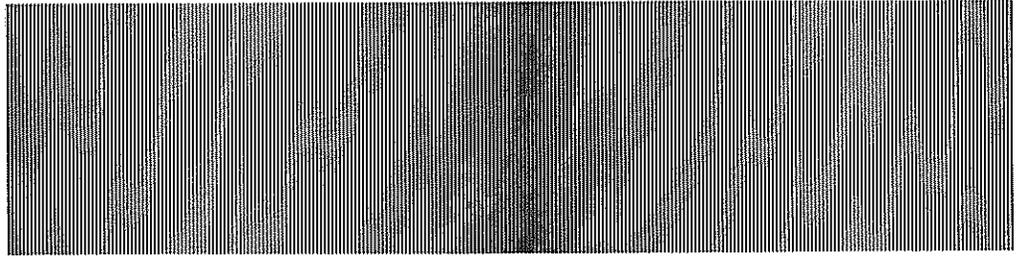


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Deciphering Wire Codes: USC Data Analysis Continues

With the release of Dr. John Peters's findings of a significant association between childhood leukemia and wire codes—but only a weak, nonsignificant association with measured electromagnetic fields (EMFs)—researchers are again asking: What do wire codes reveal about EMF exposures that short-term and spot measurements do not?

Among the variables under study are high frequency transients, angles of the magnetic fields, the earth's magnetic field, resonance conditions, on-and-off field exposures, ground currents and harmonics—as well as non-EMF factors, such as traffic density.

Dr. Nancy Wertheimer told *Microwave News* that a number of researchers who attended the Electric Power Research Institute's (EPRI) workshop, held February 5-8 in Carmel, CA, felt that, "There seems to be something with wire codes—let's find out what it is." Wertheimer and Ed Leeper, both based in Boulder, CO, devised wire coding as a method to estimate residential magnetic field exposures for their landmark 1979 study.

Peters, an epidemiologist at the University of Southern California (USC) in Los Angeles, presented preliminary results of his study at the EPRI workshop (see *MWN*, J/F91 and p.13). EPRI sponsored the USC study.

Data analysis on the five-year study continues. Dr. Joseph Bowman, a member of Peters's team, told *Microwave News*, "We have a lot more data than went into the report that EPRI released." Bowman, who recently left

(continued on p.12)

NIOSH Finds No VDT Miscarriage Risk; EMF Conclusion Sparks Debate

Telephone operators who use conventional cathode ray tube (CRT) video display terminals (VDTs) are no more likely to miscarry than are those who use other types of displays, according to a long-awaited epidemiological study by the National Institute for Occupational Safety and Health (NIOSH) in Cincinnati, OH. The NIOSH team did not find a dose-response relationship between the number of hours spent at a VDT and the risk of miscarriage, and there was no evidence of an excess risk when the data were broken down into early and late miscarriages.

NIOSH will use the same data set for a study on VDTs and birth defects, low birth weight and pre-term births—these results are expected to be released in about a year and a half.

In the March 14 issue of *The New England Journal of Medicine*, Dr. Teresa Schnorr and coworkers concluded that, "The use of VDTs and exposure to the accompanying electromagnetic fields [EMFs] were not associated with

(continued on p.10)

« Power Line Talk »

As the invited luncheon speakers at *Transmission & Distribution* magazine's *Conference on Electric and Magnetic Fields* on February 26, U.S. Rep. Frank Pallone (D-NJ) and *The New Yorker's* Paul Brodeur expressed concerns about past utility funding of EMF research and the move toward joint utility-government sponsorship. Asked during Q&A about this funding strategy proposed by the Large Public Power Council and now being pursued by the Health Effects Institute (see *MWN*, M/J90 and p.6), Pallone warned that it is necessary to avoid even the appearance of bias. Brodeur charged that the industry is dealing with EMFs as a public relations problem instead of as a medical issue. He asked the conferees whether they were "beginning to realize that EPRI has been telling you all this time not what you needed to know but what it thought you wanted to hear?" He challenged the positions of EEPA, EEI, EPRI, ERI and IEEE, branding them "wagons of the electric utility industry's E-train." Brodeur issued a warning: "As the lawsuits proliferate, so will damage awards, out-of-court settlements and legal costs....there will be a firestorm of public outrage that will result in major regulatory changes in the way utilities are allowed to conduct their business."

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Does living near power lines increase the risk of developing cancer? The *Journal of the American Medical Association* posed this question to Dr. David Savitz of the University of North Carolina in Chapel Hill. In his response, published in the March 20 issue, Savitz said: "Most reviewers of [the scientific literature] conclude that it falls short of demonstrating a causal relationship.... Nonetheless, from a public health perspective, [there] are clear suggestions of potential adverse effects on health that should be taken seriously." Ongoing research should help resolve the uncertainty, he added, predicting "substantial progress" in the next two to three years. In the meantime, the present level of knowledge is a "sufficient basis for some concern," Savitz advised, "but not necessarily action."

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The U.K.'s National Radiological Protection Board (NRPB) has joined the call for more research into EMF health effects. The lead editorial in the February 1991 issue of the NRPB's *Radiological Protection Bulletin* states that no firm EMF-cancer link has been established but adds that, "It is essential, however, that sufficient research in this area continues to be undertaken, covering epidemiology, experimental and theoretical studies, to enable exposure standards to be confirmed or revised if necessary on the basis of developing scientific knowledge." The NRPB is in the process of reviewing EPA's report on EMFs and cancer (see *MWN*, J/F91).

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In January, the Colorado Public Utilities Commission (PUC)

adopted rules requiring utilities to provide new customers with information that compares the cost of extending electric service to the cost of alternative photovoltaic solar power. Although the PUC points to the positive economics of solar energy, the new rules may be the result of a December 1989 PUC statement which cited the need for alternative power supply sources to reduce EMF levels from power lines. That report recommended a policy of prudent avoidance, stating that utility system upgrades are "no longer acceptable" unless efforts are made to "reduce or mitigate the necessity" for such enhancements (see *MWN*, N/D89). In that decision, the PUC granted permission for two new high voltage power lines. However, on February 7, Douglas County Judge Thomas Curry reversed the PUC's approval of the lines—but did prudent avoidance get struck down also? Stay tuned.

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The *Los Angeles Times* has set a precedent by becoming the first major American daily to cover the EMF controversy on its editorial page. In the February 11 issue, the *Times* editors made the case for further research into EMF health effects, citing the Peters study (see p.13) as the latest indication that, "Something is going on...." They, like many others, recommended a strategy of "prudent avoidance" until more is known about the EMF-cancer link. The February 24 *Times* featured an op-ed piece by Peter Asmus, author of the book *In Search of Environmental Excellence*, who argued that EMFs are fast emerging as the "utility environmental issue of the 1990s" and concluded that, "In this era of environmentalism, utilities as well as other businesses need to learn how to respond effectively to public concerns and to include the public as stake holders in future decision making. With the stakes so high on both sides, it makes sense to start by talking." The *Nashville Banner* took a similar position in a March 26 editorial expressing concern over magnetic fields at a school located next to a 69 kV power line and a 13.8 kV power line. Magnetic fields, measured by an engineer from Nashville Electric Service for the Tennessee paper, ranged from 4 mG in the hallways to 58 mG at the entrance to the band room, directly above the school's main electrical panels. The editors endorsed a policy of prudent avoidance, advising that, "High levels should bring concern not panic."

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The attention generated by "Calamity on Meadow Street," Paul Brodeur's July 9, 1990 *New Yorker* installment, has prompted EPRI to publish a booklet to help utilities respond to public inquiries. *Cluster Analyses Do Not Support "Calamity on Meadow Street" Claims*, prepared by Robert Banks Associates of Minneapolis, MN, disputes Brodeur's claim that cancer clusters in Guilford, CT, and Dukeville, NC, were due to EMFs and were not adequately investigated by state health authorities. The report further asserts that Brodeur misrepresented or ignored evi-

dence which contradicted his conclusions. A third cluster reported by Brodeur, in Montecito, CA, is not addressed in the EPRI booklet. The IEEE's Committee on Man and Radiation (COMAR)

is circulating another critique of Brodeur's articles, "Currents of Death" Rectified. A number of COMAR members contributed to the report, which was edited by Dr. Eleanor Adair.

EMF Litigation Heats Up

138 kV Line Challenged in Ohio

A number of Cleveland, OH, business executives have filed suit to block construction of a 138 kV, double circuit transmission line which would run along their street. In a complaint filed on March 12 in Cuyahoga County Court, they charge that electromagnetic fields (EMFs) from the line would endanger approximately 850 people who work along the street and would reduce property values.

The businessmen, who belong to the Lakeside Area Development Corporation (LADCO), at the same time filed a motion for a preliminary injunction to stop construction of the line, which is due to become operational by July 1. A hearing on the motion is set for May 2. The plaintiffs are being represented by attorney Richard Siegel of Cleveland.

The defendants named in the suits are Cleveland Public Power (CPP), the City of Cleveland (which owns CPP), Cleveland Electric Illuminating (CEI) and the Ohio Public Siting Board (OPSB) of the Public Utilities Commission. The board certified the line as safe and necessary on October 29, 1990.

In a third legal action in March, the owners petitioned the OPSB to reopen its docket on the line (No.88-1092-EL-BTX), known as the 138 kV Inland-Lake Shore Transmission Line. They contend that the siting board should have considered possible health risks and that they should have been notified of the board's September 17, 1990 public hearing, since they may be harmed by the line.

The OPSB had previously rejected an informal request by LADCO to review its decision. In a January 31 letter to LADCO President Dennis Frinzi, OPSB Chairwoman Jolynn Barry Butler said that the board would not reconsider its approval for the line. At the same time, she explained that the board's staff was investigating possible EMF health effects in a separate action.

In the petition, the business executives charge that the OPSB's refusal to consider EMF health effects in the Inland-Lake Shore case is "tragically ironic," and that "the medical and scientific communities must be heard from *before* the men and women who work [on their street] are placed at risk."

The business owners contend that operation of the line will be a "medically and scientifically recognized endangerment to the health, safety and well-being" of people working nearby. They also allege that the anticipated presence of the lines and the resulting EMFs "have adversely affected and diminished the value and marketability" of their properties.

The 20-mile line would travel along "uninhabited and seldom populated railroad rights-of-way *except* for a one-half-mile span which... pass[es] directly through and over a densely

populated work site....," according to the documents filed by the plaintiffs. All of the companies filing suit are located in that span, according to James Gallo of Gallo Displays, Inc., the lead plaintiff.

"We're trying to buy time," Gallo told *Microwave News*, until the OPSB reconsiders the line on the basis of potential health effects. "We want a power line, but we want a safe power line," he added. Gallo pointed out that the line would be 22 feet from his office and that projected magnetic field levels there would be as high as 350 mG. The estimates were prepared by Bob Huffey, an engineer who is a partner in one of the plaintiff companies.

In addition to forcing a reevaluation of the line, the plaintiffs are seeking lawyers' fees, costs and unspecified compensatory damages. The businesses expect to spend \$150,000 on their legal challenges, according to Gallo.

Along with Gallo Displays, the plaintiffs are Beverage Distributors, Inc., Hexagraphics, Inc., Milner Electric Co. and G.R.Z. Properties Co.

Michael Konicek, director of public utilities for the city, told *Microwave News* that he did not want to comment on the case because it is in court. The defendants have not yet filed their responses to the challenges.

Utility Worker's Widow Files Claim

A Seattle, WA, widow claims that her husband's death was caused by his exposure to EMFs while working for Seattle City Light, a public utility. Robert Pilisuk died on April 29, 1989, at age 44, from pneumonia brought on by acute lymphoblastic leukemia.

Pilisuk's widow, Mimi, filed a pension claim on March 20 with the Washington Department of Labor and Industries in Olympia. If successful, she could receive up to \$21,000 per year.

Seattle attorney Michael Withey, who is representing Pilisuk, told *Microwave News* that, "This is the first EMF-related pension claim in Washington that I know of." Withey, who is with the Seattle firm of Schroeter, Goldmark & Bender, was also the lead attorney in a major electromagnetic pulse suit (see box on p.4).

Pilisuk's claim is supported by an accompanying letter from Dr. Peter Wright, a medical doctor, stating that Pilisuk's leukemia, first diagnosed in 1987, resulted "on a more probable than not basis, from his employment by Seattle City Light." Pilisuk worked for the utility as an apprentice and journeyman electrician from 1982 until his death, including duty as a cable splicer and as a maintenance electrician.

Preliminary results released in 1989 of an ongoing epidemi-

Attorneys Form Group To Aid EMF Plaintiffs

Lawyers from all across the country have joined forces to evaluate potential electromagnetic field (EMF) cases and litigate on behalf of plaintiffs. The ten-member Electromagnetic Radiation Case Evaluation Team (EMRCET) will seek cases with the potential to set legal precedents.

"We feel that it is important to develop a protocol for the evaluation of electromagnetic radiation cases," the group's founder, Michael Withey of Schroeter, Goldmark & Bender in Seattle, WA, told *Microwave News*. Many previous EMF lawsuits did not establish permanent legal records because they were settled out of court, with the terms kept confidential. (For more on EMF litigation, see *MWN*, Ap81, D82 and S/O89.)

EMRCET members will provide a service to attorneys by investigating and evaluating their EMF cases. They will offer testimony and counsel to citizens' groups and individual plaintiffs. EMRCET was conceived at a November 1990 seminar, *Electromagnetic Fields: Science, Medicine and Public Health*, which was sponsored by the Robert Carl Strom Foundation of Seattle, WA, and Trial Lawyers for Public Justice (TLPJ), a Washington, DC, public interest legal foundation.

"As a consequence of the growing concern about this issue we are going to see more and more EMF litigation," Bruce DeBoskey of Silver & DeBoskey in Denver, CO, one of the organizers of EMRCET, said in a telephone interview. DeBoskey represented Beryl and Maelma Main, who settled a personal injury suit in 1990 alleging that Beryl's non-Hodgkin's lymphoma was caused by RF radiation from an FM transmitter next to their property. The terms of the award were not disclosed (see *MWN*, S/O89 and M/J90).

Withey was the lead attorney representing Robert Strom,

a Boeing technician who charged that his leukemia resulted from exposure to electromagnetic pulse (EMP) radiation (see *MWN*, N/D88 and M/J89). In a September 1990 out-of-court settlement, Boeing and codefendants agreed to pay Strom \$500,000 and to sponsor a medical program for approximately 700 EMP-exposed workers (see *MWN*, S/O90). Strom used part of his award to set up the Robert Carl Strom Foundation, an EMF information center. Another member of the new EMF law group, William Rossbach of Rossbach & Whiston in Missoula, MT, assisted with the Strom litigation.

The other members of EMRCET are: David Bossart of Conny, Feste et al. in Fargo, ND; James Browne of James Browne & Associates in Oklahoma City, OK; Macon Cowles of Williams, Trine et al. in Boulder, CO; Anthony Farmer in Knoxville, TN; Kieron Quinn of Quinn, Ward & Kershaw in Baltimore, MD; Anthony Roisman of Cohen, Milstein et al. in Washington, DC; and Aaron Simon of Kazan, McClain et al. in Oakland, CA.

In 1981, Stuart Lemle, a Washington, DC, attorney, and Barton Reppert, a Washington-based journalist, established the Microwave Radiation Information and Action Center to help victims of injuries from exposure to RF/MW radiation (see *MWN*, S81). At the time they were involved in a Freedom of Information Act suit to force the federal government to release materials on Soviet irradiation of the U.S. Embassy in Moscow (see *MWN*, Ja81). Lemle also represented Marie Lafferty, the widow of an FM radio technician who died of leukemia. Lafferty, who claimed that her husband was not adequately warned of the health risks associated with exposures to RF radiation, settled her suit out of court in 1989 (see *MWN*, M/J86 and S/O89).

ological study of telephone linemen showed that cable splicers had significantly elevated rates of a number of different cancers, especially leukemia (see *MWN*, N/D89).

As part of Pilisuk's claim, Withey submitted measurements indicating that, on the average, City Light cable splicers are exposed to 204 mG and constructors, apprentices and helpers are exposed to 13 mG. The data were collected for the Electric Power Research Institute (EPRI) by Dr. Joseph Bowman of the University of Southern California School of Medicine in Los Angeles (see *MWN*, J/F88). Bowman is now at the National Institute for Occupational Safety and Health (NIOSH) in Cincinnati, OH.

In a letter accompanying the claim, Withey and Sidney Stillerman Swan, also of Schroeter, Goldmark & Bender, also suggested that a leukemia cluster may exist at City Light. Citing Dr. Samuel Milham's 1982 epidemiological study of Washington State electrical workers and leukemia (see *MWN*, J/A82), the lawyers wrote that nine or ten of the cancer cases included in those results were electricians who worked for City Light.

Two New Studies Link Worker EMF Exposures to Leukemia

The results of epidemiological studies from the U.S. and France support the hypothesis that workers exposed to electromagnetic fields (EMFs) have an increased risk of leukemia.

A recent survey by the National Institute for Occupational Safety and Health (NIOSH) showed an excess of leukemia deaths among men exposed on the job to EMFs. The NIOSH team, led by Dr. Cynthia Robinson, concluded that the results were "a confirmation that occupational exposure in electrical occupations may be associated with enhanced leukemia risk."

With regard to past occupational studies, the researchers noted a "consistency" of an elevated risk for telephone linemen and installers and for telephone, telegraph and related communications equipment operators. "It's just another indication that we need to look into the excess of leukemia among workers exposed to EMFs," Robinson told *Microwave News*. The team

recommended that further research in this area be "pursued aggressively."

Among the 11 electrical occupations analyzed, the team found a statistically significant 19% increased risk for all leukemia. Communications equipment operators had a statistically significant 399% increase for acute myelogenous leukemia (AML) and a nonsignificant 94% increase for all leukemia. Workers in photographic equipment manufacturing had statistically significant 113% and 57% increases for AML and in all leukemia, respectively. Among telephone linemen and repairmen, there was a 247% increase for AML and a 110% increase for all leukemia, neither of which was statistically significant.

The researchers pointed out that in addition to EMF exposures, these occupations may also involve exposures to suspected leukemogenic chemicals.

They analyzed mortality data on 426,705 white men from 14 states covering one or more years from 1979 through 1985. Robinson noted that the data base used was "large" and "up-to-date."

The French study, conducted by Drs. Sylvie Bastuji-Garin and Sylvia Richardson, of Institut National de la Santé et de la Recherche Médicale (INSERM), and Dr. Robert Zittoun of l'Hôtel-Dieu hospital, both in Paris, identified a statistically significant 304% increased risk of AML among workers exposed to EMFs on the job, such as electrical engineers and electronics technicians. They did not find an increased risk for electric-arc welders.

The results also revealed a statistically significant risk of leukemia for workers exposed to benzene and weed killers. When adjustments were made for these possible confounders as well as for a history of radiotherapy or chemotherapy, there was still a statistically significant 220% increase of AML for EMF-exposed workers.

The French team questioned 185 leukemia patients and 513 controls between 1984 and 1988. Most of the cases and controls were not exposed on the job to EMFs, however, leading the researchers to warn that although the observed risk increase is notable, "this value should be treated prudently" since it is based on a small number of exposed cases.

The NIOSH paper appeared in the *Journal of Occupational Medicine*, 33, pp.160-162, February 1991. The French study was published in the *European Journal of Cancer*, 26, pp.1119-1120, 1990.

IEEE: ELF Magnetic Field Meters Are "Satisfactory"

The overall performances of 14 extremely low frequency (ELF) magnetic field monitors were "satisfactory," according to a survey by the Magnetic Fields Task Force of the Institute of Electrical and Electronics Engineers' (IEEE) Power Engineering Society.

The task force also concluded that it was more difficult to achieve consistent measurements of the magnetic fields from

JHU Male Breast Cancer Findings Published

Dr. Genevieve Matanoski and colleagues at the Johns Hopkins University (JHU) School of Hygiene and Public Health in Baltimore, MD, have published their finding of an excess of male breast cancer among New York State central office telephone technicians (see *MWN*, N/D89). Their results appear in a letter in *The Lancet* (p.737, March 23, 1991).

In a survey of 50,582 workers, including 9,561 central office technicians, employed from 1976 to 1980, Matanoski and Drs. Patrick Breyse and Elizabeth Elliott identified two cases of male breast cancer—more than six times the expected rate.

They also confirmed previous reports of four other cases of male breast cancer among telephone workers—two central office technicians, one cable splicer and one non-lineman—who were excluded from the study population because they were either too old (over 65) or were diagnosed with the disease before 1976.

The central office technicians worked near on-off switching equipment which generated EMF spikes. Some researchers have suggested that these complex fields may be more biologically effective than conventional 60 Hz exposures.

Matanoski reported that the central office technicians had mean daily exposures of 2.5 mG, while cable splicers had mean exposures of 4.3 mG. Others in the study were exposed to 1.5-1.7 mG.

The researchers pointed to possible EMF-induced changes in pineal gland activity to explain the excess of male breast cancer. The pineal gland produces melatonin, which can suppress cancer growth (see *MWN*, M/J88, J/A90 and S/O90).

After Matanoski reported the male breast cancer finding in 1989, other researchers soon began to pursue the link. Last summer, Paul Demers of the Fred Hutchinson Cancer Research Center in Seattle, WA, found a statistically significant six-fold increase among telephone linemen, electricians and electric power workers. Overall, there was a near-doubling of the male breast cancer risk among all EMF-exposed workers (see *MWN*, J/A90). In a third report, Drs. Tore Tynes and Aage Andersen of the Cancer Registry of Norway in Oslo identified a significant doubling of breast cancer in EMF-exposed workers (see *MWN*, J/F91).

electrical appliances than from power lines because of "nonuniformity and harmonic content..." There were considerable variations in frequency response among the meters, which can influence performance in environments where harmonics are present, the group noted.

The task force's assessment grew out of a workshop in which power frequency magnetic field meters on the market in 1989 were tested for calibration and harmonic response, sus-

ceptibility to high 60 Hz electric fields and electromagnetic interference. The meters were also used to measure ELF fields from typical transmission lines, appliances, substations and office machines in a typical work environment. The task force's paper appears in the January 1991 issue of *IEEE Transactions on Power Delivery* (6, pp.373-383).

The field survey instruments, data recorders and personal exposure meters evaluated were: Electric Field Measurements' 116 Plus, 120 and EMDEX-C; Electric Power Research Institute's STAR/VANA, EMDEX and AMEX; Holaday Industries' HI-3600-02; Integrity Electronics & Research's IER-109; IREQ's Electric and Magnetic Field Recording Instrument and Dosimeter; Monitor Industries' 42B-1; Positron Industries' Electromagnetic Dosimeter; and Sydkraft's 88-05 and 3-dimensional magnetic flux density meter. (For a list of ELF gaussmeters and dosimeters, see *MWN*, J/F90 and M/J90.)

Among the other findings were significant differences among the exposure measurements made by the data recorders in a low field (<10 mG) environment, but not in a high field (≈40-50 mG) environment.

The workshop was held at the Bonneville Power Administration Laboratory in Vancouver, WA, in May 1989 and was organized by the IEEE AC Fields Working Group of the Corona and Field Effects Subcommittee of the Transmission and Distribution Committee.

The Environmental Protection Agency (EPA) is also evaluating non-recording ELF gaussmeters (see *MWN*, J/A90).

Pallone Again Seeks EMF Research Funding

Rep. Frank Pallone (D-NJ) is again sponsoring federal legislation to allocate \$34 million to the Department of Energy over five years for EMF research. H.R.1483, which is identical to the bill Pallone authored last year, was introduced on March 19 with 23 cosponsors (see *MWN*, M/J90 and J/A90).

The proposal would provide increasing levels of funding each year, reaching \$10 million in 1995 to pay for health effects and engineering research, as well as for public information. It was referred to the House Committee on Science, Space and Technology and to the House Committee on Energy and Commerce.

Rep. George Brown (D-CA), chairman of the House Committee on Science, Space and Technology, and Rep. James Scheuer (D-NY), chairman of the Science Committee's new Subcommittee on Environment, are among the sponsors of Pallone's bill.

Last year, Pallone's legislation received bipartisan support at a hearing of the House Committee on Science, Space and Technology's Subcommittee on Natural Resources, Agriculture Research and Environment (see *MWN*, J/A90).

Public-Private EMF Research Program Moves Forward

An industry-led effort to set up an independent research program funded equally by the federal government and by the private sector is gaining momentum. The Health Effects Institute (HEI), a Cambridge, MA, nonprofit research organization, is the leading contender to coordinate the multiyear, multimillion-dollar effort. Indeed, HEI has already begun studying the feasibility of taking on this project.

Electric utilities and computer manufacturers have been seeking to sponsor independent research programs for the past year as reports of EMF-linked health effects have reached a broad public audience and federal funding has not increased significantly.

The HEI feasibility study, which is being funded by the Environmental Protection Agency (EPA) and private companies, will cost "up to a couple of hundred thousand dollars," according to HEI Executive Director Dr. Andrew Sivak. He expects to receive \$525,000 from EPA and to raise an equal amount in private matching funds. At least one labor union has also expressed interest in contributing to the research budget, he said. Sivak envisions a full-scale research program with a budget of \$5-6 million per year.

HEI is assembling a scientific board to direct the feasibility study, but its members have not yet been selected, according to Sivak. Nevertheless, the board is tentatively scheduled to make its final recommendations to HEI's board of directors this fall.

The feasibility study is being managed for HEI by Dr. Peter Valberg of the Gradient Corporation, a Cambridge, MA, consulting firm.

EPA's contribution is expected to come out of \$750,000 appropriated by Congress late last year at the urging of Rep. George Brown (D-CA). Earlier, Brown's amendment allocating \$1 million to EPA for EMF research was deleted from the budget (see *MWN*, J/A90). At press time, Sivak was waiting for EPA's final approval.

In January, Brown was elected chairman of the House of Representatives Science, Space and Technology Committee, increasing his authority to act on EMFs.

Rep. Frank Pallone (D-NJ), who has reintroduced legislation to increase federal EMF research funding (see box at left), prefers that the research be sponsored and supervised by the federal government. Speaking to an audience of electric industry officials on February 26, Pallone said that only government research can have the credibility that is needed to resolve questions about EMFs (see p.2).

The HEI effort grew out of a proposal made last spring by James Cunningham on behalf of the Large Public Power Council (LPPC). Testifying before the House Interior Subcommittee on General Oversight and Investigation, Cunningham called for a \$15-20-million industry-funded, government-supervised research program (see *MWN*, M/A90). "We recognize that there is a perceived bias in research funded by the utility

industry," Cunningham explained. "We deny this bias, but we cannot ignore the perception." Cunningham is a senior vice president of the New York Power Authority (NYPA), an LPPC member.

Industry support for EMF research grew at a July congressional hearing. Testifying before the House Science, Space and Technology Subcommittee on Natural Resources, Agriculture Research and Environment, Apple Computer's Dr. David Nagel offered to help fund federal EMF research (see *MWN*, J/A90 and box on p.9). He called for "cost sharing or matching government-industry contributions done at arms length to ensure the highest level of credibility and public acceptance of the results."

According to HEI's Sivak, Cunningham approached him late last year on the advice of EPA and congressional officials. Sivak later met with representatives of the Electric Power Research Institute (EPRI)—which initially resisted the LPPC plan but is now working with HEI. Apple and the Edison Electric Institute, among others, are also backing a coordinated research project.

In a telephone interview, Anne Strauss, a spokeswoman for NYPA, called HEI "the leading candidate" to head the LPPC national study effort. Other organizations considered included the National Academy of Sciences, the National Institute for

Environmental Health Sciences and academic institutions.

A joint private-public research effort has also gained the support of the National Association of Regulatory Utility Commissioners (NARUC), which approved a resolution at its winter meeting in February calling for additional federal funds and nonfederal matching funds to support EMF research through an independent organization. NARUC's Tom Choman refused to endorse the HEI project, however.

The HEI feasibility study got under way on March 18 at a briefing to educate the group's research committee on the status of EMF research, according to Valberg. The invited speakers were: Dr. Larry Anderson of Battelle Pacific Northwest Laboratory in Richland, WA, on experimental animal responses; Dr. Granger Morgan of Carnegie Mellon University in Pittsburgh, PA, on general research and policy questions; Dr. Jeffrey Saffer of the Jackson Laboratory in Bar Harbor, ME, on cell and molecular responses; Dr. David Savitz of the University of North Carolina in Chapel Hill on epidemiology; and Dr. Stanley Sussman of EPRI in Palo Alto, CA, on measurement and exposure.

HEI is best known for its work on the health effects of motor vehicle emissions and asbestos. The vehicle emissions research was funded by a 50-50 partnership between the auto industry and EPA.

HIGHLIGHTS

Cancer Cases Spurring Concern over Police Radar

A United States Park Police officer and his wife have filed a \$10 million lawsuit against Kustom Signals, Inc., of Overland Park, KS, the manufacturer of the traffic radar unit he used on the job. Hyman Rosen, who developed skin cancer after operating a Kustom MR-9 radar device regularly for almost seven years, is the first police officer to claim in court that exposure to microwaves from a traffic radar caused cancer.

At least two other suits are expected to follow as a growing number of cancer cases have surfaced among police officers who have worked with radar units.

From 1980 to 1987, while working in San Francisco, CA, Rosen used a radar unit that hung on the car window behind his head. In 1986, Rosen was diagnosed with a melanoma on the back of his neck; it was removed, but the cancer recurred.

Rosen's suit seeks compensation for strict product liability, negligence and—on behalf of his wife, Irene—loss of services. It was filed on March 12 in U.S. District Court for the Northern District of California, in San Francisco, by attorney John Sweeney of Sweeney & Pafundi in Agoura Hills, CA.

William Ruppert, a partner in Kustom Signals, told *Microwave News* that, "We don't think the suit has any merit."

Late last year, Ohio State Highway Patrol (OSHP) Trooper Gary Poynter called public attention to several police officers who had developed cancer after using traffic radar. More offi-

cers with cancer have since come forward. Among the cases identified by Poynter are:

- California officer Eric Bendure and his instructor, Leo Hutchinson, both developed cancer where they rested their active radar "guns" when not taking traffic speed readings. Bendure's lymphoma originated in his groin, while Hutchinson's cancer originated in his leg. Sweeney told *Microwave News* that he will file two suits in early April: Bendure will sue Kustom Signals and MPD, Inc., a manufacturer based in Owensboro, KY, and Hutchinson will sue Kustom.

- Arnold Sudbrink, a Wisconsin state trooper, developed eye cancer after operating a radar unit mounted less than half a meter directly behind his head. Sudbrink died on September 12, 1990.

- Sergeant Wayne Vessels of Ohio developed skin cancer below his right ear after long-term use of a unit similar to Sudbrink's. The cancer later spread to his face, eye and brain, before it was removed. Vessels has retired and is now working as a janitor.

- Officer Phil Quandt, a St. Petersburg, FL, traffic officer, developed a melanoma on his eyelid after operating a police radar since 1986. The cancer was removed and Quandt is back on duty.

Quandt's cancer, together with Poynter's warnings, led the St. Petersburg Police Department to suspend use of its radars in January. At least 18 other Florida police departments also stopped using their radar equipment after learning of the St.

HIGHLIGHTS

Petersburg decision. Some of the departments have resumed using the radars with modified operating procedures.

There are at least three types of traffic radars: those mounted on the dashboard, those mounted either on the window or behind the driver and those that are hand-held. The hand-held units are similar to the "guns" used by baseball teams to gauge speeds of pitched balls. Both use continuous wave radiation; the speeds of moving cars are measured by Doppler shifts. Poynter has estimated that a traffic officer using a radar unit is exposed "for hours every day" and that, "The cumulative total is thousands of hours in a very near field...."

Poynter has generated interest in the possible radar-cancer link. Last year, he completed a 95-page report for the Fraternal Order of Police and the Ohio Labor Council and published a two-part series in *Law Enforcement News* (November 15 and 30, 1990). The series was followed by stories in *USA Today* (February 15, front page) and in the *St. Petersburg Times* (February 7 and 21), among other newspapers.

Norbert Hankin of the U.S. Environmental Protection Agency (EPA) in Washington, DC, told *Microwave News* that he has been fielding questions on possible police radar hazards from police departments all across the nation.

Drs. Robert Davis and Samuel Milham of the Washington State Department of Health in Olympia, alerted to the anecdotal reports by Poynter, are reviewing the health records of 1,000-1,100 Washington State police academy graduates from 1950 to 1980. In a telephone interview, Davis explained that almost all academy graduates in the study period operated radar units 4-8 hours daily for 10-15 years. He hopes to complete the study by spring 1992.

The St. Petersburg police department hired a consultant to measure exposures from its 15 radar units, according to Officer Catherine Rubino, but has not yet decided whether to resume using the radar units. The exposure levels were below the 1982 American National Standards Institute (ANSI) limit of 5 mW/cm², she said.

A report prepared by Battelle, a testing laboratory in Columbus, OH, for the Ohio Bureau of Workers' Compensation, concluded that none of the OSHP's hand-held units produced exposures in excess of the ANSI limit. Three of the window-mounted units tested exceeded the ANSI limit, however, and Battelle suggested that "some changes in equipment location and/or operation may be warranted." Battelle took peak readings at four locations inside and four outside each patrol car. All

of the units tested were operating at about 10.5 GHz.

OSHP's Superintendent, Colonel Thomas Rice, informed troopers in a February 14 memo that "there is very sound probable cause established through empirical research to believe the K-55 [hand-held] radar poses no health risk to our officers."

A third set of measurements by the Institute for Police Technology and Management (IPTM) in Jacksonville, FL, was consistent with Battelle's. IPTM's Bob Bradley told *Microwave News* that he has consistently recorded power densities of 0.1-0.3 mW/cm² in the beam at two inches from the source. He has tested more than 150 units recently using a Narda 8616 meter.

Sandy Shields, a researcher with Florida's Hernando County Sheriff's Office (one of the 19 police departments that had stopped using the radar units), told *Microwave News* that her office decided in early March to relocate the radar antennas to patrol car rooftop light bars to reduce exposures. The cost of the change will be about \$20 per radar unit, she said.

There are few epidemiological data on radar exposures and cancer, although an association has been alleged in a number of lawsuits. For more on lawsuits alleging a link between RF/MW exposure and cancer, see *MWN*, D82, J/F83, Jn84, My85, S/O85, J/F86, M/A88, M/J89, S/O89 and N/D90.

IEEE Panel Rejects VDT EMF Emissions Guidelines

An Institute for Electrical and Electronics Engineers' (IEEE) working group has rejected proposed emissions guidelines for electromagnetic fields (EMFs) from video display terminals (VDTs). The P-1140 working group decided at a March 18 meeting that setting specific limits would exceed its authority.

The working group does plan to issue a measurement protocol for VDT extremely low frequency (ELF) and very low frequency (VLF) fields by July 1. The protocol, along with the emissions guidelines, was developed by a P-1140 ad hoc subgroup working under the direction of Stan Roberts of Apple Computer.

P-1140 will include the guideline levels as an appendix to the measurement protocol, under the heading, "Achievable VDT Emission Levels Using Current Technology," Dheena Moongilan of AT&T Bell Labs in Holmdel, NJ, the chairman of P-1140, told *Microwave News*.

In February, the ad hoc subgroup had recommended establishing guidelines using the same magnetic field values as Sweden's National Board for Measurement and Testing (Statens Mät och Provstyrelse, or MPR) but less stringent electric field limits. The proposed guidelines, which would have been the first in the U.S., may now be taken up by another IEEE committee, according to Moongilan.

The ad hoc subgroup's proposal was unexpected. When it began work last fall, the panel publicly stated that no limits would be developed. But there was "a little pressure" within the group to include them after the measurement protocol was developed, Roberts told *Microwave News*. "Without numbers,

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what's it going to mean?" he explained.

Moongilan confirmed that there is a perceived need for guidelines. Some computer manufacturers want specified levels "so that they can put a label on their products stating that they 'meet IEEE guidelines,'" he said.

Dr. Charles Abernethy of Digital Equipment Corp. in Maynard, MA, a member of P-1140, said that no formal action has been taken to refer the guidelines to another working group. He agreed that the computer industry wants to develop emissions guidelines. "We're trying to define what 'low-emission' is," he said in a telephone interview, adding, "Our goal is to get something simple and straightforward that we can agree on."

A major concern of the industry, according to Abernethy, is that Sweden's limits might be adopted by the European Economic Community (EEC). The EEC has a directive calling for the lowest possible emissions levels (see *MWN*, J/A90). "We need to develop a U.S. position to counter Sweden in the EEC," he said, maintaining that the suggested Swedish levels are not distinguishable from ambient fields.

The final ad hoc subgroup draft states that the limits were based on levels "which are technically and reasonably achievable" rather than on health risks. John Chubb of IBM in Research Triangle Park, NC, a member of the P-1140 ad hoc subgroup and a contributor to the development of the Swedish guidelines, told *Microwave News* that the same distinction was made by the MPR.

The IEEE subgroup's magnetic field proposal was the same as Sweden's: 2.5 mG for ELF and 0.25 mG for VLF. For electric fields, the proposed VLF guideline was 10 V/m at 50 cm, compared with the 2.5 V/m level adopted by the MPR. The panel proposed two ELF limits—50 V/m for Class I computers, which use three-prong, grounded power cords, and 250 V/m for Class II units, with two-prong cords. The MPR ELF electric field limit is 25 V/m for all computers.

Roberts explained that trial electric field measurements showed significant differences between the two types of cords, with some Class II units producing fields well above 100 V/m. In a telephone interview from his office in Cupertino, CA, Roberts said that the two-tier limits are meant for use in Europe—where the standard electrical power supply operates at 220 V—as well as in the U.S. He questioned whether the Swedish ELF guideline of 25 V/m is achievable, given the levels produced by the Class II cords.

The ad hoc subgroup's protocol prescribes 24 measurement points for both ELF and VLF magnetic fields, eight each on three horizontal planes: at the center of the terminal, 30 cm above the center and 30 cm below—all at 50 cm from the VDT. For electric fields, the draft requires four VLF readings and only one ELF reading, all at 50 cm from the terminal.

The IEEE methodology measures time-rate-of-change of magnetic fields (dB/dt), while the Swedish guidelines are based on simple magnetic field readings (see *MWN*, S/O88, M/J89 and S/O90).

Unlike the Swedish guidelines, the P-1140 draft does not address electrostatic fields. There was little discussion about

NAS Planning To Evaluate VDT EMFs

The National Research Council (NRC) of the National Academy of Sciences (NAS) is seeking federal funds for an evaluation of research on VDT electromagnetic fields (EMFs). The project was prompted by growing computer industry concern about EMF health effects, according to Dennis Mahlum, the NRC project officer (see *MWN*, J/A90).

Apple Computer in Cupertino, CA, had asked the NAS to undertake the project. In a December 10 letter to NAS President Frank Press, Apple Vice President David Nagel suggested that the NAS recommend a "nationally coordinated program of study to produce the kinds of information which can inform development of design and usage standards for a wide range of exposure conditions."

Apple offered to provide "monetary and other support" in conjunction with other computer companies. Mahlum said that IBM, Digital Equipment Corp. and the Computer Business Equipment Manufacturers Association also "expressed a great deal of interest."

In a December 21 letter, Press agreed that the NAS "should address this important issue." The NAS will not accept industry funding, however, despite the fact that its rules permit it to do so for up to 49% of a project's cost. According to Mahlum, the NAS governing board decided that "this topic is a little bit hot" and wants to avoid the appearance of bias.

The NAS proposal is currently under review by several government agencies, including the Food and Drug Administration (FDA), the National Institute for Environmental Health Studies (NIEHS) and the National Institute for Occupational Safety and Health (NIOSH), Mahlum said, adding that the response so far has been positive. The proposed budget is said to be about \$350,000. If funding is secured, Mahlum hopes to select committee members during the spring and to begin work by the summer.

This would be the second NRC panel examining EMFs. A committee set up last year is studying the potential health effects of very low frequency (VLF) radiation from the U.S. Air Force's Ground Wave Emergency Network (GWEN), with a final report due in September (see *MWN*, M/J90 and N/D90).

them, according to Roberts.

The P-1140 group was originally set up in 1987 to develop VLF measurement procedures for VDTs. In 1989, its mission was expanded to include all electrical and electronic devices. Last August the committee decided to create the ad hoc subgroup to consider VDT emissions before it looked at other devices, and to include ELF EMFs (see *MWN*, J/A87, M/A88, M/J89 and S/O90).

an increased risk of spontaneous abortion...."

The reference to EMFs surprised many observers, since the study was not designed to assess EMF reproductive risks and EMF measurements were not taken until more than one-and-a-half years after the last subject was interviewed. Moreover, according to the study's published abstract, these measurements revealed that, "Abdominal exposure to extremely low frequency [ELF] fields (45 to 60 Hz) was similar for both operators who used VDTs and those who did not."

"It was a well-designed study and makes an important contribution to the debate, but I am concerned about its limitations—particularly that it could not address ELF EMFs since the control group was exposed," said Dr. Michele Marcus of the Mount Sinai School of Medicine in New York City.

In a telephone interview with *Microwave News*, Schnorr explained that, "Since we could not conclude anything on stress and ergonomics, that left one distinct characteristic associated with VDTs—the presence of EMFs." NIOSH had planned to include questions on fertility and stress in the study, but was forced to delete them by the federal Office of Management and Budget (see *MWN*, S/O86).

The case group in the study comprised directory assistance telephone operators who worked with CRT VDTs at BellSouth offices. General—dial "0"—telephone operators who worked with light-emitting diode (LED) or neon glow tube (NGT) displays at AT&T offices served as the control group. Schnorr said that AT&T would not say how many in the control group used LEDs and how many used NGTs.

Operators using NGTs had half the abdominal ELF exposures of operators using LEDs. Schnorr said that the controls' ELF exposures were due to background EMFs and were not due to the equipment they were using (see box on p.11).

The NIOSH measurements also showed as much as a 15-fold difference in the very low frequency (VLF) magnetic field emissions of the same model IBM VDTs. In some cases, there was more than a three-fold difference in ELF magnetic field emissions from the IBM VDTs.

"We found a lot of variability between different VDTs, but given the low levels of EMFs, the exposures are not that variable," Schnorr said, adding that, overall, "The EMF exposures among the VDT operators were quite low."

The study met with mixed reactions from epidemiologists working on other VDT-reproductive risk studies. "Overall, the NIOSH study is a strong piece of work, but there are some questions which it was not designed to answer, like the role of ergonomics and job stress," Dr. Robert Hiatt of Kaiser Permanente in Oakland, CA, told *Microwave News*. In 1988, Hiatt coauthored a study with Marilyn Goldhaber and Michael Polen, also of Kaiser, which found that women who worked at VDTs more than 20 hours a week during the first trimester had approximately twice as many miscarriages as women who did not use VDTs (see *MWN*, M/J88).

Mount Sinai's Dr. Marcus noted that the NIOSH study does not shed any light on subclinical miscarriages—those which occur too early to be recognized by the mothers. Previous

animal and epidemiological studies have suggested that any increased risk of miscarriage from VDT work is most likely to be in the earliest stages of pregnancy (see *MWN*, J/F90).

Marcus is currently directing a prospective study of reproductive risks from VDT work, which will include data on sub-clinical miscarriages, job stress and ergonomics (see *MWN*, Jn85, M/J87 and J/A89). It is now in the early stages of data collection. Hiatt is also working on a prospective study of VDT reproductive risks, which he estimates will be completed in two

(continued on p.12)

More VDT-Pregnancy Studies

In addition to the much-publicized NIOSH paper, two other epidemiological studies on possible reproductive risks from VDT work have recently been released.

Dr. Gayle Windham and coworkers at the California Department of Health Services in Berkeley found a slightly increased—though nonsignificant—risk of miscarriages among VDT workers. Miscarriages in the first trimester were more likely than later miscarriages to have an association with VDT work—agreeing with several animal studies (see *MWN*, J/F90). Windham's team compared a subset of their data taken from members of Kaiser Permanente clinics with an earlier study of Kaiser members which showed a significant association between VDT use and miscarriages (see *MWN*, M/J88). Interestingly, the results again showed that Kaiser VDT users were approximately twice as likely to have miscarriages as nonusers. Windham also detected an elevated risk of low birth weight and intrauterine growth retardation for the offspring of frequent VDT users—though this finding was also not statistically significant.

In a second study, Drs. Lars Brandt and Claus Vinter Nielsen of the University of Aarhus in Denmark found no substantial or statistically significant increase in the risk of miscarriage—regardless of the amount of time spent working at a VDT. The study did show a statistically nonsignificant 80% increase in the incidence of congenital malformations among children of VDT operators who had a high level of job stress. The risk of one type of birth defect, hydrocephalus (water on the brain), was 12 times higher than expected and was statistically significant. Brandt and Nielsen had previously released preliminary results from their study (see *MWN*, M/A90).

See Gayle Windham et al., "Use of [VDTs] During Pregnancy and the Risk of Spontaneous Abortion, Low Birth Weight or Intrauterine Growth Retardation," *American Journal of Industrial Medicine*, 18, pp.675-688, 1990; Claus Nielsen and Lars Brandt, "Spontaneous Abortion Among Women Using [VDTs]," *Scandinavian Journal of Work, Environment & Health*, 16, pp.323-328, October 1990; and "Congenital Malformations Among Children of Women Working with [VDTs]," *ibid.*, pp.329-333.

NIOSH EMF Survey Most Comprehensive to Date

Seemingly identical video display terminals (VDTs) can emit vastly different levels of very low frequency (VLF) magnetic fields. In the most comprehensive set of EMF measurements ever released in the U.S., Richard Tell of Richard Tell Associates, Inc. found that the VLF fields can vary by as much as a factor of 15 according to how the cathode ray tubes (CRTs) were assembled by different manufacturers.

Tell concluded that the data from the IBM Model 4978 terminals "suggest that there are two substantially different populations of VDTs—some producing significantly greater values of magnetic fields than others, all of the same model number."

The higher-VLF IBM units were assembled by Motorola and the lower-VLF ones by Zenith, according to Tell, even though the units appeared identical on the outside. In the example cited by Tell, at 30 cm from the front of the VDTs, a Motorola-IBM unit produced a VLF magnetic field of 1.02 mG while a Zenith-IBM terminal produced a field of just 0.07 mG. The Motorola-IBM VDT's ELF magnetic field also was higher at 30 cm, though the difference was less pronounced—5.28 mG, as compared to 1.59 mG for the Zenith-IBM VDT.

Tell tested 24 IBM VDTs and the same number made by Computer Consoles Inc. (CCI) for the National Institute for Occupational Safety and Health (NIOSH) as part of its epidemiological study of VDT work and pregnancy risks (see p.1). He also measured emissions from 24 light-emitting diode (LED) displays and from 24 neon glow tube (NGT) displays. He took readings at 30 cm from all six surfaces of the terminals and at the face, chest and abdomen at the operator's position. The measurements were taken at ten BellSouth and AT&T worksites in nine cities. All the LED displays were measured at one office, however; the NGTs were also measured at one, different, site.

He found that the operators of LED displays were exposed to approximately the same extremely low frequency (ELF) magnetic fields at the abdomen as were VDT users—twice the level for the NGT operators. The VLF magnetic field exposures were "substantially less" at the operator's position for both the LED and NGT displays.

The LED and NGT ELF fields did not decay with distance from the units. In a telephone interview with *Micro-wave News* from his office in Las Vegas, NV, Tell said that these measurements led him to conclude that "the fields are predominantly a function of the ambient fields." The differences between the exposures of the LED and NGT operators were attributed to variations in the office environments.

Tell said that the measurements confirm that differences in emissions among all VDTs "fall within a given distribution—there are differences, but not dramatic differences." He added that, "We are really not going to learn anything

miraculous by measuring more VDTs but we may find more quirks like the one I found with the IBM units."

At 30 cm from the front, the CCI units produced ELF fields (at 45 Hz) below 4-5 mG and VLF fields (at 15 kHz) below 2 mG, and the IBM units produced ELF fields (at 60 Hz) below 6-7 mG and VLF fields (at 16 kHz) below 1-1.5 mG. At 30 cm in other directions, however, some ELF field levels were above 30 mG for the CCI units and above 8-9 mG for the IBM units.

Tell found that field levels at the operator's position were higher at the face than at the abdomen or the chest. Mean magnetic field levels at the face were, for ELF, 0.96 mG for the IBM units and 1.03 mG for the CCI units, and for VLF, 0.08 mG and 0.52 mG, respectively.

"[T]he apparent closer distance accounts for the greater value of magnetic field at the face," Tell said. As for electric fields, "It would appear that the head of the operator tends to be somewhat closer to the VDT and tends to attract electric field lines toward the face, thus decreasing the intensity of the electric field lines terminating on the rest of the body."

In his report for NIOSH, Tell included descriptions of the magnetic field waveforms and the calculated body currents induced by the VDT EMFs.

Among other key findings were:

- VDTs do not add significantly to ambient office ELF electric field levels. According to Tell, "ELF electric fields appear to be principally a function of the room electrical environment, probably being more representative of electrical wiring systems used in the building than of any peculiar characteristic of the display."
- VDT EMFs decay rapidly with distance. For example, as the distance between the operator and the VDT doubled, ELF magnetic fields decreased by factors of 1.9-5.4, ELF electric fields by factors of 2.0-6.7, VLF magnetic fields by factors of 1.9-7.2 and VLF electric fields by factors of 3.0-7.1.
- The ELF and VLF fields remained essentially constant whether the display screen was blank or filled with characters.
- Tell compared induced body currents due to VDT EMF exposures to those from radio broadcasts. "Normal exposure to VDTs in the workplace is not significantly different from that induced virtually all of the time by ambient radio station signals to which everyone is exposed," he concluded.
- None of the displays produced detectable X-radiation.

A copy of *An Investigation of Electric and Magnetic Fields and Operator Exposure Produced by VDTs: NIOSH VDT Epidemiology Study* (Report No. PB 91-130-500) is available for \$31.00 (\$11.00 in microfiche) from: National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22161, (703) 487-4650. For more on VDT EMF measurements, see *MWN*, Ap83, S84, O84, D84, J/F85, Ap85, S/O85 and S/O87.

years. Both the NIOSH and the earlier Kaiser studies were retrospective.

"The fact that they didn't find an increased risk agrees with the bulk of prior research," Dr. Gayle Windham of the California Department of Health Services (CDHS) in Berkeley told *Microwave News*. She added that, "If studies now under way agree with the NIOSH findings, we won't need much more research in this area." Recently, Windham and coworkers at the CDHS found a small, statistically nonsignificant increase in miscarriages among VDT workers which, they said, followed a "consistent pattern of a possibly slightly increased risk" established by earlier research (see box on p.10).

Schnorr said that she sees the need for studies of ELFEMFs and reproductive risks, though these should be done with a more heavily exposed group than VDT operators. "Our study was in-

tended to determine whether the VDT in itself could cause miscarriages. ELF is a more general question....and one we don't have a handle on yet," she said.

NIOSH first planned a VDT-reproductive risk study in late 1982 (see *MWN*, N82). The final study design was limited to telephone operators who were 18 to 33 years old and worked between January 1, 1983 and August 1, 1986. Pregnancies included in the study were limited to those which ended between January 1, 1983 and December 31, 1986 for miscarriages, and between May 1, 1983 and December 31, 1986 for live births. In all, 2,430 women were interviewed between July 1987 and August 1988; 882 pregnancies were included in the study. See Teresa Schnorr et al., "Video Display Terminals and the Risk of Spontaneous Abortion," *The New England Journal of Medicine*, 324, pp.727-733, 1991.

Deciphering Wire Codes (continued from p.1)

USC to join the National Institute for Occupational Safety and Health (NIOSH), said that the team will have more to say once the study is published—most likely in early summer.

There are indications that the USC data may still yield new and unexpected results. Indeed, EPRI held a small informal workshop on March 19, also in Carmel, to take another look at the data.

Last year, Wertheimer and Leeper proposed that wire codes may predict a combination of field intensity plus angle—the direction of the magnetic field. Using information on field angle, they reanalyzed the data from Dr. David Savitz's childhood cancer study and Dr. Richard Stevens's adult cancer study and found higher cancer risk ratios than were originally reported (see *MWN*, N/D90).

In a telephone interview, Dr. Leonard Sagan, the program manager of EPRI's EMF studies, said, "The question of wire codes needs increased attention. Clearly there's something there that needs to be understood."

Savitz, of the University of North Carolina in Chapel Hill, has long maintained that wire codes are "superior" as a long-term indicator of exposure. Savitz told *Microwave News* that Peters's findings are leading researchers to sharpen their focus on what wire codes say about residential exposures. The study "narrows the range of alternative explanations for the entire body of literature," he said.

Savitz suggested that spot measurements may be "the precise measure at the wrong time" while wire codes are "a rough measure that covers the correct time period."

"There's a lot less fluctuation in wire codes than in measurements. Perhaps the critical variable is better measured by wire codes," Dr. Samuel Milham of the Washington State Department of Health in Olympia said in an interview.

Wertheimer commented, "Measurements may not be the gold standard because we don't know what to measure." And Sagan added that, "Time-weighted averages of magnetic fields now seem to be of decreasing importance, but that doesn't mean that magnetic fields are off the hook."

Wire codes may point to other conditions not directly related to magnetic field exposures. Dr. Patricia Buffer of the University of Texas School of Public Health in Houston, who chaired the February Carmel workshop, said that the observed association may be related to traffic density and/or lower socioeconomic status: "Before you conclude that wire codes are an EMF surrogate, you have to address these other questions." Sagan concurred, pointing out the need to look at what wire codes mean in terms of demographics—the specific populations living in high-current configuration and low-current configuration homes.

Savitz also noted that contaminated drinking water from pipes corroded by ground currents may be responsible. But, he said, "If you accept that wire codes are related to cancer risk, then I think the leading candidate is magnetic field exposure."

Sagan cited a need for non-epidemiological research. "Laboratory studies have become increasingly important. We need to do both whole animal and cellular studies," he said.

Swedish EMF-Cancer Study Expected Soon

The results of an epidemiological study of leukemia and brain tumors among EMF-exposed workers by Drs. Siv Tornqvist, Bengt Knave and colleagues (see *MWN*, N/D89) were also presented at the EPRI epidemiological workshop in Carmel, CA.

Tornqvist and Knave, of the National Institute of Occupational Health (NIOH) in Solna, Sweden, both declined to release details of the study prior to publication. EPRI's Dr. Robert Black, who presented the paper, also refused to comment on the study. The paper is expected to appear shortly in the *British Journal of Industrial Medicine*.

The NIOH team was unable to present the results in person because of travel restrictions related to the war in the Persian Gulf.

USC EMF–Leukemia Study Corroborates Denver Results

On February 7, Dr. John Peters of the University of Southern California (USC) in Los Angeles presented preliminary data showing that children living in homes near high current power lines had a two-and-half-fold increased risk of leukemia (see *MWN*, J/F91 and p.1). The study confirms findings by Dr. Nancy Wertheimer and Ed Leeper and by Dr. David Savitz of a statistically significant association between wire codes and increased childhood cancer risks in Denver, CO.

The greatest leukemia risk for measured magnetic fields was consistently observed in the highest exposure category—a 50% increase—but the association was not statistically significant, according to the Electric Power Research Institute (EPRI), the sponsor of the study. There was no link to electric field measurements.

In a telephone interview, Peters declined to comment directly on his study, saying only that, “I don’t think we’re ready to put our final interpretation on the results.” He noted that the USC team is in the process of verifying the numbers and that he hopes to publish the results by early summer.

In his presentation at an EPRI workshop in Carmel, CA, Peters asked participants not to reveal details of the study. Peters’s results were released by EPRI.

Nevertheless, some attendees told *Microwave News* that Peters’s study indicated a threshold of about 2 mG for an increased childhood leukemia risk—similar to that reported by Savitz.

“The meeting was a turning point,” Dr. Richard Stevens of Battelle Pacific Northwest Lab in Richland, WA, said. “It’s now a legitimate field of research taken seriously by mainstream scientists.”

UPDATES

COMMUNICATIONS

Antenna Farm Concern...Comsite Pacific Inc., a communications company, moved a pregnant woman and her husband from a house it owns in the middle of an antenna farm in Santa Barbara, CA, to a new residence after measurements revealed radiofrequency (RF) levels as high as 501 $\mu\text{W}/\text{cm}^2$ in and around the house. Rita and Robert Obenreder were advised by a County of Santa Barbara official that “a potentially significant hazardous health condition exists...” in a January 14 letter. County officials learned of the situation from Bruce Lusignan, a consultant with the Communications Satellite Planning Center in Palo Alto, CA, who notified them in a December 31 letter that “the residence has levels greatly exceeding the ANSI levels... I urge you to take steps to get the residents off the property.” Copies of both letters were obtained by *Microwave News*. Lusignan had taken measurements as part of an environmental impact as-

essment on behalf of Comsite, of Santa Maria, CA, which intends to add 50 antennas to the property, according to the *Santa Barbara News-Press* (January 27). Currently some 600 companies—FM radio stations, paging services, security alarm companies and others—transmit from the 40-acre farm, the paper reported.

In a telephone interview, Dr. David Savitz of the University of North Carolina in Chapel Hill called the Peters study “well-designed and well-executed” and said that, “The results seem very much compatible with our study and with Wertheimer and Leeper’s study....In a sense, it corroborates them.” In his 1988 study, Savitz also found a more consistent association with wire codes than with measured fields.

The most unexpected finding of the Peters study was a statistically significant link between childhood leukemia and exposures to black-and-white televisions and hair driers. “It is also not clear whether short-term, very high exposure[s] of children to magnetic (or electric) fields from electric appliances are responsible for the observed risk or whether associated exposures are responsible,” according to a USC statement released by EPRI. The finding “suggests the need for more emphasis to be placed on examining transient, high-level exposure to fields or threshold effects,” EPRI noted in its own public statement.

Some experts who attended the workshop cautioned that too much emphasis has been placed on the issue of appliance use. “I think the critical variables are related to where the house is in the electric distribution system rather than to what is going on inside,” Dr. Samuel Milham of the Washington State Department of Health in Olympia said. Indeed, EPRI’s Dr. Leonard Sagan told *Microwave News* that the data are “suggestive,” but, “I don’t think we should make too much of it.”

The team looked at 232 cases of childhood leukemia in children no more than ten years old between 1980 and 1987 in Los Angeles County. The cases were matched with the same number of controls. The team took spot measurements and 24-hour to 72-hour continuous measurements in the rooms where the children slept. Exposures were also assessed by wire codes. Parents were interviewed by telephone on appliance use, occupational histories of both parents, environmental exposures and other potential confounders.

INTERNATIONAL

Romanian Bioelectric Society...The recently formed *Romanian Society for Bioelectricity and Bioradiations* will promote education and research into the biological effects of EMFs and NIER. The new group, created in the wake of the downfall of Nicolae Ceausescu, is a “professional, scientific, nongovernmental, nonpolitical society, based upon democratic principles.” The president of the society is Dr. Ioan Mamulas and the executive secretary is Dr. Valentin Musat. The society is based at 4-6 Visarion St., District 1, Bucharest, Romania.

LAW

Compensation for Power Line Fears...The courts should recognize EMF fears in determining compensation for property seized under eminent domain proceedings, David Zachary Kaufman argues in a recent law review article. He favors a rule stating that, "Evidence of lost market value due to the fear of adverse health effects may be introduced regardless of the reasonableness of the fear." Citing numerous claims of property value damages due to power line health concerns, Kaufman contends that this rule—as opposed to two others which reject "speculative fears" as a cause of property devaluation—is the most "economically efficient" because it permits landowners to be compensated for decreased market value resulting from both objective and subjective risks. Kaufman refers to a number of well-known power line lawsuits, including *Houston Power and Lighting v. Klein* (see *MWN*, N/D85, N/D87, J/A88 and M/J89) and *San Diego Gas & Electric Co. v. Daley*, although he does not mention the Marcy-South suit (see *MWN*, S/O88 and S/O89). Noting that the courts have been ambivalent about adopting this rule—due to concerns over presenting alarming or inflammatory testimony to the jury about possible health effects—Kaufman suggests that the solution is to omit scientific evidence from the record on the basis that "it is irrelevant and unnecessary and may tend to inflame the jury." Kaufman maintains that trials would then be less confusing to both judge and jury, would be less expensive to all the parties and would proceed at a faster pace. See *George Mason University Law Review*, 12, pp.711-736, 1990.

MEDICAL APPLICATIONS

MRI Safety...In a recent paper, Drs. Frank Shellock and Emanuel Kanal, cochairs of the Society for Magnetic Resonance Imaging (SMRI) Safety Committee, provide guidelines and suggestions for MRI safety and patient management, including warnings about patients with pacemakers and metal implants. Shellock and Kanal recommend that a "cautious approach" should be taken with pregnant women, particularly during the first trimester, although no "definitive association has been demonstrated" between MRI and effects on the developing fetus. Their paper appeared in the inaugural issue of the *Journal of Magnetic Resonance Imaging*, January/February 1991. Shellock is at the Cedars-Sinai Medical Center in Los Angeles, CA, and Kanal is at the Pittsburgh (PA) NMR Institute.

Magnetic Stimulation...The January 1991 *Journal of Clinical Neurophysiology* is a special issue devoted to "Magnetic Stimulation of the Nervous System." Among the papers are eight review articles, four original contributions and several technology and equipment reviews, covering the history, basic principles and clinical and research applications. Dr. Dudley Dinner of Cleveland, OH, served as the issue's guest editor. It is available for \$50.00 from: Raven Press, 1185 Avenue of the Americas, New York, NY 10036, (212) 930-9500. Subscrip-

tions to the quarterly journal, which is the official publication of the American Electroencephalographic Society, are available from the same address: in the U.S., \$99.00 for individuals and \$165.00 for institutions; elsewhere, \$132.00 for individuals and \$198.00 for institutions.

TENS for Muscle Spasms...Transcutaneous electrical nerve stimulation (TENS) may be an effective treatment for severe muscle disease, according to a letter in the December 1, 1990 issue of *The Lancet*. Drs. Jennifer Bending and Lynn Cleeves of the U.K.'s National Hospital for Neurology and Neurosurgery in London report that TENS significantly reduced the pain, tremors and involuntary movements of a 34-year-old man with chronic muscle disorders. The patient showed the most improvement when treated with frequencies of 20-25 Hz....See also "TENS for Chronic Low-Back Pain," an editorial in the February 23 issue of *The Lancet*; TENS is ineffective in the treatment of lower back pain, according to a study reported in the June 7, 1990 issue of *The New England Journal of Medicine* (see *MWN*, J/A90).

MEETINGS

NIOSH EMF Meeting Papers...The National Institute for Occupational Safety and Health (NIOSH) will publish a technical report this summer containing the invited papers and summary recommendations from its January 30-31 workshop on occupational EMF exposures (see *MWN*, J/F91), according to NIOSH's Philip Bierbaum. *Proceedings of the NIOSH Workshop on the Health Effects of Electromagnetic Radiation on Workers* will be edited by Bierbaum and Dr. John Peters of the University of Southern California in Los Angeles (see p.1).

1992 IRPA Workshop in Canada...The International Radiation Protection Agency (IRPA) has announced that its *2nd International Workshop on Non-Ionizing Radiation* will be held May 11-14, 1992, at the University of British Columbia (UBC) in Vancouver, Canada. The workshop will precede the *8th IRPA Congress*, to be held May 17-24 in Montreal. A lecture series and panel discussions designed to give participants an overview of the EMF issue will be featured at the workshop. A similar IRPA workshop was held in conjunction with the 1988 congress in Australia (see *MWN*, S/O87). For more information, contact: Dr. Wayne Green, Director of Occupational Health and Safety, 50/2075 Westbrook Mall, UBC, Vancouver, BC V6T 1W5, Canada, (604) 228-4218.

EMF World Congress in 1992...Orlando, FL, will be the site of the *1st World Congress for Electricity and Magnetism in Biology and Medicine*, June 14-19, 1992. The meeting will bring together the interests of those involved with the beneficial aspects of bioelectromagnetics and those concerned with the potential health effects of EMF exposures. For more information, contact: 1st World Congress, c/o W/L Associates, 120 W. Church St., Frederick, MD 21701, (301) 663-1915.

Dr. **Herbert Fröhlich**, a pioneer in the search for theoretical explanations of microwave interactions with biological systems, died on January 23 at the age of 85. A professor emeritus at the U.K.'s University of Liverpool, he was a fellow of the Royal Society.... The Canadian Centre for Occupational Health and Safety (CCOHS) in Hamilton, Ontario, has lost its two experts on NIER, Dr. **Karel Marha** and **David Charron**. Marha has opened a consulting firm, Karel Marha & Associates. He had emigrated from Czechoslovakia, where he headed the Department of High Frequency at the Institute of Industrial Hygiene and Occupational Diseases in Prague. Marha, a biophysicist, is the author of *Electromagnetic Fields and the Life Environment*. Charron has joined the Radiation Protection Service of the Ontario Ministry of Labour in Weston. CCOHS spokesman David Cohen told *Microwave News* that the organization will continue its EMF work but has not yet named replacements for Marha and Charron.... Dr. **Robert Kulikowski** has been named acting director of New York City's Bureau of Radiation Control, replacing Dr. **Leonard Solon**. Solon, who authored the city's 50 $\mu\text{W}/\text{cm}^2$ RF/MW standard, will assume other duties.... **Warren Sinclair** is retiring from the presidency of the National Council on Radiation Protection and Measurements (NCRP), a position he has held since 1977.... **Anthony Valentino** has been appointed vice president of the Applied Sciences Group of the IIT Research Institute (IITRI) in Chicago, IL. He has long been associated with EMF research.

Radon Rationale... Electrostatic charges on VDT screens can attract airborne radon progeny which might harm computer users, according to Frank Ziembra of the Applied Electron Corp. in Santa Clara, CA. In a recent letter in *Nature* (349, pp.659-660, February 21, 1991), he reported finding relatively high levels of radon progeny—radioactive isotopes of polonium, bismuth and lead—on VDTs in his company's office. "My measurements suggest that natural radioactivity and high electrostatic fields are more likely to be the cause of various common complaints," he wrote. In a telephone interview, Ziembra cited reproductive abnormalities and eyestrain as among the possible effects of VDT-related radon exposure. The maximum radon buildup occurs "shortly after" VDTs are turned off, he wrote, when the screen face has a large negative voltage and becomes an "efficient collector" of positive ions. This can continue "for many hours if the air is dry and the main source of air ionization is from the radon background." In his tests, color monitors, which operate at higher voltages than monochrome units, attracted the highest levels of radon particles. Ziembra, who is preparing a more complete report on his findings for publication, told *Microwave News* that the most important safety step is to reduce or eliminate radon levels, and he also recommended preventing VDTs from charging up.

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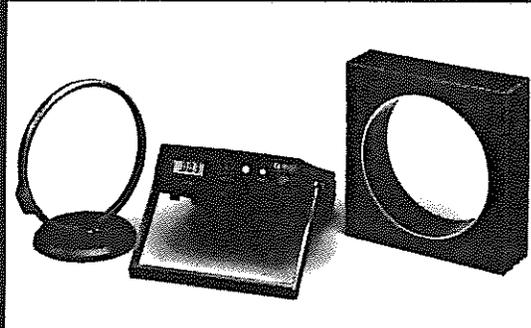
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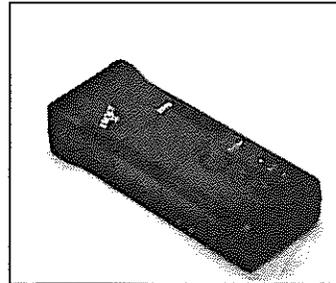
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