VDT radiation: What's known, what isn't

by LOUIS SLESIN

Video display terminals (VDTs) are now an integral part of the newsroom, and the odds are if you don't work on one now, you soon will. No one knows exactly how many are in use, but the best guess is about ten million. One quick way to get an idea of how important they have become to the American economy is to count the number of VDTs that appear in the ads of a random issue of *The Wall Street Journal*. This morning I found twenty-two — a bumper crop.

As with television sets before them, VDTs have generated widespread concerns about radiation hazards. (A TV and a VDT are basically the same machine, but the VDT can tune in only its host computer, not the afternoon soaps.) The common response to radiation anxiety, especially from employers, is that there is nothing to worry about. As George Cashau, technical director of the American Newspaper Publishers Association, told a congressional hearing last June: "We have tested approximately 1,000 VDTs, and we have never found a radiation emission which even approached the federal standard." These tests, he went on to say, covered both ionizing and nonionizing radiation.

Mr. Cashau is probably right about ionizing radiation, though it is possible for a VDT to emit excessive levels of x-rays. With respect to nonionizing radiation, however, Mr. Cashau needs a refresher course.

First, there are *no* federal standards for the kinds of nonionizing radiation emitted by VDTs. The absence of standards is in large part due to how little we know about the biological effects of this type of radiation. Second, what is known indicates that VDT radiation *may* have harmful effects. And, third, you cannot measure the nonionizing radiation levels from a VDT in the workplace: it is a difficult business and you need the controlled environment of a laboratory.

The heart of a VDT is a cathode ray tube (CRT). The images on the VDT screen are created by a roving electron beam which activates chemicals called phosphors. The CRT can emit x-rays, though normally these will be absorbed by the tube's glass envelope. It is possible that some units, mainly old sets, could give off unacceptable levels of x-rays, but the vast majority of surveys show that this is not a cause for concern. (Measuring the x-rays is not difficult.)

The nonionizing radiation story is more complicated. Simply put, there are two types of radiation: ionizing and nonionizing. Ionizing radiation is the stronger of the two, with enough energy to strip electrons off atoms, turning them into ions and making them biologically reactive. Ionizing radiation is associated with nuclear bombs and reactors and chest and dental x-rays.

Nonionizing radiation is less powerful but can agitate molecules, causing a heating effect. At low intensities, most scientists now agree, certain types of nonionizing radiation can induce other, nonthermal effects. How it does this and what the biological implications are remain mysterious. Nonionizing radiation is used to broadcast television and radio and satellite communications and is associated with power lines, radar, microwave ovens, and scores of industrial applications.

Contrary to popular belief, VDTs do not emit microwaves. The type of nonionizing radiation they do give off is called very low frequency, or VLF, radiation. The VLF comes from the flyback transformer — the gizmo which moves the CRT's electron beam from left to right and then back to left at the end of each line, much like an automatic carriage return on a typewriter. As it moves the beam back and forth, it emits pulses of radiation. A standard VDT gives off about 16,000 of these pulses a second, designated 16 kilohertz radiation.

The fact that the radiation is pulsed means that the energy comes in packets, like radar "blips." Because the pulses are so short (a few millionths of a second), standard measuring instruments will yield an average, not a peak, energy value. Moreover, such instruments tell you nothing about the "shape" of the pulses.

An important point is that the flyback transformer is located on the side or at the back of a VDT. Thus, the radiation levels are highest near the flyback, not in front of the screen. This raises the possibility that it is not the operator of a given VDT who is most at risk from VLF radiation, but anyone working near the transformer, perhaps the operator of a neighboring VDT.

Recent measurements of VLF fields from VDTs indicate that there is a similarity between the shape of the pulses from the flyback transformer and those found to be biologically active. Two years ago, members of Dr. José Delgado's laboratory at Centro y Cajal Hospital in Madrid, Spain, discovered that extremely weak levels of pulsed magnetic fields can have dramatic, adverse effects on chick embryos. Subsequent work by Delgado implicates the shape of the pulse as the key variable for causing ill effects.

Tests run in a number of labs show that, in both shape and intensity, the VDT pulses are similar to those that damaged Delgado's chick embryos.

Although Delgado is a respected scientist and his laboratory has an international reputation, researchers have reacted to his findings with extreme skepticism. They cannot understand how such weak radiation could have such devastating effects. Attempts to repeat Delgado's experiments are under way in

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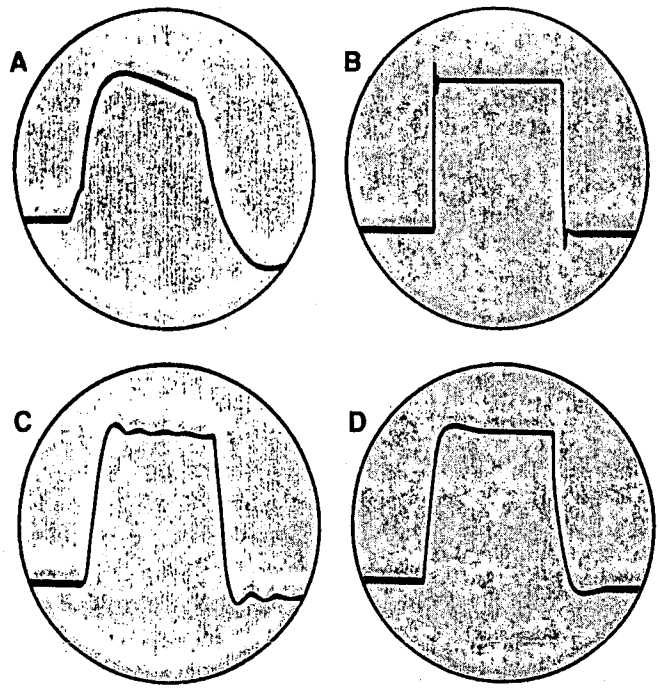
Europe and the U.S.; these may help clarify the nature of the interaction. For now, as one industry expert put it, VLF is the Achilles' heel of the VDT radiation question.

The VDT pulses are also similar to those generated by certain medical devices approved by the Food and Drug Administration and available by prescription to treat hard-to-heal bone fractures — a clear indication that nonthermal effects do exist. But these therapeutic pulses are stronger than those emitted by VDTs.

The wild cards in the VDT debate are the eleven clusters of problem pregnancies and miscarriages among women who work on or near VDTs. The clusters have turned up randomly in offices in the U.S. and Canada. In both countries, government and industry officials maintain that these clusters are statistical flukes. Operators and their unions are not so sure.

The "normal" miscarriage rate is relatively high, approaching 20 percent, so it is definitely possible that clusters of miscarriages could have popped up by chance. The incidence of birth defects is harder to account for. But those people who point to chance overlook the fact that all the clusters have been reported by the operators themselves; no one has gone out looking for them.

The obvious questions remain unanswered: Are there more clusters out there? And, if so, how many will it take to satisfy the powers that be that some research is in order?



The Delgado effect: *The forms shown are of magnetic field pulses. Shape C has no harmful effect; B and D adversely affect chick embryos, as can A at certain intensities. The question is: Are similar VDT pulses biologically active?*

Basic statistics dictate that if these clusters are indeed random occurrences, they should also show up among office workers without VDTs. (Yes, some people still use typewriters.) No such clusters have been reported. Should we conclude that it takes the fear of VDTs to induce secretaries and clerks to discuss their reproductive problems?

The Delgado effect may turn out to be quite subtle. The abnormal pregnancy clusters could therefore be statistical flukes of a different type: they may show up only in environments where all the criteria for biological action are met. Unlike a toxic chemical that will cause harm if the dose is above some threshold, the efficacy of the radiation may depend on a host of variables, such as the position of the operator in relation to the VDT's flyback transformer.

Facts about VDT radiation have dribbled out very slowly. Canadian researchers, prompted by union concerns, have been far ahead of their American counterparts. Nevertheless, it was only last year that the Canadian Center for Occupational Health and Safety released a white paper announcing that its staff could not ignore the possibility that VLF radiation had some untoward effects on operators.

In the U.S., the way officials at the National Institute for Occupational Safety and Health (NIOSH) have handled operators' fears about VDTs has aggravated an already tense situation. In November 1982, Dr. Michael Rosenberg, then chief of reproductive health at NIOSH in Cincinnati, Ohio, announced that a study of pregnancy risks would soon be underway. No such study was initiated and in 1983 Rosenberg left NIOSH to join a consulting firm.

After conducting numerous surveys of VDT radiation levels and issuing countless assurances that radiation emissions are not threatening, NIOSH staff members admitted in the spring of 1983 that they could not measure VLF at a job site. NIOSH's William Murray maintained that there was no problem anyway, because the radiation could not produce significant heating.

A new NIOSH epidemiological study is in the works, but it will take three years to complete after a study population is selected and a questionnaire is cleared by the federal Office of Management and Budget. The latter step alone could take years. Furthermore, because so little is known about how VLF radiation interacts with the human body, epidemiological studies may reveal little new information. After all, if you don't know the right questions to ask, the answers you do get may not mean much.

All the uncertainties have been a source of stress among VDT operators. And therein lies a Catch-22, because stress itself can cause miscarriages. If the clusters are not chance events, it will take some clever studies to untangle stress from radiation effects.

The sad aspect of all this is that shielding a VDT's VLF radiation emissions could, in all likelihood, go a long way toward mitigating the whole problem. Yet now, with employers and employees increasingly polarized on the radiation issue, it seems as unrealistic to expect industry to concede that there may be a hazard as to expect workers to concede that their fears may be groundless. ■