

ACTIVITIES AT THE SWEDISH NATIONAL INSTITUTE OF RADIATION PROTECTION
(NIRP) FOR THE CONTROL OF HAZARDS FROM NON IONIZING RADIATION

Enn Kivisäkk
The Swedish National Institute of Radiation Protection

INTRODUCTION

In 1976, the Swedish radiation protection legislation was amended to give NIRP the task to design and carry out a programme for the control of hazards from non ionizing radiation.

Initially optical radiation, laser and UV, was given priority in that programme because of the rapidly increasing use of optical sources for various purposes. A number of studies of emission characteristics, especially of UV sources, used for medical and cosmetical treatments, were carried out (1,2,3 and 4). In later years, the programme has become more and more focused on electromagnetic radiation and fields in the radiofrequency range, especially at very low frequencies.

OPTICAL RADIATION

Regulations concerning laser equipment calling for type-testing of all devices prior to marketing in Sweden have been issued by the NIRP (5). The testing, which is carried out by the National Testing Institute located in Borås, includes a classification procedure and an inspection of the technical protective devices. The technical substance in these regulations is in close correspondence with that of the IEC Publication 825.

NIRP has also issued regulations concerning work with lasers with the objective to protect the general public against harmful laser radiation (6). The regulations contain, among other things, rules for the set-up and operation of laser light shows.

One well-known result of the activities concerning optical radiation at NIRP is the set of sun-lamp regulations issued in 1982 (7). In these regulations limiting values are given for radiation at the treatment distance.

The source of optical radiation which causes by far the greatest number of detrimental effects is however the sun. Induction of various kinds of skin cancers by solar UV-radiation is one such effect which is causing health authorities in Sweden and also in the other Nordic countries growing concern. The rapid annual increase of cases of in particular malignant melanomas is now acknowledged as a serious threat to the health of the general public.

In 1960 there occurred 3.2 cases of malignant melanomas per 100 000 in Sweden, in 1980 the corresponding number was 11.5. These incidence numbers are age adjusted to 1970. The annual incidence has thus more than tripled over these two decades and the annual increase is now 6% indicating a doubling time of approximately 12 years.

NIRP has during the latest years carried out several studies of solar UV intensities in Sweden and in popular vacation resorts such as the Canary Islands (8,9) and also funded such studies at external research laboratories (10). The material thus obtained is intended to be used in information campaigns with the objective to teach people sensible sun habits, which are now planned by public health authorities on central as well as local levels of the society.

LOW FREQUENCY ELECTROMAGNETICAL FIELDS

In the early eighties alarming reports about adverse pregnancy outcomes and birth defects among female VDU (Video Display Units) operators reached Sweden from the United States and Canada. These reports were published in the Swedish news media and caused a lot of concern at the Swedish office workplaces, which at that time were in the beginning of the computerization process.

Because in many of the reports radiation was suspected to be the causal factor, an extensive study of emitted electromagnetic radiation and fields of various kinds from such equipment was carried out by L-E Paulsson et al at the NIRP laboratories for non ionizing radiation (11). The report from this study includes measurements of about 45 different makes of VDU's. The measurements continued however after the report was completed - now usually on commission from manufacturers. At the conference "Work with display units 86" held in Stockholm in the spring of 1986 Paulsson reported statistics from measurements of 147 different types of VDU's (12).

Figure 2 from (12) illustrates the distribution of measured magnetic induction (dB/dt) at the distance of 30 cm in front of the unit. The values in the figure are peak to peak values of the dominating component of the field, which usually is vertical. The lowest value recorded among these 147 types was 4 and the highest 345 mT/s i.e. a ratio of almost 100.

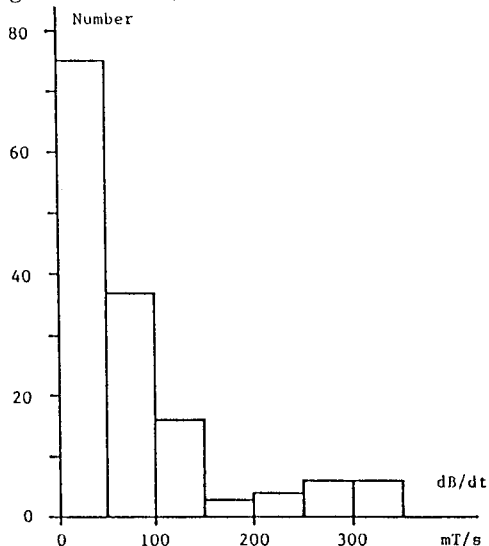


Figure 2. Statistical distribution of magnetic induction for 147 types of VDT's.

The measurements also showed that there was a trend towards higher magnetic field intensities caused by the desire for better visual ergonomics, which can be obtained for instance by using positive image polarity. Such demands lead to higher horizontal frequencies, usually resulting in high values of the magnetic fields. The measurements however also showed that this is not necessarily always the case. Units with high horizontal frequencies - in the interval 30 - 65 kHz - could also be found with low values of the magnetic fields.

The observations made during this series of measurements enabled NIRP to state low levels of emitted magnetical and electrical fields, which are technically achievable without impairing good performance from other aspects such as visual comfort and ergonomics (13).

Recently a voluntary testing system for video display terminals including keyboards has been established in Sweden on an initiative from the Swedish government. The Swedish National Council for Metrology and Testing was given the task - in collaboration with several other national authorities and organisations, among them NIRP - to elaborate methods for testing of VDU's and keyboards and also accreditate laboratories for the voluntary testing of such equipment. The NIRP laboratories recieved accreditation in June 1987, and are so far the only accredited laboratories in the country.

The testing programme (14) is extensive and covers 45 different properties of the display unit and keyboard:

VDU		Keyboard	
Visual ergonomic properties	19	Ergonomic properties	4
Emission properties	7	Physical design	5
Physical design	6	Other properties	4

In a guide which will be published by the National Council recommended values etc. are given for the properties included in the test programme. For the emission properties these recommended values are based on the abovementioned report from the NIRP (13):

Static electricity: The equivalent surface potential should be within the interval +/- 500 V.
Electrostatic lead off in the keyboard - resistance less than 100 Megaohms

Magnetic fields: dB/dt below 25 mT/s at a distance of 0.5 m
B " 100 " " "

No magnetic emission during longer intermissions

The magnetic field intensities are measured in the frequency range 1 kHz to 400 kHz.

IRP has initiated and finances several studies at external reseach laboratories, in order to clarify possible relationships between exposure to low frequency electromagnetic fields and biological effects. In two successive studies the possible teratogenic effect of pulsed magnetic fields of similar kind as emitted by VDU's has been examined in pregnant mice (15,16). The studies have however yielded conflicting results.

In the first study, conducted by B. Tribukait at the Karolinska Institute in Stockholm, a slight overrepresentation of malformations was

found in the exposed fetuses. The study was however too small to allow for definite conclusions. In the second one, which was designed to extend the earlier experiment and thus included greater number of animals, no increase in the number of malformations was found - not even among dead fetuses. However the number of placental resorptions and of dead fetuses were higher in the exposed females. This had not been the case in the first study.

An explanation for the different results in these experiments may be the fact that different strains of mice were used which may differ in their sensitivity for the applied electromagnetic fields. Therefore further experiments in order to clarify this are planned by NIRP.

NIRP has also initiated experiments in order to clarify possible relationships between exposure to electrostatic fields from VDU's and skin disorders. At the time of writing (Nov 1987) no definite results are available, but so far no obvious, simple correlation has been found.

REFERENCES

1. Paulsson L.E. (1979) UV-radiation from fluorescent tubes. NIRP, SSI:1979-005.
2. Wester U. (1980) UV radiation from high intensity UV-A sunlamps. NIRP, SSI:1980:24.
3. Glansholm A. (1985) Light resin curing devices - a hazard evaluation. NIRP, SSI 85-26.
4. Lydahl E. (1984) Ocular exposure to infrared radiation in the Swedish iron and steel industry. Health Physics Vol 46, No 3 (March) 1984.
5. NIRP (1982) The regulations of NIRP concerning lasers. SSI:FS 1982:2, (In English, IJS 4)
6. NIRP (1983) The regulations of NIRP concerning work with lasers. SSI FS 1983:3, (In English, IJS 7)
7. NIRP (1982) The regulations of NIRP concerning sun lamps. SSI FS 1982:1, (In English, IJS 3)
8. Wester U. (1984) Erythematous efficiency of UV radiation from the sun and from sun lamps. Dep of Rad. Phys., Karolinska Institute, RI 1984-05.
9. Wester U. Solar UV radiation on the Canary Islands and in Sweden - A comparison of irradiance levels. In Human exposure to uv radiation, Risks and Regulations. Excerpta Medica. Int. Congress Series 744.
10. Josefsson W. Solar UV radiation in Sweden. SMHI Reports Nr 53, Oct 1986. Available from SMHI S- 601 76 Norrköping, Sweden.
11. Paulsson L.-E. et al. (1984) Strålning från dataskärmar. NIRP Report a84-08.
12. Paulsson L.-E. Radiation emission from VDU's. In Work with display units 86. Elsevier Science Publishers B.V. 1987.
13. NIRP (1986) Technical properties of video VDU's from a radiation point of view. i 86-01. (In English, IJS 15)
14. Nat. Council for Metrology and Testing. (1987) Testing VDU's - Test methods. MPR-P 1987:2; Available from MPR S-501 15 Borås, Sweden.
15. Tribukait B. et al. (1986) Effects of pulsed magnetic fields on embryonic development in mice. In Work with display units 86. Elsevier Sci. Pub. B.V. 1987.
16. Frölén H. et al. (1987) Upprepade studier av verkan av pulserande magnetfält på fosterutvecklingen hos mus. Sveriges Lantbruksuniversitet, Uppsala. (Summary in English).