

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 Buffler 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-a-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."

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.

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.

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, cochairmen 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 Cleaves 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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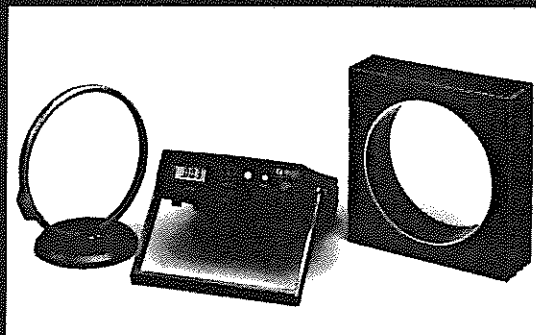
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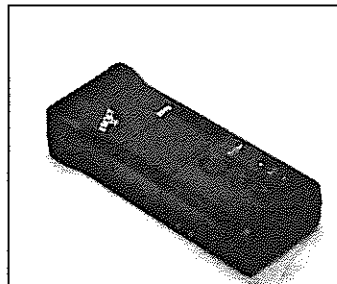
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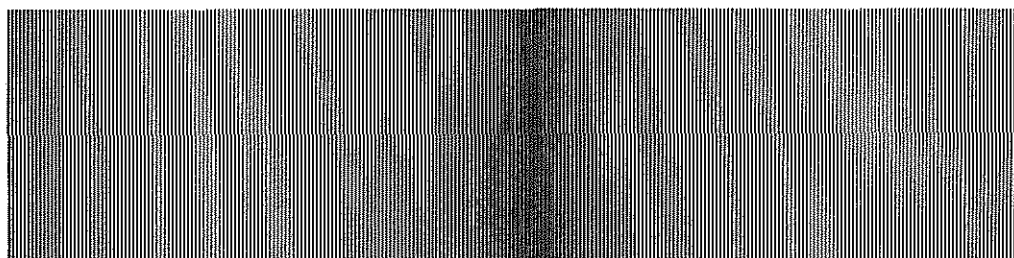
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\$65 Million EMF Research Bill Heads to House Floor

The House of Representatives Science, Space and Technology Committee approved a \$65 million electromagnetic field (EMF) research and communication measure on March 31 and sent it to the floor of the House as part of the national energy bill. In the process, the committee shortened the research program from ten years to five, effectively doubling the annual research budget. (The bill's ban on outside consulting and expert testimony by researchers was substantially weakened; see box, p.11.)

The House is now likely to act on the EMF research proposal this year since it is attached to legislation that is a high priority for both the President and Congress. However, House leaders have not yet scheduled action on the energy bill. The original EMF bill, H.R.3953, was approved as a backup, with language identical to that in the energy bill.

The EMF legislation has broad support. At a March 10 hearing of the science committee's environment subcommittee, utility, state and labor union officials endorsed H.R.3953 (see *MWN*, N/D91 and J/F92). "We hope this bill becomes law this year," Bob Bergland of the National Rural Electric Cooperative Association (NRECA) told the subcommittee. The Electric Power Research Institute (EPRI) "supports the objectives of the proposed program," said EPRI's Dr. Stanley Sussman.

(continued on p.11)

Strong VDT Magnetic Fields Linked to Higher Rates of Miscarriages

Women who use video display terminals (VDTs) that emit strong magnetic fields may be at a greater risk of having miscarriages than those using low-field VDTs, according to the preliminary results of a new Finnish epidemiological study. This is the first time magnetic field exposures have been an integral part of an epidemiological study of VDT reproductive risks.

Speaking at the *First Congress of the European Bioelectromagnetics Association* (EBEA) in Brussels, Belgium, on January 25, Dr. Maila Hietanen of the Institute of Occupational Health in Helsinki, Finland, reported that VDT operators who were exposed to extremely low frequency (ELF) magnetic fields of greater than 9 mG had a miscarriage risk close to three-and-a-half times greater than those who used VDTs with ELF exposures of less than 4 mG. The increase was statistically significant.

Women exposed to 4-9 mG ELF magnetic fields had nearly twice as many miscarriages as those exposed to less than 4 mG and there appeared to be a dose-response relationship between magnetic fields and miscarriages, but neither finding was significant.

(continued on p.12)

« Power Line Talk »

The DOE is sticking to its ambitious schedule for developing a unified national EMF research program by this summer (see *MWN*, N/D91), but some federal officials seem wary of the department's way of doing business. Rep. James Scheuer (D-NY) objected to DOE's decision to exclude the press, the public and congressional aides from its February 28 meeting of representatives from more than a dozen federal agencies. He delivered a lecture on "open democracy" to DOE's Michael Davis at the March 10 congressional hearing on EMF research (see p.1). Davis, assistant secretary for conservation and renewable energy, countered that DOE officials closed the interagency meeting to create "an environment where we could have a no-holds-barred discussion." Marvin Gunn, the DOE official directing the planning process, told *Microwave News* that the department convened the meeting to ensure that DOE officials understand what work other agencies are doing on EMFs and to emphasize the need for a unified federal program. He said that he sensed a "clear willingness to cooperate" at the meeting. But one participant who asked for anonymity told *Microwave News* that he could not shake the feeling that the DOE has a "hidden agenda." "The DOE will hold additional interagency meetings as needed," Gunn said. The department plans a round of meetings this spring for working groups on science, engineering and communications. Public meetings are also on the agenda; dates and locations will be announced in mid-April, according to Gunn.

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In February, the Health Effects Institute's (HEI) board of directors concluded that the institute "has an obligation" to pursue EMF research if it can secure adequate funding from the government and the private sector (see *MWN*, N/D91). Based on what has been learned during its planning effort, HEI is preparing a report addressing the question, "Does EMF exposure cause human health effects?" It should be completed by the end of this summer. HEI, based in Cambridge, MA, is ready to implement the five-year research plan that is being developed by the NERP steering committee (see p.5). Alternatively, the HEI board suggests that with \$3 million in new funds HEI could collaborate with the National Toxicology Program on its animal studies; or it could develop ways to improve epidemiological studies with an initial grant of \$1 million.

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The DOE and EPRI have agreed to work together again as joint sponsors of the annual review of EMF research, held every November. At the 1989 meeting, EPRI announced that it would no longer ask its contractors to attend future reviews—instead they would present their findings at the summer meeting of the Bioelectromagnetics Society (see *MWN*, N/D89). A new steering committee has been set up to broaden participation at the meeting and to select the papers to be presented. The members are: Dr. Daniel Driscoll of the New York State Department of Public Service, Paul Gailey of Oak Ridge National Lab, DOE's

Dr. Imre Gyuk, EPA's Dr. Doreen Hill and EPRI's Dr. Charles Rafferty. "We are pleased to be working with the other research sponsors to put together a more broadly representative conference on ongoing research," EPRI's Dr. Stan Sussman said in an interview. Driscoll said that he would encourage those who will work on the NERP to attend the reviews. This year's meeting will be held November 8-12 at the Holiday Inn on the Bay in San Diego, CA.

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The Trial Lawyers for Public Justice (TLPJ) Foundation will hold its *Second Annual Multidisciplinary Seminar and Citizen Action Conference* on May 15-16 in Ann Arbor, MI. The May 15 seminar is for lawyers, and the May 16 conference is being held to develop "an effective response to the public health hazards of EMFs on the grass-roots and workplace level." The first TLPJ conference, held in November 1990, served to launch the ten-member Electromagnetic Radiation Case Evaluation Team (EMRCET), set up to investigate and evaluate EMF cases for attorneys (see *MWN*, M/A91). Speakers at this year's meeting will include EMRCET attorneys, as well as Drs. Abe Liboff, Bruce McLeod and Peter Wright. The registration fee is \$150 for May 15 and \$25 for May 16. However, lawyers who have represented utilities and manufacturers of EMF-emitting equipment must pay \$1,000 to attend the seminar and will be barred from the conference. The Robert Carl Strom Foundation and the Michigan State Trial Lawyers Association are cosponsors of the May meetings. For more information, contact: Michael Withey, Schroeter, Goldmark & Bender, 810 Third Ave., Suite 500, Seattle, WA 98104, (206) 622-8000.

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Answering a spate of recent criticism, Dr. Granger Morgan defends the concept of prudent avoidance in the March 15 issue of *Public Utilities Fortnightly*. He responds directly to a vehement attack by the *Electromagnetic Energy Policy Alliance* (EEPA), published last October in the *Health Physics Society Newsletter*. EEPA condemned prudent avoidance as "the abandonment of science" and a "great danger to society, as we know it." Morgan counters that his strategy "is an example of using incomplete science to make a reasoned judgment in the face of uncertainty." He makes it clear that he does not see EMFs as a grave health threat: "On the basis of the epidemiological results, I'd give pretty good odds (better than a 90% chance) that if fields pose a risk, they pose a modest risk (of the order of 1 in 10,000 per year) to all exposed people, rather than posing a very high risk to a few unfortunate people." Yet he argues that these odds still demand prudent avoidance. He adds that, "Whether or not there is a risk, there is a good chance it will be at least a decade before the mainstream scientific community will be able to reach a consensus." While acting on the possibility of a risk "runs contrary to the usual societal habit of declaring everything either safe or hazardous," he suggests, most people in their daily lives know

how to make common sense judgments about uncertain risks. Hethen asks whether "our legal and regulatory system [is] so set in concrete that we must ignore common sense? I think the answer is no...." Morgan and his colleagues at Carnegie Mellon University in Pittsburgh, PA, Drs. Indira Nair and Keith Florig, put forward the idea of prudent avoidance in a 1989 OTA report (see *MWN*, J/A89).

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In our last issue, we reported that a committee of top scientists

convened by the JASON Program Office (JPO) held a meeting to consider EMF health effects. This, however, was just an introductory session: EMFs will now be one of the topics at the JASONS' main summer session, to be held June 15-July 31 in La Jolla, CA, according to DOE officials. The DOE expects a final report by the end of the summer. EMFs were selected from among some 25 issues submitted by various DOE offices, assistant secretary Michael Davis explained at the March 10 congressional hearing (see p.1).

Bowman's Brave New Theory on Geomagnetic Resonances

Dr. Joseph Bowman may have an explanation for the sometimes puzzling results of epidemiological studies of childhood cancer and power frequency magnetic fields. He believes the key to the problem is the earth's static magnetic field.

"When a 60 Hz magnetic field is in resonance with the natural geomagnetic field, there is a trend of increased childhood leukemia risk with *measured* magnetic fields in the University of Southern California [USC] epidemiological study," Bowman told *Microwave News*. His analysis of the USC data resulted in odds ratios (ORs) as high as 6.0 and 9.0 for those exposed to field levels greater than 3.0 mG, although he emphasized that these findings are not statistically significant.

The USC study showed a leukemia risk with wire codes, but not with 24-hour or spot magnetic field measurements (see *MWN*, M/A91 and S/O91). Bowman, a member of the USC team, is now at the National Institute for Occupational Safety and Health in Cincinnati, OH.

Dr. John Peters, the lead investigator of the USC study, thinks that Bowman may be on to something important. "This may be where the answer lies," he said at a March 16 seminar at the Harvard School of Public Health in Boston, MA.

Dr. Abe Liboff of Oakland University in Rochester, MI agrees. "Bowman has struck boldly, like a swashbuckling scientist. He deserves a lot of credit for looking at the earth's magnetic field in the context of epidemiology," he said in a telephone interview.

Bowman said he was inspired by Dr. Carl Blackman's studies on calcium efflux, Liboff's experiments on cyclotron resonance and Russia's Dr. V.V. Lednev's theoretical models. Resonances occur for 60 Hz fields at static fields of 380 mG and 506 mG, according to Bowman's calculations; he assumes that there is a 91 mG bandwidth around each of the two resonances.

Working primarily with Peters and Dr. Duncan Thomas, also of USC, Bowman found that when the cases that fit in these two resonance bands were combined, there was a trend of increasing risk that began climbing at the second lowest power frequency exposure group of 0.7-1.4 mG (OR=2.40) and peaked for those exposed to more than 3.0 mG (OR=6.00). The trend of this dose-response curve approached statistical significance ($P=0.056$). For the cases in resonance at 380 mG, the risk of developing leukemia was nine times the expected rate. The original USC study found no trend with measured magnetic fields.

Bowman's analysis has been hampered by the small size of the data set and by the intensity of the geomagnetic field in Los Angeles, the site of the USC study. Static field measurements were only available for 128 of the 232 leukemia cases included in the USC study. Of these 128 cases, only 32 were in the 380 mG resonance and only 14 were in the 506 mG resonance—the remaining 82 cases fell between the two.

While applauding Bowman's work, Liboff has doubts about some aspects of the model, including the use of Liboff's own lymphocyte data for determining the width of the resonance bands. Liboff suspects the bandwidths are too large but acknowledges that Bowman's assumptions were driven in part by the need to include a sufficient number of cases to test his hypothesis. "As far as possible, Bowman used the tools available to him, but, at this point, there aren't enough experiments to answer some of the questions that have to go into the analysis," Liboff said.

"There are plenty of questions to be answered and the hypothesis has not yet been thoroughly tested," Bowman said. Nevertheless, he believes that his findings are strong enough to motivate the next generation of childhood cancer studies. He has talked to researchers at the National Cancer Institute who are working on a large-scale EMF-childhood leukemia study, which will include measurements of static magnetic fields (see p.6 and *MWN*, N/D89). Peters and Bowman think that Denver is a good test site for future studies because resonance conditions would be met more often than in Los Angeles. Liboff, however, prefers New Orleans, LA or Phoenix, AZ because their geomagnetic fields are closer to the predicted resonance conditions.

Bowman's model will no doubt encourage researchers to move away from the idea that average magnetic field measurements can predict cancer risks. One of the USC team likened their use of an EMDEX meter to measure fields to evaluating a symphony orchestra with a noise meter, Bowman pointed out.

Bowman said that he has received "fairly heated, but justified, criticism" from a number of scientists since he began discussing his theory. He first presented his findings at the November 1991 Department of Energy Contractors Review in Denver, CO. He maintains that his model has motivated people to think more in terms of mechanisms and to apply theoretical and experimental results to epidemiological studies. "This is the way to go in the future," he said.

Legal and Administrative Notebook

Neurological Claim Against Wisconsin Utility

The parents of a child with a neurological disorder have sued Wisconsin Electric Co., seeking unspecified punitive damages. Leo and Cathy LaBonte of New Berlin, WI, a suburb of Milwaukee, state in their February 26 claim, filed in Waukesha County Circuit Court, that the utility failed to warn them about potential health risks associated with electromagnetic fields (EMFs), particularly for people with neurological disorders. They allege that EMFs from Wisconsin Electric power lines induced seizures in their seven-year-old daughter, who suffers from lissencephaly, a congenital neurological brain disorder. The plaintiffs' attorney, Timothy Aiken, is with the firm of Aiken & Scopur in Milwaukee.

EMFs inside the family's home ranged from 16 to 27 mG, according to Leo LaBonte's measurements. The utility found EMFs of 10-20 mG indoors and 50 mG outdoors, at the edge of the right-of-way (ROW), under summer peak load conditions. The house is about 70 feet from 230 kV and 138 kV transmission lines, as well as from 26 kV and 8 kV distribution lines, all belonging to Wisconsin Electric.

"There is nothing unusual about the LaBontes' home," Wisconsin Electric's EMF issues coordinator, Jackie Olson, told *Microwave News*. "We feel our facility neither caused nor aggravated their daughter's condition." The Milwaukee-based utility noted in a letter to the LaBontes that EMFs at the edge of the ROW fall below the standards set by Florida and New York—the only two states that have established magnetic field standards for transmission lines.

EMF Trespass Suit Dismissed in Virginia

On February 10, a Hanover County, VA circuit court judge dismissed a lawsuit claiming EMFs as a trespass violation. The plaintiffs will not appeal the decision.

Nineteen local families had filed suit against Virginia Power, alleging that EMFs from the utility's proposed power lines would invade their properties. Judge Richard Taylor agreed with the utility that the State Corporation Commission (SCC), not his court, has authority over power lines. The SCC approved Virginia Power's proposal for the disputed 31.5-mile, 230 kV transmission line in 1990.

The plaintiffs' attorney, Todd Benson, of the Richmond firm of Press, Jones, Waechter & Stoneburner, told *Microwave News* that EMFs constitute a trespass and that the claim is allowed under Virginia anticipatory trespass law. Virginia Power attorney John Holleran, of the Richmond firm of Hunton & Williams, disagreed. "You've got to have a physical invasion to show trespass and since EMFs don't constitute a physical invasion...there's nothing the court can do," he said in a telephone interview.

In his written complaint, Benson called Virginia Power's plan to take a 60-foot easement on either side of the transmission line "grossly inadequate." Dayna Page, principal plaintiff in the

suit and leader of Virginia RAGE, Residents Against Giant Electric, told *Microwave News* that the group wanted to be compensated for at least 300 feet of land on each side of the proposed line. She said their goal was to raise costs for the power company and force it to bury the lines. Although the plaintiffs will not appeal—mostly because of high legal costs, according to Page—they are collecting signatures to send to the Army Corps of Engineers, requesting that it prepare another environmental impact report. Page said that a correct assessment would show that construction along the proposed ROW would damage wetlands.

Missouri PSC Approves Power Line Siting

The Missouri Public Service Commission (PSC) decided on December 13 that the Union Electric Co. of St. Louis does not need to mitigate EMFs from a proposed transmission line. In a written report (case no. EA-91-56), the commission said that it cannot order the utility to reduce EMFs when there is no scientific evidence that EMFs from power lines damage health. The commission added, however, that it cannot conclude that EMFs are harmless.

The PSC's findings undermine a local municipality's opposition to the siting of the power line. The city of Linn Creek, in Camden County, sought to block or alter the proposed route for the 161 kV line, 700 feet of which will fall within its bounds. The city intervened before the PSC, claiming that the line would threaten public health and lower property values.

But the PSC, in Jefferson City, approved the line, stating that it will provide reliable service in the face of a growing demand for electricity in the area. Linn Creek had requested that the utility adopt a policy of prudent avoidance and reroute the power line, but the commission responded that the proposed route is the most direct and least intrusive.

PG&E Sued Over Property Sale

A Santa Cruz, CA couple is pursuing a lawsuit against Pacific Gas and Electric (PG&E), claiming that the utility sold them property that it knew was unfit for development. The suit, filed in California Superior Court in 1990, had been on hold until the couple could formally establish that they were denied the intended use of their property, according to Dale Dawson, attorney for the plaintiffs, Jacqueline and Michael Keogh. On February 11, 1992, the Santa Cruz County Board of Supervisors denied the Keoghs' application for a residential subdivision.

The board agreed with the county planning department determination that the property is "not suitable" for the proposed development because "residents would be exposed to unsafe levels of EMFs." The 1.95 acre parcel, which the couple purchased in 1983, contains two 115 kV transmission lines and one 21 kV distribution line, all belonging to PG&E. EMF measurements at the site are as high as 18.7 mG in some locations, according to the board's report.

"The suit was filed because PG&E did not disclose that

there was a problem with high EMFs," Dawson, a partner with the Scotts Valley firm of Dawson, Passafiume & Bowden, told *Microwave News*. Dawson alleges that the utility participated in EMF studies before the sale, and should have, under California real estate law, disclosed any material fact that might affect the value of the property.

But Stephen Jones, with the San Francisco law firm of Sedgwick, Detert, Moran & Arnold, who is representing PG&E, said in a telephone interview that, "Back when the Keoghs purchased the property, no one anticipated there would be a problem in obtaining a building permit." Furthermore, the utility believes that there would be no substantial health risk for residents if the property were to be developed, Jones said.

Legal Advice

- When faced with legal defense fees and possible liability costs, utilities must determine whether these claims will be covered under their insurance policies, writes Keith Meyer in the February 15 issue of *Public Utilities Fortnightly*. Meyer, a partner with the Los Angeles firm of Paul, Hastings, Janofsky & Walker, represents policyholders in insurance litigation. His article urges utilities to fight for the coverage they are entitled to under their CGL (comprehensive general liability) policies before a poor precedent is established. "Too frequently carriers look for ways to deny coverage," he writes. "EMF claims may become the next wave of continuous, progressive disease cases where the total amount of liability could exceed the amount paid out in asbestos cases."

- In a February 19 *Toxics Law Reporter* article, corporate defense lawyer Richard Dandrea argues that claims alleging that EMFs cause cancer should be dismissed before trial. He contends that scientific data establishing an EMF-cancer link are inconclusive—and that any testimony is therefore based on inadequate information and should not be permitted in court. Dandrea notes that, for the same reason, hired consultants should not be permitted to testify that EMFs "probably" caused a plaintiff's cancer. Causation cannot be proved, he concludes, adding that the subject requires "further, more formalized analysis." The *Toxics Law Reporter* is published by the Bureau of National Affairs in Washington, DC.

- When considering what can be done now to minimize the risk of liability in future EMF cases, Paul Hanzlik, a litigator representing public utilities at the Chicago law firm of Hopkins & Sutter, recommends that utilities weigh the following measures: encouraging public utility commissions to establish reasonable EMF standards; mitigating EMFs in new transmission lines and locating the lines away from schools, hospitals and playgrounds; and encouraging companies with EMF-generating equipment to form groups to monitor research and meet with customers and community officials. "The utility with a program that includes a reasonable response to what is presently known will decrease its risk of future liability," Hanzlik writes in his paper, "Electric and Magnetic Field Litigation—Thinking Beyond Today's Challenges," which he presented at a March 9-10 conference sponsored by *Transmission & Distribution* in Arlington, VA.

NERP Pushes Ahead Despite Funding Uncertainties

The National EMF Research Program (NERP) is moving forward despite uncertainty about funding sources and the support of government agencies.

At its March 24-25 meeting in Arlington, VA, the NERP steering committee decided to issue a request for proposals (RFP) this summer for a research administrator and to begin research by January 1, 1993.

"We're in a very fluid situation," said NERP Chairman John Coughlin, referring to the possibility that pending congressional legislation may siphon funding from the NERP. Like the NERP, the legislation would set up a long-term research program funded by federal, state and private sponsors (see p.1 and *MWN*, N/D 91 and J/F92).

Anne Strauss of the New York Power Authority (NYPA), which has been the primary utility industry supporter of the public-private approach, said in an interview that industry does not want to contribute to more than one national program. NYPA is a member of an informal group of potential private sector sponsors that NERP officials call the "significant contributors group."

The DOE and the Environmental Protection Agency (EPA) also plan to fund EMF research, and it is not clear how their plans will mesh with the NERP's. The DOE has asked Congress for \$7.5 million for the fiscal year that begins on October 1, 1992. It is in the process of formulating an EMF research program for federal and state agencies and private companies.

EPA currently has \$1.94 million for EMF research. It has not decided whether to spend it on research by agency scientists, allocate it according to DOE's plan, contribute it to a federal-state program such as the NERP or give it to a private research organization such as the Health Effects Institute (HEI) of Cambridge, MA (see p.2). A decision is expected soon, according to agency sources.

Working in their favor, steering committee members say, is NERP's ability to begin research and produce results faster than the pending congressional program could. Energetics Inc. of Columbia, MD, which is providing staff support to the NERP, estimates that the bill would require at least 20 months of planning before research would begin.

At its March meeting, the steering committee introduced two new members and announced one member's resignation. The addition of David Kleffman, deputy director of EPA's Office of Health Research, makes EPA the first federal agency to join the NERP. The utility contributors had considered the lack of federal participation a major drawback, NERP sources say. Coughlin hopes to add at least one more federal representative. Wendell Holland, a public utility commissioner from Pennsylvania, has also joined the steering committee.

Dr. Mark Cooper of the Consumer Federation of America (CFA) has resigned. Sources involved with the NERP told *Microwave News* that Cooper withdrew after the American

Public Power Association (APPA) and the National Rural Electric Cooperative Association (NRECA), both of which are members of the CFA, questioned its involvement with the NERP. The CFA decided independently to have Cooper resign, the sources said. Cooper did not return calls for comment.

The steering committee plans to add a member from a national environmental or consumer organization. It also is considering adding a representative of the Electric Power Research Institute (EPRI), at the urging of steering committee member Dr. Charles Imbrecht, a California energy commissioner. But Coughlin said that he has already met with EPRI officials and he does not think they want to join the NERP.

In its effort to issue an RFP, the committee directed Energetics to propose, by May 1, an organizational structure, a job description for the research administrator, a conflict of interest policy and bylaws. Energetics was also asked to incorporate the NERP as a nonprofit organization.

The steering committee will next meet this summer, when it hopes to finish the RFP.

Major New U.K. Epi Study

On April 1, the U.K.'s Coordinating Committee for Cancer Research (CCCR) will start a large-scale epidemiological study in an effort to determine the causes of childhood cancer, with the possible role of electromagnetic fields (EMFs) among the hypotheses tested.

The five-year, £6 million (about \$10.4 million) effort will be run by a management committee chaired by Sir Richard Doll, an epidemiologist at the Imperial Cancer Research Fund in Oxford. "This very important study is the largest and most wide-ranging to be carried out anywhere in the world," said Professor Dame Margaret Warwick, the chairwoman of the CCCR.

The families of all children under 15 newly diagnosed with cancer in England and Wales will be approached for the case-control study. Over the course of the study, the CCCR expects to investigate 1,000 cases of acute lymphoblastic leukemia—the most common type of childhood cancer—and 3,000 cases

State EMF Actions

Connecticut...A task force created by the Connecticut legislature last July has decided that adopting a policy of prudent avoidance of EMFs would be premature. The group, cochaired by representatives of the Departments of Environmental Protection and Health Services, wrote in its interim report, issued in February, that the state should not rule out "an association between EMFs and health risks and...the subject needs more investigation." The task force is hiring a consultant to conduct a literature review. Its final report is due by October (see *MWN*, M/J91 and J/A91).

Illinois...A bill requiring a three-year moratorium on the construction of power lines carrying more than 60 kV was introduced into the House on February 13 by Rep. John Matijevich. HB 2775 would also require the Illinois Commerce Commission to conduct a study of the effects of EMFs on health and to submit a report to the legislature before January 1995. The measure states that power lines greater than 60 kV could be repaired and rebuilt as long as the modifications didn't increase capacity. The bill is pending in the House Rules Committee. Senate sponsors have not been named....Another bill with a similar three-year moratorium was introduced by Rep. Suzanne Deuchler on March 4. HB 2863 would require the Department of Energy and Natural Resources to conduct a study on the health effects of EMFs. The measure—which was assigned to the House Environment and Energy Committee on March 25—would require a report to the legislature by January 1994.

Indiana...An EMF bill introduced by Senator Robert Meeks passed the Senate on January 27 but died two days later after it was moved to the House Committee on Rules and Legislative Procedures. SB 223 would have required the Utility Regulatory Commission to study scientific literature about the health effects of EMFs and to establish EMF safety requirements with regard to transmission lines.

New York...An EMF bill introduced by Assemblyman Maurice Hinchey is awaiting a hearing in the Committee on Environmental

Conservation after being returned there by the Ways and Means Committee in January. AB 4657 would authorize the Department of Environmental Conservation (DEC) to regulate EMFs. The measure also recommends EMF exposure limits along ROW edges: for example, 150 mG for a transmission line of no more than 230 kV and 200 mG for a 500 kV line. The DEC would be required to review literature on the health effects of EMFs and to submit a report to the governor and the legislature by January 1993. New York already follows standards set by the Public Service Commission (see *MWN*, S/O90).

Pennsylvania...HB 2273, introduced by Rep. Patricia Carone, would authorize the Public Utility Commission (PUC) to develop an EMF avoidance program to reduce public exposure to EMFs from power lines. The program would be based on the concept of prudent avoidance. The measure, introduced last December 10, awaits a hearing in the conservation committee. It would authorize the PUC to adopt standards for maximum EMFs at ROWs. In addition, the PUC would collect a power line siting fee from any public utility authorized to build a transmission line.

Wisconsin...AB 698, which would require a survey of the location of transmission lines in relation to schools and other public facilities, was passed by the Assembly on March 11. Introduced by Rep. Maxine Hough last November, the bill originally called for a moratorium on the construction of new lines of at least 60 kV. This requirement was later deleted. "Even though the final bill is much reduced from the original language, it's a great victory," said Paulette Quick, legislative aide to Hough. "A survey is the most minor action you can take, yet it received tremendous opposition from utilities and individuals." The legislation still must be passed by the Senate and then signed by the governor. The Wisconsin Public Service Commission decided in January that state utilities must use the best available control technology to reduce EMFs from new and upgraded transmission lines; however, it rejected a citizens group proposal for a three-year moratorium on new lines of at least 60 kV (see *MWN*, J/F92).

of other types of cancer. A similar study among Scottish children began a year ago.

Along with EMFs, four other possible risk factors will be investigated. They are: ionizing radiation (exposure both in utero and after birth); carcinogenic chemicals and drugs; damage to the father's sperm by chemicals or ionizing radiation; and infectious agents.

A large-scale study of childhood cancer is already under way at the National Cancer Institute (NCI) in the U.S. (see *MWN*, J/F89). It should be completed by 1995, according to NCI's Dr. Martha Linet. The possible EMF-childhood cancer link is also being studied in Australia (see *MWN*, J/A91).

A previous U.K. study on power line EMFs and childhood cancer failed to show any association, but few of the participants were, in fact, exposed: more than 95% of the cases' and controls' homes had calculated magnetic fields of less than 0.1 mG (see *MWN*, J/F91).

Doll is also the chairman of an advisory group that reviewed the status of EMF research for the National Radiological Protection Board and that formulated priorities for future study (see p.9).

California Group Reaches Limited Agreement

California EMF Consensus Group members were unanimous in their basic belief that "society can no longer ignore the warnings that electromagnetic fields [EMFs] are a potential problem," according to a March 20 report. Although the group's 17 members—who represent diverse interests including utili-

ties, labor unions and citizens groups—recommended that the California Public Utilities Commission (PUC) adopt research, education and mitigation policies, they could not always agree on how these requests should be implemented. The consensus group was charged in October 1991 with developing recommendations on interim EMF policies for the PUC.

First among the consensus group's policy recommendations was that the PUC adopt an interim plan that permits utilities to take no-cost or low-cost steps to reduce EMFs. There was no consensus on how to define "low-cost" mitigation, however.

In the field of research, recommendations for state and national EMF research programs were restrained by members' inability to agree on funding levels for the programs.

Although the consensus group recommended an EMF education plan for electric utility personnel and customers, the members could not agree on how much more should be spent than the \$3 million California electric utilities now contribute annually to EMF education programs, and on who should pay to implement the plan.

The consensus group also recommended that the commission ask electric utilities to consider public concerns about EMFs when siting new facilities, and, at the same time, proposed that the public take action to protect itself—for example, by adopting a policy of prudent avoidance. The PUC must decide if it wants to hold formal hearings and adopt the recommendations.

For a copy of the report, *Issues and Recommendations for Interim Response and Policy Addressing Power Frequency Electric and Magnetic Fields*, contact: CA PUC, CACD-Environmental Section, 505 Van Ness Ave., San Francisco, CA 94102, (415) 703-2523. (For more on the consensus group, see *MWN*, N/D91.)

HIGHLIGHTS

Testicular Cancer Cluster Among Police Radar Users

Seven officers in two small Michigan police departments have been diagnosed with testicular cancer, and traffic radar is suspected as a possible cause. The two departments, in Grand Rapids and the nearby suburb of Wyoming, have 265 and 75 officers, respectively—and a total of about 200 patrol officers.

"This strikes me as very odd, very unusual," said Dr. Robert Davis, who is studying cancer rates among police officers in Washington State. "We shouldn't just dismiss it out of hand." He added that, "My gut feeling is that, given that we don't know what causes testicular cancer, radar is the common factor among these officers that is unusual."

Four officers in the Grand Rapids department developed testicular cancer over the last ten years—diagnosed in 1982, 1984, 1988 and 1991. Each of the first three had used hand-held radar units for over ten years prior to diagnosis, according to a series of interviews. The fourth had used radar for less than a year and only for a short time before his cancer was diagnosed.

In Wyoming, three officers developed testicular cancer. Two were diagnosed in 1979: one used hand-held radar for about five years, the other for more than ten years. The third officer was diagnosed last year; he had used hand-held radar for six months in a previous job in the early 1980s and had used dashboard-mounted radar more recently for two-and-a-half years in Wyoming.

Davis, of the division of general pediatrics at the University of Washington Medical Center in Seattle, explained that to quantify the possible link between the testicular cancer cases and radar use, he would count only six of these cases. He would include the most recent Wyoming case, but he called it "questionable," since the officer's exposure to hand-held radar was limited. He said the Grand Rapids officer diagnosed most recently apparently was not exposed to radar long enough prior to diagnosis to be considered.

There are at least two other cases not included in the cluster:

HIGHLIGHTS

a fourth Wyoming officer who used radar had a benign testicular tumor removed in the late 1970s; and an officer in the local sheriff's department was diagnosed with testicular cancer in 1989.

Davis designed his analysis to bias his calculations *against* finding any excess incidence of testicular cancer. He considered a group of 300 officers; going back to 1960, he allowed for a complete turnover in the work force every ten years; he also used the peak testicular cancer rate, which is for men 25-35 years old, though many officers would be older and at less risk. With these assumptions, he still found that only about two cases would be expected in this group. Thus, five or six cases in the actual population is up to triple the expected rate.

"The numbers are strong," said Davis, since they show an elevated risk even in an analysis designed to avoid such a result. He cautioned, however, that any disease cluster can be a statistical anomaly. "The way to follow this up is to do a large-scale study," looking at the cancer rates among at least 50,000 to 100,000 law enforcement officers, he explained.

The policemen themselves suspect hand-held radar to be the cause of their cancer and they point to the way they used their radar guns. David Berndt, the Grand Rapids officer who was diagnosed in 1988, told *Microwave News* that he often left the radar, which transmitted continuously, resting near his groin. In

what he described as common practice among fellow officers, Berndt would point the unit out the window to clock traffic, then rest it on the seat, on his lap or between his legs when it was not in use. "You would plug the unit in and then typically it would be on for the duration of the shift," Berndt said, adding that most units had an on/off switch, "but no one used it."

Berndt has sued the manufacturers of the radar guns he used: CMI Inc. and MPD Inc., both of Owensboro, KY, Decatur Electronics Inc. of Decatur, IL and Kustom Signals Inc. of Overland Park, KS. "It seems to me that there is both a statistical and a logical connection between the cancers and the radar units," explained Berndt's attorney, Barbara Crozier of Bremer, Wade, Nelson, Mabbitt and Lohr in Grand Rapids. Crozier told *Microwave News* that she "anticipate[s] there will be more claims filed." (See box below.) Berndt's case was filed in Michigan Circuit Court on November 8, 1991.

Davis is developing a questionnaire, which he hopes to use to interview officers with testicular cancer in the Grand Rapids area and elsewhere (see p.13). In Washington State, he is conducting a cohort study of state patrol officers, looking for elevated cancer rates related to radar use, in collaboration with Dr. Samuel Milham Jr., an epidemiologist for the state Department of Health in Olympia (see *MWN* M/A91).

Other Police Radar Developments

- A hearing date of August 11 has been set for police officer Eric Bendure's lawsuit against Kustom Signals Inc. and MPH Industries Inc. of Lenexa, KS. Bendure alleges that the companies' hand-held radar units caused his lymphoma, which originated in his groin (see *MWN*, M/A91). Meanwhile, the suit filed by Hyman Rosen against Kustom Signals in March 1991—the first police radar case—has now been dismissed. Attorney John Sweeney of Agoura Hills, CA said he voluntarily withdrew Rosen's suit because of difficulties in establishing the extent of the officer's radar use. Rosen was diagnosed with melanoma on the back of his neck in 1986 and died November 7, 1991. Sweeney explained, "We were unable to get his testimony about his radar usage as his condition was deteriorating and he had difficulty communicating toward the end of his life." Sweeney told *Microwave News* that the logs kept by Rosen's employer, the U.S. Park Police, were incomplete. "Rosen told me he used radar continuously since 1979 or 1980, and I believe that," Sweeney is also representing Bendure and is cocounsel with Barbara Crozier on the lawsuit filed by David Berndt in Michigan (see story above). Kustom Signals declined to comment.

- A police officer is subject to the greatest radar exposure when a hand-held unit is placed on the front seat next to the officer, according to a report on a series of measurements commissioned last fall by the Connecticut State Police. Emissions from a Decatur MVR724 fixed-position radar and from a Kustom Signals HR-8 hand-held unit were measured at Retlif Testing Labs in Ronkonkoma, NY. Exposures were measured at head height in the driver's position of a patrol car while the radars were operated in a variety of positions an officer might use. With the hand-held unit on the seat, facing the driver, the exposure was $164 \mu\text{W}/\text{cm}^2$. Facing

away from the driver, it was $265 \text{ nW}/\text{cm}^2$, and pointed over the driver's shoulder toward the rear of the vehicle, it was $90 \text{ nW}/\text{cm}^2$. With the fixed unit, the lowest exposure was achieved when the radar was mounted on the dashboard and angled away from the driver; the highest exposure, $16 \text{ nW}/\text{cm}^2$, was measured when the antenna was mounted on the inside of the rear, driver's-side window. Even stronger exposures came from a police radio system that Retlif tested: the highest measurement from the radio was $19 \text{ mW}/\text{cm}^2$. While pointing out that the radar emissions were all below current national standards, the report states that "the levels observed were still quite interesting and of concern considering what may be viewed as long-term exposure to police officers." Prepared by Retlif and F.L. Helene Inc., a Wallingford, CT consulting firm, the report recommends "certain prudent steps" to minimize exposure: fixed-position units should be used rather than hand-held radars, and certain locations within a patrol car should be avoided. A limited number of copies of the report are available from: Connecticut State Police Union, 2138 Silas Deane Highway, Rocky Hill, CT 06067, (203) 721-0121.

- The controversy that flared in Connecticut last year over the possible police radar-cancer link led not only to testing of radar units, but also to legislation to restrict their use. HB 5070 would ban the use of hand-held radar units in the state—a step that many local police departments and the Connecticut State Police instituted at least temporarily last October (see *MWN*, N/D91). It is scheduled to be considered by the full House on April 9, according to the secretary of the Labor and Public Employees Committee, which approved the measure 14 to 1. Another bill, requiring the labor commissioner to study possible cancer risks associated with the use of hand-held radar, died in committee.

U.K. Panel Discounts ELF & RF Cancer Risks, Seeks Research

An advisory group set up by the U.K.'s National Radiological Protection Board (NRPB) has concluded that there is "no firm evidence" of a cancer risk from exposure to extremely low frequency (ELF) electromagnetic fields (EMFs).

In a report released on March 31, the NRPB panel said that, "The experimental evidence [on ELF EMFs] provides no reason to suggest that a carcinogenic effect of any sort is at all likely except possibly for a small risk attributable to melatonin." With respect to epidemiological studies of brain cancer, the panel concluded that for children the "weak evidence" of an association with EMFs may be due to "artefacts of the method of enquiry" and that for workers it is "impossible to decide" whether the risk is due to EMFs or to chemicals.

For radiofrequencies (RF) above 100 kHz, the panel found that animal studies provide "some evidence for effects on tumor incidence," but noted that they could be due to heating.

At a press conference held in London, Dr. Roger Clarke, the director of the NRPB, said that, "The epidemiological data in particular do not appear to provide the basis for restricting human exposure to non-ionizing electromagnetic radiation."

The panel cited the need for more research. It recommended epidemiological studies of workers exposed to EMFs on the job and of children exposed at home and said these studies should be undertaken "as soon as practical" (see p.6). In a reference to male breast cancer risk, the panel said that the "evidence is suggestive enough to require further investigation."

Experimental studies—both animal and cellular—were also suggested because they "can play a significant role in resolving current uncertainties on the possible association between [EMFs] and carcinogenesis."

The advisory group, which was chaired by Sir Richard Doll, was set up to review the U.S. Environmental Protection Agency's (EPA) report on EMFs and cancer (see *MWN*, J/F91). In contrast to the EPA report, which placed a higher risk on ELF EMFs than on RF radiation, the U.K. panel found that RF is of greater concern. "There is room for more doubt" that there is no cancer risk above 100 kHz, said Doll, who is at the Imperial Cancer Research Fund in Oxford.

"Electromagnetic Fields and the Risk of Cancer: Report of an Advisory Group on Non-Ionizing Radiation," *Documents of the NRPB*, Vol.3, No.1, 1992 is available for £10.00 from: HMSO Publications Center, PO Box 276, London SW8 5DT, U.K. It will soon be available for \$25.00 from: Unipub, 4611-F Assembly Drive, Lanham, MD 20706, (800) 274-4888.

Research Update: New EMF & NIER Books and Papers

Glenn Bell et al., "Human Sensitivity to Weak Magnetic Fields," *The Lancet*, 338, pp.1521-1522, December 14, 1991, and "Electrical States in the Rabbit Brain Can Be Altered by Light and Electromagnetic Fields," *Brain Research*, 570, pp.307-315, 1992.

This research group from Louisiana State Medical Center in Shreveport, including Dr. Andrew Marino, found that half of a group of 14 volunteers responded to 250 mG or 500 mG magnetic fields. The second paper explores the effects of EMFs on the EEGs of rabbits.

D. Sh. Beniashvili, V.G. Bilanishvili and M.Z. Menabde, "Low Frequency Electromagnetic Radiation Enhances the Induction of Rat Mammary Tumors by Nitrosomethyl Urea [NMU]," *Cancer Letters*, 61, pp.75-79, 1991.

These researchers, based in Tbilisi in the Republic of Georgia, found that both static and 50 Hz magnetic fields acted synergistically with NMU, a chemical carcinogen known to increase the incidence of breast tumors and reduce the mean latency period for their development. As the magnetic field exposures grew longer, more tumors developed, and they grew more quickly.

Zoreh Davanipour et al., "Electromagnetic Field Exposure and Amyotrophic Lateral Sclerosis [ALS]," *Neuroepidemiology*, 10, p.308, 1991.

Six years ago, USC scientists reported that electricians had elevated rates of ALS, a degenerative and usually fatal neurological disease (see *MWN*, S/O86). Now, researchers at the Loma Linda University

School of Medicine in Loma Linda, CA describe the case of a 61-year-old man with ALS whose desk chair was above a power transformer on the floor below his office. When the man's feet were near the transformer, the exposure reached as high as 75 mG. While the researchers caution that the link may be a coincidence, they note that, "His first symptom was foot dragging and loss of control of the toes."

Richard P. Gallagher et al., "Brain Cancer and Exposure to Electromagnetic Fields" (letter), *Journal of Occupational Medicine*, 33, pp.944-945, September 1991.

The authors, from the British Columbia Cancer Agency in Vancouver, Canada, found a nonsignificant elevated risk of brain tumor mortality among workers exposed to EMFs. But they also found higher rates of brain tumor deaths among those in other occupations. On analysis, the only common factor they could identify was that those afflicted were, for the most part, of high socioeconomic status: government officials, engineers aboard ships, civil and mechanical engineers. Bus drivers were an exception.

Reba Goodman and Ann Shirley-Henderson, "Transcription and Translation in Cells Exposed to Extremely Low Frequency Electromagnetic Fields," *Bioelectrochemistry and Bioenergetics*, 25, pp.335-355, 1991.

A review of EMF effects on RNA transcription (see *MWN*, J/A83 and J/A88).

Leland H. Hemming, *Architectural Electromagnetic Shielding Handbook, A Design and Specification Guide*, New York,

HIGHLIGHTS

NY: IEEE Press, 1992, 240 pp., \$59.95.

Written for architects and engineers, this volume includes detailed information on the need for RF shielding, some basic shielding theory and complete descriptions of the major types of commercial shielding.

René R. Kuijten et al., "Parental Occupation and Childhood Astrocytoma: Results of a Case-Control Study," *Cancer Research*, 52, pp.782-786, February 15, 1992.

In this case-control study of 163 pairs of children, researchers from The Netherlands and the U.S. observed a significant risk of brain tumors among the children of electrical and electronic repairmen. However, they write that this finding "has to be interpreted very cautiously, since it was based on only nine discordant pairs and since we were unable to replicate the previously observed elevated risk in the combined group of electrical assembling, installing and repairing. Furthermore, odds ratios for [EMF] exposure were only slightly elevated."

Martin C. Moore-Ede, Scott S. Campbell and Russel J. Reiter, eds., *Electromagnetic Fields and Circadian Rhythmicity*, Boston, MA: Birkhäuser, 1992, 210 pp., \$49.50.

The ten review papers in this collection were first presented at a conference sponsored by EPRI in 1989 (see *MWN*, S/O88). Among the authors are: Drs. Martin Kavaliers, James Olcese, Klaus-Peter Ossenkopp, Russel Reiter, Walter Rogers, Kurt Salzinger, Peter Semm and Rütger Wever, as well as groups from Battelle Pacific Northwest Labs and from the Max Planck Institute. In addition, there are three short commentaries by Drs. Sue Brinkley, Bruce Goldman and Alfred Lewy.

J. Michael Muhm, "Mortality Investigation of Workers in an Electromagnetic Pulse [EMP] Test Program," *Journal of Occupational Medicine*, 34, pp.287-292, March 1992.

Muhm, an epidemiologist at Boeing, found a suggestion of "an association between death due to leukemia and employment in the EMP test program" but notes that "firm conclusions could not be drawn because of limitations of the study." He advocates "further investigation in an independent cohort." In 1990, Boeing paid \$500,000 to settle a suit by Robert Strom claiming that he had developed leukemia following EMP exposure (see *MWN*, S/O90).

Charles Poole and Dimitrios Trichopoulos, "Extremely Low Frequency Electric and Magnetic Fields and Cancer," *Cancer Causes and Control*, 2, pp.267-276, 1991.

The authors conclude that, "The hypothetical carcinogenicity of ELF EMF[s] represents an intriguing scientific problem and a potentially important public health issue but, at this stage, nothing more. It clearly is not possible to exonerate ELF EMF[s]. In order to do so, very large and valid studies showing very little or no association between ELF EMF[s] and cancer would be needed....On the other hand, the empirical evidence linking ELF EMF[s] to cancer is weak and inconsistent. Causal interpretations are not supported by available biologic data."

Gregory B. Rauch et al., "A Comparison of International Residential Grounding Practices and Associated Magnetic Fields," *IEEE Transactions on Power Delivery*, 7, pp.934-939, April 1992.

Grounding systems used in Australia, Germany, Japan, the U.K. and

Computer Companies Form VDT Health Research Foundation

In response to customer concerns about electromagnetic fields (EMFs) from video display terminals (VDTs), IBM Corp., Apple Computer Inc. and Compaq Computer Corp. have committed \$2.25 million over three years to create the VDT Health Research Foundation.

Dr. Glenn Haughe, IBM's director of health, announced the initiative at the March 10 congressional hearing on federal EMF research funding (see p.1). He said that the foundation is soliciting additional financial support from other computer manufacturers.

The foundation will sponsor a VDT Health Research Center, to be located at a university, with the goal of creating an independent and credible research program, Haughe said. He explained that the center will have an independent board to help it "maintain an 'arms-length' relationship from the foundation and its member companies." The host school has not yet been selected.

Haughe stressed that the computer industry does not believe that EMFs from VDTs pose a health risk, but he added that there is an urgent need for additional research. He said that creation of the foundation does not preclude the three companies' support for other EMF research programs.

The foundation was launched by the chief scientists of the three computer giants: David Nagel, an Apple senior vice president, is chairman of the foundation; John Armstrong, IBM's vice president for science and technology, is vice-chairman; and Christopher Gintz, director of corporate development at Compaq, is on the foundation's board. Other companies that contribute \$250,000 annually will be represented on the board, IBM spokesman Michael Dutton told *Microwave News*.

In addition to studying the health effects of extremely low frequency and very low frequency EMFs, the foundation will investigate the role of ergonomic factors in repetition strain injuries among computer users.

the U.S. are described. Different systems can result in a range of magnetic fields: "These differences illustrate the need for tailoring a residential magnetic field measurement protocol to take into account the consideration of grounding schemes as magnetic field sources." The researchers also note that, "Possible future strategies to manage household magnetic fields might take into account alternatives to present-day grounding system practices."

Leonard A. Sagan, "EMF Danger: Fact or Fiction? A Hypothetical Link Between Magnetic Field Exposure and Cancer Continues to Tantalize Researchers," *Safety & Health*, pp.46-48, January 1992; and Gordon Hester, "Electric and Magnetic Fields: Managing an Uncertain Risk," *Environment*, 34, pp.7-11, 25-32, January/February 1992.

Sagan, who recently stepped down as EPRI's program manager for

EMF studies, concedes at the outset that he cannot answer the question in the title of his paper. At the close of this short review, he advocates more research because "observations of effects of EMF exposure in cells indicate that something is going on, even if physicists can't explain it." At this time, Sagan believes that it is still "too early to make judgments about...what should be done should there be a risk." In his more detailed overview, Hester, an EPRI project manager, also calls for more research, and goes further, suggesting that, "In constructing new transmission and distribution facilities, many utilities may wish to consider low-cost modifications to reduce fields." But he cautions that, "The modification of existing lines cannot be justified on the grounds of necessity." *Safety & Health* is published by the National

Safety Council in Chicago, IL.

Richard G. Stevens et al., "Electric Power, Pineal Function and the Risk of Breast Cancer," *The FASEB Journal*, 6, pp.853-860, February 1992.

This is a detailed and updated exposition of Stevens's landmark 1987 paper, which first put forward the hypothesis that EMFs and/or light-at-night could be responsible for the increasing number of breast cancer deaths among women in industrial countries (see *MWN*, J/F 87). The authors, from Battelle Pacific Northwest Labs and from the Fred Hutchinson Cancer Research Center, cite 106 references.

EMF Research Bill (continued from p.1)

Other industry witnesses backing the bill represented the American Public Power Association (APPA), the Edison Electric Institute (EEI), the Electromagnetic Energy Policy Alliance (EPPA), the New York Power Authority (NYPA) and Southern California Edison Co.

H.R.3953 was also endorsed by IBM Corp., Apple Computer Inc. and Compaq Computer Corp., testifying jointly as the newly formed Video Display Terminal Health Research Foundation (see box, p.10), and by James DuShaw of the International Brotherhood of Electrical Workers (IBEW).

Only one witness was generally critical of the bill. Dr. Granger Morgan of Carnegie Mellon University in Pittsburgh, PA objected to its joint public-private funding approach. "We need a strong independent federal research program," he said. "It should not be tied to what the private sector chooses to do." Morgan said that, "The basic problem is that *there has been too little research*" (emphasis in written testimony), and he called for a \$20 million annual research budget.

Dr. Keith Florig of Resources for the Future (RFF), a Washington, DC think tank, termed the bill's \$6 million annual research budget "grossly incommensurate with the economic costs of the EMF problem," but said he nonetheless supported the measure. He estimated that the current costs associated with the EMF issue "likely exceed \$1 billion annually."

Department of Energy (DOE) assistant secretaries Michael Davis and Paul Ziemer also recommended a funding increase, noting that the proposed research budget was less than the \$7.5 million request the department made for fiscal year 1993 (FY93) (see *MWN*, J/F92).

In its amended form, the EMF legislation would now call for \$12 million for research and \$1 million for communications annually from FY93 through FY97. Nonfederal sources would provide up to half this research budget.

DOE's Office of Environment, Safety and Health would coordinate the effort, a designation the DOE opposes. Davis and Ziemer testified that the Secretary of Energy should be allowed to decide whether this role should remain with the Office of Conservation and Renewable Energy, which is now developing the department's EMF research strategy. Rep. George Brown (D-CA), chairman of the science committee and chief sponsor of H.R.3953, considers the shift of offices within the DOE a key

aspect of his legislation (see *MWN*, J/F92).

Another issue raised at the hearing centered on the ways in which the bill tries to ensure the credibility of the research program. James Cunningham of NYPA opposed H.R.3953's inclusion of utility and electric industry representatives on the advisory committee the bill would create. APPA's Alan Richardson also cautioned that industry involvement "could subject the overall effort to credibility charges." Rep. James Scheuer

House Panel Relaxes Ban on Consulting and Expert Testimony

The EMF legislation approved by the House science committee virtually eliminates a proposed ban on consulting and expert testimony by researchers funded under the measure. The only remaining restriction prohibits researchers from testifying about work they are doing under the federal EMF program.

Nearly all the witnesses at the March 10 hearing had urged the sponsors of H.R.3953 to relax its provision barring researchers from EMF consulting, but comments about expert testimony were divided.

Dr. Keith Florig of RFF supported the ban on testimony, noting that only a small number of researchers testify in adversarial cases. He objected to the restrictions on consulting, however: "Since the majority of EMF researchers engage in consulting of one type or another, [the ban] would severely limit the pool of available talent." James Dushaw of the IBEW also favored the ban on expert testimony.

EPRI's Dr. Stanley Sussman opposed the restrictions altogether. He testified that the bill might exclude "qualified researchers who are receiving or had received funding from other sources. This would be an unfortunate outcome...." EEI's Girard Anderson argued that "as long as all prior or current associations in this field are fully disclosed, any reputable researcher should be free to be involved with and pursue proposals for the program."

(D-NY), chairman of the environment subcommittee, disagreed. When the subcommittee marked up the bill on March 26,

it was amended to retain utility representatives on the advisory committee and weaken the committee's authority.

Finnish VDT-Miscarriage Study (continued from p.1)

Hietanen also reported a significant increase in the number of miscarriages among women exposed to strong, very low frequency (VLF) magnetic fields.

Interestingly, the Finnish study did not reveal a miscarriage risk when women were classified according to the number of hours they worked at a VDT—the method used in most past pregnancy studies. "It's only when exposures are classified according to actual magnetic field exposures that you see an effect," Hietanen said in an interview with *Microwave News*.

Hietanen, a physicist, was responsible for measuring the VDT electromagnetic fields (EMFs); she collaborated with a research team led by Dr. Marja-Liisa Lindbohm, an epidemiologist at the Helsinki institute.

"VDT workers should not be worried, because new models do not have high magnetic fields—only the older models have high fields," Hietanen said. She added that, "If your VDT meets the MPRII emissions guidelines, you need not be worried." The MPRII guidelines were developed by the Swedish Board for Technical Accreditation, known as SWEDAC (see *MWN*, M/J91).

"This is an important study because it is the first to look at measured magnetic field exposures for VDT operators and it is therefore possible to see who is exposed to higher than average fields," Dr. Jukka Juutilainen of Finland's University of Kuopio told *Microwave News* in Brussels. (For more on recent VDT pregnancy studies, see *MWN*, M/A91 and S/O91).

The VDT study population was composed of clerical workers at three different companies in offices all over Finland: 191 women who suffered miscarriages were compared with 394 who had live births from 1975 to 1985. Most of the women used VDTs. The women completed questionnaires about the number of hours of VDT work they performed and the type of VDT they used. The intensity of the ELF magnetic field and the time-rate-of-change of the VLF magnetic field (dB/dt) were measured for each of 23 different types of VDTs used by the women. There was very little variation in EMF emissions among the same models, according to Hietanen.

The clerks were assigned to one of three groups based on whether they worked at VDTs with "low" (less than 4 mG), "moderate" (4-9 mG) or "high" (more than 9 mG) ELF magnetic fields. (Four of the 23 models were in the "high" group.) A similar assignment was made on the basis of the women's VLF exposures.

As in the 1988 Kaiser Permanente study (see *MWN*, M/J88), there was an indication that women were at greater risk during the first 12 weeks of pregnancy, but this finding was tentative given the small number of women exposed to high ELF EMFs. The Finnish study population was too small to allow any inferences about the risk of birth defects.

Hietanen and Lindbohm concluded that, "There is an obvious need for future studies on the effects of low frequency magnetic fields on the outcomes of pregnancy using precise

assessment of exposures in the actual working environment."

The researchers stress that their results should be interpreted very cautiously because theirs is the first study on reproductive risks associated with VDT magnetic fields. They have submitted their results for publication. Lindbohm will present the final results of this epidemiological study at the *Work With Display Units '92* international conference, to be held in Berlin, Germany, the first week of September.

Power Frequency EMFs Increase Miscarriage Risk

A soon-to-be-published study indicates that women exposed to power frequency magnetic fields in their homes have significantly higher rates of early pregnancy loss. A team from the University of Kuopio in Finland, led by Dr. Jukka Juutilainen, found that women who lived in homes with magnetic fields of at least 6.3 mG—as measured at the front door—had five times the rate of miscarriages as those whose exposures were less than 1.1 mG.

There were no power lines near the homes of the women in the study, Juutilainen told *Microwave News*, leading him to suspect that the observed elevated magnetic fields were due to the electrical distribution systems in and around the houses (many of the subjects lived in multistory buildings).

Similar results were obtained when exposures were specified by the average of the measured values at the front door, in the living room, in the kitchen and in the parents' bedroom. Smaller increases in miscarriages were found when the maximum measured magnetic field was used as the exposure index. Early pregnancy loss was detected by assaying the women's levels of serum human chorionic gonadotropin (HCG). The study population was composed of 89 cases and 102 controls.

The results are "far from conclusive," according to the Kuopio researchers. They urge further studies, especially because their findings are consistent with observations in laboratory experiments.

The Juutilainen study and the Finnish study of VDT workers support previous work by Dr. Nancy Wertheimer and Ed Leeper showing increased rates of fetal loss among women exposed to magnetic fields from electric blankets (see *MWN*, M/J86) and those exposed to ceiling cable heating systems (see *MWN*, N/D88). The Juutilainen study has been accepted for publication in *Bioelectromagnetics* and is scheduled to appear later this year.

FROM THE FIELD

Police Radar and Cancer

To the Editor:

I am compiling a database of police officers who used traffic radar and later developed cancer. From a short, confidential questionnaire, which I ask each officer to complete, I record the type of cancer and type of radar. I also talk directly to many of the officers.

To date, there are 89 officers in my database, with diagnoses as follows:

Testicular cancer	22
Skin cancer	17
Lymphoma	13
Brain cancer	10
Eye cancer	9
Leukemia	7
Thyroid cancer	3
Prostate cancer	2
Bladder cancer	1
Bone cancer	1
Nasal-pharynx cancer	1
Spinal cord cancer	1
Stomach cancer	1
Unknown	1

Some patterns emerge when the type and location of the cancers and the type of traffic radars are cross-referenced:

- Among officers with testicular cancer, 20 out of 22 reported using hand-held radars. The other two cases are officers who used dashboard-mounted antennas. When the hand-held units are not being used to clock the speed of oncoming traffic, a common practice is to rest the radar in one's lap. Since some units have no on/off switch—and few officers know to turn them off even when it is possible—the radars continue to transmit while resting there.
- Among officers with eye cancer, all but one used window- or dashboard-mounted antennas. The lone user of hand-held radar said he would hold the antenna in front of his face and aim it out the back window of his vehicle to clock the speed of cars coming from behind as he sat on the shoulder of the interstate.
- Among officers with brain tumors, all but one reported using window- or dashboard-mounted radars. Their radars' antennas would sometimes be aimed directly at their heads. Some used older radar units with the antennas mounted on the inside of the window directly behind the driver's seat. The antennas pointed forward, directly at the officers' heads, and had no on/off switch. This means these officers were exposed to the radar signal for most of every shift.
- The officer with bladder cancer said he used hand-held radar while he was a motorcycle officer. He told me that he would rest the radar unit on the gas tank of the motorcycle, between his legs. He would always place the antenna so it was aimed toward him—continuously transmitting right at his bladder.
- One officer reported lymphoma in his right hip. He commonly rested a hand-held radar unit on the seat next to his right hip.
- Another officer related his thyroid cancer to the use of hand-held radar: when he was not aiming it out the window to clock the speed of approaching cars, he would rest the antenna against his chest, aiming upwards toward his throat.

From an examination of my database, it appears that all types of radar are potentially dangerous—and that hand-held units pose the greatest risk to police officers.

I am an 11-year veteran of the Ohio State Highway Patrol and have been investigating the connection between traffic radar and cancer for over three years. Officers have never been warned not to

rest the antennas in their laps or not to aim the antennas at their heads or other parts of their bodies. Officers have not been given enough information to make an informed decision about their use of traffic radar.

Sincerely,

Gary Poynter
6693 Cincinnati-Dayton Rd.
Middletown, OH 45044

EMFs and Toys

To the Editor:

In the course of performing a routine EMF survey with an EMDEX C gaussmeter, we found extraordinarily high ELF magnetic fields associated with a toy air hockey game set. (Other popular versions include air football and air soccer.)

The game is powered by a motor in the center of the playing board, which is about 2 feet by 4 feet. EMFs from the motor were measured at nearly 2,000 mG about 2-3 inches from the motor. EMF readings 6 inches from the sides of the game ranged from 15 to 50 mG.

Because children lean over the game to play it, they may be exposed to several hundred milligauss during actual play. Children play these games for hours each day.

This exposure is much higher than the average residential exposure for children (about 1 mG in California). By comparison, the highest readings I've taken for pad-mounted ground transformers are in the range of 900-1,000 mG. These are off-limits for all children and are marked with warnings. Compared with occupational exposures for adults, the air hockey game ranks higher than all but a few in the "electrical occupation" categories.

Parents may wish to scrutinize toys and games more closely before purchasing them. Until science can confirm or eliminate concerns about the link between magnetic fields and adverse health effects, it would be prudent to know the exposures from elective purchases such as toys.

Sincerely,

Cindy Sage
Sage Associates, Environmental Consultants
1283 Coast Village Circle, Suite 5
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UPDATES

CELLULAR COMMUNICATIONS

Statistical Abstract...The Cellular Telecommunications Industry Association (CTIA), a Washington, DC-based trade group, reports that 2.3 million customers signed up for cellular service in 1991—some 6,400 new subscribers each and every day—bringing the total number of cellular users in the U.S. to 7.6 million. Other CTIA facts: the industry's 1991 revenues were \$5.7 billion; at the end of the year, there were 1,252 cellular systems in operation at 7,847 cell sites; and the industry's total capital investment was \$8.7 billion as of December 1991.

INTERNATIONAL

Singapore Standards...The Republic of Singapore's Radiation Protection Act of 1991, which covers microwave ovens, MRI equipment, UV sunlamps, lasers and ultrasound units, took effect on February 1, 1992. The legislation appears in the November 1, 1991 *Government Gazette*; copies are available from: Aubrey Covey, Standards Code and Information Program, NIST, TRF Bldg., Room A163, Gaithersburg, MD 20899, (301) 975-4036.

OVENS

WHO Assures Safety...Foods prepared in microwave ovens are not a health risk as long as the manufacturers' instructions are followed to ensure that any pathogens are killed, according to a position statement issued by the World Health Organization (WHO) in Geneva, Switzerland. "The WHO has no information to support the contention that cooking with microwaves induces any toxic substances or harmful effects," WHO stated in a February 7 press release. WHO did not say what prompted the assurances, but, over the years, there have been recurring concerns over health risks due to incomplete cooking (see *MWN*, Jun81, Ap82, S/O88, M/A89 and M/J90). In 1989, researchers at the University of Vienna in Austria wrote to *The Lancet* (December 9) that cooking milk in a microwave oven could cause molecular changes in some amino acids, leading to the formation of neurotoxic compounds. *Microwave News* requested more details from the Vienna team, but has received no response. Experts in the U.S. and the U.K. have sharply discounted these claims. Some 70% of U.S. households have microwave ovens, as compared with 20% in France and 15% in Germany, according to WHO estimates.

PEOPLE

Dr. Ben Greenebaum of the University of Wisconsin-Parkside in Kenosha will take over from Dr. Don Justesen as the editor of *Bioelectromagnetics* this summer after the completion of Volume 13. "We're working on speeding up the publication process," Greenebaum said in a telephone interview....In June, Dr. Gregory Lotz will join NIOSH's research labs in Cincinnati,

OH to work on EMF issues after 15 years at the Naval Aerospace Medical Research Lab in Pensacola, FL....Two former members of the EPRI staff have returned to the institute. John Dunlap has left Florida Power to become project manager of EMF research within the Electrical Systems Division. And Dr. Robert Kavet is becoming the manager of exposure assessment research in the EMF Health Studies Program. Kavet is taking over from Dr. Stan Sussman, who has moved up to become the manager of EMF issues being addressed by four EPRI divisions....Dr. Zory Glaser has retired from FDA's Center for Devices and Radiological Health. He plans to continue to teach and to consult on NIER issues....John E. Gerling has stepped down as the head of Gerling Laboratories, which he founded in 1979. The company has been sold to Applied Science and Technology Inc., a major producer of microwave power generators. John F. Gerling, his son, will continue to manage the firm, which is based in Modesto, CA....Dr. Frank Shellock has left Los Angeles's Cedars Sinai Medical Center to join the UCLA Medical Center; he will continue to be affiliated with Tower Imaging....Dr. Jeffrey Guttman has joined Enertech Consultants as a senior research engineer after nine years at Lockheed's Palo Alto research lab. Guttman will work on magnetic field transients....There have been rumors that Dr. Tom Budinger has resigned as the chair of IEEE's Committee SCC28, which develops standards for both RF/MW radiation and ELF EMFs. Although Budinger would not speak directly to *Microwave News*, he said, through his secretary, that he has not resigned.

RADAR

Affordable Homes...A housing group for two Cape Cod, MA towns plans to use unoccupied homes on the North Truro Air Force Station as low-income residences, but the presence of a nearby radar facility has some officials worried. The tract of homes is about a quarter-mile from an FPS/91A long-range air traffic control radar. According to the FAA, this is the same type of radar—based on the same transmitter—as the FPS/66A in South Patrick Shores, FL, which is seen as a possible cause of a cluster of Hodgkin's disease cases among nearby residents (see *MWN*, J/F92). Raymond Crowell, chairman of the Wellfleet-Truro Creative Housing Partnership, raised the group's concerns with the FAA and was assured that the site is safe, according to a January 28 article in the *Cape Cod Times*. Officials at the FAA's New England regional offices in Burlington, MA told *Microwave News* that human exposure would only exceed FAA safety guidelines (4.3 mW/cm²) within 630 feet of the radome. "The houses are both beyond this area and below the level of the antenna," said Patrick O'Connors, an FAA engineer. The officials said they were not familiar with the Hodgkin's disease cluster. The agency has announced plans to replace the existing radar with a less powerful unit in 1993.

NY NEXRAD Report...A January 1992 report by the New York State Assembly Environmental Conservation Committee

states that the committee will "work to ensure that radars are sited only in areas where any environmental and health impacts can be minimized." The report is based on a year of research on the health effects of ELF and RF radiation and on a public hearing held in Sayville, NY in 1990. The National Weather Service (NWS) sought to site one of its Next Generation Weather Radars (NEXRAD) in Sayville, but protests by local residents—who feared that the 2.7-3.0 GHz radar could threaten public health—forced the agency to abandon the proposed site in 1990. The agency is now considering an alternative site at the nearby Brookhaven National Lab, which will most likely be approved, according to Lewis Boezi, department assistant for modernization at the NWS in Silver Spring, MD. The NWS is also facing opposition in Batavia, one of four other NEXRAD sites being considered in New York State. For more on NEXRAD, see "A Modern Weather Service," *Technology Review*, January 1992, and "Weather Radar Forecast: Mostly Cloudy," *Microwaves and RF*, March 1991. To order a free copy of *Non-Ionizing Radiation: A Report on the Proposed Next Generation Doppler Effect Radar System*, contact: Assemblyman Paul Harenberg, Room 724, LOB, Albany, NY 12248, (518) 455-5937.

RESOURCES

Workshop Report... The DOE has released the final report of its November 20-21, 1991 meeting (see *MWN*, N/D91). *The Development of a Coordinated Research and Communication Program on the Potential Health Effects of Electric and Magnetic Fields: Workshop Report* (February 1992) is available from: Marvin Gunn, Director of the Advanced Industrial Concepts Division, CE-232, 5E-066, DOE, 1000 Independence Ave., SW, Washington, DC 20585, (202) 586-5377.

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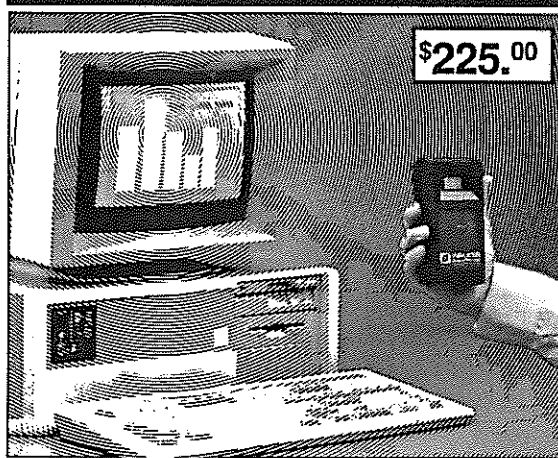
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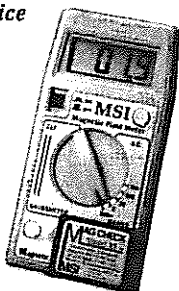
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A Report on Non-Ionizing Radiation

March/April 1993

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Office Building Cancer Clusters: Are EMFs Responsible?

Three office building cancer clusters—one in Washington, DC, and two in California—continue to defy explanation. Electromagnetic fields (EMFs) have been raised repeatedly as a possible cause and have been measured in each building, but they have not been linked to the cancers.

Health officials and scientists have provided few answers. Two of the investigations ended with the admission that no cause could be identified. And most of the details of the third cluster are being kept under wraps. The workers in these buildings are frustrated. With more than a dozen studies pointing to a link between EMFs and brain tumors (see *MWN*, M/A90), they are pushing for more thorough studies. Here is what is known so far.

Ford House Office Building, Washington, DC

Twelve cases of cancer among 500 employees at the Ford House Office Building (FHOB) in Washington remain unexplained following an investigation by the National Institute for Occupational Safety and Health (NIOSH). The agency did not determine whether the rate of cancer in the FHOB was unusual.

NIOSH concluded that the cancers—which include five brain tumor cases—were not related to “the physical environment” of the building and noted that even though some studies suggest an association between brain cancer and EMFs, “the body of evidence is inconclusive.” The NIOSH Health Hazard Evaluation (HHE), released in September 1992, states that “exposures to [extremely low

(continued on p.8)

EMF Mitigation: Cost-Effective in New Buildings, Costly in Existing Offices

A ground-breaking effort by the World Bank demonstrates that mitigating EMFs is inexpensive if tackled while a new building is being designed. The news is not as good for those who seek to reduce EMFs in existing offices, however. It can be done, but magnetic field shielding is expensive.

In the design and construction of its new headquarters in Washington, the World Bank has embraced “prudent avoidance.” Working with the project's architects and engineers, Richard Barry, a consultant who is spearheading the bank's mitigation efforts, has identified a number of cost-effective steps for cutting exposures. Barry found, for example, that EMF reductions can be achieved in the way offices are laid out—by putting the areas where workers spend most of their time farthest from the electrical service equipment and the office machines that generate the strongest fields. “There was very little cost associated with this,” Barry said.

(continued on p.10)

« Power Line Talk »

In case their position is not clear, the authors of the recent White House EMF report "consider it necessary" to let everyone know that the new Swedish studies "are not sufficiently compelling" to alter their conclusion that EMF risks are "weak and biologically implausible" (see *MWN*, N/D92). In a letter published in the April 2 issue of *Science* magazine, the authors, an 11-member panel assembled by Oak Ridge Associated Universities for the Committee on Interagency Radiation Research and Policy Coordination (CIRRPC), point to inconsistencies between the results of Maria Feychting and Dr. Anders Ahlbom and those of Dr. Lennart Tomenius, also of Sweden, as well as between the findings of Feychting-Ahlbom and Dr. Birgitta Floderus. The letter no doubt represents the views of the two epidemiologists on the CIRRPC panel: Dr. Leon Gordis of Johns Hopkins University's School of Hygiene and Public Health in Baltimore and Dr. Dimitrios Trichopoulos of the Harvard School of Public Health in Boston. Trichopoulos, who has been a consultant to Crowell & Moring's Utility Health Sciences Group (see *MWN*, J/F91), previously criticized the new Swedish studies in an article by *Science* reporter Richard Stone, which appeared on December 11 (see p.6). Also in the April 2 *Science*, Ahlbom and Feychting respond to the CIRRPC panel. Addressing Trichopoulos's comment, quoted by Stone, that they had not observed an association between present-day measurements and cancer risk, they point out that the "measured fields refer to a 20-minute period, in some cases as many as 26 years after diagnosis." The two Swedish epidemiologists stress their belief that "EMF calculations are better predictors of past fields than the actual measurements." Ahlbom and Feychting, who are based at the Karolinska Institute in Stockholm, say that of the nine childhood cancer-EMF studies that they are aware of, three should be discounted: Tomenius's effort is undermined by problems in assessing exposures; Dr. John Fulton's 1980 study in Rhode Island has problems due to bias in the way the controls were selected; and the recent U.K. study by Dr. A. Meyers and coworkers has too few exposed subjects (see *MWN*, J/F91). In the remaining six, "a fairly clear consistency across studies" is apparent, they say, with all relative risk estimates in the range of 1.5 to 3.0 and only two falling short of statistical significance. "It would indeed be appealing if all available evidence—from residential and

occupational studies, from children and adults and from studies on different types of cancer—fit together in an intelligible pattern, but this does not appear to be the case," they write. "However, in our view, the evidence on leukemia in children is actually fairly consistent, and inconsistent results from studies of other types of cancer or on adults should not detract from this."

« « » »

Dr. Ahlbom and Feychting's epidemiological study of childhood cancer and power line EMFs has been accepted for publication by the *American Journal of Epidemiology*, Ahlbom told *Microwave News* (see *MWN*, S/O92 and N/D92). The journal anticipates that it will appear this summer—the precise date had not been set at press time. Meanwhile, Dr. Floderus and coworkers have submitted a paper on their occupational EMF exposure study—there's no word yet on where or when it will be published.

« « » »

Two large epidemiological studies, by Dr. Gilles Thériault and by Dr. David Savitz, which should be released later this year, promise to gain widespread attention. The results of these major occupational studies are being held tightly. Both researchers plan to publish them in a journal with no prior public announcements. "I hope there will be no leaks," Thériault told *Microwave News* from his office at McGill University in Montreal, Canada. In early March, he gave a draft of his analysis to epidemiologists at Electricité de France, Hydro-Québec and Ontario Hydro—his sponsors—whose workers are participating in the study. The utility officials all signed confidentiality agreements before seeing the results, Thériault said. Their comments are due by mid-April, at which time Thériault will begin preparing his final manuscript. He predicted that his paper will be published this summer. Neither Thériault nor Savitz would say where they would like their papers to appear, though Savitz said that he was leaning towards a weekly journal for its "speed of publication"—to allow less time for the results to trickle out. Savitz, who is at the University of North Carolina, Chapel Hill, told *Microwave News* that he hopes to have his paper ready by the end of the year. Savitz said that even he does not yet know his own findings: "Until the data are integrated, I have no idea what they will show." EPRI is sponsoring the Savitz study, and its scientific advisers, Drs. A.A. Afifi of the University of California, Los Angeles, Patricia Buffler of the University of California, Berkeley, and James Quackenboss, who recently joined the Environmental Protection Agency in Las Vegas, NV, will be the first to see his paper. Savitz said that he will give them a draft for comment before he submits it for publication.

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Contrary to popular expectations, *Zuidema v. San Diego Gas & Electric* may not be EMF litigation's "watershed case," Tom Watson of the Washington law firm of Crowell & Moring told a gathering of utility managers at *Transmission & Distribution*

DOE-EPRI Meeting in Savannah, GA

The annual review of EMF bioeffects research, sponsored by the DOE and EPRI, is set for October 31-November 4 in Savannah, GA. The meeting, which is open to the public, will be held at the Radisson Plaza Hotel; call (912) 233-7722 for room reservations.

For those wishing to present papers, abstracts are due in early September; a call for abstracts will be mailed in June. For more information, contact: W/L Associates, 120 West Church St., Frederick, MD 21701, (301) 663-1915.

Waiting for the National EMF Research Program

The national EMF research and communications program (NERP) is in trouble. The first deadlines specified by law have all been missed and there is little hope that the DOE and NIEHS will meet those that are fast approaching. No money has yet been appropriated for the five-year, \$65 million program—none is expected before next fall. And now there are rumblings that the program may fall victim to the deficit-cutting ax.

All this comes at a time when a consensus is growing that a much larger research effort will be needed to resolve key questions about EMF health risks.

At an April 1 hearing before the House subcommittee on energy and power, Dr. Raymond Neutra of the California Department of Health Services and Dr. Thomas Tenforde of the Battelle Pacific Northwest Lab both urged Rep. Philip Sharp (D-IN), the chairman of the subcommittee, to ensure that Congress makes good on its promises to support the NERP.

"It's a tremendously good investment," Neutra said, comparing the \$32.5 million that the federal government plans to spend on EMF research—an amount to be matched by industry—with the hundreds of billions of dollars in economic impacts on the national economy if the public demands premature action. Tenforde went further, "strongly" recommending that Congress invest more than the \$12 million a year earmarked for the NERP in the energy bill passed last October. The bill also allocates \$1 million a year for risk communications.

A few weeks earlier, at the annual meeting of the American Association for the Advancement of Science, held in Boston, Dr. Granger Morgan of Carnegie Mellon University in Pittsburgh called for at least \$20 million a year for EMF health studies.

In February, three senior congressmen wrote to Secretary of Energy Hazel O'Leary to "make clear" that they are seeking \$18 million for EMF research in fiscal year 1994 (FY94),

which begins next October 1: \$12 million for the NERP as well as \$6 million to continue DOE's own long-running effort. Rep. George Brown (D-CA), the chairman of the Science, Space and Technology Committee, Rep. Henry Waxman (D-CA), the chairman of the health and environment subcommittee, and Rep. Sharp wrote that they want an "*expanded and accelerated* research program" (their emphasis). They may be disappointed.

What no one mentioned at Sharp's hearing is that the NERP will not be funded until FY94—a year after the energy bill was signed into law. Whether you blame the change of administrations, an ambivalent Congress or lackadaisical federal agencies, the longer it takes to unravel the mysteries of EMF effects, the harder it will be for electric utilities to site new power lines and substations. Just ask Consumers Power Co., in Jackson, MI, which, on March 1, announced that it was abandoning plans to build a 60-mile, 345 kV line in the face of intense public opposition.

As we go to press, the President has requested only \$10 million in his proposed FY94 budget—\$6 million for the NERP (to be matched by industry) and \$4 million for the ongoing DOE program. It will be interesting to see if anyone in Congress will push for more than \$16 million when confronted with budget cuts in many popular programs.

When Sharp asked the panelists testifying before his subcommittee how long would it take to reduce some of the uncertainties associated with EMF health risks, Neutra and Tenforde, as well as Dr. Keith Florig of Resources for the Future and DOE's Dr. Robert San Martin, replied that the odds of resolving much in the next three to five years are at best fifty-fifty. Only NIEHS Director Dr. Kenneth Olden anticipated some useful scientific results in the near term.

The imperative that prompted the NERP has not changed: We need answers—sooner, not later.

magazine's 1993 EMF Conference on March 23 in Arlington, VA. As the first personal injury suit to go to trial, it's an "important case," he said. "If the plaintiffs win, there will be more EMF cases, but it's California and a lot of strange things happen there." Watson argued that the round of litigation *after* Zuidema will be more telling as to whether "the floodgates are to open." Watson also noted that litigation stemming from occupational EMF exposures is "an area of rising interest." Ted and Michelle Zuidema are alleging that their daughter developed kidney cancer from *in utero* exposure to EMFs from nearby power lines (see *MWN*, J/A91 and N/D92). The trial opened in San Diego on April 5. John Ward of the Baltimore firm of Quinn, Ward & Kershaw, who represents plaintiffs in EMF cases, offered the utility audience some advice: "I suggest to you as a public interest lawyer to stop demanding more studies before taking action." He warned that

property damage litigation will "dwarf" personal injury cases and that the number of disputes between insurance companies and utilities is growing. It will not take "untold billions of dollars to attack this problem," Ward predicted, "and taking action will dramatically decrease the number of lawsuits."

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The Ohio Power Siting Board has approved a rule that requires utilities to identify schools and hospitals near proposed transmission lines and to review alternative ways of constructing the lines to reduce EMFs. Until "scientific findings are more conclusive, prudence dictates that electric facilities should be designed and sited using methods which address EMF issues," said Craig Glazer, chairman of both the siting board and the Public Utilities Commission of Ohio. The March 22 order also requires utilities

to look at the possible health effects of EMFs and to estimate levels of magnetic fields beneath proposed transmission lines. Other states have taken similar action. Last fall, Colorado formally adopted a policy of prudent avoidance (see *MWN*, J/F93) and Wisconsin—going further than either Ohio or Colorado—has ordered utilities to use the “best available control technology” to mitigate EMFs from transmission and distribution systems (see *MWN*, J/F92).

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Dr. **Keith Florig**, a fellow at Resources for the Future in Washington, has urged Congress to sponsor more research on the possible link between EMFs and breast cancer. In his testimony before the House subcommittee on energy and power on April 1, Florig cited the NCI study under way at the Fred Hutchinson Cancer Research Center in Seattle (see *MWN*, J/F92 and M/J92), but he added, “Given the high stakes of the breast cancer question, it would seem to deserve much more scrutiny from the federal government than this one study will be able to provide.” At the same hearing, chaired by Rep. **Philip Sharp** (D-IN), Dr. **Thomas Tenforde** of the Battelle Pacific Northwest Lab in Richland, WA, took aim at the physicists who argue that most sources of power frequency EMFs cannot cause any ill effects. These physicists are looking at individual cells, while a “more realistic model of living tissues is that of a large collection of cells communicating with each other,” Tenforde said. “From this perspective, the claims made in several recent publications that signals produced in tissue by environmental 60 Hz fields are too weak to overcome background noise and exert biological effects are unwarranted,” he concluded.

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In our last issue we quoted from a letter Dr. **Raymond Neutra** of the California Department of Health Services sent *The New*

Yorker as well as from an op-ed article he wrote with Dr. **John Peters** of the University of Southern California in Los Angeles, both criticizing **Paul Brodeur's** December 7 article on the cancer cluster at the Slater School in Fresno, CA. Here's what happened next: On January 8, two *New Yorker* editors wrote back to Neutra that, “We stand by Paul Brodeur's reporting.” They emphasized that, “[A]t no point in your letter do you claim that Brodeur misquoted you or misrepresented your work.” They also pointed out that, “Brodeur has presented a history of events at Slater school based on reports written by you and your colleagues, on the recollections and notes of others involved in those events and on recordings of meetings.” And on February 15, Brodeur sent a letter to Peters taking issue with the op-ed article: “Kindly note that at no time have I ever advocated the ‘immediate rerouting of high power transmission lines away from thousands of American schools,’ nor have I ever suggested that cancer clusters should ‘drive environmental policy.’ What I have recommended is that cancer clusters in schools ‘should occasion in-depth investigations,’ and that, ‘While these studies are in progress, interim preventive measures should be undertaken to reduce the magnetic field exposure of children in hundreds of schools and day-care centers across the nation which have been built perilously close to high voltage and high current power lines.’” Brodeur went on: “I note with interest that the joint op-ed piece you have written with Neutra calls for ‘well-designed’ studies, but omits any reference to the recent Swedish studies conducted by Ahlbom and Feychting, and by Floderus and her colleagues....[O]ne must question the public health wisdom of your apparent readiness to wait for the completion of studies yet to be funded or begun (studies that will probably take several years to complete once they have begun) before recommending preventive measures to reduce the exposure of school children to power line magnetic field levels that have been associated with the development of childhood cancer.”

Congress, States Seek To Limit Power Line EMFs at Schools

A bill that would forbid the siting of new schools and day-care centers on property where EMFs exceed 2 mG was introduced on March 25 by Rep. George Miller (D-CA). The congressional move comes on the heels of two state actions: All New York electric utilities have agreed to survey EMFs at schools next to power lines, while in Oregon, a bill has been introduced that would require utilities to ensure that schoolchildren are not exposed to power line EMFs in excess of 2 mG.

Miller, the chairman of the Committee on Natural Resources, said that his bill would require “prudent steps to protect our children's health until such time as the federal government and scientists determine that [EMFs] created by transmission lines are not a threat.” He explained that the legislation, known as the Children's Electromagnetic Field Risk Reduction Act of 1993 (H.R. 1494), was proposed in response to a growing body of

scientific evidence that shows “a possible dose-response relationship between human exposure to EMFs from electric transmission lines and development of cancer, particularly childhood cancer.” The bill has been referred to the House Committee on Education and Labor.

At New York State Attorney General Robert Abrams's request, seven electric utilities will follow in the footsteps of the Niagara Mohawk Power Corp., based in Syracuse, which, in 1991, initiated a survey of power lines on or adjacent to school property (see *MWN*, N/D92). “The school survey is a valuable start in providing utility companies, government and the public with meaningful information,” Abrams wrote in a February 26 letter to the utilities. Niagara Mohawk will release the results of its measurements by April 15, according to Jack Toennies, the company's director of environmental licensing and planning. Niagara Mohawk has already agreed to reduce EMFs at the Voorheesville School, near Albany, which is within 100 feet of two power lines. One of the lines will be removed and the other will be reconfigured.

And on March 12, Oregon Rep. Lisa Naito introduced HB 3608, a bill that would require public electric utilities to "inventory the magnetic fields around [their] power lines or [sub]stations that are located within 500 feet of any public school building or grounds and...take appropriate corrective action to prevent human exposure to magnetic fields [above 2 mG]." Recent articles and studies suggesting a link between power line EMFs and cancer prompted Naito to introduce the bill, according to Kristen Funk-Tracy, her legislative assistant.

The debate over power line EMFs and schools is not a new one. Several years ago, a school district in Houston forced Houston Lighting & Power to remove a high voltage transmission line from school property at a cost of \$8.6 million (see *MWN*, N/D85 and J/A88). In 1988, California adopted guidelines requiring a minimum distance between schools and power line rights-of-way (see *MWN*, M/J88).

No Excess Occupational Cancer Risk, California Utility Says

Researchers at Southern California Edison (SCE) in Rosemead and at the University of California, Los Angeles, have failed to find a consistent association between on-the-job EMF exposures and mortality from leukemia, brain cancer or lymphoma.

The study, which SCE describes as "the most comprehensive and best designed" to date, investigated 36,221 company employees who worked for at least one year between 1960 and 1988. "This result substantially weakens the argument for EMFs being a significant cause of cancer in the Edison work environment," SCE announced, but the utility added that, "The lack of an association does not 'prove' that EMFs [are] not a cause of cancer."

Jack Sahl, a senior research scientist at SCE, told *Microwave News* that his study is "a substantial advancement in exposure assessment" over past efforts. He explained that the workers were a homogeneous population, that he had access to the workers' full occupational histories and that he took detailed measurements with EMDEX meters.

In interviews with *Microwave News*, other epidemiologists gave Sahl's effort mixed reviews. "It's a carefully done study," said Dr. Raymond Neutra of the California Department of Health Services in Emeryville. And Dr. David Savitz of the University of North Carolina, Chapel Hill, said that the exposure assessment was "a reasonable try" and that there was "no obvious fatal flaw." On the other hand, Dr. Nancy Wertheimer of Boulder, CO, took issue with the way the exposures were estimated. "All the exposure assessments seem to be dependent on how long a subject worked for SCE and we are not told if the cases and controls worked for comparable amounts of time," she said. Wertheimer added that she would have liked for Sahl to have presented age-specific relative risks.

Dr. Sam Milham of Olympia, WA, commented that, "It is curious that having gone to the time, trouble and expense of doing a cohort mortality study with excellent follow-up, they did not publish SMRs," referring to standard mortality ratios, which

Dutch Study Finds No Increased Cancer Mortality Among Adults

A group of epidemiologists at the University of Limburg in Maastricht, The Netherlands, has found no increased mortality among adults living near high voltage transmission lines or a substation.

The Dutch team identified 192 men and women who died after living at least five years within 100 meters of two 150 kV lines or a substation and compared them to 239 controls who had lived more than 100 meters away. The magnetic fields in the area near the EMF sources ranged from 1 to 11 mG, while the control group was exposed to 0.2 to 1.5 mG.

There was no difference in the cancer rates among the two groups—except for an excess of Hodgkin's lymphoma among the exposed women. The researchers conclude that the "study does not support previously reported associations of exposure to [EMFs] with leukemia, brain cancer and breast cancer." They warn, however, that, due to the small number of cases, their study has limited statistical power.

See Gerrit Schreiber et al., "Cancer Mortality and Residence near Electricity Transmission Equipment: A Retrospective Cohort Study," *International Journal of Epidemiology*, 22, pp.9-15, 1993.

compare age-adjusted cancer rates in the study population with those in the population at large.

Milham raised the possibility that the SCE workers did indeed have some elevated cancer risks and that some of Sahl's control population may have been exposed to EMFs. "By my preliminary calculations, Sahl's data show an increased frequency of leukemias, brain cancer and lymphomas over the expected numbers," he said.

When asked about whether young workers had a greater cancer risk, Sahl replied that, "We don't see an effect based on age in our analysis." With respect to why he omitted SMRs, Sahl said that he did not understand the criticism: "The method we used is the method of choice."

The trouble with trying to estimate EMF exposures is that no one knows what aspect of the magnetic field is biologically relevant. Are the short-term EMDEX measurements used by Sahl's team better than job titles? A similar question has arisen in residential studies: Why are wire codes better than spot measurements? "The crucial issue is whether the careful and reasonable attempts to characterize the long-term exposures of the workers really get us closer to the truth or whether the more traditional, usual job title is better," Neutra said. Or as Savitz put it, "They are different stabs in the dark."

See Jack Sahl, Michael Kelsh and Sander Greenland, "Cohort and Nested Case-Control Studies of Hematopoietic Cancers and Brain Cancer Among Electric Utility Workers," *Epidemiology*, 4, pp.104-114, 1993. Sahl said that a second paper, with more details on the worker exposures, has been accepted for publication in *Bioelectromagnetics*.

Industry Consultants on the Feychting-Ahlbom Epidemiological Study*

[The F&A] study is in several ways the most complex investigation yet done on the relationship of residential exposure to [EMFs] and cancer. Despite the complexity of the study and an impressive attention to detail, it does, however, have a crucial limitation: it is very small with respect to children. With regard to leukemia in children, the study reports some association with an indirect measure of magnetic field exposure, but this association is not present when actual spot measurements of magnetic fields are used and is not present at all among children living in apartment houses. In general, inconsistencies in the findings (e.g., the association between magnetic fields and leukemia comes almost entirely from the period 1975-1985 and is almost absent in 1960-1974) preclude making a cause-effect inference. The results with regard to leukemia among adults are suggestive, but only that, of an association between magnetic fields and chronic myeloid leukemia, but provide no foundation for accepting a cause-effect relationship. The study provides evidence against a link between power frequency field exposure and cancer of the brain or central nervous system both in children and adults. Indeed, these associations tend to be inverse and suggest that all of the results must be interpreted with great caution.

—Dr. Philip Cole, Chairman, Dept. of Epidemiology, School of Public Health, University of Alabama, Birmingham, for Cap Rock Electric Cooperative Inc. and Southwestern Public Service Co., before the Texas PUC†, December 30, 1992

A major strength of the Swedish residential study is that the researchers estimated exposure as *historical* calculated fields. In previous residential epidemiology studies, past exposure to electric and/or magnetic fields was estimated at the time of the study....The major limitation of the Swedish study in children is the small number of cases....While the results support the association of childhood leukemia with calculated fields from power lines, there are inconsistencies in the findings. The association comes from cancer cases diagnosed during the period 1975-1985 and is almost absent in 1960-1974; the association is present for single family residences but does not appear for apartment dwellers. Other limitations within the study include the fact that cases were included regardless of how briefly they lived near the power line, and known potential risk factors for childhood leukemia were not evaluated, such as exposure to prenatal X-rays or certain preexisting medical conditions.

—Dr. Linda Erdreich, Bailey Research Associates, New York, NY, for Northeast Utilities, Hartford, CT, November 5, 1992

Even taken at face value, the results for childhood leukemia showed some inconsistencies. For example, there was no evidence of association for residents of apartments, but only for those in single family dwellings. In Stockholm, a lower apparent leukemia risk was reported for children in homes with higher calculated magnetic fields than for children in homes in intermediate categories....Overall, the results for children indicate no increased cancer risk; the risks of brain tumors appear unrelated to exposure, and the results for leukemia are internally inconsistent and suggest the need for further investigation of the few cases which account for the apparent associations in some analyses. Overall, the results for adults indicate no association of leukemia as a whole and varied patterns of risk estimates for specific leukemia types, with only one of 249 statistical tests being nominally significant. For adult brain cancer, there ap-

pears to be no significant association, with most estimates of risk being negative, including the only one which is nominally significant. The suggestions in some portions of the report that there may be an increased risk of a particular type of cancer in children or adults should be balanced against the inconsistencies of the results, the limited number of statistically significant results even when taken at face value, and the decreased risks suggested for other types of cancer.

—Dr. Darwin Labarthe, Dept. of Epidemiology, School of Public Health, University of Texas, Houston, for Metropolitan Edison Co., Pennsylvania Electric Co., Jersey Central Power & Light Co. and Duquesne Light Co., before the Pennsylvania PUC†, December 14, 1992

When actual measurements of the electric and magnetic fields have been used, there have been no reports of an increased risk of childhood cancers (e.g., Savitz et al., 1988; London et al., 1991; [F&A], 1992).

—Dr. Lucius Sinks, Director, Cancer Center, Middlesex Hospital, Middletown, CT, for Gulf States Utilities, before the Texas PUC†, November 1992

It is my view that both of the Swedish studies, especially the residential study by [F&A], appear to have been well-conducted within the limitations necessarily imposed...in this kind of research....Unfortunately, despite this effort the size of both studies is still quite small....When we compare the results of the studies, either one to another or to the existing body of research, we see that there are numerous inconsistencies....For adult brain cancers, the occupational study reports some increased odds ratios....while the authors of the residential study note that their data on adult brain cancers are erratic and do not lead to a conclusion of an association....For adult leukemias, the inconsistencies are even more striking....For childhood cancers the residential study found no increased risk for measured magnetic fields. This is consistent with the results of previous studies....[I]n the residential study the research period covered such a long timeframe (25 years) that important improvements in diagnosis of cancers took place during the period covered by the study....[P]ossible error can be introduced into the study by combining data that were collected under fundamentally different assumptions at various times during the past....When evaluated in the context of the large existing body of research results, the Swedish studies have not appreciably changed the overall conclusion....EMF exposure has not been demonstrated to cause cancer in humans.

—Dr. Jan Stolwijk, Dept. of Epidemiology and Public Health, Yale University School of Medicine, New Haven, CT, letter to the Electricity Supply Association of Australia, Melbourne, October 29, 1992

...Dimitrios Trichopoulos, chair of the epidemiology department at the Harvard School of Public Health...points out that Ahlbom failed to come up with a correlation between present day EMFs and cancer risk. He also claims that Ahlbom's findings diverge from previous Swedish studies and notes that some of Ahlbom's calculated cancer risks aren't statistically significant, because of the small number of cases of childhood leukemia. Trichopoulos concludes that the scientific community needs better designed epidemiological studies.

—Richard Stone, "Polarized Debate: EMFs and Cancer," Science, p.1725, December 11, 1992 (see also p.2)

*Maria Feychting and Anders Ahlbom (F&A), *Magnetic Fields and Cancer in People Residing near Swedish High Voltage Power Lines*, Stockholm, Sweden: Karolinska Institute, 1992; to appear in the *American Journal of Epidemiology* (see p.2 and MWN, S/O92 and N/D92). † PUC=Public Utilities Commission.

Epidemiology Roundup

Acute Leukemia Linked to EMF Exposure

French researchers have confirmed and extended their previous report that linked occupational EMF exposures with leukemia (see *MWN*, M/A91). Their case-control study of 185 workers over 30 years old and 513 controls found up to a fivefold increase in acute myelogenous leukemia (AML) among those exposed to EMFs.

Dr. Sylvia Richardson of INSERM in Villejuif found a non-significant increase for all acute leukemias among workers exposed to all types of EMFs, but the odds ratio rose to 3.9, a statistically significant result, when exposures from arc welding were excluded. The researchers advise caution on interpreting the results because of the unclear role of arc welding and because "there was no association with level or length of exposure."

Nevertheless, after citing the many previous studies that link EMFs to leukemia, the French team writes that "the hypothesis of EMF being leukemogenic has reached consistency." The researchers conclude that, "Our study adds credence to the hypothesis that pesticides and EMFs are leukemogenic agents, together with benzene." See S. Richardson, "Occupational Risk Factors for Acute Leukemia: A Case-Control Study," *International Journal of Epidemiology*, 21, pp.1063-1073, 1992.

Leukemia Among Telephone Linemen

Dr. Genevieve Matanoski and coworkers at the Johns Hopkins University (JHU) School of Hygiene and Public Health in Baltimore have published the final report on their study of leukemia among telephone linemen. In the summer of 1991, Matanoski announced that her team had found higher rates of leukemia among certain linemen and for certain measures of exposures.

In a report to EPRI, which sponsored the study, the JHU group concludes: "It does not seem prudent to assume that [EMF] exposure has no risk."

In earlier presentations, Matanoski has reported that workers exposed at an early age are more vulnerable to EMF risks (see *MWN*, J/A91 and J/A92), but she does not cite these results in her EPRI report. Matanoski could not be reached for comment.

Copies of *Leukemia in Telephone Linemen* (TR-101813), December 1992, are available for \$200 each from: EPRI Distribution Center, 207 Coggins Dr., Pleasant Hill, CA 94523, (510) 934-4212. There is no charge for EPRI members, government agencies or not-for-profit groups.

The JHU results will also be published in the March 15 issue of the *American Journal of Epidemiology*, which is behind schedule and will appear in late April.

NHL Among Swedish Power Workers

A team of American and Swedish researchers has found that engineers and technicians in the electric power industry have close to five times the expected rate of non-Hodgkin's lymphoma (NHL), a statistically significant increase. Using the Swed-

ish cancer registry, Dr. Martha Linet of the U.S. National Cancer Institute and coworkers also found excesses of NHL among office workers, bank employees and shoemakers, among others.

With respect to power plant workers, Linet's team notes that, "As well as possible exposures to [EMFs], the Swedish workers may have had contact with various solvents, other chemicals and nonchemical exposures." See "Non-Hodgkin's Lymphoma and Occupation in Sweden: A Registry-Based Analysis," *British Journal of Industrial Medicine*, 50, pp.79-84, 1993.

EPRI Workshop on Future Studies

In February 1991, EPRI held a by-invitation-only workshop on *Future Epidemiologic Studies of Health Effects of Electric and Magnetic Fields* in Carmel, CA. Some 21 months later, Dr. Patricia Buffler, who organized the workshop, has published a report outlining the recommendations of the 70 attendees, together with the conclusions of four working groups—on residential and occupational cancer studies, on reproductive outcomes and on methodological issues.

Overall, the researchers put the highest priority on studies: (1) to "explore the relationship between 'very high current configuration' homes and childhood cancer risks"; (2) to "explore the relationship between wire configuration codes and characteristics of magnetic fields other than time-weighted average field intensity"; (3) to "survey presumably highly exposed industries or occupations to identify cohorts for occupational studies, giving special attention to exposures of female workers"; and (4) to "improve exposure assessment in ongoing and future residential studies to address questions raised by [the] Los Angeles and Denver childhood cancer studies."

Drs. John Peters and Stephanie London of the University of Southern California (USC) in Los Angeles first announced the results of their epidemiological study at the Carmel workshop, and their presentation is included in an appendix (see *MWN*, M/A91 and S/O91).

Another appendix lists the key findings of the more than 100 epidemiological studies published through 1990. And a third lists the names and addresses of the attendees.

Future Epidemiologic Studies of Health Effects of Electric and Magnetic Fields (TR-101175), September 1992, is available for \$200 from the EPRI Distribution Center. See ordering information at left.

Updates from Wertheimer-Leeper, Vena & Peters

- Dr. Nancy Wertheimer and Ed Leeper, both of Boulder, CO, have commented on two recent papers on electric blankets and cancer in order to "alert researchers to some of the pitfalls possible in assessing only one of the multiple sources of [EMF] exposure to which all subjects are exposed." One of the papers, by Dr. John Vena and coworkers at the State University of New York, Buffalo, addressed the risk of breast cancer (see *MWN*, S/O91), and the other, by Dr. Rene Verreault and coworkers at the Fred Hutchinson Cancer Research Center in Seattle, investigated testicular cancer (see *MWN*, M/J90). Vena responded to

Wertheimer and Leeper, but Verreault did not. The exchange appears in the *American Journal of Epidemiology*, 137, pp.252-257, January 15, 1993.

• USC's Drs. John Peters and Stephanie London have issued a correction to one of the tables in their paper on EMFs and childhood leukemia (see above). The correction appears in the *American Journal of Epidemiology*, 137, p.381, February 1, 1993.

EPA Tests Gaussmeters

In a new report, the Environmental Protection Agency (EPA) offers a large amount of data on the performance of 15 hand-held, single-axis magnetic field meters but does not draw any conclusions about which meters are the most reliable or which offer the best value for the money.

"This report presents just the facts," Edwin Mantiply of EPA's Office of Radiation and Indoor Air in Montgomery, AL, told *Microwave News*. The report was completed a year and a half ago but its release was delayed by concerns within the agency over liability. Some EPA managers had wanted to delete the names of the meter manufacturers. The project was initiated in mid-1990 (see *MWN*, J/A90).

The EPA evaluated meters made by the Dindima Group, Electric Field Measurements (EFM), Electromagnetics Design, ExpanTest, Holaday Industries, Integrity Research, Macintyre

Electronic Design, Magnetic Sciences International, Magnetic Technology, Monitor Industries, Safe Computing, Sydkraft, Walker Scientific and Widerange Instruments. Meters by F.W. Bell and Teslatronics, and an additional meter from Holaday Industries, were not included because EPA did not receive two of each model in time; raw data for these meters are available from Mantiply.

The number of gaussmeters on the market has risen dramatically over the last few years—25 companies are currently selling over 60 different models.

The EPA tested meters for accuracy over a range of field strengths, for sensitivity to an increase in field intensity and for the likelihood of interference from other electromagnetic signals. There was a large variation in performance.

For instance, a Widerange Instruments meter gave readings which were, on average, approximately 36% in error. Widerange Instruments has subsequently taken its meters off the market, in part due to their poor performance in the EPA report, according to Widerange's president, George Work.

Mantiply said that the report, which cost less than \$50,000, was prepared by Science Applications International Corp. of McLean, VA, under an EPA contract with Sanford Cohen & Associates, also of McLean.

Laboratory Testing of Commercially Available Power Frequency Magnetic Field Survey Meters (EPA Report No.400R-92-010) was released at the end of 1992, though it is dated June 1992. A limited number of copies are available free from: EPA, Office of Radiation and Indoor Air, 1504 Avenue A, Montgomery, AL 36115, (205) 270-3400. For a list of gaussmeters now being sold in the U.S., send \$1.00 and a self-addressed, stamped business envelope to: *Microwave News*, PO Box 1799, Grand Central Station, New York, NY 10163. (For an earlier review of gaussmeters, see *MWN*, M/A91.)

National EMF Advisory Committee

The Department of Energy (DOE) and the Department of Health and Human Services (DHHS) have selected their candidates for the National EMF Advisory Committee. The committee, mandated by the energy bill enacted last October, will help mold the new five-year, \$65 million EMF research and communication program.

On March 31, letters of invitation were sent to: Dr. Peter Bingham,* North American Philips Corp., Briarcliff Manor, NY; John Coughlin,* Wisconsin Public Service Commission, Madison, WI; Margaret Seminario, AFL-CIO, Washington, DC; Shirley Linde, Citizens for Safer EMF, Los Angeles, CA; Kate Brown Maracas,* Salt River Project, Phoenix, AZ; Dr. James Melius, New York State Department of Health, Albany, NY; Dr. Thomas Rozell, National Academy of Sciences, Washington, DC; Robert Schell, Maine Bureau of Health, Augusta, ME; Dr. Louis Slesin,* *Microwave News*, New York, NY; Dr. Paul Zweigacker,* Texas Utility Services, Dallas, TX. (The asterisks indicate those selected by the DOE; the others were picked by the DHHS.)

Formal announcement of the committee members is expected after the candidates have agreed to serve, according to DOE's Dr. Robert San Martin. Members of a companion EMF interagency committee have not yet been named. Under the law, the two committees should have been set up by December 24, 1992 (see *MWN*, N/D92 and J/F93).

Office Building Cancer Clusters (continued from p.1)

frequency] fields in the FHOB are typical of modern office environments."

Robert Reischauer, the director of the Congressional Budget Office (CBO), asked for an investigation in a January 1992 letter, noting "the unusual number of brain tumors and cancers suffered by individuals working in the building." The FHOB houses the CBO, a computer services center and congressional staff offices.

NIOSH's Gene Moss, an industrial hygienist, found that readings in the CBO's fourth-floor offices reached a maximum of 6.80 mG and averaged 1.82 mG. EMFs in the hallways did not exceed 1.50 mG. Magnetic fields in a computer room on the sixth floor ranged from 0.4 to 66 mG. Electrical equipment is located directly above the entrance to the computer room, according to the HHE.

But Moss's survey did not answer one question Reischauer raised when he requested the study: Had the people with cancer worked "close to any equipment that might have generated strong electromagnetic fields?" The details of the EMF survey are sketchy, and few employees are reassured. "The investigation

was not handled in a professional manner," said an FHOB employee who has followed the investigation. "No good came out of the report," he added. The employee asked that his name not be used.

Moss told *Microwave News* that he tried to take measurements where he believed people worked and called the survey "the best attempt he could make," given his work load.

In its report, NIOSH said that the HHE was not supposed to be a detailed study: "The limited number of measurements taken was not intended to represent an in-depth evaluation of the radiation fields at the site, but rather to approximate workplace exposure levels found on the days of measurement." The report (HHE 92-156-2256) was coauthored by Moss and Dr. Allison Tepper, an epidemiologist at NIOSH.

Santa Clara County Office Building, San Jose, CA

The California Department of Health Services (DHS) in Berkeley could not find the cause of eight cases of cancer of the central nervous system among employees in an office building in San Jose. "We have not been able to come up with any other plausible explanation except for chance," Dr. Raymond Neutra, acting chief of the DHS's Environmental Health Investigations Branch in Emeryville, told *Microwave News*.

The DHS determined that there was a fourfold cancer excess in the west wing of the Santa Clara County office building, where approximately 1,800 people had worked between 1962 and mid-1991. The agency counted seven cases of primary brain tumors and one cancer of the spinal cord among three women and five men who had been employed there as planners, lawyers and clerks.

The DHS report—like NIOSH's study of the FHOB—states that environmental factors could not account for the tumors. "No existing or recorded physical or chemical agent could be identified as the likely cause" for the cancer excess, according to the 65-page study, released in April 1992.

Much of the DHS investigation addressed EMFs from two 115 kV power lines located "several blocks away" from the building. Indeed, the report presents 25 pages of EMF measurements taken at one-foot intervals up to 700 feet from the power lines, where magnetic fields measured less than 0.35 mG. The DHS concluded that the lines had "no demonstrable influence" on the west wing.

Indoors, the DHS took readings in the centers of offices and determined that "all areas and rooms in the west wing measured less than 0.5 mG." In addition, five employees were given EMDEX meters to measure exposures over a 24-hour period. This survey revealed average workplace EMFs of 1.19 mG, while maximum on-the-job exposures ranged between 14 and 40 mG. Dr. Gerri Lee, an epidemiologist at the DHS, said in an interview that the peak readings corresponded to brief exposures to appliances like copy machines.

But representatives of the Service Employees International Union (SEIU), who had originally requested the DHS investigation, say that they are not satisfied. "We wanted more people wearing the meters for more time, and we wanted mapping for

Widow of Office Worker with Brain Tumor Files Suit

The widow of a California office worker who died of a brain tumor is suing the city of San Jose, claiming that microwave radiation from a city owned and operated transmitter was responsible. Michael Popolizio was a district attorney who worked in the west wing of a Santa Clara County office building (see story at left) from 1976 to 1988 and who died of brain cancer in 1991 at the age of 45. The claim was filed in state superior court on March 20, 1992, by Flora Chu of the San Jose firm of Hawes & Chu.

Although the claim points to radiation from a microwave transmitter located next to the building in which Popolizio worked, Chu told *Microwave News* that she is considering amending the suit to include exposure to EMFs from the building's electrical equipment.

Chu criticized the DHS survey of EMFs in the Santa Clara building. "The report was not done completely," she said. "They needed to look more carefully at where people spent their time." Chu noted that two of the eight people with cancer in the west wing had worked next to each other, calling this a "significant piece of information that did not come out" in the DHS report. "If we can discover the historical information, we may be able to prove or disprove our theories," Chu said, explaining that she is taking her own measurements in the building to assess her client's EMF exposure.

potential hot spots," SEIU representative Beth Shafran, who is based in San Jose, said in a telephone interview.

Neutra said that the agency had made no attempt to take readings where the people with brain tumors had worked. He said that estimating past exposures was virtually impossible, in part because sections of the west wing had been remodeled and rewired over the years. "We did this investigation under incredible resource restraints," Neutra said. "The purpose was to assess the safety of the building in general with the resources we had." Neutra added that he does not think it is useful to look at individual cancer clusters. He said that he would prefer a "large, well-designed" investigation, noting that he has asked the California Public Utilities Commission to fund such a study.

Meanwhile, NIOSH has agreed to SEIU's request for an additional study of EMFs in the west wing, according to Dr. Allison Tepper, who studied the FHOB cancer cluster. Tepper said that NIOSH had denied an earlier request by the union, but "this time decided it was reasonable to provide employees with more information."

Pacific Bell, Garden Grove, CA

Between 1984 and 1991, 13 out of 89 Pacific Bell clerical employees who had worked in the basement of a building in

Garden Grove, CA, were diagnosed with various forms of cancer. None of the consultants or researchers hired by Pacific Bell to study the basement office could find an environmental cause for the cluster.

At least three reports investigating the cluster were prepared for Pacific Bell, but the telephone company refused to release them. Spokeswoman Linda Bonnicksen, based in Los Angeles, would only provide the company's press statements, which were issued between August 1991 and April 1992. The following information is based on those press releases:

- The total number of cancer cases in the Garden Grove basement office exceeds the expected number in the general population, but when the cluster is separated by type of malignancy, the varieties, taken individually, do not occur at high rates, according to Dr. Hoda Anton-Culver of the University of California, Irvine. Anton-Culver declined to release her report, referring queries to Pacific Bell.
- The highest EMF measurement taken in the basement area was 186 mG, according to Dave Rainer, formerly of Bellcore, the research arm of Pacific Bell and the other regional Bell companies. Using Rainer's data, Pacific Bell concluded that EMFs in the basement office are "well within acceptable industry guidelines"—referring to those adopted by the International Radiation Protection Association (IRPA) and the American Conference of Government Industrial Hygienists (ACGIH), which allow EMF exposures of up to 5,000 and 10,000 mG, respectively. Rainer, who is now director of the environmental health and safety center at North Carolina State University in Raleigh, declined to be interviewed. Rainer took measurements in Garden Grove as part of Bellcore's national study of telephone company workers and EMFs, which Bellcore has refused to release (see *MWN*, M/J92).
- As part of Rainer's survey of the basement office, Garden Grove employees, like their counterparts in Santa Clara, wore EMDEX meters to gauge EMF exposures. Average on-the-job EMFs ranged from 0.8 to 7.22 mG, according to Pacific Bell.
- No further environmental or epidemiological studies are needed at Garden Grove, according to Dr. Howard Frumkin of the School of Public Health at Emory University in Atlanta. Frumkin—who was recommended to Pacific Bell by the DHS—based his opinion on the reports by Anton-Culver and Rainer, and on other environmental surveys. Frumkin also declined to release his report.

Although Pacific Bell did not reveal the employees' maximum EMF exposures, Bellcore's survey of the Garden Grove office, obtained by *Microwave News*, indicates that peak levels recorded on the EMDEX meters ranged between 4.0 and 77.5 mG. These readings are a result of "very brief" exposures, the report states, but their source "has not been clearly defined." The 186 mG spot measurement was taken one foot from a circuit breaker in a power room next to the basement office.

"I have reservations about the way Bellcore's study was done," said John Theriault, who is with the Communications Workers of America. He said that he would have preferred the EMF survey to have been done by an independent consultant.

Theriault, a Pacific Bell communications technician who works in Costa Mesa, noted that electromechanical switching gear at Garden Grove had been replaced with digital equipment a few years before Bellcore's EMF measurements were taken. Theriault said that the measurements might not accurately reflect past exposures of the basement employees, who worked a floor below the room that housed the old equipment.

He pointed to a 1989 Johns Hopkins University study, which found that male telephone workers exposed to complex EMFs from mechanical switching gear had elevated rates of leukemia, breast cancer, lymphoma and prostate cancer (see *MWN*, N/D89).

Dr. Michael Yost, an industrial hygienist formerly with the University of California, Berkeley, who was a consultant to the DHS, said that the agency had been aware of the cancer cluster at Garden Grove but had decided not to pursue it. "The DHS has no resources," he said, "and Garden Grove was a low priority—several things were competing for [DHS's] attention." Yost is now at the University of Washington, Seattle.

Building EMF Mitigation (continued from p.1)

Since employees have to live with the results, you want to get it right, he said. "You only get this opportunity once every 30 or 40 years."

The most expensive measure taken in the World Bank project was putting the main electrical switching equipment in the fifth subbasement. This is commonly placed where the electrical service comes in from the street, exposing adjacent areas to strong magnetic fields. "This is your biggest emitter," Barry explained, noting that magnetic fields nearby "can easily be in the hundreds of milligauss."

Placing this equipment on the building's lowest level, which is used primarily for parking, was "a fairness issue," said Dr. Keith Florig of Resources for the Future in Washington, who was also a consultant on the project. Any other alternative would have forced some employees to work in very strong magnetic fields—a situation that was considered undesirable, Florig said.

In existing buildings, demand is growing for substantial reductions of magnetic fields. "We are seeing a huge number of requests for shielding," explained Larry Maltin, president of Amuneal Manufacturing Corp. in Philadelphia. "I believe the recent Swedish studies and the press coverage they have received have sensitized the public," he added. Maltin's firm specializes in the preparation and installation of μ -metal alloys and low-carbon steel for EMF mitigation. For many years, the company's main activity was protecting electronic equipment from magnetic field interference, but, in response to customers' health concerns, area shielding is now Amuneal's fastest growing business.

"Generally, the first indication that there are elevated magnetic fields is interference on VDTs," Maltin told *Microwave News*. Reducing fields to less than 10 mG throughout an office is adequate to eliminate the interference problem—and results in average fields that are lower than 10 mG. A limit of 5 mG can double or triple the cost, and further reduction, to 1-2 mG, is a "fundamentally different" undertaking, according to Maltin, since the common contents of an office—lighting, copiers, fax machines, VDTs, electrical cords—generate fields above this level.

A job that involved reducing magnetic fields to 10 mG or less for two large offices directly above a building's electrical

(continued on p.12)

EMFs at New York City's Best Addresses

From Wall Street to Park Avenue, tenants and landlords of some of New York City's prime commercial properties are finding high EMFs—often in excess of 1,000 mG—in their buildings. In most cases, the problem is due to electrical equipment, such as wiring and transformers (see *MWN*, M/J91). Some companies have taken measures to put the space to new use or to shield it; others have moved out and are pursuing legal action. Here is a sampling.

Marine Midland Bank

After discovering high magnetic fields in its second-floor offices at 250 Park Avenue, Marine Midland Bank signed an agreement with its landlord to shield the space—at a cost of \$1 million, according to a knowledgeable source, who asked to remain anonymous. The bank had originally filed a suit against the landlord, Vista Properties Corp., but dropped it when Vista agreed to take remedial action. Floor-level magnetic fields of up to 300 mG were generated by power cables or the switching gear below the second floor, according to a report by HealthWaves Inc.—which is no longer in business—obtained by *Microwave News*. A subsidiary of Marine Midland's parent company, Hong Kong Shanghai Bank, now occupies the space. Richard Menaker of the New York City law firm of Menaker & Herrmann, who represented Marine Midland, declined to comment.

The Chrysler Building

Magnetic fields of more than 2,000 mG in its offices on the 31st floor of the landmark Chrysler Building have prompted the Klockner Chemical Co. to move out. It is preparing to file suit against its landlord, according to Klockner's attorney, Kenneth Everett of Becker, Glynn, Melamed & Muffly in New York. Klockner's claim will follow an earlier suit by Darby & Darby—a law firm that sublets to Klockner—against the chemical company for not paying rent and against Cooke Properties Inc., the owner of the building, for “uninhabitable premises” due to high EMFs, according to Darby's lawyer at the Manhattan firm of Wormser, Kiely, Galef & Jacobs. Fred Helene of Wallingford, CT, measured magnetic fields of 2,050 mG on the 31st floor, and Consolidated Edison Co., the local utility, later recorded levels as high as 2,700 mG. The EMFs were generated by electrical equipment located on the 30th floor, directly below Klockner's offices, Everett said.

Children's Television Workshop

The Children's Television Workshop (CTW), best known for *Sesame Street*, paid \$60,000 to reconfigure its second-floor offices to reduce worker exposures to EMFs, according to Ellen Morgenstern, CTW's director of media relations. CTW moved its employees out of the space for several months until the changes could be made. Morgenstern said that EMF readings in its offices, which are across the street from the Lincoln Center for the Performing Arts, are now “no higher than in any of CTW's offices on other floors.” She could not specify the field levels, either before or after the alterations, referring questions to Milford Managing Corp., which runs the building. A company representative said he knew nothing about the issue.

American Express Tower

Jitter on computer screens provided employees in the American Express office tower in the World Financial Center with their first clue that they were working in strong magnetic fields. A survey by American Power Technologies Inc. of Lake Success, NY, later showed

that the fields near the affected computers were as high as 90 mG. In other parts of the lobby-level offices, EMFs reached a maximum of 105 mG; just outside, in the lobby, they were 168 mG. (All of the measurements were taken at three feet above the floor.) “We believe it is evident that the problems...are being caused by magnetic fields produced by the electric service equipment (principally the low voltage collector bus and switchboards) located in the service level below the area,” according to the report, obtained by *Microwave News*. The office was later shielded “as a preventive measure,” said American Express spokeswoman Susan Miller, who declined to provide further details.

Gateway Plaza, Battery Park City

A subsidiary of Watermark Associates found EMFs of nearly 2,000 mG in the offices it rents in Gateway Plaza, a high-rise residential building in Battery Park City in lower Manhattan. As a result, in October 1992, it filed a suit in New York State Supreme Court to break its lease with Hudson Towers Co.—a subsidiary of the LeFrak Organization, which owns Gateway Plaza—claiming that the space was unsafe. Watermark declined to comment on the matter, but *Microwave News* has learned that an out-of-court settlement is being negotiated. EMFs in the ground floor offices ranged between 850 and 1,980 mG, according to a report by Jen-Mar Electric Co. of Brooklyn, NY. Four Con Edison transformers below the offices are believed to be responsible.

Columbia University School of Public Health

Administrators at the Columbia University School of Public Health rearranged a suite of basement offices after discovering high EMFs from nearby electrical equipment. A survey ordered by Dr. Edward Christman, director of environmental health and safety, found magnetic fields of 100-180 mG along a wall separating the offices from the equipment. EMFs at a VDT workstation next to the wall reached 58 mG. (The user of this VDT was relocated.) The fields in the room next door, near a switch panel, were 800-2,000 mG. The offices are occupied by the school's Center for Population and Family Planning. In a July 21, 1992, letter, Christman wrote that “there should be no concern for adverse health effects” since the levels are well below the standards limiting occupational exposure to EMFs, referring to guidelines set by the International Radiation Protection Association, the American Conference of Governmental Industrial Hygienists and the U.K.'s National Radiological Protection Board. But he noted that the decision to reconfigure the space was “prudent since it will eliminate VDT interference problems and the associated eye strain.” The office space with the strongest EMFs is now being used for filing cabinets.

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switching equipment cost roughly \$280,000—a price tag that is “not unusual,” according to Maltin. Another site—the ground-floor offices in Gateway Plaza in lower Manhattan (see p. 11)—presented a more difficult situation. This space is directly above transformer vaults, and surveys indicated that magnetic fields in some areas approached 2,000 mG. Amuneal engineers estimated that shielding for this area, which is roughly 1,100 square feet, would cost more than \$500,000.

Cost estimates from Consolidated Edison Co. in New York City are similar. “The fact is, we can reduce magnetic fields 20-fold, 30-fold, 50-fold, but at a price and only in a given area,” explained Dr. Daniel Mark, a senior Con Ed engineer. The utility has worked with Amuneal on several demonstration projects designed to assess the effectiveness of various types of shielding.

Con Ed does not presently shield its equipment in response to customer requests, spokesman Martin Gitten said, because it is impossible to know what a safe magnetic field exposure is. But Mark explained that, since New York State has adopted a 200 mG magnetic field limit for power line rights-of-way (see *MWN*, S/O90), utility officials want to know “what we can do” to reduce magnetic fields from other electric power facilities.

In one Con Ed project, completed in 1990, a 460 volt distribution vault was shielded with μ -metal on the walls and ceiling, yielding a 25 to 1 reduction of the magnetic field at a cost of \$200,000. In another, engineers put a fence lined with μ -metal around a 30-foot by 15-foot capacitor bank that is part of an outdoor substation. The magnetic field measured about 1,000 mG outside the fence before the shielding was in place, and 20-25 mG after, Mark said. The cost of this effort, completed in 1991, was \$180,000. The utility is currently experimenting with shielding methods at one of its power plants.

“It would be impossible to shield all Con Ed installations for magnetic fields,” Mark said, adding that he is far from convinced it is necessary. “I can’t imagine New York City covered with tons and tons of μ -metal,” he said.

The World Bank evaluates emissions when purchasing new office equipment, Barry told *Microwave News*. While low emission VDTs are fairly easy to find, Barry explained, levels vary widely among different types of copy machines, computer printers and even desktop lamps. EMFs can be cut sharply simply by choosing these products carefully, he said.

Mitigation Resources

Norman Beddows of EPA’s regional office in Boston has prepared a ten-page guide, *Extremely Low Frequency (ELF) Magnetic Fields in Offices, and Mitigation*. Copies are available from Amuneal Manufacturing Corp., 4737 Darrah St., Philadelphia, PA 19124, (215) 535-3000.... Amuneal’s Larry Maltin will give a tutorial on shielding DC and AC EMFs on June 16 at the Bioelectromagnetics Society’s annual meeting in Los Angeles. Call W/L Associates for details: (301) 663-1915.

The World Bank team also adopted the following mitigation measures for its new headquarters:

- Electrical transformers for each floor are being placed near elevator lobbies so that storage closets, corridors and common areas that are only used intermittently form a buffer between this EMF source and employee areas. Magnetic fields reach 100 mG or more right next to this equipment, according to Barry, but drop off to negligible levels about 12 feet away.
- Electronic ballasts rather than magnetic ballasts are being used for fluorescent lights, and two banks of lights are being run on each ballast, cutting the number of sources in half; ballasts are also being positioned back to back, to promote field cancellation. “This is a real win-win situation,” Barry pointed out, since the design improves energy efficiency and costs less to install.
- Desks are being positioned away from the fan coil units that are used for ventilation in window offices. These emit relatively high fields—stronger than those of most office equipment—but the levels drop off quickly with distance, Barry said.

The first phase of the World Bank headquarters will be completed this year, after which Barry plans a thorough survey of magnetic field levels to evaluate the effectiveness of the mitigation efforts. The entire complex, covering one city block, is scheduled to be finished in 1996.

FROM THE FIELD

PG&E Mitigates Existing Transmission Line EMFs

To the Editor:

Recently, I was called in to measure magnetic fields for CAT Software, a company in Palo Alto, CA, which is 50 feet from the transmission lines supplying all of Palo Alto. The company’s original complaint was the flickering of their VDT screens. My measurements showed 10.5 mG in the offices closest to the lines and 4.5 mG in those furthest away.

Soon afterward a meeting was held, attended by Pacific Gas & Electric (PG&E) engineers, a city engineer, the landlord, company representatives and myself. Though PG&E representatives wanted to focus only on the flickering of the VDTs—suggesting ways to reduce the symptoms—company representatives were aware of the health research and wanted the fields reduced.

I suggested reverse phasing the lines in accordance with EPRI research. The PG&E engineer, Tomm Marshall, agreed to look into the feasibility of this mitigation strategy. Within a week he had ordered the reverse phasing. I remeasured the magnetic fields on the same day of the week and at the same time of day as my first measurements and found a 76% reduction at the front (2.5 mG, down from 10.5 mG) and a 73% reduction at the rear (1.2 mG, down from 4.5 mG). The VDTs no longer flickered. According to Tomm Marshall, the reverse phasing was accomplished during the day, with no disruption of service, and was considered a minor task.

Considering the number of residences, businesses and recreation areas that have similar problems, all utilities might want to adopt similar mitigation measures as standard procedure.

Sincerely,

Karl Riley

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HIGHLIGHTS

\$1.6 Million Award for Worker Fired After Radar Accident

Richard Eldridge, one of six civilian employees who were exposed to strong radar radiation in a 1983 accident at Clear Air Force Station near Fairbanks, AK, has won a jury award of \$1.6 million for being wrongfully dismissed by his employer, Felec Services Inc., after he sought expert medical treatment for his injuries. Eldridge's was the only wrongful termination case filed, but he and three others also have personal injury claims pending.

Felec, a subsidiary of ITT, has asked Judge Russel Holland, who oversaw the case in U.S. District Court in Anchorage, AK, to either throw out the jury's February 17 decision—a move known as granting judgment as a matter of law—or grant a new trial. "The jury got sidetracked," said Marcus Clapp, an attorney in the Fairbanks offices of Hughes, Thorsness, Gantz, Powell and Brundin, who represents Felec. The jury was instructed to find for Eldridge only if it was shown that Felec's motivation was "to prevent him from exercising his right to see a physician of his own choosing, or to retaliate against Mr. Eldridge for pursuing his workers' compensation rights." But Clapp maintains that the plaintiff's case did not demonstrate anything about Felec's motives, focusing instead on Eldridge's employment contract.

Richard Friedman, Eldridge's attorney, dismisses these views. He told *Microwave News* that Eldridge "really pushed to see doctors who knew something about radiation injuries." The case he presented showed that this was why he was fired, said Friedman, who is with the firm of Friedman, Rubin & White in Anchorage.

Eldridge, a welder, was servicing a powerful tracking radar—part of the Air Force's Ballistic Missile Early Warning System—when it was accidentally turned on by another worker (see *MWN*, N83). He and five other workers were 80 feet above the ground on the superstructure that houses the radar when they began to feel warm and realized the radar was in operation.

Eldridge was a vocal critic of Felec's and the Air Force's handling of his injuries. Immediately after the accident, the six workers were examined by the company's nurse, who found that they had elevated body temperatures, high blood pressure and some burns. Eldridge and the others complained of vision loss, partial hearing loss, nausea and other symptoms. The next day, they were sent to a hospital in Fairbanks, but doctors there had no experience with radar radiation injuries, according to Eldridge. For a full week, the workers were told that the radiation badges they wore to detect ionizing radiation would also document their exposures to non-ionizing radiation from the radar. Nine days after the accident, the workers were informed that they would be sent to the School of Aerospace Medicine at Brooks Air Force Base in Texas to see doctors who were familiar with radiofrequency and microwave radiation, but that trip was delayed several more weeks. Eldridge decided to seek his own medical experts and went from Brooks to see doctors in New York and Massachusetts.

Eldridge recently told *Microwave News* that he still suffers

from short-term memory loss. "I have to write everything down," he said.

The jury awarded Eldridge \$630,000 for lost wages and pension benefits. Felec will also have to pay interest and attorneys' fees, bringing the total to more than \$1.6 million. Felec's motion to overturn the jury award should be heard sometime in April, according to Clapp, and if it is denied, an appeal is still possible.

Meanwhile, the personal injury claims brought by Eldridge and the three other workers are the subject of a complex and drawn-out legal battle. Along with Felec, the defendants are RCA Corp. (now owned by General Electric Co.), which manufactured the radar and operated it for many years, and the Air Force (see *MWN*, S/O85). These claims have been consolidated before Judge Holland. Currently, the court is considering a motion from the defendants to dismiss the claims, pursuant to a provision of the Federal Tort Claims Act that precludes certain types of actions against the government.

The defendants "have made every possible attempt to delay and impede discovery in this case," said Tulsa, OK, attorney Jon Running, who represents all the plaintiffs except Eldridge. Clapp, whose firm is also handling Felec's defense in these cases, admitted that the legal complexities being raised in this case are "bizarre." He said that any trial is probably several years away.

The circumstances of the accident are subject to controversy. The Air Force, in a report based on a reconstruction of the events at Clear, stated that the maximum exposure for any of the workers was 105 mW/cm² and estimated that Eldridge was exposed to radiation levels of 12-19 mW/cm² for seven or eight minutes. The workers, however, maintain that the exposures were as high as 135 mW/cm² and lasted up to seventeen minutes (see *MWN*, D83 and J/F84). A subsequent investigation by the General Accounting Office found that the accident was due to "basic problems" in Felec's operational and safety practices (see *MWN*, N/D85).

EMS Technicians Question Safety of Their Two-Way Radios

New York City's Emergency Medical Service (EMS) technicians are concerned that their walkie-talkies may be affecting their health. Female EMS employees are reporting menstrual irregularities and abnormal pap smear tests, according to the EMS Women's Coalition, an employee group. They worry that the Motorola STX and Sabre radios they use may be responsible, and some are refusing to carry them, Anne Collazo, head of the Women's Coalition, told *Microwave News*.

As many as 100 of the city's 680 female EMS employees may be affected, according to the March 22 *New York Daily News*. Collazo, however, declined to estimate how many women have health complaints, explaining that her group has just begun a survey of all EMS personnel to try to determine the scope of the problem. "Since all this hit the papers," Collazo said, "a lot more women are coming forward."

Motorola is defending its radios. When used properly, they

are held "well away from the head," Motorola pointed out. "There is no credible evidence to suggest that the weak signals from these radios could penetrate the skull and reach the pituitary gland at levels that could cause any adverse effects," the company said in a statement prepared in response to press reports. An EMS spokeswoman, Lynn Schulman, concurred, suggesting that job stress or nighttime work could be responsible for the women's health problems.

Female EMS workers reject this reasoning. They point out that the first reports of gynecological problems surfaced in mid-1989, just after EMS replaced its older radios, which operated at around 400 MHz, with the new 800 MHz Motorola equipment. Soon thereafter, 15 out of about 40 women who worked in the Bellevue Hospital EMS unit in Manhattan began complaining of menstrual irregularities, according to Collazo. The women suspected the new radios, so the union that represents EMS technicians, Local 2507 of District Council 37, had radiation measurements taken by Professor Leo Birenbaum of Polytechnic University in Brooklyn, NY. At 10 cm from the antenna, the new radios produced power densities of approximately 2 mW/cm², according to Birenbaum's report. The union also suggested that video display terminals (VDTs), installed in EMS vehicles at about the same time, might be responsible for the menstrual problems.

The health concerns reemerged after the controversy over cellular telephone radiation erupted earlier this year (see *MWN*, J/F93). The EMS radios operate at 800-900 MHz with a 3-watt maximum input power—the precise frequencies are programmed when the system is set up. This is the same range used by cellular phones, but the radios are more powerful than 0.6-watt handheld cellular phones.

In 1989, the environmental epidemiology unit of the New York City Department of Health (DOH) agreed to investigate the workers' complaints and interviewed 34 women from the Bellevue unit. The study was never completed, however. The agency will now revisit the issue, according to Steven Matthews, a DOH spokesman. "We'll look at any factors that seem to present themselves as opportunities for study," Matthews said, but he added that he could not yet say whether the DOH would consider emissions from either the radios or the VDTs.

Navy To Cancel EMPRESS II

The Navy's controversial seagoing electromagnetic pulse (EMP) simulator, known as EMPRESS II, will not be funded in fiscal year 1994, due to reductions in the military budget, Navy officials report. "This is one of the areas that we could not afford to keep funding, given other priorities," said Captain William Mahew of the Naval Sea Systems Command in Crystal City, VA. "It's not likely to be reactivated," he added.

There will be one more set of tests this summer, at a site in the Atlantic Ocean off the coast of North Carolina, where EMPRESS II has been operating since the summer of 1988 (see *MWN*, J/A88). Fiscal year 1993 runs through September 30.

Several years ago, the Navy said it needed to run as many as ten testing cycles per year. Because weather conditions only allowed use of the Atlantic site during the summer, the Navy proposed a second site in the Gulf of Mexico, off the coast of Alabama and Mississippi, for use in the winter (see *MWN*, J/A89). Communities along the Gulf Coast vehemently opposed the Navy's plans, which were dropped in March 1992 (see *MWN*, J/F92 and M/J92). At the time, the Navy reported that it was scaling back the EMPRESS II program due to budgetary constraints. The North Carolina site itself was selected after the Navy abandoned its planned site on Chesapeake Bay. The Navy faced strong opposition in Maryland and Virginia to use of the Chesapeake site (see *MWN*, J/F87 and M/A87).

Mahew told *Microwave News* that the Navy's other EMP testing programs will not be affected by the decision to curtail EMPRESS II. The older EMPRESS I facility is still in use at the Patuxent River Naval Air Station, MD, he noted.

EMPRESS II—the acronym stands for EMP Radiation Environment Simulator for Ships—was designed to test the ability of electronic systems on Navy vessels to withstand the EMP of a nuclear blast. Mahew told *Microwave News* that the program has been useful for understanding the "whole-ship influence" of EMP. The Navy has learned that the effort required to harden ships so they are not disabled by EMP is "reasonably manageable, at reasonable cost," Mahew said.

VDT Research Center Weighs EMF-Breast Cancer Studies

Researchers are seeking funds from the Center for VDT and Health Research to investigate the possible link between EMFs and breast cancer. And the center, located at the Johns Hopkins University (JHU) School of Hygiene and Public Health in Baltimore, seems receptive, having asked for detailed proposals for breast cancer studies from two well-known EMF experts, according to its director, Dr. Ronald Gray.

Dr. Genevieve Matanoski, also of JHU's public health school, is seeking support for a pilot study to investigate whether women who use video display terminals (VDTs) have an elevated rate of breast cancer. Matanoski and coworkers were the first to identify a link between male breast cancer and EMFs when, in 1989, they reported a breast cancer cluster among young New York Telephone Co. workers (see *MWN*, N/D89 and M/A91).

Dr. Robert Liburdy of the Lawrence Berkeley Laboratory in Berkeley, CA, who has shown that power frequency EMFs can block the body's defenses against the growth of breast cancer cells (see *MWN*, J/A92), is applying for a grant to extend his work to the sawtooth waveforms emitted by VDTs.

The center is also considering a third study, by Dr. Michele Marcus, an epidemiologist at Emory University in Atlanta, who is in the midst of a major prospective study of pregnancy loss among office workers (see *MWN*, J/A89). Marcus wants a grant to measure her subjects' EMF exposures over a 24-hour period.