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LEGAL LIABILITY FOR THE HEALTH HAZARDS RESULTING FROM THE USE OF VIDEO DISPLAY TERMINALS: WHO MUST PAY?

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I. INTRODUCTION

Video display terminals ("VDTs") have permeated the workplace. According to various estimates, there are between 40 and 70 million VDTs in use.[1] This number is expected to swell to 100 million by the year 2000.[2] Half of all North American workers spend some part of each work day in front of a VDT.[3] The catalyst for this surge in the use of computers is America's hunger for increased productivity. The price of VDTs has declined so drastically that most companies cannot afford to forego an entirely computerized system, at least in the information management field.

As with other innovations of the technical age, with progress come problems. "Manufacturers of VDT equipment and the companies that use them have focused on designing a device that will increase worker output but have neglected the comfort and well-being of the wage earner who is essential to operate it," says Morton Bahr, President of

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1. A.M.A. Council on Scientific Affairs, *Health Effects of Video Display Terminals*, 257 J. A.M.A. 1508 (1987) [hereinafter A.M.A. Council]; Rossignol, Morse, Summers & Pagnotto, *Video Display Terminal Use and Reported Health Symptoms Among Massachusetts Clerical Workers*, 29 J. OCC. MED. 112 (1987) [hereinafter Rossignol]; Eisen, *Health Protection for VDT Operators: Is Legislation the Answer?*, presented at the American Optometric Association Symposium on Vision in the High Tech Society in Washington, D.C. (Mar. 20, 1985); THE NORAD CORPORATION, VDT HEALTH HAZARDS (1989).

2. A.M.A. Council, *supra* note 1; LaBan & Meerschaert, *Computer-Generated Headache*, 68 AM. J. PHYS. MED. & REHAB. 183 (1989).

3. McAlister, *Visual Display Terminals and Operator Morbidity*, 78 CAN. J. PUB. HLTH. 62 (1987).

the Communication Workers of America.[4] Unfortunately, Americans are not leaders in identifying potential problems in this area and the ways to avoid them. As VDT radiation expert, author, and journalist Paul Brodeur articulated, "[t]he issue has been so shrouded by denial on the part of manufacturers and employers, and addressed with such incompetence by state and federal regulatory agencies, that computer users scarcely know what to think about it, who to turn to for reliable information, or how to protect themselves."[5]

In the early 1970s, Sweden became the first country to recognize the potential dangers of VDTs. The Swedish National Board of Occupational Safety and Health received complaints from Scandinavian Airlines System ("SAS") employees who used VDTs.[6] Approximately 85% of these SAS employees reported blurred vision or temporary nearsightedness.[7]

It was not until 1976 that the United States began to investigate the problems associated with the use of VDTs, particularly radiation. Members of the Newspaper Guild were the first to use VDTs on an industry-wide basis. In 1976, two *New York Times* editors complained of bilateral, incipient cataracts.[8] One editor had been using a VDT for twelve months; the other had done so for only four months.[9] Spurred by these reports, the Wire Service Local polled AP and UPI members and found that 50% had visual problems after working on VDTs and 40% continually went home with headaches. These, and six other cases over a five year period, led the Guild to believe that the problem was related to VDT use.[10] Subsequent reports included complaints of eyestrain, musculoskeletal disorders, adverse pregnancy outcomes, and other injuries. The Guild later issued a "VDT Collective Bargaining Kit" that required various concessions on the part of management in connection with VDT use.[11]

The federal government initially dismissed the possibility of harm from VDT radiation due to the small amount emitted from each unit.[12] However, it was later discovered that weak electromagnetic fields are

4. Betts, *Hand Impairment Plagues Industry*, COMPUTERWORLD, June 26, 1989, at 17.

5. Brodeur, *The Magnetic Field Menace*, MACWORLD, July 1990, at 136.

6. Brodeur, *Annals of Radiation: The Hazards of Electromagnetic Fields, Part III*, NEW YORKER, June 26, 1989, at 39, 40.

7. *Id.*

8. *Id.*

9. *Id.*

10. A.M.A. Council, *supra* note 1, at 1509.

11. BUREAU OF NATIONAL AFFAIRS, VDTS IN THE WORKPLACE: A STUDY OF THE EFFECTS ON EMPLOYMENT 34 (1984).

12. Goldhaber, Polen & Hiatt, *The Risk of Miscarriage and Birth Defect Among Women Who Use Video Display Terminals During Pregnancy*, 13 AM. J. INDUS. MED. 695, 696 (1988), citing U.S. Dept. of Health and Human Services, Bureau of Radiological

capable of causing changes in biological systems.[13] In February of 1977, Wordie H. Parr, Chief of the Physical Agents Effects branch of the National Institute for Occupational Safety and Health ("NIOSH"), the research arm of the Occupational Safety and Health Administration ("OSHA"), measured the radiation emitted from VDTs. He concluded that the emissions were too weak to be detected by his instruments at a distance of ten centimeters. Brodeur claims, however, that the NIOSH investigation was faulty because it attempted to measure the strength of the electromagnetic fields of VDTs in terms of milliwatts per square centimeter, while very low frequency ("VLF") and extremely low frequency ("ELF") fields that are emitted from VDTs "cannot accurately be measured in this manner."[14]

NIOSH subsequently determined that it was unlikely that such power levels could cause cataracts to develop. Yet Brodeur notes that Parr and other NIOSH investigators concluded that VLF fields did not present a health hazard because no studies had yet shown that VLF fields could cause biological effects. In fact, Parr declared in a 1980 interview that "[w]e [NIOSH] don't particularly give a damn about them. It's not our responsibility to go out and test VDTs. We just don't think there's a radiation problem. To be quite honest, nobody knows a damn thing about that low a frequency."[15]

Eventually, NIOSH produced general recommendations on mitigating the potential health hazards of VDTs in February 1982. These recommendations included individual lighting for each computer terminal, a fifteen minute break every two hours, vision examinations, adjustable seats, and adjustable screen brightness.[16]

Since that time, OSHA has become increasingly aggressive with employers. It has levied fines against Pepperidge Farm, IBP Inc., and John Morrell & Co for workplace conditions that caused repetitive motion injuries.[17] Corporations are also taking independent action to prevent injuries. For example, Aetna has redesigned work tasks and has

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Health, *An Evaluation of Radiation Emissions From Video Display Terminals*, Publ. FDA 81-8153 (1981).

13. Mackay, *The Alleged Reproductive Hazards of VDUs*, 1 WORK & STRESS 5 (1981).

14. Brodeur, *supra* note 6, at 41. *See also* Sorenson & Swan, *VDTs: The Overlooked Story Right In The Newsroom*, COLUM. JOURNALISM REV. Jan.-Feb. 1981, 32, 38 (NIOSH, in conducting tests of VDTs, had used instruments that were inadequate for measuring VLF and ELF electromagnetic fields).

15. Brodeur, *supra* note 6, at 41-42.

16. *Kaiser Permanente Medical Care Program, Video Display Terminal Guidelines*, Employee Relations Weekly (BNA) Special Supplement, Vol. 8, at 25-32 (July 30, 1990).

17. Mallory, *An Invisible Workplace Hazard Gets Harder To Ignore*, BUS. WK., Jan. 30, 1989, at 92.

installed a Director of People/Technology Issues and Programs.[18]

Yet the medical community continues to discount fears concerning the safety of VDTs. The consensus among some medical professionals that VDTs are not even potentially dangerous should not distract us from the severe problems that *have* arisen and the steps that may prevent them. These steps might include cautious measures undertaken by the user or full liability for the manufacturer of the VDT in those cases where causation can be established.

Several lawsuits have already been filed against manufacturers of VDTs by injured users.[19] These actions are based on theories of negligence and theories of design defect and failure to warn under strict liability.[20] However, no court has yet ruled on a claim by a user against a VDT manufacturer. One case settled for an undisclosed amount, and others are still pending.

Manufacturers of VDTs and related products are in the most efficient position to perform research regarding the actual health effects of VDT use. However, they are hesitant to perform the necessary research or to publicize the information they have uncovered. This reluctance is due primarily to the fact that a manufacturer is more likely to be held liable for injuries if the manufacturer knew or should have known of the potential for injury.[21] Instead, manufacturers constantly assert that there are not any risks associated with VDT use. VDT users, however, feel differently. A survey conducted by Alan Westin, professor at Columbia Law School, found that two-thirds of the employees surveyed were concerned about potential VDT-related health effects and wanted more information related to possible health and safety problems from their employers.[22] Although three-fourths of the companies in the survey had taken some action, Westin predicted that half the companies in the country would not take serious steps to decrease the potential problems with VDT use until regulation compelled them to act. Similar results were reported in a study by Louis Harris and Associates.[23]

Brodeur explains this failure to accept the possibility of VDT-re-

18. *VDTs in The Workplace: New Issues, New Answers*, LABOR RELATIONS WEEK (BNA) at 83 (2d Ed. 1987).

19. Merrill v. Computer Consoles, No. 87-B-1784 (D.Colo. filed Nov. 25, 1987); Harrigan v. Elec. Pre-Press Sys., Inc., No. 90-CIV-4081 (S.D.N.Y. filed June 15, 1990).

20. Merrill v. Computer Consoles, No. 87-B-1784 (D.Colo. filed Nov. 25, 1987); Harrigan v. Elec. Pre-Press Sys., No. 90-CIV-4081 (S.D.N.Y. filed June 15, 1990).

21. *See infra* text accompanying notes 154-66.

22. Reynolds, *New Illnesses in The Age of Computers*, MGMT. REV., Aug. 1989, at 56, 57.

23. *See* Bureau of National Affairs, *VDTs in the 1990's: Advancing Technologies, Mounting Concerns*, BNA EMPLOYEE REL. WKLY, July 30, 1990, at 5.

lated health hazards as "a reluctance on the part of many people to recognize the possibility that their health might be threatened by invisible emanations from something they regard as both pervasive and indispensable."[24]

The field of ergonomics, or human factor engineering, has developed in part as a response to the problems posed by VDTs and the computerization of the modern office. Mary Knowles, executive administrator for the Human Factors Society, defines ergonomics as the science of design for human use in order to optimize the relationship between people and technology. While the American National Standards Institute ("ANSI") has promulgated a set of ergonomic standards in connection with the use of VDTs,[25] those standards do not attempt to regulate or define proper workplace practices.

Unlike most technologically advanced countries, the United States has no national standards for VDTs or VDT workstations. At present, there is little governmental regulation related to VDT safety. Efforts to impose restrictions upon employers related to lighting, work breaks, equipment, and workstation furniture have been introduced or approved by certain state legislatures, only to be struck down by courts in actions brought by local businesses. A detailed discussion of government response and regulation is found later in the paper.[26]

Therefore, with no legislation requiring manufacturers of VDTs to maintain design standards for their equipment or to warn users and with no court yet holding manufacturers liable for VDT health hazards, users anxiously await further scientific study in connection with these hazards. No manufacturer to this date has issued a warning or an instruction manual showing how to correctly use a VDT and how to maintain proper distances in order to protect from both ergonomic and radiation hazards. Such warnings could actually eliminate most, if not all, of the potential for harm at virtually no cost to the manufacturer.

Because VDT related injuries exist, someone must pay for these injuries. Should the individual pay through pain, suffering, and monetary losses from hospital costs, lost wages, and increased insurance payments? Should the employer pay through increased workers' compensation insurance? Should society pay through the increased burden of payments to this injured individual? Or should the manufacturer pay through enforcement of strict liability? This paper will address whether sufficient causal connection exists between the use of VDTs

24. Brodeur, *supra* note 6, at 39.

25. American National Standard for Human Factor Engineering of Visual Display Terminal Workstations, ANSI/HFS 100-1988, accepted Feb. 4, 1988, American National Standards Institute.

26. *See infra* text accompanying notes 190-210.

and health problems to support a claim of strict liability against the VDT manufacturer and the related question of whether this problem is best solved through legislation as opposed to judicial action.

II. THE SOLUTION: STRICT LIABILITY FOR VIDEO DISPLAY TERMINAL HEALTH HAZARDS

A. TECHNICAL ASPECTS OF THE VDT

In order to understand the causal relationship between VDTs and resulting injuries, it is imperative to understand how a video display terminal actually works.

The video screen of a computer uses electrons and phosphor to create images. Inside the VDT is an "electron gun" in a cathode ray tube ("CRT"), which shoots the electrons from their source towards the screen. The interaction of the electrons shot towards the screen and the phosphor coating on the screen produces a glow. This glow irradiates the screen and causes radiation emissions similar to that of a television set, except that a TV produces ionizing rays while a computer transmits both ionizing and non-ionizing rays. Ionizing rays can be dangerous because they disrupt the normal structure of cells in the human body. Non-ionizing radiation has less energy and does not alter the structure of atoms.[27] VDTs can produce ionizing x-rays as the electrodes strike the front of the CRT. Low frequency radiation is emitted from the deflection circuitry and the power lines running to the terminal. There is relatively little research regarding the potential health effects of ELF and VLF non-ionizing radiation.

Most VDTs generate sixty 262-line pictures every second while an electron beam travels across the VDT screen more than 15,000 times a second.[28] This produces a horizontal scan frequency of approximately fifteen thousand hertz, or fifteen kilohertz which is in the VLF range. Many of these rays are absorbed by the glass of the cathode ray tube and are not considered to present a health risk. However, VDTs also produce ultraviolet, visible light, ELF, infrared, microwave, radiowave, and static electric fields. Most of this radiation consists of pulsed VLF fields of between fifteen to twenty kilohertz and pulsed ELF fields of sixty hertz.[29]

B. POTENTIAL HEALTH HAZARDS OF USING VDTS

What is the state of the knowledge in the scientific community and

27. S. SAUTER, IMPROVING VDT WORK: CAUSES AND CONTROL OF HEALTH CONCERNS IN VDT USE, Preliminary Edition at 46.

28. Brodeur, *supra* note 6, at 39, 40.

29. *Id.*

the computer industry related to health effects of using VDTs? If it can be shown that manufacturers of VDTs know or should know that VDTs may cause health problems, their failure to warn consumers of these dangers may be actionable under a strict liability theory.

The possible health hazards resulting from the use of a VDT can be categorized into two distinct areas: those related to ergonomics such as simple eyestrain, posture related problems, and shoulder, neck, and back pain, and those related to radiation emissions such as cataracts, miscarriages, face rashes, birth defects, and male and female chromosomal damage. While experts argue regarding the effect of low levels of radiation emitted from VDTs, there is a greater consensus regarding the ergonomic problems associated with their use.

1. *Ergonomic and Vision Injuries*

a. Repetitive strain injuries:

The area of greatest concern is that of repetitive strain injuries ("RSIs"), also identified as "cumulative trauma disorders." These disorders are usually due to nerve entrapments caused by repetitive physical motions. While these injuries are merely a subset of ergonomic injuries, they are so severe and frequent that they merit separate attention. RSIs were first reported in the United States as early as 1912 when telegraph operators complained of "telegraphists' cramp." Seemingly occupation-specific ailments such as tobacco pickers' thumb, washerwoman's thumb, cotton-twister's cramp, and gold-beater's palm all now appear to be connected with RSIs.[30] While there were only approximately 18,000 job-related cases of RSIs reported in 1983, that number dramatically increased in 1987 to almost 75,000, making repetitive motion injuries the fastest growing occupational injury of the 1980s.[31] NIOSH reports that more than five million people, or 4% of the workforce, suffered repetitive motion injuries in 1986 alone.[32] RSIs have thus become the industrial disease of the information age.[33] The United States spends more than $16 billion per year compensating and treating repetitive strain injuries.[34] Roger Stevens, chief ergonomist at OSHA, predicts that RSIs will account for 50% of all worker compensation claims by the year 2000.

Adding fuel to the fire, RSIs are not completely curable. If a

30. Hembree & Henry, *A Newsroom Hazard Called RSI*, COLUM. JOURNALISM REV., Jan.-Feb. 1987, at 20.

31. Mallory & Bradford, *supra* note 17, at 92.

32. Reynolds, *supra* note 22, at 56.

33. Betts, *supra* note 4, at 17.

34. Brown, *CTD's: Big Disabilities from Small Injuries*, THE WORKPLACE HEALTH FUND, 1 (1990).

worker returns to a job that has caused a RSI, the condition will worsen unless the job is changed to eliminate the risk.[35]

At present, there are at least two suits claiming RSI injuries from VDTs.[36] However, the paucity of actions filed is no indication of the pervasiveness of the VDT-RSI connection. To the contrary, it merely illustrates the fact that many employers have taken it upon themselves to protect their employees. The *Los Angeles Times* has spent more than $250,000 on office changes to accommodate its employees with RSIs and to prevent future RSIs. This change evolved from a study that reported almost one-fifth of its employees suffered from carpal tunnel symptoms. Michael Manfro, Safety and Environmental Affairs Manager, reports that between 1985 and 1987 there were forty reports of musculoskeletal problems at the *Times* that were diagnosed as carpal tunnel syndrome or tendonitis. Mark Saunders, the ergonomics consultant retained by the *Times*, suggested that the newspaper purchase new equipment, educate employees, and start a vision care program.[37]

John Morrell & Co., a large meat packing company, was fined $4.3 million by OSHA for poor conditions in its plants, including the repetitive requirements of its labor force. As a partial settlement of an OSHA claim, they have agreed to hire a neurologist and an ergonomist to oversee medical treatment at the plants. Another California newspaper, the *Fresno Bee*, received thirty-eight complaints of RSIs between 1987 and 1989.[38]

One specific RSI that has been in the news recently is carpal tunnel syndrome ("CTS"). As of 1987, more than 23,000 workers had developed CTS.[39] It is estimated that one in ten Americans will develop CTS.[40] This is a disorder that affects the hands and wrists and, in extreme cases, is entirely debilitating. CTS is the most common of all RSIs and is thought to result from the constant use of video keyboards or other repetitive motions. Surgery is possible, but the movement that caused the injury must completely cease. CTS results when the eight flexor tendons or the ligaments in the wrist become irritated and swollen and press against the median nerve, "the major pathway for nerve impulses travelling from the spinal cord, down the arm, through the wrist and palm into the fingers. This nerve supplies most of the sensa-

35. *Id.* at 7.

36. These cases are discussed *infra* at text accompanying notes 167-72.

37. Bureau of National Affairs, *supra* note 23, at 51.

38. Flynn, *Computeritis: Who's Responsible When PC's Make Employees Sick?*, INFOWORLD, May 1, 1989, at 51.

39. Hembree & Henry, *supra* note 30, at 20.

40. Pechter, *The Odd Disease That Wrecks Your Wrists*, PREVENTION, Apr., 1988, at 50.

tion to the hand as well as most of the muscle power to the thumb."[41] In CTS, the median nerve does not permit the neurotransmitters to pass. Early clues to the disorder include intermittent numbness, pain, weakness in the hands or wrists, and a tingling, pins-and-needles sensation in the thumbs and fingers, similar to the symptoms of arthritis. Later, pain starts in the lower arms and continues to the elbows, then up the arms to the shoulders. Some sufferers have lost complete sensation or even use of their hands in advanced cases. Because of its similarity to arthritis, many sufferers ignore the pain and continue their daily activities under the incorrect belief that nothing can be done. CTS can be detected by an electromyography, a test where an electric charge is transmitted through electrodes on the skin. The electromyography is the least intrusive manner in which to determine if the nerves continue to properly receive impulses.[42]

The specific connection between CTS and computers lies in the increased speed with which keyboard operators can type on a video keyboard as compared to a standard typewriter. It is estimated that a VDT operator can type up to 40% faster than a manual typist.[43] Also, operators now sit in front of a terminal typing for eight hours or more a day. It is estimated that some VDT operators hit keys more than 45,000 times per hour.[44] Experts have stated that we are not biologically equipped to perform thousands of repetitive motions an hour.[45]

The precise position of the hands and wrists when typing at a VDT, coupled with the speed of action and the repetitive nature of the act, make the computer operator especially prone to CTS. However, before some newer studies, researchers have pointed out that VDT users were encouraged to rest their wrists on the keyboard while typing in order to relieve the strain or stress to the neck and shoulders, thus exacerbating the incorrect angle of the wrist that causes CTS.[46] In reporting the results of a study performed prior to 1980, several researchers concluded that "hands and forearms [of VDT users] are rested if there is good opportunity!"[47] Only as research progressed did experts determine the most ergonomically correct positioning of the hands and forearms.

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41. *Id.* *See* Dyck, *Diseases of The Peripheral Nervous System*, TEXTBOOK OF MEDICINE (Wyngaarden, Smith, Eds. 1982).

42. Pechter, *supra* note 40, at 50.

43. Riordan, *Technology Can Be A Pain When It Leads To CTS*, PEOPLE, May 7, 1990, at 127 (discussion with Abner Bevin, Director of the Hand Rehabilitation Center at the University of North Carolina in Chapel Hill).

44. Hembree & Henry, *supra* note 30, at 19.

45. Riordan, *supra* note 43, at 127-29.

46. Sauter, Chapman, & Anderson, *Case Example of Wrist Trauma in Keyboard Use*, 18 APPLIED ERGONOMICS 182, 183 (1987).

47. *Id.* at 182, citing Hunting, Laubli & Grandjean, *Constrained Postures of VDU Operators*, ERGONOMIC ASPECTS OF VIDEO DISPLAY TERMINALS 175 (E. Grandjean ed. 1980).

Women are twice as likely to develop CTS as men[48] because their wrists are narrower than men's. Pregnant women are even more likely to develop it due to fluid retention and the resulting pressure on the nerve. Women are also more likely to suffer from eye discomfort, musculoskeletal complaints, headaches, and skin disorders.[49]

The treatment for CTS is varied. Merely changing the position of the hands may work. "In some cases, people have found symptom relief just by learning to use their hands in ways that don't put pressure on their median nerve."[50] Others immobilize the wrist using a forearm splint. Steroids are recommended in severe cases in order to reduce swelling around the nerve and to relieve pressure. Some doctors have recommended the use of vitamin B6, as they believe B6 deficiency may exacerbate the symptoms.[51] However, many doctors refuse to place too much value or hope in the use of B6 to treat CTS as there is little convincing evidence regarding its effectiveness.[52] The last resort for sufferers is hand surgery.[53] The surgery involves cutting the ligament to free the underlying median nerve from the pressure.[54]

Ezra Shapiro, a journalist specializing in computer industry issues, suffers from CTS. He used to work at a computer six to eight hours each day for a period of almost eight years. He suffered symptoms of the disorder for about four years until they became unbearable. "My fingers felt like I had hit a wall with my fist. All of the symptoms decided to hit simultaneously."[55] He went to the Kaiser Permanente clinic in California and was told to wear wrist splints and to lay off the offending device. His present practice is to limit his use of the computer to only those times where it is absolutely necessary and to use wrist rests. He no longer spends time at the VDT playing games and has ceased using on-line services which require a great deal of time in front of the VDT. Shapiro wrote several articles for *MacWeek* describing his problems and reports that those columns generated a greater response than any article previously written by him.

It is undisputed that the prevention or control of RSI's and other musculoskeletal problems comes from special attention to the use and positioning of the VDT. Further "enlargement" of jobs by employers to include less repetition and greater variation of tasks will reduce the

48. Pechter, *supra* note 40, at 52.

49. Knave, Wibom, Bergqvist, Voss & Hedstrom, *Work With Video Display Terminals Among Office Employees*, 11 SCAND. J. WORK ENVTL. HLTH. 457 (1985).

50. Pechter, *supra* note 40, at 52.

51. *Id.* at 50, 101.

52. *Id.* at 101, 116.

53. *Id.* at 116.

54. *Id.* at 117.

55. Conversation with Mr. Shapiro, Oct. 1990.

possibility of repetitive strain injuries. Rest breaks are also advised. Finally, awareness/eduction regarding potential problems will allow afflicted employees to identify and treat all problems in a timely and more effective manner.[56] Also, there is a new keyboard designed by Stuart Herzog that is designed to alleviate the stress to the wrist that apparently causes CTS.[57]

b. Vision and eye problems:

Another area of grave concern related to the health hazards of using a VDT focuses on the effect of such use on the operator's eyes. Complaints of eye strain, blurred vision, vision fatigue, cataracts, burning sensation in the eyes, headaches, and disturbances of color perception have been reported by users. In one study, 10-15% of VDT users reported daily eye irritation, and 40-50% experienced occasional problems.[58] The Canadian Labor Congress reported that, of 1742 VDT users surveyed in one study, 22% of those users who used the VDT seven to eight hours per day experienced almost daily eye irritation, while only 6% of those users who used the VDT less than two hours per day had the same complaint.

The flicker of the VDT screen is one source of the problem. Since the VDT's image is created by the reaction of electrons aimed at a phosphor-coated screen, the electrons must be refreshed constantly in order to produce a continuous image. A refresh rate of 100 hertz or more is imperceptible, but most VDTs have refresh rates of approximately 50 hertz.[59] The computer screen therefore produces a noticeable flicker that can cause undue strain on the user's eyes. Further, visual fatigue may be attributable to the way in which the eye perceives text on a VDT. The eye loses its sensitivity to contrasts so focusing is more difficult.[60]

Experts have also found the existence of a "McCullough effect" in VDT users.[61] The McCullough effect is typified by faintly colored ach-

56. Arndt, *Working Posture and Musculoskeletal Problems of Video Display Terminal Operators - Review and Reappraisal*, 44 AM. INDUS. HYG. ASSN. J. 437, 442 (1983).

57. *Carpal Tunnel Syndrome Sufferers Find Relief With Ergonomic Designs*, OCC. HLTH. SFTY., Aug. 1988, at 49.

58. Matula, *Effects of Video Display Units on the Eyes*, 23 HUM. FACTORS 581 (1980), citing Grandjean, *Ergonomics of VDU's: Review of Present Knowledge*, ERGONOMIC ASPECTS OF VIDEO DISPLAY TERMINALS, at 1 (1980).

59. McAlister, *supra* note 3, at 62.

60. Lunn & Banks, *Visual Fatigue and Spatial Frequency Adaptation to Video Displays of Text*, 28 HUM. FACTORS 457 (1986).

61. Seaber, Fisher, Lockhead & Wolbarsht, *Incidence and Characteristics of McCullough Aftereffects Following Video Display Terminal Use*, 29 J. OCC. MED. 727 (1987).

romatic patterns appearing for several hours after using a VDT, caused by the repeating character line of VDT text.

There are, however, correctable factors that contribute to the problem. If the user were aware of the effect of these factors, changes can be made to reduce their effects on the eyes. Improper lighting and positioning of the terminals produces glare. Indirect artificial lighting with constant, controllable levels is preferable to variations of natural light. Older units that produce low-intensity images should be replaced with units that have contrast and intensity controls.

Anti-glare screens or filters, some of which also claim to reduce radiation effects from the monitor's screen, are one response to eye problems. They are widely available from mail order catalogues and cost from $25.00 to $200.00. Polaroid, Glare Guard, Dysan and NoRad are some of the most popular manufacturers. The screen is actually a polarizing filter made of specially treated glass, plastic, or mesh. Tests have shown that these shields may reduce VDT radiation.[62] The problem with glass or plastic filters is that they may tend to collect dust or other deposits, or cause their own reflection, while the mesh filters may blur the screen's image. These filters are sold as an after-market add-on; no manufacturer has yet offered the filter as an optional item for purchase with the computer. However, even with the screen in place, a VDT continues to emit non-ionizing radiation from the back and sides of the machine. In order to reduce these emissions, experts suggest covering the back and sides of the machine with grounded copper foil.

In addition, Zenion Industries, Inc. has a product called the Screen Elf that does not reduce radiation emissions but instead produces a pulsed plasma field. Its manufacturer claims that this field contains a stream of negatively charged ions that are intended to counteract the VDT's electrostatic charge, which has been linked with headaches, fatigue, and skin rashes.[63] Vision Aerobics, Inc. sells software designed to exercise a user's eyes during prolonged use of the VDT. The manufacturer claims that the software "increases the stamina of the visual system and delays the onset of fatigue and eye strain."[64] Rearranging the work space in order to reduce the potential for glare from overhead

62. CARNEL LABS CORPORATION, TEST REPORT: ELECTROMAGNETIC RADIATION SHIELDING EFFECTIVENESS TEST, Oct. 17, 1987, available from Norad Corporation, Santa Monica, California. *But see Preventive Medicine*, INFOWORLD, Nov. 12, 1990, at 73, 83. Infoworld researchers test three types of anti-radiation filters, manufactured by NoRad Optical Coating Laboratory, Inc. and Kensington Microwave, Inc. Infoworld found that none of the three products tested showed "appreciable protection" against VLF emissions.

63. *Preventive Medicine*, *supra* note 62.

64. *Id.*

lighting or desk lamps is another possible remedy.[65]

Various studies have put to rest remaining questions regarding the causal connection between VDT use and eye-related problems. Researchers at the Johns Hopkins Wilmer Eye Institute have found that microwaves kill the cells that line the cornea, blurring vision.[66] In 1981, Etienne Grandjean of the Swiss Federal Institute of Technology found a statistical correlation between the clarity and quality of letters printed on eight different VDT monitors and eye pain and blurred vision.[67] A study of 1,545 Massachusetts clerical workers found an increased risk of problems related to vision, musculoskeletal disorders, and headaches among clerical workers who used VDTs.[68] The Massachusetts study found that the intensity of the increased risk depended upon the amount of VDT use. Other vision studies support the conclusions of these researchers.[69]

A study conducted at the Video Display Terminal Eye Clinic in Berkeley, California, of more than 150 patients at their facility found that an unusually large number of the clinic's patients who used VDTs had problems focusing their eyes. Dr. Sheedy of the Clinic reported that it was possible that "looking at the VDT for long periods of time can cause the focusing mechanism to break down."[70]

c. Other ergonomic problems:

Complaints of non-RSI ergonomic problems are also prevalent within the VDT industry. These problems include headaches not related to vision problems,[71] backaches, and other musculoskeletal problems:

> The neck, shoulders, back and wrists are more commonly affected than the arms, hands and legs. Typically reported are shooting pain in the arms; acute pain or stiffness in the arms, legs, neck, shoulders and/or

65. *Ways to Reduce Glare From A Computer Screen*, 53 CONSUMER REPORTS, 422 (1988).

66. *Researchers See More Danger in Microwave Radiation*, BUS. WK., Dec. 7, 1987, at 127.

67. Raloff, *VDTs: The European Experience*, SCI. NEWS, Aug. 29, 1981, at 137.

68. Rossignol, *supra* note 1.

69. Rey & Meyer, *Visual Impairments and Their Objective Correlates*, in ERGONOMIC ASPECTS OF VIDEO DISPLAY TERMINALS, (Grandjean & Vigliani eds.) at 77-83 (1983); Rossignol, *supra* note 2, citing Schleifer, *Questionnaire Survey of VDT Operators at The New York State Departments of Motor Vehicles and Taxation and Finance*, U.S. DEPT. OF HEALTH AND HUMAN SERVICES, CENTER FOR DISEASE CONTROL (NIOSH) (1985).

70. Boffey, *Study Hints VDT May Affect Focus*, N.Y. Times, Aug. 11, 1988, § 1, at 14.

71. LaBan & Meerschaert, *Computer-Generated Headache*, 68 AM. J. OF PHYS. MED. & REHAB., 183 (1989) (The authors found that headaches bore a direct relation to the use of VDTs. The headaches even resumed or became more intense with the resumption of the work week.).

> back; acute wrist or finger pain; anesthesia or paresthesia of the extremities; and chronic pain in the neck, shoulder, back or extremities. Although the cause is usually attributed to an individual's posture, it is more likely to result from one or more of the following factors: inadequately designed desks and chairs that do not permit personalized adjustments; lack of exercise on the job; repetitive tasks; work pacing; personal traits; and work stress. The physical environment, such as furniture, keyboards, lighting and glare reduction, can be designed or modified to eliminate the inadequacies. With a little effort and cost, comfort as well as work performance can be increased.[72]

The solution is often to redesign the work station to change the set up of the chair, machine, or other necessary equipment. However, "even with improved design, workers are still subject to the effects of back and neck strain, slowed circulation in the legs, and reduced muscle tone if they must sit in one position for long periods of time."[73] A host of factors may affect musculoskeletal complaints, including viewing distance, display angle, display height, keyboard location, working height, foot rests, leg room, arm support, chair height, back support, arm angle, document holder, and head angle.[74]

German researchers studied more than 1000 VDT operators and discovered that 40% of those operators sought treatment for back injuries during the time they were working on VDTs. Of those individuals, 27.3% had worked on the VDT for less than one year.[75] In one study that compared the complaints of VDT users to those of clerical workers who did not use a VDT, the researchers found that 67% of the VDT users complained of back pains compared to 36.2% of the non-VDT users; 61.8% of the users complained of neck and shoulder pain compared to 46.8% of the non-users; and 35.3% of the users complained of leg pains compared to 17% of the non-users.[76] Norman Bodek, the President of the Data Entry Management Association, admits that "ever since this association was formed, we have fought against the 'sweatshop' image of data-processing environments. But perhaps that depiction is, in many cases, accurate."[77]

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72. A.M.A. Council, *supra* note 1, at 1510.

73. Brooks, *VDTs and Health Risks: What Are Unions Doing?*, PERSONNEL, July, 1986, at 59, 60.

74. Arndt, *supra* note 56.

75. Rossignol, *supra* note 1, citing Cakir, Rueter, von Schmude & Armbruster, *Investigations of the Accommodation of Human Psychic and Physical Functions to Data-Display Screens in The Workplace*, Institute for Occupational Science, Technical University of Berlin (1977).

76. Eisen, *supra* note 1, citing Data Entry Management Assn., *Management, Not Machines, Source of VDT-Related Problems*, Data Entry Management Assn. Newsletter, Aug. 1984.

77. *Id.*

d. Other non-radiation related problems:

Several other areas have generated research into possible links with VDT use, yet questions remain related to these areas. The Communications Workers of America has published information suggesting that exposure to polychlorinated biphenyls ("PCBs"), also emitted by VDTs, may cause birth defects, reproductive disorders, skin rashes, developments and liver disorders, and cancer.[78]

Swedes Gunn Johansson and Gunnar Aronsson published results of their research which found that after-work catecholamine levels (an indicator of stress) was higher among VDT users than among non-VDT users. Triglyceride levels, a factor considered in connection with heart disease, was also higher among VDT users than non-users.[79]

One area which remains in question concerns various complaints of facial dermatitis. According to several medical studies, facial irritation may develop in certain individuals within two to six or more hours of VDT exposure.[80] Experts claim that this may be due to an electrostatic field set up between the operator and the VDT screen that, depending on the lack of humidity in the air, causes suspended particles in the air to be deposited on the user's skin. Adjustments in the air humidity and ventilation of the workspace have eliminated this problem where it occurs. Some researchers have also found prevalence among female VDT users of increased acne, rosacea, and seborrhoeic eczema.[81] The same density of particulates in the air has been found to cause conjunctivitis.[82] In contrast, several groups of researchers have found no support for the claim that VDTs produce facial skin disease.[83]

Several researchers have found a relationship between the use of VDTs and angina and heart related problems.[84] However, researchers

78. Brooks, *supra* note 73.

79. Raloff, *supra* note 67, at 143.

80. Linden & Rolfsen, *Video Display Terminals and Occupational Dermatitis*, 7 SCAND. J. WORK ENVTL. HLTH. 62 (1981); *see also Face Rashes Linked With Use of VDTs*, SCIENCE NEWS, Sept., 1981, at 150.

81. Knave, Wibom, Voss, Hedstrom & Bergqvist, *supra* note 71; Liden & Wahlberg, *Work at Video Display Terminals: An Epidemiological Health Investigation of Office Employees, V: Dermatological Examination*, 11 SCAND. J. WORK ENVTL. HLTH. 489 (1985); Nilsen, *Facial Rash in Visual Display Unit Operators*, CONTACT DERMATITIS, Aug. 1982, at 25; Fisher, *Terminal Dermatitis Due to Computers*, 38 CUTIS 153 (1986); *Defective Video Display, Shields and Skin Problems*, LANCET, Apr. 4, 1987, at 800.

82. *VDTs in the Work Place*, *supra* note 18, citing Mason, *A Consideration of VDT Health Concerns*, UP AND RUNNING, Nov. 1986.

83. Berg, Liden & Axelson, *Facial Skin Complaints and Work at Video Display Units*, 22 J. AM. ACAD. DERMATOLOGY 621 (1990).

84. Sutherland, *Working at VDTs Linked to Coronary Disease*, 21 Med. Post no. 3, at 98 (1985); Silberner, *Heart Work*, 127 SCI. NEWS 78 (citing report of Haynes & LaCroix,

at NIOSH discovered conflicting evidence.[85] NIOSH researchers found problems with the earlier study in that the questionnaire used in the study did not discriminate between chest pain due to coronary artery disease and that due to other causes. Also, the response rate was less than 35%, indicating that the "interpretation of the association between VDT use and chest pain [is] precarious."[86]

2. *Radiation-Related Problems*

In July 1982, Dr. Samuel Milham, a physician and epidemiologist for the Washington State Department of Social and Health Services, publicized a study indicating that among workers in Washington, ten out of eleven occupations that required exposure to electromagnetic fields had a much higher rate of deaths by leukemia.[87] There is no question that VDTs emit radiation. Conflicts arise, however, when experts attempt to identify whether the radiation emitted from the VDTs contributes to adverse health conditions for VDT workers.

In their 1979 study, Nancy Wertheimer and Ed Leeper found an increased incidence of cancer in children who had been exposed to low level electromagnetic fields from high current electrical distribution wires.[88] In Fremont, California, the planning commission now requires that the state real estate department warn potential buyers of homes in new subdivisions near power lines that those lines may pose a significant health risk.[89] "Most unsettling of all, perhaps, is the fact that pulsed VLF and ELF magnetic fields found routinely within a radius of about two feet from the average [VDT] can be as strong as, or even stronger than, the fields found inside the homes in which [researchers] discovered children to be dying unduly often of cancer," says Brodeur, thus the actual hazards posed by VDT-generated radiation may be underestimated.[90] In 1988, Dr. Ross W. Adey discovered that electric fields similar to those emitted by an overhead electric line could increase the activity of an enzyme called ornithine decarboxylase, which may promote cancer.[91] In March 1990, based on the results of a two year study, staff members of the Environmental Protection Agency rec-

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presented at the Office of Technology Assessment Conference, Washington, D.C., Dec. 1984).

85. Schnorr, Thun & Halperin, *Chest Pain in Users of Video Display Terminals*, 257 J. A.M.A. 627 (1987).

86. *Id.* at 627.

87. Brodeur, *supra* note 5, at 140.

88. Brodeur, *supra* note 6, at 39, 44.

89. Paul, *Concern About Low-Energy Radiation Leads to New Rules, Research and Suite*, Wall St. J., Oct. 11, 1988, at B6, col. 4.

90. Brodeur, *supra* note 6, at 67.

91. Brodeur, *supra* note 5, at 141.

ommended that magnetic fields be classified as Class B1 carcinogens, along with other known dangers such as formaldehyde and PCBs. Prior to the publication of the findings, however, the head of the EPA removed magnetic fields from the list.[92]

The greatest area of concern in connection with radiation-related health effects is that of adverse pregnancy outcomes, including miscarriages and birth defects. In 1982, one researcher reported that lower levels of pulsed electromagnetic radiation than previously believed may have adverse biological effects on developing embryos.[93] Dr. Jose M.R. Delgado, a neurophysiologist and the Director of Research at the Centro Ramon y Cajal Hospital in Madrid, kept fertilized eggs from hens in an incubator for forty-eight hours while exposing them to ELF magnetic fields of varying frequencies and strengths. He reported that 100 hertz magnetic fields of twelve milligauss in intensity had "a powerful effect on chicken embryogenesis, delaying or arresting it at a very early stage and limiting development to the formation of three primitive layers." Almost 80% of the embryos used in the experiment developed defects.[94]

This study has been successfully replicated. First, in 1986, *VDT News* reported that Julea Juutilojnen had confirmed Delgado's study.[95] Also, a project dubbed the "Hen House" project, headed by Thomas Rozzell and later by Ezra Berman, both of the Office of Naval Research, replicated the Delgado study. The project included scientists from six different labs in the United States, Sweden, Canada, and Spain. Results of the experiments indicated that extremely weak pulsed magnetic fields can adversely affect the development of chick embryos.[96]

Further, in 1986, Dr. Bernhard Tribukait, a professor of radiobiology, and Eva Cekan, a research teratologist of the Department of Medical Radiobiology at the Karolinska Institute in Stockholm, and Lars-Erik Paulsson, an engineer at the National Institute of Radiation Protection, discovered that weak pulsed magnetic fields caused congenital malformations in the fetuses of exposed mice at almost five times the rate of abnormal results as in the control group.[97] The emissions were specifically designed to mimic the type of field emitted by a VDT.

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92. *Preventive Medicine, supra* note 62, at 75.

93. Delgado, *Embryological Changes Induced by Weak Extremely Low Frequency Electromagnetic Fields*, 134 J. ANATOMY 533 (1982).

94. *Radiation Effects*, VDT NEWS, July-Aug. 1986, at 9.

95. *Id.*

96. *Very Weak Magnetic Fields Cause Chick Abnormalitites*, VDT NEWS, Mar.-Apr. 1988, at 1.

97. Presented at May, 1986 International Conference on Work with Display Units in Stockholm, Sweden.

Other studies replicated the Karolinska result.[98] Dr. Irving Selikoff, Professor at the Mount Sinai School of Medicine, stated that the results of these studies related to the health effects on mice "provide a 'good index of suspicion' " that there is a problem resulting from exposure, but added that translating the effects on animals to effects on humans is difficult and more research would be necessary in order to determine the true effects on humans.[99]

In Autumn 1988, Dr. Selikoff and Dr. Michelle Marcus began a prospective study of 800 women from the Service Employees Worker Union, half of whom used VDTs for some part or all of their work day. The study, which will proceed over the course of several years, will study the effects of radiation from the VDTs, smoking, alcohol, caffeine, prior reproductive history, and stress on the reproductive outcomes of these women.[100]

Recently, one of the first large scale epidemiological studies of the incidence of miscarriages and birth defects among female VDT users found that women who used VDTs for more than twenty hours per week had 1.8 times the number of miscarriages of unexposed workers.[101] The study also showed a 40% higher rate of birth defects. The study that was performed by doctors at the Kaiser Permanente Medical Center in June 1988 included 1583 women who attended their obstetrics and gynecology institute. While they found that twice as many miscarriages and birth defects occurred in women who used VDTs, they cautioned that further study is necessary regarding the influence of workplace stress and posture problems. However, this caution was based on the Kaiser researchers' reliance on earlier studies that reported that the non-ionizing radiation and magnetic fields of VDTs were at such low levels that no biological effect could be possible. The Delgado research appears to put these concerns to rest. However, another recent study found no connection between the use of VDTs and spontaneous abortions.[102]

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98. 1988 study performed by Dr. Hakron Froelen at the University of Agricultural Sciences in Sweden found that mice exposed to magnetic pulses suffered twice as many early fetal deaths as unexposed mice. *See* Paul, *Latest Study on VDTs Adds to Safety Fears*, Wall St. J., Oct. 20, 1988, at B1, col 5. Further, Dr. Gunnar Walinder of the University of Agriculture in Uppsala, Sweden, replicated the Karolinska study and found that the exposure of mice embryos to pulsed magnetic fields resulted in an increase in fetal deaths.

99. Paul, *supra* note 98.

100. Conversation with the author, 1990.

101. Goldhaber, Polen & Hiatt, *The Risk of Miscarriage and Birth Defects Among Women Who Use VDTs During Pregnancy*, 13 AM. J. INDUS. MED. 695 (1988).

102. Schnorr, Grajewski, Hornung, Thun, Egeland, Murray, Conover, & Halperin, *Video Display Terminals and the Risk of Spontaneous Abortion*, 324 NEW ENG. J. MED. 727 (1991).

It is important to note that stress may play a role in the adverse consequences of VDT use. Stress may result from the following factors, as described by the American Medical Association's Council on Scientific Affairs:

> The worker may feel a loss of control, reduced status, fear of job loss, and less need or opportunity to participate in the affairs of the organization. In most instances where this occurs, the tasks have become more impersonal, repetitive, and boring; there is a real or imagined sense of work overload; individual skills are underutilized; responsibilities are reduced; and social interaction with fellow workers is reduced or lacking. The situation is aggravated when one's performance is paced and/or measured by the machine.[103]

It is argued that the link between VDT use and adverse pregnancy outcomes is difficult to establish because pregnant women normally experience 10-20% miscarriages and 2-4% birth defects.[104] However, a number of clusters of miscarriages or birth defects among VDT users have occurred in particular offices and have served to cast a doubt of the VDT's clean bill of health. More than a dozen such clusters have been reported in the United States and Canada, but government investigations have concluded that these clusters represent mere coincidences. At one congressional hearing, an American Electronics Association representative claimed that, statistically, fifty such clusters could or should turn up in any three year period; a representative from American College of Obstetricians and Gynecologists concurred.[105] Brodeur, however, argues that the expected rate of adverse pregnancies in the United States is much lower.[106]

The following represent "clusters" of birth defects or other adverse pregnancy outcomes reported between 1978 and 1988:

> Toronto Star, Classified Advertising Department (1980): Four out of seven pregnant VDT operators gave birth to children with birth defects. Three other employees at the Star who were not exposed to VDTs had normal births during the same three month period.[107]
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> Air Canada: At the Air Canada checkout counter at Dorval Airport in Montreal, between February 1979 and February 1981, seven out of thirteen pregnant woman miscarried.[108]
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> Sears, Roebuck's Southwest Regional Office in Dallas: Between

103. A.M.A. Council, *supra* note 1, at 1510.

104. Clever & Omenn, *Hazards for Health Care Workers*, 9 AM. REV. PUB. HLTH. 273, 292 (1988).

105. Welch & Bayer, *Watch for Health Complaints*, Chicago Daily L. Bull., Mar. 8, 1989, at 4, 18.

106. Brodeur, *supra* note 6, at 48.

107. *Id.* at 44.

108. *Id.* at 45.

January and September 1980, eight out of twelve pregnancies ended in miscarriages or neonatal deaths.[109]

Defense Logistics Agency, Regional Headquarters in Marietta, Ga.: Between October 1979 and October 1980 three cases of congenital malformation and seven cases of first trimester miscarriages. These ten women worked in a single building and all spent some part of their working day at a VDT.[110]

Surrey Memorial Hospital, Vancouver, British Columbia: Between May 1978 and October 1982, there were reports of three miscarriages, one premature birth, and two children born with severe birth defects. These seven women all worked in the same room, and all had VDTs on their desks.[111]

Office of the Solicitor General in Ottawa: Between 1979 and 1982, seven pregnant women experienced poor outcomes. Four women had miscarriages, one gave birth prematurely, and two children were born with respiratory-related birth defects.[112]

Pacific Northwest Bell Telephone, Renton, Washington: Between July 1980 and August 1982, three out of five pregnancies ended adversely. There were two birth defects and one stillborn baby.[113]

Southern Bell Telephone and Telegraph Company's Data Processing Center in Atlanta, Ga.: Six out of fifteen pregnant women working on the same floor at the center experienced miscarriages.[114]

United Airlines Reservation Center in San Francisco: Between 1979 and 1984, twenty-four of forty-eight pregnant women experienced miscarriages and other abnormal pregnancies or children born with birth defects.[115]

General Telephone Co., Alma, Michigan: Between December 1981 and March 1983, seventeen of thirty-two pregnancies ended in miscarriage or had other abnormal results.[116]

USA Today headquarters in Arlington, Va.: Between September 1987 and Autumn 1988, fourteen miscarriages had been reported among women working on two floors of the headquarters. Further, of those employees who had become pregnant after December 1987,

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109. *Id.*
110. *Id.* at 48.
111. *Id.*
112. *Id.* at 49.
113. *Id.*
114. *Id.* at 55.
115. *Id.*
116. *Id.*

thirteen of thirty-six employees had suffered miscarriages.[117]

Nevertheless, in May 1981, a hearing was held by the Subcommittee on Investigations and Oversight of the House Committee on Science and Technology. Except for Dr. Milton Zaret, an Associate Clinical Professor of Ophthalmology at the New York University Medical Center, and some union officials who called for further research on VDT operators, the testimony from over thirty of the government's experts reflected the government's conclusion that VDT radiation posed no health risk.

Further, there are many studies that have found that there is no "teratogenic" risk for operators of VDTs, that is, that VDTs do not cause birth defects.[118] In March 1990, NIOSH released the results of the first large-scale epidemiological study related to the effects of VDTs on pregnancy outcomes. The study concluded that VDTs did not have an adverse effect on pregnancy outcomes.[119] However, the study also noted that stress, as a variable, was not controlled.[120] Therefore, stress as a cofactor was not tested by the study. Second, the study also failed to evaluate the effect of VDTs on adverse pregnancy outcomes other than spontaneous abortions. Therefore, the possible causal connection between VDT use and pregnancy problems cannot be entirely dismissed.

In October 1982, Karel Marha, a Canadian scientist and Manager of the Physical Hazards Group of the Canadian Centre for Occupational Safety and Health, came forward to question this consensus. When working with other Czechoslovakian researchers, Marha, a Czech emigre, had found neurological effects among people working around radiation-producing products.[121] Marha noted that an American study had found electric fields within twelve inches of a VDT to be more than five times as strong as those allowed for occupational exposure in the Soviet Union, Czechoslovakia, Bulgaria, and Germany. Marha was the first to discover that the exposure to VDT-related radiation may be greater to those surrounding the machine than to the operator. This conclusion was supported by later research into proper location of VDTs.[122]

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117. *Id.* at 64.

118. Kurppa, Holmberg, Rantala, Nurminen & Saxen, *Birth Defects and Exposure to Video Display Terminals During Pregnancy*, 11 SCAND. J. WORK ENVTL. HLTH. 353 (1985); McDonald, Cherry, Delorme & McDonald, *Visual Display Units and Pregnancy*, 28 J. OCC. MED. 1226 (1986); Ericson & Kallen, *An Epidemiological Study of Work With Video Screens and Pregnancy Outcome: I and II*, 9 AM. J. INDUS. MED. 447 (1986).

119. Schorr, Grajewski, Hornung, Thun, Egeland, Murray, Conover, Halperin, *Video Display Terminals and the Risk of Spontaneous Abortion*, 324 NEW ENG. J. MED. 727, 730 (1990).

120. *Id.* at 732.

121. Marha, *The State of Knowledge Concerning Radiation Emissions from Video Display Terminals*, paper presented at Carleton University, Ottawa, Oct. 6, 1982.

122. Brodeur, *supra* note 5, at 136.

Most recently, *Infoworld* tested seven popular VDTs, four low emission monitors and one Liquid Crystal Displaying ("LCD") monitor that the maker claimed emitted no radiation for VLF magnetic radiation emissions.[123] The VDTs were tested according to the guidelines promulgated by the Swedish National Board for Metrology and Testing. The Board sets Maximum Permissible Radiation ("MPR") standards of .50 milligauss at a distance of twenty inches. The proposed MPR II standard, which has not yet been approved, is .25 milligauss. The researchers discovered that monochrome monitors produce lower levels of VLF emission than do color monitors. The low emission monitors were, indeed, within the MPR guidelines. The other standard monitors measured well above the MPR guidelines when tested from various angles.[124] Safe Computing Company's LCD display monitor emitted no electromagnetic radiation.[125]

Predictably, IBM and other manufacturers have begun marketing terminals shielded against VLF magnetic field emissions in Scandinavia and elsewhere in order to comply with Sweden's MPR. Another way to reduce the danger of VDT radiation is to make the keyboard movable, and not fixed to the CRT. One NIOSH representative affirmed that "if you put it into your contracts that all keyboards should be removable from the [CRT], you'd get every manufacturer in the country to start building them that way."[126] But once the computer manufacturers begin to market these safer terminals, allegedly in response to consumer demand, the questions of what manufacturers know and how long they have had this knowledge, yet failed to change the product, may remain unanswered.

NIOSH has issued recommendations related to the proper use of VDTs. Pursuant to NIOSH research, the Workers' Compensation and Safety Department of Kaiser Permanente Medical Care Program has promulgated its own set of guidelines for the safe use of a VDT. Employers and doctors do not always have the computer education necessary in order to train their employees or patients regarding these health problems, their treatment, and prevention; nor do the employees themselves have the information necessary to protect themselves from the hazards of VDT use. Consumers and users do not expect to develop the serious injuries described above from correctly performing their normal duties. The manufacturers of the VDTs are in the most efficient position to disseminate the information and have the most knowledge of potential hazards. A direction regarding proper use and proper protective

123. *Preventive Medicine, supra* note 62.

124. *Id.* at 83.

125. *Id.*

126. EISEN & LEGRANDE, VIDEO DISPLAY TERMINALS: A HEALTH GUIDE FOR USERS (Workplace Health Fund, 1987).

equipment could be programmed into the VDT so that it would appear on the screen before each use in order to ensure that all users were warned and instructed regarding safety. Experts in this field have performed the research to, at least, lay the foundation for questions regarding the safety of VDTs. Louis Slesin, editor of *VDT News*, says "there is enough ambiguity to be concerned. There is a massive amount of miscommunication."[127] There is, he concludes, a conscious disregard on the part of the manufacturers for the warnings the research has suggested. "Until conclusive scientific data are available, VDT operators should not have to wonder if exposure will result in health problems."[128] Manufacturers should not be able to rely on employers in order to guarantee that their products are used in a safe manner.

C. Application of Strict Liability Theory

Manufacturers and employers generally downplay the possibility of VDT dangers, citing concerns about workplace hysteria. They claim that VDTs are safe, although they sometimes acknowledge that poor ergonomic design of the workplace may cause or aggravate musculoskeletal and vision problems. Charlotte LeGates of the Computer and Business Equipment Manufacturers Association states: "It's wrong to put blame on the computer manufacturers. We have meat-cutter's elbow, but meat-cutters don't blame their injury on the meat. And what about tennis elbow? Nobody blames the tennis court manufacturers or the person who invented tennis. Our responsibility is to provide as good as possible equipment, and I think we do that."[129] However, when one purchases a piece of equipment, there is generally an instruction guide directing the user regarding the correct, proper, and safe manner of use. Therefore, instructions on how to safely use a product should be provided if incorrect use can result in injury.

Through strict liability, courts and legislatures have attempted to protect the consumer from unknown risks and irreparable harms. They recognized that consumers were being victimized by the complex network of designers, manufacturers, distributors, and retailers. Prior to the inception of today's products liability rules, consumers had the burden of proving that the allegedly harmful product was not designed, made, or distributed in accordance with "reasonable" standards.

Strict liability imposes a duty on all who introduce products into the market. Traditionally, strict product liability exists where an article, placed on the market by the manufacturer with knowledge that it is to be used without inspection for defects, proves to have a defect that

127. Conversation with the author, October 1990.

128. *Id.*

129. Bureau of National Affairs, *supra* note 18, at 50.

causes injury to someone.[130] The Restatement (Second) of Torts ("Restatement") Section 402(A) codifies this common law formulation and was first adopted by the Illinois Supreme Court in *Suvada v. White Motor Co.*[131]

Section 402(A) states that:

1) One who "sell[s] any product in a defective condition unreasonably dangerous to the user or consumer or to his property . . . for physical harm thereby caused to the ultimate user or consumer, or to his property if:
   a. the seller is engaged in the business of selling such products; and
   b. it is expected to and does reach the user or consumer without substantial change in which it is sold.
2) The rule in subsection (1) applies although
   a. the seller has exercised all possible care in the preparation and sale of his product; and
   b. the user or consumer has not bought the product from or entered into any contractual relation with the seller.

This formulation imposes strict liability on the manufacturer, meaning that liability does not depend on whether the manufacturer was at fault. It does not, however, impose absolute liability, which would cause the manufacturer to be liable whether or not the defect caused the injury.[132] A plaintiff must prove that the product was defective, that the unreasonably dangerous condition existed at the time that the product left the manufacturer's control, and that the injury resulted from the defective condition of the product.[133] In turn, the manufacturer has a duty to either warn the consumer of the inherent risks of using the product or, where the danger can be eliminated without excessive cost and without unacceptable interference with the product's function, to eliminate the defect.[134] This is a question of law and not fact.[135]

Further, no privity of contract between the manufacturer and the ultimate user is necessary.[136] In *MacPherson v. Buick Motor Co.*,[137] the New York Court of Appeals rejected the privity requirement where a

130. Greenman v. Yuba Power Products, Inc., 59 Cal. 2d 57, 60, 377 P.2d 897, 900, 27 Cal. Rptr. 697, 700 (1963).

131. 32 Ill. 2d 612 210 N.E.2d 182 (1965).

132. Manufacturers are not absolute insurers, required to produce a product which represents the ultimate in safety. Kerns v. Engelke, 76 Ill. 2d 154, 390 N.E.2d 859 (1979).

133. Suvada v. White Motor Company, 32 Ill. 2d 612, 623, 210 N.E.2d 182, 188 (1965).

134. RESTATEMENT (SECOND) OF TORTS § 402(A) (1965).

135. Argubright v. Beech Aircraft Corp., 868 F.2d 764 (5th Cir. 1989); Mason v. Texaco, Inc., 862 F.2d 242 (10th Cir. 1988).

136. *See also* Suvada v. White Motor Co., 32 Ill. 2d 612, 623, 210 N.E.2d 182, 188 (1965).

137. 217 N.Y. 382, 111 N.E. 1050 (1916).

manufacturer's negligence produces an article imminently dangerous to human life or health. The Uniform Commercial Code now extends a seller's warranty to "any natural person who might reasonably be expected to use, consume or be affected by the product."[138] Therefore, there are a variety of individuals who may have standing to file suit against a manufacturer. The consumer of the product and the ultimate user are unquestionably appropriate plaintiffs. A parent who miscarries or who has a child born with birth defects may take legal action on that basis.[139] But a child who survives and who is born with a birth defect may not be able to bring suit. The problem here is that some jurisdictions recognize causes of action for pre-natal injuries, but not always for pre-conception injuries. For instance, if a father who is continually exposed to radiation transmits a defective chromosome, the child may not have a cause of action. Whether the injury occurred due to post-conception exposure or pre-conception exposure is difficult to prove and therefore may act to bar suits.

In addition, the employer may sue the manufacturer based upon its damages from medical costs and lost employee time. However, traditional limits on tort recovery solely for economic loss may prevent recovery. In many jurisdictions, a plaintiff cannot recover for economic loss under a negligence or strict liability theory; economic damages are only recoverable where other injuries are pled.[140] Where the loss is primarily economic in nature, the Uniform Commercial Code provides a more appropriate legal remedy through its warranty provisions.[141] Class actions have proven to be another vehicle for recovery, although this type of action may prove to be difficult to maintain due to the substantial variation in exposure and damages among potential class members.

While this article focuses its analysis on claims against the manufacturer of the VDT, plaintiffs may name other defendants based on a product liability theory. The liability of distributors and retailers is coextensive with that of the manufacturer, but they may demand indemnification from the manufacturer. Distributors and retailers are only liable if they have knowledge of the defective design or that a warning is necessary; one who merely endorses a product is not liable for de-

138. U.C.C. § 2-318:2, Ed. Bd. Comment, Alt. C (1983).

139. Jorgenson v. Meade Johnson Laboratories, 483 F.2d 237 (10th Cir. 1973).

140. Moorman Mfg. Co. v. National Tank, 92 Ill. 2d 69, 440 N.E.2d 840 (1982); *but see* People Express Airlines v. Consolidated Rail Corp., 100 N.J. 246, 495 A.2d 107 (1985).

141. Moorman Mfg. Co. v. National Tank, 92 Ill. 2d 69, 440 N.E.2d 840 (1982); *see* Devience, *The Developing Line Between Warranty and Tort Liability Under The Uniform Commercial Code: Does 2-318 Make A Difference?*, 2 DE PAUL BUS. L.J. 295, 314 (1990).

fects.[142] In addition, beyond workers' compensation, employers may be liable in tort. Pursuant to the court's ruling *Johns-Manville Products Corp. v. Superior Court*,[143] the employer may be liable for aggravation of an existing injury through fraudulent concealment of the condition, its cause, and its connection to employment. In *Johns-Manville*, the company physician concealed from the employee the fact that his asbestosis was related to his work. The court therefore allowed recovery against the employer based on the concealment.

Software publishers may also be liable for injuries related to the use of the VDT. A plaintiff may claim the computer is safe for normal use, but the particular type of software heightened the risk. A manufacturer selling to a telephone company may know that the operators will use the machine up to ten hours a day, but a manufacturer is not responsible for anticipating that a poorly designed third party software package requires users to perform twice as many keystrokes as normal or requires unusual key combinations that enhance strain. In fact, the 1990 Chicago Bar Association's Moot Court Competition used this scenario as the basis for its problem case. In the case, drafted by the Bar Association, a child sues a manufacturer of a particular software program based on a product liability theory. The child purchased a video game to be used on his computer. However, due to the peculiar key stroke combinations required for play of the game, the child, after prolonged play, developed carpal tunnel syndrome ("CTS"), a repetitive strain injury. While no case of this sort has yet been brought in a "real" court, the scenario provides insight into the potential claims of injured plaintiffs.

The specific software used by a VDT operator may also be a defense for VDT manufacturers. For example, the manufacturer may claim that the anticipated use of the computer was with database and accounting work only, to be used only a few hours per day. Now, however, with the advent of powerful spreadsheet and desktop publishing programs, many professionals are in front of a computer for eight to ten hours a day. Office design and computer consultants are also subject to suits. A VDT user may have a claim against an office designer on the theory that he or she failed to keep the VDT operator a safe distance from any VDT by failing to specify detached keyboards, large monitors, and widely spaced workstations. It is likely that a claim such as this would not be for strict liability, but for negligence.

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142. *See* Hutson v. Fehr Bros., Inc., 584 F.2d 833 (8th Cir. 1978); Pan-Alaska Fisheries, Inc. v. Marine Construction & Design Co., 565 F.2d 1129 (9th Cir. 1977). *But see* Rice v. Armstrong World Industries, Inc., 683 F.2d 763 (D. Colo. 1987); Kosters v. Seven-Up Co., 595 F.2d 347 (6th Cir. 1979).

143. 27 Cal. 3d 465, 612 P.2d 948, 165 Cal. Rptr. 858 (1980).

A VDT may be defective, though not necessarily ultra-hazardous or abnormally dangerous.[144] The defective condition may result from the manufacturer's failure to warn consumers of the product's dangerous propensities, even if the product is faultless in design, material, and workmanship.[145] This duty to warn is triggered by the existence of a risk that is not known by the ordinary user. Courts utilize both the consumer expectation test and the risk-benefit test in order to determine the necessity of a warning. Under the consumer expectation test, a product is deemed defective only if the average consumer would not expect the product to create a hazard when normally used.[146] The risk-benefit test balances the product's utility with the risks associated with its use. Under this test, even if the danger associated with a product is open and obvious to the average consumer, the manufacturer is liable for damages if the magnitude of the danger outweighs the cost of avoiding that danger.[147]

In *Maquire v. Pabst Brewing Company*[148] and *Pemberton v. American Distilled Spirits Co.*,[149] the courts applied the consumer expectation test and held that risks associated with drinking beer and grain alcohol,

144. Wade, *On The Nature of Strict Tort Liability for Products*, 44 MISS. L.J. 825, 832 (1973).

145. Woodill v. Parke Davis & Co., 79 Ill. 2d 26, 29, 402 N.E.2d 196 (1980); Lee v. Butcher Boy, 169 Cal. App. 3d 375, 215 Cal. Rptr. 195 (1985).

146. Linegar v. Armour of America, 909 F.2d 1150 (8th Cir. 1990); Elliot v. Brunswick, 903 F.2d 1505 (11th Cir. 1990); Lovell v. Marion Power Shovel Co., Inc., 909 F.2d 1088 (7th Cir. 1990).

147. Siminski v. Klein Tools, Inc., 840 F.2d 356 (6th Cir. 1988); Barker v. Lull Engineering Co., 20 Cal. 3d 413, 431, 573 P.2d 443, 455, 143 Cal. Rptr. 225, 237 (1978); O'Brien v. Muskin Corp., 94 N.J. 169, 463 A.2d 298 (1983). Dean Wade has suggested that the following factors be taken into consideration pursuant to the risk-benefit test:

> (1) The usefulness and desirability of the product - its utility to the user and to the public as a whole.
> (2) The safety aspects of the product - the likelihood that it will cause injury and the seriousness of that injury.
> (3) The availability of a substitute product which would meet the same need and not be as unsafe.
> (4) The manufacturer's ability to eliminate the unsafe character of the product without impairing its usefulness or making it too expensive to maintain its utility.
> (5) The user's ability to avoid danger by the exercise of care in the use of the product.
> (6) The user's anticipated awareness of the dangers inherent in the product and their avoidability, because of general public knowledge of the obvious condition of the product, or of the existence of suitable warnings or instructions.
> (7) The feasibility, on the part of the manufacturer, of spreading the loss by setting the price of the product or carrying liability insurance.

Wade, *On The Nature of Strict Liability for Products*, 44 MISS. L.J. 825, 837-38 (1973). *See* KEETON, OWEN & MONTGOMERY, CASES AND MATERIALS ON PRODUCTS LIABILITY AND SAFETY 247-48 (2d ed. 1989).

148. 387 N.W.2d 565 (Iowa 1986).

149. 664 S.W.2d 690 (Tenn. 1984).

respectively, are known to the average consumer. Therefore, no warnings were necessary from the manufacturers of those products due to the conspicuous and obvious nature of the danger. The decision in *Melton v. Deere and Co.*[150] also illustrates the application of this test. The plaintiff was injured when he put his hand into a machine with the motor running. His hand was severely damaged. The machine had on it a warning which the court held was sufficient, given the open and obvious danger of putting one's hand into a running motor. In contrast, the court in *Huffman v. Caterpillar Tractor Co.*[151] held that the danger associated with the use of a hydraulic braking system on a pipe-laying machine was beyond the expectation of the ordinary user of the machine.

Under the consumer expectation test, in order to hold a manufacturer of a VDT liable for injuries resulting from its use, the plaintiff must show that the average consumer or user would not expect to develop injuries such as repetitive strain injuries, musculoskeletal problems, adverse pregnancy outcomes, or vision disorders when using a VDT in its intended or foreseeable manner. These grave harms that may result from the use of a VDT are somewhat avoidable by a user who has adequate warnings regarding correct usage. "Even the best designed workplace will be ineffective in controlling job and health problems in VDT use if operators are unfamiliar with methods of adjustment or operation of equipment and facilities" states Steve Sauter, of the Department of Preventive Medicine of the University of Wisconsin.[152] One sufferer of carpal tunnel syndrome complains that "[computer] manufacturers should have warned people; I never heard a word about RSIs until people started having problems."[153]

While there appears to be no defense available for manufacturers of VDTs related to their duty to warn, manufacturers have found a relatively safe harbor until now in the "state-of-the-art" defense. The Restatement[154] imposes an obligation on the manufacturer to warn of those risks of which it is aware or should be aware. Conversely, the Restatement imposes on the manufacturer no duty to issue warnings regarding risks not known or reasonably known. Manufacturers claim that the causal connection between the use of VDTs and alleged health effects is inconclusive. Therefore, no reasonable manufacturer should know of the hazards involved in the use of the VDT. Consequently, the

150. 887 F.2d 1241 (5th Cir. 1989).

151. 908 F.2d 1470 (10th Cir. 1990).

152. S. SAUTER, *supra* note 27, at 9.

153. Hembree & Henry, *A Newsroom Hazard Called RSI*, COLUM. JOURNALISM REV., Jan.-Feb. 1987, at 19, 21.

154. RESTATEMENT (SECOND) OF TORTS § 402(A), comment j (1965).

Court in *Woodhill v. Parke Davis & Co.*[155] held that a plaintiff must show that the manufacturer of a product had or should have had knowledge of the dangerous propensities of its product in order to avoid making the manufacturers insurers of their product's safety. The Illinois Supreme Court considered whether the defendant "ha[d] knowledge, or by the application of reasonable, developed human skill and foresight should have [had] knowledge" of the dangerousness of the product.[156] The court then concluded that: "Once it is established that knowledge existed in the industry of the dangers of the manufacturer's product, then the plaintiff must establish that the defendant did not warn, in an adequate manner, of the danger."[157]

The impact of this kind of holding is that a court will not hold a manufacturer liable where the injury results from a completely unexpected danger in connection with an apparently innocuous product.[158] The New Jersey Supreme Court, which has been the catalyst for much of the expansion of products liability doctrine, recently retreated from its position that "unknowability" is no defense to a defective product claim. The court, in *Beshada v. Johns-Manville Products Corp.*,[159] suggested that the company was liable for failing to warn of risks even before health hazards to the general public were known. Later, in *Feldman v. Lederle Laboratories*,[160] the same court limited *Beshada* to its facts because that case involved data and other information that was generally available that could or should have alerted the manufacturer at an early stage to the dangers associated with the product's use.

In a recent case, *Novak v. United States*,[161] the Sixth Circuit held that a warning in a consent form for a swine flu vaccine was adequate but that, in light of the scientific knowledge available at the time of the vaccination, there was no duty to warn of the possibility of the plaintiff's resulting illness. However, several courts have rejected the state-of-the-art defense. A Kansas court held that "[w]here scientific or medical evidence exists tending to show that a certain danger is associated with the use of [the product], the manufacturer may not ignore or discount that information in drafting its warning solely because it finds it to be unconvincing."[162] That same year, a Missouri court ruling in con-

155. 79 Ill. 2d 26, 402 N.E.2d 196 (1980).

156. Woodhill v. Parke Davis & Co., 79 Ill. 2d 26, 35, 402 N.E.2d 196, 198 (1980); *see also* RESTATEMENT (SECOND) OF TORTS § 402(A), comment j (1965).

157. Woodill v. Parke Davis & Co., 79 Ill. 2d 26, 35, 402 N.E.2d 196, 198 (1980).

158. *See also* Elgin Airport Inn, v. Commonwealth Edison Co., 89 Ill. 2d 138, 432 N.E.2d 259 (1982).

159. 90 N.J. 191, 447 A.2d 539 (1982).

160. 97 N.J. 429, 479 A.2d 374 (1984).

161. 865 F.2d 718 (6th Cir. 1989).

162. Wooderson v. Ortho Pharmaceutical Corp., 235 Kan. 387, 681 P.2d 1038, 1042, *cert. denied*, 469 U.S. 965 (1984).

nection with an asbestos product liability case held that "state of the art evidence has no bearing on the outcome of a strict liability claim; the sole subject of inquiry is the defective condition of the product and not the manufacturer's knowledge, negligence or fault."[163]

In other related cases, the bases of expert opinions have become the subject for contention. Where the state of the knowledge of an industry is in dispute, courts must rely on the testimony of various industry experts. In *Ferebee v. Chevron Chemical Co.*,[164] an expert testified that the plaintiff's injuries were caused by long term, low level exposure to a certain chemical. However, there were no statistical or animal studies that evidenced such exposure would or could cause the resulting injuries. The court held that the expert's testimony was admissible nonetheless and could serve as support for the plaintiff's ultimate award. Other courts have examined the *basis* of the expert's opinion much more closely. In *In Re Agent Orange Product Liability Litigation*,[165] the judge held that an expert's opinion was inadmissable as evidence unless it was grounded on verifiable propositions of fact. Brodeur contests this legal conclusion related to the state of the industry's knowledge. He argues that determination of the causes of a disease should not be by consensus but by laws of biology.[166]

At present, RSIs are the subject of at least two pending federal suits. In Colorado, twenty-nine directory assistance operators employed by Mountain Bell have filed an action against Computer Consoles, Inc. and Computer Consoles Service Corporation, the manufacturer and distributor of the computer equipment used by the operators.[167] The plaintiffs allege the following: (1) the VDTs manufactured and sold by the defendants were ergonomically defective; (2) the defendants failed to eliminate the defect or to warn the ultimate users of the defects, risks, and dangers of the machines; and (3) the defendants failed to instruct the users concerning the proper and safe use of the machines.[168] The Complaint also requests relief based on negligence and breach of warranties claims.[169] One hundred fifty employees at Mountain Bell suffered similar problems (forty of whom were diagnosed as having repetitive strain injuries), and many employees sought workers compensation.[170] David LeGrande, Health and Safety Director for

163. Elmore v. Owens-Illinois, Inc., 673 S.W.2d 434, 437-38 (Mo. 1984).

164. 736 F.2d 1529 (D.C. Cir. 1984).

165. 611 F. Supp. 1223 (E.D.N.Y. 1985), *aff'd*, 818 F.2d 187 (2d Cir. 1987).

166. Brodeur, *supra* note 5, at 136.

167. Merrill v. Computer Consoles, Inc., No. 87-B-1784, (D. Colo., filed Nov. 25, 1987).

168. *Id.* Complaint, ¶ 12.

169. *Id.* ¶¶ 15-24.

170. Welch & Bayer, *Watch for Health Complaints*, CHICAGO DAILY L. BULL., Mar. 8, 1989, at 4, 18.

Communication Workers of America, states that the international and local unions first approached Mountain Bell management in 1986 with the results of a worker survey. LeGrande attributes the health problems experienced by Mountain Bell employees to the poor design of the particular model of VDT used by the company.

The second case filed against a manufacturer of VDTs was *Harrigan v. Electronic Pre-Press Systems, Inc.*[171] Two groups of journalists filed suit against Atex, Inc. based on injuries resulting from allegedly defective VDTs and keyboards sold by Atex. The total amount of claims is over $300 million. The plaintiffs are reporters from the Associated Press, *New York Newsday*, *American Banker*, *Discount Store News*, and *The Village Voice*. They claim that the defendant is strictly liable as it knew that the VDTs were used for reporting and editing and that the use of these VDTs would expose the workers to the risk of repetitive strain injuries. The plaintiffs claim that Atex disregarded evidence of the relationship between VDT use and repetitive strain injuries. They also allege that the defendant was negligent in warning users of the potential hazards of using the VDTs and related equipment and in defectively designing the equipment. Further, the spouses of the affected journalists have joined in the actions, demanding additional amounts for loss of support.[172]

III. ALTERNATIVES TO STRICT LIABILITY

A. ALTERNATIVES FOR COMPENSATION OF INJURED EMPLOYEES

1. *Workers' Compensation*

The exact number of worker's compensation claims related to VDT use is difficult to ascertain as they are not designated VDT-related when filed. Sharon Danann, Research Director for 9 to 5, the National Association of Working Women, stated that the claims filed represent only the "tip of the iceberg."[173] In contrast, the National Council on Compensation Insurance reports that the number of VDT-related claims is rather small.[174] This, the Council suggests, is due to the fact that many of the types of disabilities associated with VDT use are temporary in nature, and workers' compensation covers only those claims that persist beyond a mandatory waiting period.[175] For example, vision problems due to VDT use are usually temporary. Because the Council

171. Dist. Ct., S.D.N.Y., No. 90-CIV-4081, filed June 15, 1990.

172. Booker, *Users Haul Atex to Court*, COMPUTERWORLD, July 2, 1990, at 57.

173. Bureau of National Affairs, *VDTs in the 1990's: Advancing Technologies, Mounting Concerns*, BNA EMPLOYEE REL. WKLY, July 30, 1990, at 11.

174. *VDTs and Office Safety: An Overview*, National Council on Compensation Insurance, N.Y., N.Y., 1986.

175. Bureau of National Affairs, *VDTs in The Workplace: New Issues, New Answers*, 1

refuses to recognize any causal link between VDT radiation emissions and adverse health effects, they report few, if any, radiation-related claims. The reported claims are mostly concern concentrated in musculoskeletal problems.

Workers' compensation claims are difficult to win because the employee must prove that the injury is work-related. Therefore, many injured parties merely collect unemployment insurance for their lost time at work. Unemployment insurance requires no showing that the work has been missed due to a work-related injury, as does workers' compensation.[176] Further, while medical expenses and two-thirds of lost wages are recoverable, compensation for pain and suffering is not recoverable in a worker's compensation case.[177] Most employees simply do not know that their health problems may be work-related, say union officials.[178]

An employee may have a tort claim under the state workers' compensation statute if the actions of the employer amount to "serious and willful" misconduct.[179] This may occur if the employer knew of the danger present and of the consequences and *deliberately* failed to take appropriate steps to protect its employees.[180] Gross negligence is insufficient.[181] This "deliberateness" would appear to be difficult to prove and, as a matter of fact, has not been found by any court in connection with VDT-related injuries.

The employee must show only causation to recover actual damages. However, with the research in the area, this may be a great burden on the employee. Fortunately, all reasonable doubts are to be resolved by the courts in favor of the employee,[182] and there is sufficient evidence

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LABOR RELATIONS WEEK 59 (2d Ed. 1987); *see also* National Council on Compensation Insurance, *supra* note 174.

176. Conley & Noble, *Workers' Compensation Reform: Challenge for the 80's*, in I RESEARCH REPORT OF THE INTERDEPARTMENTAL WORKERS' COMPENSATION FORCE 9, 15, 18-19 (1979).

177. *Id.*

178. Bureau of National Affairs, *supra* note 18, at 11.

179. Trupiano v. Swift & Co., 755 F.2d 442 (5th Cir. 1985); McDaniel v. Johns-Manville Sales Corp., 487 F. Supp. 714 (N.D. Ill. 1978). *See* Annotation, *Employer's Tort Liability to Worker for Concealing Workplace Hazard or Nature or Extent of Injury*, 9 A.L.R. 4th 778 (1990).

180. *See* Johns-Manville Products Corporation v. Superior Court, 27 Cal. 3d 465, 612 P.2d 948, 194 Cal. Rptr. 51 (1980).

181. *See generally* Annotation, *What Conduct is Willful, Intentional, or Deliberate Within Workers' Compensation Act Provision Authorizing Tort Action for Such Conduct*, 96 A.L.R.3d 1064 (1990).

182. Geddes v. Benefits Review Board, U.S. Dept. of Labor, 735 F.2d 1412 (D.C. Cir. 1984); Hensley v. Washington-Metro Area Transit Authority, 655 F.2d 264 (D.C. Cir. 1981); Newport News Shipbuilding v. Director, Office of Workers' Compensation Programs, U.S. Dept. of Labor, 583 F.2d 1273 (4th Cir. 1978).

of potential harm from VDTs.

A separate problem arises regarding standing to recover under workers' compensation laws. Most statutes allow recovery for legitimate, job-related radiation injuries to the employees themselves but will not allow compensation for spontaneous abortions, miscarriages, birth defects, or other genetic injuries since this class of injury has no effect on the worker's earning power.

2. *Unemployment Compensation*

The purpose of unemployment coverage is to "enable unfortunate employees, who become and remain involuntarily unemployed by adverse business and industrial conditions, to subsist on a reasonably decent level."[183] If an employee must leave his or her employment due to illness or disability, many courts have held that the employee is covered if the employee can show that the condition is so severe as to render the departure involuntary. Some courts have interpreted this to include mental breakdowns.[184] These courts have not required proof of any causal relationship between the employment and the resulting injury in order to recover unemployment compensation, which would benefit those who claim injuries caused by computers.[185] However, other courts have held that such a departure is voluntary and therefore uncompensable.[186]

All courts have held that if the employee is presently fit for any type of employment, he or she may recover no benefits.[187] Pregnant women also may recover unemployment compensation if they choose not to work at a VDT due to concerns regarding the health of their fetus from stress or radiation exposure. Courts have held that it is a violation of Title VII of the Civil Rights Act for an employer to fail to make reasonable accommodation for employees who seek less potentially dangerous work during the term of their pregnancies.[188] The approval of these claims, however, is based on the claimant's ability to persuade the court that her fetus may be harmed, a burden that may be relatively difficult based on the state of today's medical knowledge.

3. *Handicap Discrimination Suits*

Handicap discrimination suits are another possible method by

183. 76 AM. JUR. 2D *Unemployment Compensation* § 5 (1991).

184. Quenot v. Iowa Dept. of Job Services, 339 N.W.2d 624 (Iowa 1983); Central Data Centers v. Pennsylvania Unemployment Comm., 458 A.2d 335 (Pa. Commw. Ct. 1983).

185. 76 AM. JUR. 2D *Unemployment Compensation* § 64 (1991).

186. *Id.*

187. *Id.*

188. *Id.* at § 74. *See also* Hayes v. Shelby Mem. Hosp., 726 F.2d 1543 (11th Cir. 1984); Zuniga v. Kelburg Cty. Hosp., 692 F.2d 986 (5th Cir. 1982).

which the injured employee may recover for damages suffered. Four telephone operators in Washington filed a complaint in January 1990 against King County alleging that the county failed to accommodate their handicap, a repetitive strain injury.[189] The operators' requests for adjustable equipment was denied by their employer. The court has yet to rule on the issue.

B. LEGISLATIVE ALTERNATIVES

The "Radiation Control for Health and Safety Act of 1968"[190] gives the Bureau of Radiological Health the authority to set maximum radiation exposure safety standards. The Act regulates the CRTs used by VDTs and prohibits exposure rates that "exceed 0.5 milliroentgens per hour at a distance of five centimeters from any point in the external surface of the receiver . . . ."[191] But the Bureau developed this standard in connection with television sets, which was the stimulus for the original legislation. A viewer's use of a television set differs substantially from a worker's use of a VDT. It should be noted that the ionizing radiation standard for American manufacturers is 1000 times less restrictive than Soviet standards. Therefore, separate legislation regulating not only the maximum allowable radiation exposure, but also the proper design of the VDT, is warranted.

On June 23, 1981, Suffolk County, New York, became the first local legislature to pass a comprehensive statute regulating the use of VDTs purchased after January 1, 1989.[192] The county legislature concluded that preventing VDT injuries before they occurred was in the public interest and designed Local Law 21 with that express purpose.[193] The statute was subsequently struck down by the New York Supreme Court in December 1989.[194] The case is presently on appeal.[195] Opinions regarding the law were varied. As a brief on the appeal stated, "[t]he importance of local governments taking innovative steps to confront serious health, safety and environmental problems should not be underestimated. Often, a program which succeeds on a small scale becomes the archetype for addressing problems of state and national scope."[196] AT&T Vice President David Chittick called the legislation "one more

189. Palmer v. King County, No. 90-2-02650-7 (Wash. Sup. Ct., filed Jan. 30, 1990).

190. 42 U.S.C. §§ 263(b)-(3) (1990).

191. 21 C.F.R. § 1020.10(c) (1990).

192. Suffolk County Resolution No. 378-1988, adopting Local Law No. 21, 1988.

193. *Brief of Amicus Curiae*, Comm. Workers of America, at 6; ILC Data Device Corp., v. County of Suffolk, No. 90-01134.

194. ILC Data Device Corp. v. County of Suffolk, 146 Misc. 2d 462, 550 N.Y.S.2d 993 (1989), *appeal filed*, No. 90-01134 (Dec. 27, 1989).

195. ILC Data Device Corp. v. County of Suffolk, No. 90-01134 (filed Dec. 27, 1989).

196. *Id.* at 39.

burden for business to carry around."[197] The legislation applied only to VDTs purchased after January 1, 1989.

In December 1990, the San Francisco County Board of Supervisors passed Ordinance No. 405-90 (as amended by Ord. No. 17-91, Jan. 7, 1991) that provided employee education into workstation standards and other job modification regulations. Based on the Supervisor's findings relating to the causal connection between computer use and adverse health effects,[198] the statute provides that each position which requires repetitive keyboard motions for four hours or more per shift also provide fifteen minutes per hour of alternative work.

Colorado, Massachusetts, New Mexico, Washington, and Wisconsin have enacted statutes to establish machine performance and ergonomic standards for VDTs, and thirty other states are considering these same laws.[199] Maine has enacted legislation to study various aspects of the problem.[200] Legislation in Connecticut has been enacted requiring a review of the available literature and a report to the legislature.[201] Other legislation has been introduced requiring inspection and maintenance of VDT equipment and eye exams for VDT users.[202] California requires state universities and colleges to consider human and ergonomic factors in selecting and procuring office equipment and related support equipment.[203] Maine now requires employers with twenty-five or more terminals in one location to train employees who use VDTs four or more hours per day. The Massachusetts Legislature has proposed a law which would require employers to provide pregnant VDT operators alternative radiation-free employment opportunities during the period of their pregnancies. A vote on this bill has been postponed in anticipation of the expected publication of the NIOSH report related to its study of AT&T operators later this year.[204] Germany, Norway, and Sweden have government standards regarding VDTs, and two Canadian provinces and Great Britain are considering their imposition.

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197. Bureau of National Affairs, *supra* note 18, at 114. Oregon Governor, Victor G. Atiyeh, vetoed an Oregon bill regulating the operation of VDTs, finding that such a law would be harmful to the state's business climate. Weinstein, *Explosion in Use of VDTs Spurs Regulation Debate*, L.A. Times, Aug. 10, 1985, pt. 1, at 1, col. 1.

198. Ord. 405-90, § 1301(b), (c).

199. *Maryland Legislature Kills Measures That Would Have Required Ergonomic Stations*, 15 OCC. SFTY. FOR HLTH. REP. 1071 (1986). See also the following statutes, Calif.: A.B. 3175; Illinois: H.B. 2397; Mass.: H.B. 2910; Minn.: S. 2217; Ohio: H.B. 552; Rhode Isl.: H. 7012; Wisc.: LRB 364312.

200. Maine H.P. 1265 LD 1675.

201. Conn. S.B. 8110.

202. C.B. 5763.

203. CAL. EDUC. CODE § 67420 (Deering 1990).

204. Bureau of National Affairs, *supra* note 18, at 14.

There are presently two bills before Congress[205] that recommend the formation of fact-finding research teams to investigate the connection between VDT use and resulting health problems.[206] However, a 1985 House Education and Labor Committee's Subcommittee on Health and Safety staff report concluded that legislative standards would inhibit the flexibility of employers and employees in getting the best use of VDTs.[207] The staff report found that, based on the steady infiltration of VDTs into the workplace, employers and employees must work together in order to resolve the problems. "Is the Congress or any other legislative body prepared to tell an employer that an employee must be given other tasks to do as a form of respite from VDT work?"[208]

The answer to that purportedly rhetorical question must be a resounding "Yes!" The Newspaper Guild has proposed a Model State Act to Provide Occupational Safeguards for Operators of VDTs. This act attempts to incorporate the state of current knowledge regarding the potential for harm from VDTs. If manufacturers are not going to voluntarily address these issues by eliminating product defects or by issuing warnings regarding proper and safe use of VDTs, state and federal legislatures must protect the employee who has no information or control regarding his or her own protection. Employers, who emphasize output, will not voluntarily make the changes that may reduce output. Neither will manufacturers. Management may not even be aware of the problems or the solutions.[209] "Without [VDT legislation], employees, particularly that vast number without union protection, are at the mercy of employers of whom the [sic] great majority are, at best, ambivalent on VDT protective measures. And where health is concerned, that just isn't good enough."[210]

IV. POTENTIAL FOR SEX DISCRIMINATION IN APPLICATION OF PROTECTIVE LEGISLATION

In many ways, women and men face similar risks from long periods of exposure to VDTs. Studies indicate that most of the dangers of VDT

205. H.R. 4801 and H.R. 4873.

206. *Preventive Medicine, supra* note 62, at 83.

207. Bureau of National Affairs, *supra* note 18, at 119.

208. *Id.* at 120; OVERSIGHT OF OSHA WITH RESPECT TO VIDEO DISPLAY TERMINALS IN THE WORKPLACE, STAFF REPORT FOR THE SUBCOMMITTEE ON HEALTH AND SAFETY OF THE COMMITTEE ON EDUCATION AND LABOR, HOUSE OF REPRESENTATIVES, NINETY-NINTH CONGRESS, FIRST SESSION, 1985.

209. Palermo, *A Case Study: Comparison of An Automated Work Environment To Proposed State Laws*, Proceeding of the 1984 International Conference on Occupational Ergonomics, Human Factors Assn. of Canada, Rexdale, Ont. *See also* EISEN & LEGRANDE, *supra* note 126.

210. EISEN & LEGRANDE, *supra* note 126, at 13.

radiation emissions are gender neutral.[211] In some ways, however, men and women may face different risks. The hazards of VDTs may disproportionately burden women because women dominate the clerical workplace.[212] The risks posed by radiation may affect men and women differently and, as explained above, are especially dangerous to pregnant women and their unborn children.[213] In addition, women also seem to be slightly more susceptible to cataracts than men, and women are more susceptible to carpal tunnel syndrome as their wrists are narrower than men's. Pregnant women are also more prone to the syndrome as they retain fluid that impedes wrist movement. Men's genitals, however, are more susceptible to radiation hazards than are women's genitals because the male genitals lack protective tissue layers.[214] Men and women may thus experience hazards that are different in kind, but not necessarily in effect or intensity.

Whether VDT radiation affects men and women differently provides the basis for regulation of VDTs. The problem with regulating VDTs is that legislators and regulators cannot look solely to science for guidance in deciding whether to consider men and women equally susceptible to VDT radiation emissions. They must look to social and legislative goals — in this case, the goals of promoting workers' health and promoting sexual equality in employment.[215] The query regarding the potential for discriminatory behavior under the guise of fetal or female protection is difficult as employees should receive warnings regarding VDT use even where the risk remains a mere potentiality, while discrimination against women should not be tolerated where it is based solely on that same mere potentiality.

Despite the absence of conclusive evidence that men and women face dissimilar hazards, women have been treated differently than men in the workplace. Employer exclusion of fertile women from particular jobs[216] and legislative "protection" of women from risks of allegedly hazardous employment[217] have been justified in the past by inconclu-

211. Scott, *The Mechanization of Women's Work*, SCI. AM., Sept. 1982, at 166, 176.

212. *Id.*

213. Sigler, Lilienfeld, Cohen, and Westlake, *Radiation Exposure in Parents and Children and With Mongolism*, 48 JOHNS HOPKINS HOSP. BULL. 396 (1931); *Birth Defect and Miscarriage Clusters Stir Up More Fears Over VDT's*, MICROWAVE NEWS, Nov. 1981, at 1.

214. Sigler, Lilienfeld, Cohen, and Westlake, *supra* note 213.

215. Occupational Safety and Health Act § 651(b), 29 U.S.C. § 651(b) (1988); American Smelting and Ref. Co. v. Occupational Safety and Health Review Comm'n, 501 F.2d 504, 505 (8th Cir. 1974); Lederberg, *The Freedoms and the Control of Science: Notes from the Ivory Tower*, 45 S. CAL. L. REV. 596, 609-10 (1972).

216. *See* Howard, *Hazardous Substances in the Workplace: Implications for the Employment Rights of Women*, 129 U. PA. L. REV. 798, 806 (1981); Wright v. Olin Corp., 697 F.2d 1172, 1190 n.27 (4th Cir. 1982).

217. Wright v. Olin Corp., 697 F.2d 1172, 1188 (4th Cir. 1982); Muller v. Oregon, 208

sive evidence. Inconclusive evidence formed the basis for one Canadian company's transfer of four pregnant women to non-VDT work with no loss in pay.[218] A review of VDT clauses in major collective bargaining agreements reveals no distinction between male or female operators,[219] but at least one major union, the United Auto Workers, acknowledges that VDTs raise questions of more adverse health effects to women.

The regulators must weigh concerns over women's health and sexual equality in the work force. For example, under the approaches described above, women may receive preferential health protection, but may simultaneously lose employment opportunities. The Pregnancy Discrimination Act[220] is the basis for judicial decisions regarding the employers' policies.

The Fourth Circuit has already mandated gender-neutral treatment of susceptible employees in the absence of evidence sufficient to justify differential treatment. That court, in examining the fetal vulnerability issue in the context of hazardous work place chemicals, found that an employer's policy of excluding fertile women from particular positions violated Title VII of the Civil Rights Act of 1964.[221] The court reasoned that the standard for justifying such an exclusionary program must include "the significance of the risk, the extent of its confinement to the unborn children of women as opposed to men workers, the consequent necessity of protective measures confined to women workers, and the effectiveness of the actual program for the intended purposes as established by independent, objective evidence."[222]

Fetal protection policies are currently in the news[223] due to the recent case, *International Union, UAW v. Johnson Controls, Inc.*,[224] in which the defendant company initiated a policy pursuant to which wo-

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U.S. 412, 421-23 (1908); *see* KAY, TEXT, CASES AND MATERIALS ON SEX-BASED DISCRIMINATION 7-9 (2d Ed. 1981).

218. *Pregnant CRT Operators Win Work Boycott*, COMPUTERWORLD, Apr. 20, 1981, at 14.

219. These observations are based on VDT clauses in contracts with the Bay Area Typographical Union, No. 21 and on Standard Contract language proposals of the Service Employees International Union, AFL-CIO, CLG, and International Typographical Union (23) B. BROOKS, GUIDE TO VISUAL DISPLAY UNITS 9 (U.A.W., June 1982).

220. Pub. L. No. 95-555, § 1, 92 Stat. 2076 (1978) (codified as 42 U.S.C. § 2000e (1990)) (amending § 701 of the Civil Rights Act of 1964).

221. Wright v. Olin Corp., 697 F.2d 1172, 1187 (4th Cir. 1982).

222. Wright v. Olin Corp., 697 F.2d 1172, 1190 (4th Cir. 1982); Howard, *supra* note 216, at 854-55.

223. Oil, Chem. and Atomic Workers Int'l Union v. American Cyanamid Co., 741 F.2d 444 (D.C. Cir. 1984); Brierton, Lichter-Heath, *Fetal Protection Policies: Balancing The Interests of The Employee, Employer and The Unborn Under Title VII*, LABOR L. J., October 1990, at 725; Paskal, *Dilemma: Save The Fetus or Sue The Employer*, 39 CCH LABOR L. J. 323 (1988).

224. 886 F.2d 871 (7th Cir. 1989).

men of childbearing years could not be assigned to certain positions within the company due to those positions' exposure to lead.

The Seventh Circuit noted that the "business necessity" defense may act as a shield for the defendant's policy and said the policy may also be justified under the "bona fide occupational qualification" defense. "The touchstone of this inquiry [into the business necessity defense] is a reasoned review of the employer's justification for the use of his challenged practice. A mere insubstantial justification in this regard will not suffice, because such a low standard of review would permit discrimination to be practiced through the use of spurious, seemingly neutral employment practices. At the same time, though, there is no requirement that the challenged practice be 'essential' or 'indispensable' to the employer's business for it to pass muster: this degree of scrutiny would be almost impossible for most employers to meet, and would result in a host of evils."[225]

The Supreme Court applied a similar analysis but reached the opposite conclusion when *Johnson Controls* was appealed.[226] The court ruled that, as the policy only applied to women, the policy did not "effectively and equally protect the offspring of all employees."[227] Further, as the policy differentiated between women and men "because of or on the basis of pregnancy, childbirth or related medical conditions," the policy directly violated the Pregnancy Discrimination Act.[228]

The Court concluded that Johnson Controls' policy was not gender neutral and therefore violated Title VII "because it does not apply to the reproductive capacity of the company's male employees in the same way as it applies to that of the females. Moreover, the absence of a malevolent motive does not convert a facially discriminatory policy into a neutral policy with a discriminatory effect . . . . The beneficence of an employer's purpose does not undermine the conclusion that an explicit gender-based policy is sex discrimination under § 703(a) [Title VII] and thus may be defended only as a BFOQ [Bona Fide Occupational Qualification]."[229]

The Court then rejected Johnson Controls' claim that its fetal protection policy falls within a "safety exception" to the BFOQ requirement.[230] The Court held that "the BFOQ provision and the PDA, which amended it, as well as the legislative history and the case law, prohibit an employer from discriminating against a woman because of

225. International Union, UAW v. Johnson Controls, 886 F.2d 871, 887 (7th Cir. 1989). *See also*, 58 U.S.L.W. 3568, 3/6/90, Case No. 89-1215.

226. 111 S. Ct. 1196 (1991).

227. *Id.* at 1203.

228. *Id. See* Pregnancy Discrimation Act of 1978, 42 U.S.C. § 2000(e)(k) (1988).

229. 111 S. Ct. at 1203-04.

230. *Id.* at 1205.

her capacity to become pregnant unless her reproductive potential prevents her from performing the duties of her job."[231]

Women's issues are characteristically undervalued by society. "There's a very deep cultural bias about office work being light stuff. But stress is real, not imagined. People do get carpal tunnel syndrome and have to have operations on their wrists. People do have chronic back problems. We don't do anything about it because culturally we don't take women's work seriously."[232]

The twentieth century clerical work force faces potential dangers from the radiation emissions of VDTs. The widespread use of VDTs, the gravity of potential dangers to VDT operators and to their unborn children, and the national goal of protecting the public from radiation all compel the adoption of new standards designed specifically to protect VDT operators. The national goal of equality of employment opportunity for both sexes compels the adoption of gender-neutral standards.[233]

V. CONCLUSION

As there appears to be some possible connection between VDT use and various injuries, whether due to ergonomic-related problems or radiation problems, manufacturers must begin to warn users of these potential dangers and direct users to take precautions with the assistance of the employers. Such warnings would not be difficult to disseminate and would be practically cost-free to the manufacturer, as compared with any attempt to alter the radiation emissions or general design of the computer.

While there appear to be several solutions users may implement to protect against some of the health hazards of using a VDT, users do not have the appropriate information with which to protect themselves. Warning and educating the users is necessary. Further, as employers become more educated about the risks of VDT use, they will educate their employees in order to prevent losses from increased employee sick days. However, this voluntary education program should not replace the liability to be imposed on manufacturers for injuries that continue to occur related to the use of the computers.

While it appears easy to warn users of potential problems with VDT use and ways to address them, manufacturers are hesitant to insert or disseminate warnings until they are regulated by the government. No one manufacturer wants to be the first to warn its

231. *Id.* at 1207.

232. Weinstein, *supra* note 197, at 27.

233. McCloud, *Pink Collar Blues: Potential Hazards of Video Display Terminals Radiation*, 57 S. CAL. L. REV. 139, 171 (1983).

consumers. They do not want it to be misunderstood that their product is the only one that warrants a warning, just because no other manufacturer has warned the consumer about its product.[234] Therefore, regulation or large court awards may be the only way to coerce manufacturers to conform to the best interests of their consumers.

One may recall the response to cigarette-caused lung cancer in the 1950s. Before warnings were issued concerning the potential health hazards of cigarette smoking, few people considered the two to be related. The link between VDT use and various serious and severe disorders may be just as disastrous.

234. Manufacturers may choose to issue no warning to avoid jeopardizing their marketing strategy. *See* Salmon v. Parke Davis & Co., 520 F.2d 1359, 1362 (4th Cir. 1975) (Manufacturers must ensure that selling efforts do not erode the effectiveness of otherwise adequate warnings.).