacer.

Article 12. - Les dispositions des articles 7 à 11 ci-dessus ne s'appliquent que dans la mesure où les éléments considérés existent dans le poste de travail et où les caractéristiques de la tâche en rendent l'application possible.

Chapitre VI. - Conditions d'ambiance

Article 13. - Les équipements des postes de travail ne doivent pas produire un sursoit de chaleur susceptible de constituer une gêne pour les travailleurs.

II. Toutes radiations, à l'exception de la partie visible du spectre électromagnétique, doivent être réduites à des niveaux négligeables du point de vue de la protection de la sécurité et de la santé des travailleurs.

III. Une humidité satisfaisante doit être établie et maintenue dans les locaux affectés au travail sur écran de visualisation.

IV. Le bruit émis par les équipements du poste de travail doit être pris en compte lors de l'aménagement du poste de façon, en particulier, à ne pas perturber l'attention et l'audition.

V. En ce qui concerne l'éclairage, les dispositions des articles R. 237-7 à R 232-7-10 du code du travail sont applicables.

Chapitre VII - Dispositions finales

Article 14 - Les dispositions du présent décret entrent en vigueur à compter du 1er janvier 1993; toutefois, pour les matériels mis en service avant cette date, les dispositions des articles 7 à 11 ne sont applicables qu'au 1er janvier 1997.

Article 15 - Le ministre de l'agriculture et de la forêt et le ministre du travail, de l'emploi et de la formation professionnelle sont chargés, chacun en ce qui le concerne, de l'exécution du présent décret, qui sera publié au Journal officiel de la République française.

Fait à Paris, le 14 mai 1991

Michel Rocard