



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

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 burn effects at **ELF**). When these effects occur in humans, 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.**

◆ **ELF EMF**

◆ **VLF EMF**

◆ **Video Display Terminal**



◆ **Guidelines**

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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 wfl 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:

TAB&. 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 (ROW)

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 are 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 wfl 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** baased 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 Substances 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.*