U.S. Army Center for Health Promotion and Preventive Medicine

Just the Facts

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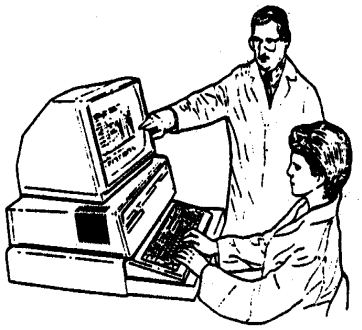
Extremely Low Frequency and Very Low Frequency Electric and Magnetic Field Emissions From Video Display Terminals



- **ELF EMF**
- **VLF EMF**
- **Video Display Terminal**
- **Miscarriage**
- **Guidelines**

Introduction

In recent years, the question has been asked, "is there a possible link between video display terminal (VDT) use and miscarriage?" The question comes from reports of occasional groups or "clusters" of miscarriage among VDT workers. Yet the most comprehensive epidemiological studies to date are telling us that the risk of miscarriage among VDT workers does not differ from the risk of miscarriage within the whole population. In spite of such epidemiological findings, there is still concern within the workforce about this question. Some of the factors that have been suggested as causes in these continuing allegations include stress, ergonomics, and electric and magnetic fields (EMFs). This fact sheet reviews the EMF issues pertinent to the question.

Health Issues, VDTs, and EMFs

There are two categories of EMFs from VDTs, classified according to relative energy level. The most energetic of the two Is called "ionizing," and the least energetic is called "nonionizing." The type of ionizing radiation found in VDTs is x-radiation. The typical VDT has been fully and permanently shielded to assure that there is virtually no x-radiation present outside of the VDT itself.

There are several different nonionizing frequency/wavelength emissions associated with a VDT. These include light, which comes from the screen; heat or infrared, which comes from a variety of sources in the VDT (filaments, resistive components, etc.); and sub-radiofrequency EMF. The sub-radiofrequency EMFs generally occur in two frequency bands. The lower band is called Extremely Low Frequency (ELF) and is generated by the 60-Hz electric power components and wires in the VDT. The higher band is called Very Low Frequency (VLF) and is generated by several electrical and electronic components of the VDT (oscillators, fly-back transformer, etc.).

The 19 March 1991 issue of The New England Journal of Medicine contains a summary report of the most comprehensive epidemiological study to date on this question (reference 5). In an article titled "Video Display Terminals and the Risk of Spontaneous Abortion," the following conclusion was reported: "The use of VDTs and exposure to the accompanying electromagnetic fields were not associated with an increased risk of spontaneous abortion in this study." The EMFs specifically addressed in this conclusion are ELF; however, the fact remains that the VLF exposures were present as well, whether quantified, considered, or not and the negative finding also applies to such exposures.

Some studies have confirmed biological effects from exposure to EMFs at very high power levels or ""dose rates" (so called "thermal" effects at VLF and electrical shock and bum effects at ELF). When these effects occur in human, they can have negative health effects if the exposure time is long enough. The levels of VLF and ELF associated with VDT EMFs are several orders of magnitude less than the levels that could produce such dose rates. There are no confirmed negative health effects associated with EMF exposures to the levels found even very close to VDTs.

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EMF Exposure Control Levels

There is a permissible exposure limit (PEL) for VLF exposure control (Reference 1). The level specified is 0.614 kilovolts per meter (kV/m) for the electric field (**E**) and 163 A/m [2000 milligauss (mG)] for the magnetic field (**H**). The maximum VLF-E levels found anywhere around the VDTs (tight up against the case of the VDT) are 0.075 kV/m, with 0.002-0.003 kV/m (2-3 V/m) in the worker location. The maximum **H** levels found tight up against the set are 1-2 A/m (12.5 - 25 mG).

There is no exposure control standard for ELF EMF. There are guidelines (References 2 & 3) designed to keep induced ELF EMF below the ELF levels already present in a person ("noise" levels at ELF produced by biological processes). The more conservative guideline (Reference 1) specifies maximum PELs of 10 kV/m and 500 microtesla (ut) for **E** and **H**, respectively. This 500 uT level is equivalent to 400 A/m or 5000 mG. Milligauss is the term most often encountered in the literature. The maximum levels measured anywhere around the VDTs are 0.015 kV/m and 20 mG (tight against the back of the cabinet). Typical levels found in the worker position are 0.002 kV/m and 2-3 mG. The highest ELF levels against the cabinet will also reduce to 2 V/m and 2 mG about 30 cm from the cabinet, in any direction.

The following Table compares typical ELF-EMF exposure levels:

TABLE. Common ELF EMF Exposure Levels.

Source	Electric Field (kV/m)	Magnetic Field (MG)
Power Line (500 kV)*	1-10	10-1000
Electric Blanket	0.1-5	5-100
Electric Razor	0.05-1	100-5,000
Electric Toaster	0.005-0.1	1-50
VDT	0.002-0.015	2-20
Home Background	0.001-0.01	0.1-10

* Measured at the typical right-of-way (ROV4

Conclusions and Recommendations

There is no known link between VDT EMF exposures and miscarriage, or cancer, or for that matter any of the several reported negative health effects alleged as caused by EMFs from VDTs. The Environmental Protection Agency draft report which concluded there is a possible but not proven link between ELF EMFs and certain cancers was critically flawed and will probably remain unpublished. The claims in that draft report and other alleged claims linking ELF EMF with cancer am based on several epidemiological studies that have been challenged, even by the epidemiological community. A recent government sponsored report (Reference 4) concluded "...there is no convincing evidence in the published literature to support the contention that exposures to ELF-EMF generated by sources such as household appliances, video display terminals, and local power lines are demonstrable health hazards." This report does support continued research efforts to understand ELF EMF interactions with biological systems.

The USACHPPM will continue to collaborate with the rest of the U.S. Government and other agencies world-wide in the ongoing study of VDT-related real and alleged issues and other critical preventive medicine issues. We will continue to inform all affected personnel of our findings and will support the development and enforcement of exposure standards where this is necessary to protect the health and safety of workers in every environment.

Strategies to avoid exposure to ELF EMFs are not warranted at this time based on present knowledge. The VDT users should not be encouraged to take evasive action to avoid ELF EMF exposure. Also, the use of ELF EMF reduction screens should be discouraged. When choosing a VDT, the ELF EMF levels should not be used as selection criteria.

References

1. Institute of Electrical and Electronics Engineers, "IEEE C95.1-1991, IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz," 27 April 1992, New York, 1992.

2. International Non-ionizing Radiation Committee of the International Radiation Protection Association (IRPA), "Interim Guidelines on Limits of Exposure to 50/60 Hz *Electric and Magnetic Fields, "Health Physics, Vol 58, No. 1 (January), pp 113-122, 1990.*

3. American Conference of Governmental Industrial Hygienists (ACGIH), "1995-1996 Threshold Limit Values for Chemical Sub-stances and Physical Agents and Biological Exposure Indices," Cincinnati, 1995.

4. Oakridge Associated Universities Report 92/F8, Health Effects of Low-Frequency Electric and Magnetic Fields. Prepared by an Oak Ridge Associated Universities Panel for the Committee on Interagency Radiation Research and Policy Coordination, June 1992.

5. *Schnorr, T. M., et. al., "Video Display Terminals and the Risk of Spontaneous Abortion The New England Journal of Medicine, Vol 324, No. 11 (19 March), pp 727-733, 1991.*