

Fact Sheet N201

July 1998

ELECTROMAGNETIC FIELDS AND PUBLIC HEALTH

VIDEO DISPLAY UNITS (VDUs)

Over 30 years have passed since the introduction of mass-produced video display units (VDUs) into the workplace. These machines are also called video display terminals (VDTs) and most commonly take the form of computer screens. The rapid proliferation of computers has led to a large increase in VDU use in both the workplace and at home. It is estimated that by the year 2000, 60% of the North American workforce will be using VDUs and more than 150 million units will be in service worldwide.

What are VDUs?

A VDU is essentially a television-type monitor that displays information received from a computer rather than from a broadcast signal for television. The typical VDU creates images in a large evacuated cathode-ray tube (CRT) by directing a beam of high-energy electrons from the cathode onto a special phosphor-coated, glass screen. This coating emits light when struck by the fast-moving electrons. The electron beam creates the image from computer signals that control coils, at the back of the CRT, that sweep the electrons in the vertical and horizontal directions. These coils are called vertical and horizontal deflection coils. The electronic circuitry used to create the image gives rise to static electric and magnetic fields, as well as low and high frequency electromagnetic fields.

Radiation and Fields

Almost the entire electromagnetic spectrum is included in the electric and magnetic fields and optical radiation produced by VDUs. The optical radiation emitted includes long-wavelength ultraviolet (UV), visible, and infrared (IR) radiation. Visible light forms the image that the VDU is intended to produce. IR appears as heat dissipated by the unit. Very small amounts of UV are emitted from the tube, much less than that coming through the window on a winter's day.

Electric and magnetic fields are emitted in three different frequency ranges. The horizontal deflection coils emit fields operating predominantly in the frequency range 15-35 kHz. Extremely low frequency (ELF) fields at 50 or 60 Hz come from the power supply, transformers and the vertical deflection coils. Finally, weak signals at higher radio frequencies (RF) come from the VDU's interior electronic circuitry and signals received from the computer.

Static electric fields are also present, particularly when there is low humidity, from the build-up of electric charge by electrons striking the front of the screen. In addition, high frequency sound or ultrasound radiation, possibly detected as a high pitch noise, is emitted from various VDU components, mostly by the horizontal deflection circuits.

Very low-energy X-rays are produced inside the CRT, but the glass screen is thick enough to completely absorb them before they escape from the VDU.

Health Concerns

When first introduced into the workplace, VDUs were suggested as the cause of many health complaints, for example, headaches, dizziness, tiredness, cataracts, adverse pregnancy outcomes and skin rashes. Many scientific studies were conducted to determine if electromagnetic fields (EMF) could have any health consequence. WHO and other agencies have reviewed factors, including indoor air quality, job-related stress and ergonomic issues, such as posture and seating while using a VDU. These studies (see below) have suggested that the work environment, and not EMF emissions from VDUs, may be a determining factor of possible health effects associated with VDU use. A brief review of the scientific findings follows:

Adverse Pregnancy outcomes

Suggestions that working with a VDU could affect the outcome of a pregnancy arose in the late 1970s, when several "clusters of adverse pregnancy outcomes" were noticed in Australia, Europe and North America. These clusters were groups of pregnant women who worked with VDUs and who seemed to experience an unusually high occurrence of spontaneous abortion ("miscarriage") or birth of malformed children. This led to many epidemiological and animal studies being conducted in North America and Europe. Taken as a whole, these studies have failed to demonstrate any effect on reproductive processes due to EMF emitted from VDUs. Studies have suggested, however, that if there are effects on reproduction, they may be related to other work factors, such as job stress.

Effects on the eye

Cataracts and other eye diseases were not found to have any link with VDU work. Glare and reflections from VDU screens have been identified as a source of eye strain and headaches in extreme circumstances.

Effects on the Skin

An excess of symptoms such as skin rashes or itching has been studied, particularly in Scandinavian countries. However, they could not link these symptoms to EMF emissions from VDUs. Laboratory tests conducted on people with these symptoms showed their

symptoms were not a result of any EMF exposure.

Other Factors

Researchers have studied various factors related to the indoor work environment. These include indoor air quality, room temperature, eye fatigue caused by improper illumination, and ergonomically improper workstations. Some individuals have experienced headaches or dizziness, and musculo-skeletal discomfort. These are largely preventable if proper work environment and ergonomic measures are introduced for working with VDUs. Such measures include designing equipment, lighting and other aspects of the environment to encourage proper posture and to reduce muscular and eye strain and other stress-producing tensions.

The above conclusions are in agreement with reviews conducted by the International Commission on Non-Ionizing Radiation Protection (*ICNIRP*), the International Labour Office (ILO) and WHO.

Protective Measures

Fear of adverse health effects from EMF emitted by VDUs has led to a proliferation of products supposedly offering protection from any adverse effects of these fields and radiation. These include special aprons, screen shields or "radiation absorbing" devices for use with VDUs. These items have no protective effect whatsoever on VDU emissions. Even those that do reduce emissions are of no practical value, since the EMF fields and radiation are only a very small fraction of exposure limits permitted in national and international standards. Except for screens that reduce glare (causing eyestrain), protective devices are not recommended by WHO. Use of protective devices to reduce EMF emissions is also not recommended by the ILO.

Where Can I Find More Information?

WHO's International EMF Project has a home page with links to the WHO Fact Sheets on various aspects of EMF exposure and health. The home page also provides further information on the Project, publications and its scientific and public information activities. You can access the WHO EMF home page at: <http://www.who.int/emf/>.

The following references can provide a more in-depth treatment of this subject:

- *Visual Display Terminals and Workers' Health*, WHO Offset Publication No. 99, World Health Organization, Geneva 1987. (Gives particular attention to non-radiation induced disorders such as eyestrain and musculo-skeletal injuries.)
- *Electromagnetic Fields 300 Hz - 300 GHz*, WHO Environmental Health Criteria No. 137, World Health Organization, Geneva 1993. (Comprehensive review of the physics and biological effects of electromagnetic fields emitted by VDUs.)

Visual Display Units: Radiation Protection Guidance, Occupational Safety and Health Series No. 70, International Labour Office, Geneva, 1994. (Succinct, recent overview of the issues.)

- Matthes, R. editor: *Non-Ionizing Radiation: Proceedings of the Third International Non-Ionizing Radiation Workshop*, Baden, Austria, ICNIRP, 1996. (Contains a series of papers on NIR protection, including VDUs.)

For further information, please contact the Office of the Spokesperson, WHO, Geneva. Tel (+41 22) 791 2599, Fax (+41 22) 791 4858. Email: inf@who.int. All WHO Press Releases, Fact Sheets and Features as well as other information on this subject can be obtained on Internet on the WHO home page <http://www.who.int/>