

WORKING WITH VISUAL DISPLAY UNITS, By Dr Nuing Jeluing

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INTRODUCTION

Visual Display Units (VDU's) were first introduced in the 1940s in the field of radar operation. Since this small beginning, their usage has grown until now in the 1980s they play a vital role in almost all areas of work activity. VDU's are now as common place in control rooms and warehouses as in offices and computer suites. It is true to say that the vast majority of people will come into contact with VDU's and screen-based communications to a greater or lesser extent in the course of their work.

This massive proliferation has lead to anxiety amongst many users who fear that working with VDU's may damage their health. However, research to date indicates that any health aspects associated with VDU's relate to the working environment, which can be controlled, and not the VDU itself.

The Guide comprises:

Part 1: Perceived Health Risks

Medical research into the perceived health effects of Visual Display Units is ongoing. This Part summarises areas where concern has been expressed and makes Policy recommendations where appropriate.

Part 2: Introducing Visual Display Units

This Part identifies and discusses the key areas for consideration in the introduction of visual display units to a working environment. It is sub-divided into three Sections: Planning; VDU Equipment; Workstation Design.

PART 1: PERCEIVED HEALTH RISKS

There are a number of perceived health risks relating to VDUs which have caused concern to users. However, to date there is no evidence of such a risk to substantiate concern; nevertheless, this should not preclude discussion.

1.1 Radiation

Radiation emissions from VDU's is still a concern of many users.

The potential sources of radiation are the Cathode Ray Tube, which may produce X-rays, ultraviolet, optical and infrared radiations, and the electronic circuitry, which may produce emissions of extremely low frequencies (ELF) and radio frequencies (RF).

Scientific evidence indicates that radiation emissions from VDUs are well below normal background levels. In view of this, it can be stated with confidence that radiation from a VDU does not in itself pose a health risk to operators, either in the short or long term.

1.2 Cataracts

Research indicates that cataracts cannot be induced by radiation emissions at the levels associated with VDUS. Cataract is a condition in which the lens of the eye becomes opaque, restricting the amount of light that passes through the lens.

1.3 Photosensitive Epilepsy

Working with a VDU does not cause epilepsy. However, there is a rare form of epilepsy in which a seizure can be triggered off by a flickering light. This form usually manifests itself in adolescents aged

between 10 and 14 and it is extremely unlikely that a first attack would occur in an adult working with a VDU.

A history of epilepsy should not preclude that person from undertaking VDU work but it might be prudent to seek medical advice before starting such work.

1.4 Facial Dermatitis

Such cases that do arise are probably related to environmental factors such as low relative humidity and static electricity rather than the use of the VDU. Action on the part of the Company to eradicate these causes may be of value where this is a problem.

1.5 Miscarriages and Birth Defects

There have been a number of reports of miscarriages or birth defects among pregnant VDU users, but no cause attributable to VDUs has been found. The evidence indicates that there is no difference in the numbers of birth defects or miscarriages occurring in women working with VDUs and the general population.

Nevertheless in order to minimise anxiety or stress related problems, if, after counselling, a woman who is pregnant is still concerned, consideration should be given to transferring her to alternative work.

1.6 Visual Fatigue

One of the commonest complaints of the VDU user is visual fatigue more usually referred to as "eye strain". The symptoms vary but may include headaches, visual discomfort, pain behind the eyes, blurring of vision or even double vision.

These symptoms may be the result of task, equipment or environmental problems or eye defects which are wholly or partially uncorrected.

Whatever the cause of visual fatigue, it is a temporary, reversible phenomenon. Nonetheless, measures should be taken to minimise those factors which will aggravate symptoms and specific recommendations on these are given in item 1.6.1 Spectacles and Part 2.

1.6.1 Spectacles

It is estimated that about 30% of the working population have uncorrected or inadequately corrected vision which may only be highlighted when first carrying out a visually demanding task. The use of spectacles or contact lenses (see also item 2.3.2.3. Humidity) should cause no problems although those operators who need reading glasses (usual focal length 33cm) may require special lenses to correct their eyesight to an appropriate viewing distance for VDUs (usually between 35-70cm). Such cases should be referred to an Ophthalmic Consultant for an opinion and an accurate measurement of the operator's preferred VDU viewing distance. If special lenses are recommended, consideration should be given to the cost being for Company account.

VDU work often makes different demands of bifocal spectacles to those of everyday wear and therefore are not always suitable - this is also true for multifocal (varilux) lenses. Where these are recommended, lenses must be accurately matched to the respective viewing distances and segment height requirements. Again such cases should be referred to an Ophthalmic Consultant.

1.6.2 Eye Tests

Research to date has produced no evidence that working on a VDU damages eyesight.

Apart from aspects detailed in item 1.6.1 Spectacles, no special eye test related to VDU work is considered necessary.

1.7 Postural Fatigue (Musculo-skeletal Disorders)

Together with visual fatigue, postural fatigue is a frequent complaint of VDU operators with symptoms of discomfort in the head, neck, between the shoulders and in the lower back. Where there is constant overloading of particular muscle groups from repetitive use, more specific disorders relating to muscle, tendon and joint fatigue may also result.

In general, these complaints are the result of poor design of the job and/or working area. To alleviate problems of postural fatigue specific recommendations are given in Part 2.

PART 2: INTRODUCING VISUAL DISPLAY UNITS

The main areas for consideration are discussed below.

SECTION 1: PLANNING

2.1.1 Planning for Change

Practically all symptoms reported by VDU users are the result of inadequate workstation design, job design and environmental factors such as lighting, noise, temperature and humidity. VDU's are frequently introduced to the established working environment with no prior consideration to any revised needs of the worker. The new user is required to adjust to the inappropriate working environment with unsatisfactory results and contrary to basic ergonomic principles. In addition, there may be problems arising from low motivation and poor morale following the inevitable change away from orthodox working procedures that a VDU based system will bring.

The successful introduction of Visual Display Units, therefore, requires thoughtful planning from the selection of the VDU itself (including software), its acquisition and installation within the prepared work place to the acceptance of new technology by the user. At all times prime consideration should be given to the requirements of the user. As systems mature and their users become accustomed to working with them, the views and concerns of the users will change. It is therefore important to remain in touch with user requirements, in order to anticipate and react to them in an appropriate manner.

2.1.2 Implementing Change

An implementation plan should be developed to anticipate and address the physical and psychological changes that will take place in the organizational environment of an office before, during and after introduction of a new or modified information system.

A good implementation plan should consider factors such as:

- are changes necessary?;
- is organisation restructure required?;
- what staff training should be provided?;
- are current training facilities adequate?;
- what ergonomic design features, both for the individual workstations and work environment, will be necessary?;
- are system support requirements adequate?

2.1.2.1. Old Installations

Many existing systems will have been designed and installed without the benefit of the present guidelines. Where this is the case, these work areas should be reviewed in accordance with the recommendations given in this Guide.

2.1.2.2 New Installations

Major installations will usually be handled by a specialist Steering Group. However, Managers should make themselves aware of the pitfalls involved in implementing any new installation, major or minor, and monitor accordingly. It is important to ensure that the designers and users of the system, particularly the VDU operators themselves, are jointly involved throughout the various phases preceding the introduction of new techniques.

2.1.3 Task Design

Planning of any VDU workstation should commence with a thorough understanding of the tasks to be carried out. In particular, careful consideration should be given to the following factors which are directly proportional to the extent to which ergonomic principles need to be applied:

- (a) duration - the proportion of working time spent operating the VDU equipment;
- (b) intensity - the degree of concentration required by the user to undertake the task.
- (c) dependence - the degree to which the user is dependent on the system to perform the task as a whole.

A further factor is the individual's control over the use of the system, eg. is it the best means of achieving the objective?

The thoughtful design of a task will do much to reduce the likelihood of operator fatigue (refer also to Item 2.1.4 Work Organisation). The characteristics of a well designed task are:

- (a) some variety in the activities and skills used;
- (b) a degree of individual control over the pace of work;
- (c) some cohesion so that the task forms an understandable part of the work of the organization;
- (d) an opportunity for individuals to use their existing skills and experience, and to gain new skills;
- (e) sufficient feedback on the quality and quantity of task performance.

It should be remembered that tasks that are interesting to the operator reduce the stress and tiredness that he or she may feel, while boring repetitive jobs will produce the opposite effect.

2.1.4 Work Organisation

Where the prolonged use of the VDU cannot be avoided, problems of user body fatigue will follow. This will be exacerbated where the work organisation provides only limited scope for the user to move about and so relax tensed muscles through changes in work routine and task content.

In these situations it is recommended that operators are encouraged to take frequent breaks and perform simple exercises to combat fatigue. A suitable exercise scheme is given in the appended booklet "VDU User Guide" (refer also to item 2.1.5 Education and Training). The operator should be allowed some discretion to decide when and for how long he or she needs to take a break.

2.1.5 Education and Training

All parties involved in the selection, installation and use of VDU's should receive comprehensive training in all aspects of VDU's and workstation design to ensure installations and their use are such as to optimise user comfort. With regard to the user, such training will also do much to dispel the inherent fears which seem to have arisen.

A booklet entitled "VDU User Guide" is available for distribution to staff and is supported by a training video entitled "With a View to Your Screen". The booklet is appended to this Guide.

SECTION 2: VDU EQUIPMENT

All equipment should comply with a recognised safety standard which is particularly important in respect of electrical safety.

2.2.1 Selection Criteria

A wide variety of VDU models is available. Selection criteria should include:

- A degree of flexibility: screen tilt and rotation facilities*; low profile detached keyboard with clearly labelled keys.
- A clear, well defined display with a stable screen image incorporating both brightness and contrast

controls.

- Glare reduction features: etched screen finish; matt surround to the screen and keyboard; low reflectance surface on keys.
- Specialist job requirements e.g. the need for an auxiliary numeric key set and high resolution screens.

Various data input mechanisms are available in addition to the standard keyboard, e.g. mouse, for which no specialist requirements have been identified.

2.2.2 Colour of Display

The choice of a particular display colour is one of personal preference. However, it should be noted that the eye does not accommodate equally readily to all colours and the use of colours at the blue or red ends of the spectrum would make the image appear less distinct. This, and the fact that 4-8 % of male operators are colour-blind, means some caution should be exercised in the selection of a multicolour display. Where it is selected, the display should conform to the industry Enhanced Graphics Standard.

A positive presentation VDU display (dark text on a light background) should be considered where frequent reference to source documentation is required, to complement the usual format of hard copy reference material.

*Footnote:

Although many VDUs do not of themselves have screen tilt and rotation facilities, separate stands can be purchased which provide such facilities must their consideration need not influence the selection of a screen.

2.2.3 Software

Where possible the user should be involved in the selection and design of software with the specific nature of the VDU task taken into account. "User friendly" software and clear, well presented screen information will assist in minimising fatigue and frustration in the user.

2.2.4 Maintenance

The screen display will deteriorate after a period of time and it is important to ensure that where display clarity has been adversely affected these units are taken out of service. Turning off the screen when not in use, even for short periods, will prolong the life of the screen.

Equipment should be kept free of dust deposits as far as possible. Dust accumulation will obscure the screen display and may also act as a glare source by reflecting light into the operator's line of sight. Only cleaning products recommended by the equipment manufacturer should be used.

Electrical safety aspects should be checked on an annual basis by a competent person.

2.2.5 Portable Computing Equipment

By their nature, portable computers are designed as small compact units for ease of carriage. However, in view of this feature their ergonomic design is poor - usually comprising a combined screen and keyboard both of which are considerably smaller than the static unit models. Their usage as a permanent workstation unit should be strongly discouraged.

2.2.6 Fire

As with any electrical appliance, VDU equipment is a potential fire risk if its electrical connections are abused or the in-built cooling mechanism obstructed. Guidance on safe working practice with VDUs is given in the User Guide under the Section entitled "General Points".

Only halon, carbon dioxide or dry powder extinguishers should be used to extinguish a fire involving electrical apparatus.

SECTION 3 WORKSTATION DESIGN

2.3.1 Workstation Requirements

In designing the workstation to satisfy the task and user's postural requirements consideration must be given to the type of chair and desk with regard to working levels, arm reach, back support etc., as well as space for equipment and documentation.

A typical workstation should comprise:

- Work chair which is stable but will allow the worker easy freedom of movement e.g. five-starbase with castors. The chair should be adjustable in height with the back rest adjustable both in height and tilt. A foot rest may be required by some workers.
- work desk which is sufficiently large with a low-reflective surface and allows a flexible arrangement of the screen, keyboard, documents and related equipment. There should be adequate leg space.
- Document holder positioned adjacent to and in the same plane as the screen to minimise head and eye movement.

Where there are several users of a workstation sufficient flexibility in the workstation is particularly important to satisfy the postural and task requirements of each potential user. Staff should be encouraged to adjust the furniture to meet their individual needs.

A further consideration is the provision of adequate electrical socket outlets and the strategic siting of a mainframe port, if appropriate. It is strongly recommended that wire-management desking incorporating a multi-socket outlet is standard equipment.

2.3.2 Environmental Factors

2.3.2.1 Lighting

When planning the layout of VDU workstations the following points should be considered with regard to lighting.

Avoid:

- Gloom and harsh light equally.
- Glare from unshielded light sources, artificial and natural, and reflections in the operator's field of view.
- Screen reflections.

Ensure:

- Levels of 300-500 lux on the working plane.
- Use of diffusers with a narrow angle of light distribution on overhead light sources or provide diffuse lighting from indirect sources, complemented where necessary with task lighting.
- Low reflectance work surfaces and equipment with matt finished surrounds.
- Where possible locate screens between and parallel to overhead light units and at right angles to windows. Screens should never face or back on to windows unless adequate control of daylight glare is available.
- Where indirect lighting or low luminance light sources are used, ensure that the surface reflectivity of walls, ceilings and floor are higher than that used for other forms of lighting.

Screen Filters

Display screen filters may prove an effective means of minimising screen glare. However, as the filter will diminish the clarity of the screen display, they should be considered only as a last resort. There are many screen filters on the market and expert advice should be sought prior to selection.

2.3.2.2 Temperature

Heat output from VDU equipment may be a concern dependent on the number of units relative to the size of the environment and other existing sources of heat such as people, lights and other forms of equipment. Recommended office temperatures are:

Winter: 18-22°C

Summer: 24-26°C.

Where these levels are exceeded as a result of the VDU equipment a cooling unit may be required. It is important, however, to avoid draughts.

2.3.2.3 Humidity

Relative humidity should be maintained at a level between 40-60% for optimum comfort of VDU users.

When performing a sustained visual task, the normal frequency of blinking may be reduced with a constant drying effect on the eyes. Low relative humidity will add to this effect and wearers of contact lenses may be particularly affected.

A low level of relative humidity may also add to the generation of static electricity - anti-static carpeting may be helpful in this regard.

2.3.2.4 Noise

VDU's cause very little noise and are much quieter in operation than a typical typewriter.

An impact printer associated with the VDU may exceed the 50 dB(A) limit recommended for office environments. Where this is the case it is recommended that the printer(s) be placed in a separate area or alternatively, enclosed in an acoustic hood.