MICRO WAVE NEWS

Vol. X No. 4 A Report on Non-Ionizing Radiation July/August 1990

INSIDE...

Male Breast Cancer Again Tied to Occupational EMF Exposures

Support for the Johns Hopkins Study

Epidemiologists at the Fred Hutchinson Cancer Research Center in Seattle, WA, have uncovered new evidence for an association between occupational exposures to electromagnetic fields (EMFs) and the development of male breast cancer. The study supports the preliminary findings of a Johns Hopkins University (JHU) study, reported late last year, showing an increased risk of male breast cancer among young New York telephone workers (see *MWN*, N/D89).

Paul Demers, working with Dr. David Thomas's research group at the Hutchinson center, has found that telephone linemen, electricians and electric power workers have six times the expected rate of male breast cancer—a statistically significant increase. For radio and communications workers, the risk was almost tripled. Overall, there was almost a doubling of the cancer risk for all EMF-exposed workers.

Special Report on EMFs and Breast Cancer: Are Women at Risk? Is the Pineal Gland Responsible? pp.9-10

"Our results support the theory that EMFs are related to male breast cancer and raise the possibility of a tie to breast cancer among women," Demers told *Microwave News*. Indeed, Demers's findings are leading experts to take the possible link to female breast cancer more seriously (see story on p.9).

"It's a very important study that seriously raises the suspicion that

(continued on p.8)

Prospects for Federal EMF Research Funding Improve

The outlook for an expanded federal research program on the biological effects of electromagnetic fields (EMFs) has greatly improved. At a congressional hearing on July 25, industry and government representatives endorsed a research budget of $34 million over the next five years. The bill, H.R.4801, which was introduced by Rep. Frank Pallone (D-NJ), is now likely to advance in the House of Representatives.

Rep. James Scheuer (D-NY), chairman of the House Committee on Science, Space and Technology's Subcommittee on Natural Resources, Agriculture Research and Environment, convened the hearing to consider H.R.4801, saying, "Much more must be done before we can be complacent

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ELF NEWS

« Power Line Talk »

Three years after beginning its study and two years after its last meeting, a working group on ELF fields set up in 1987 by **Health and Welfare Canada** has issued its report, *Electric and Magnetic Fields and Your Health*. Members of the working group were recruited from governmental agencies, academia, labor unions and utilities (see *MWN*, M/J87). One member, **Gary Cwitco** of the Communications and Electrical Workers of Canada, is unhappy not only for the delay in publication, but because the working group's real report—including its recommendations and conclusions—is buried in an appendix at the back of the published pamphlet. In an April 19 letter to Canada's Minister of National Health and Welfare, Perrin Beatty, Cwitco charged that the report had taken so long to be published that it is considerably weaker than if it had been written today. In addition, he expressed his surprise and frustration that the minister had not yet acted on one of the two recommendations made by the working group—to set up a committee to advise on future bioeffects research. Cwitco said that he had been "misled" by Health and Welfare Canada and that his concerns were "so great" that he would "seriously consider abstaining from any further work" with the department. At last word, Cwitco had not heard back from Beatty.

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A "very concerned grandmother" has gone directly to the White House to express her concern over cancer risks from **electric blankets**. In a May 27 letter, she asked **Barbara Bush** to "do everything in your power to increase public awareness of this grave, potential danger." Her suspicions were aroused two years ago, when her 2½-year-old granddaughter was diagnosed with a neuroblastoma. After seeing a TV report on EMFs and electric blankets, the woman questioned her daughter, who contacted five other mothers of children with neuroblastomas and discovered that the six of them had all used electric blankets during their pregnancies. "It is a heartbreak to think that possibly a lot of these cancers might never have happened had the public been warned," she wrote. The grandmother, who lives near New York City, asked that her name not be published.

"Microwave News" in "Time"

The recent explosion in media coverage of nonionizing radiation health risks reached new heights with the July 30 issue of *Time* magazine, in which *Microwave News* was profiled in a three-column article by Philip Elmer-DeWitt titled "Hidden Hazards of the Airwaves: An Obscure Newsletter Uncovers the Perils of the Information Age."

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"Open, frank and honest communication..." is essential if the electric power industry is to head off a stampede toward restrictive public policy on power line construction, the Electric Power Research Institute's (**EPRI**) Director of Corporate Communications **Richard Claeys** told the American Public Power Association (APPA). In a June 11 speech at the APPA's annual meeting in Denver, CO, Claeys described a rising tide of public concern over EMF hazards. An EPRI poll of 100 utility CEOs last December found that customer inquiries and press calls about EMFs have tripled and that employee concerns are up 50 percent. "I exhort you, as industry leaders and communications professionals, to plan now...prepare yourselves for the possibility of positive research evidence or—and maybe worse—conflicting or inconclusive findings in an atmosphere of rising public anxiety," Claeys said. He advised his audience not to dismiss fears out of hand, but rather to acknowledge their legitimacy and support further scientific research: "You have to help in giving this issue the attention and the sincere concern that it deserves."

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IBM in Boulder, CO, has agreed to pay $680,000 to bury a planned 230 kV line that nearby residents feared would create higher EMF levels and reduce the value of their homes. IBM's contribution represents the difference in cost between building a double-circuit overhead line (reportedly $2.3 million) and a single-circuit underground line ($3 million). The line, which will be approximately two miles long, is intended to serve IBM's needs exclusively. An IBM spokesman told us that following an agreement with the local utility, Public Service Co., the company now has "happy neighbors." Construction is expected to begin in the spring of 1991.

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After hearing testimony on the potential health hazards of power line EMFs, the **Great Yarmouth Borough Council** in the **U.K.** has rejected a new 132 kV overhead transmission line proposed by Eastern Electricity, according to the July 22 issue of *The Observer*, a U.K. weekly newspaper. The council is asking Eastern to bury the line, a move which would add £4 million ($7 million) to the £120 million ($216 million) project. This is the first time a power line project has been derailed on health grounds in the U.K., *The Observer* noted. Power line EMFs have been the subject of sharp debate in England since *Electronics World+Wireless World*, a monthly trade magazine, ran a cover story on the "Killing Fields" in its February 1990 issue (see *MWN*, M/A90).

Mother of Leukemia Victim Sues Washington State Utility

In June, the mother of a teenage girl who died of leukemia in 1987 filed a "wrongful death" suit against the Public Utilities District (PUD) of Clark County, WA. The suit alleges that exposure to electromagnetic fields (EMFs) from power lines at home and at school and from a substation near her home caused the cancer.

Between 1979 and 1983, Ariana Hightower attended Crestline Elementary School, which has a 12.5 kV distribution line and a 115 kV transmission line running adjacent to school property. There were seven cases of cancer reported among Crestline students between 1982 and 1989.

In the suit, Ariana's mother, Sheila Hightower Anderson, contends that the utility "has a common law duty to prevent harm to the public" and was negligent in that it failed to warn citizens in Clark County of potential EMF hazards, according to the July 6 issue of *Clearing Up*, a Pacific Northwest energy industry weekly. Anderson's complaint was filed shortly before the statute of limitations deadline.

"We don't feel the utility is to blame," said Clark PUD spokesman Bruce Bosch. In response to community concerns, the utility measured EMF levels at Crestline and other schools in the Vancouver, WA, area earlier this year and found "very low levels of both electric and magnetic fields that were caused by the fluorescent lighting...."

Michael Hicks, the Vancouver attorney who is representing Mrs. Anderson, would not comment on whether suits from other Crestline parents would be forthcoming.

The apparent cancer cluster has prompted the Southwest Washington Health District to initiate an investigation into possible causes, including EMFs. Dr. Karen Steingart, the chief investigator on the case, told *Microwave News* that, compared with other schools in the area, Crestline does not have significantly elevated EMF levels. She also noted that there were four different types of cancer among the seven children, and four of the seven had lived in the area for less than one year prior to diagnosis. A final report has not yet been issued.

In December 1987, a Texas family sued Houston Lighting & Power, alleging that EMFs from a 345 kV power line caused Michael Scott to develop an astrocytic brain tumor at age 26 (see *MWN*, J/F88). John McDowell of Bankston & McDowell in Houston, TX, the attorney representing the Scott family, told *Microwave News* in late July that the suit is still pending and that he expects a trial date in early 1991.

Correction

In the M/J90 issue, the stated increase in brain tumors observed by Dr. David Savitz among children whose mothers used electric blankets during the first trimester of pregnancy was incorrect. It should have read 300%. See *American Journal of Epidemiology, 131*, pp.763-773, 1990.

Prudent Avoidance —Swedish Style

The Swedish National Energy Administration (NEA) has advised that new schools, day-care centers and playgrounds not be located near power lines, "pending further research."

In a February 1 letter that has been widely distributed among utility officials and health researchers, Jaak Nõu, the head of NEA's department of electrical safety, recommended that magnetic fields in those areas not exceed 2-3 mG—the threshold for increased childhood cancer risks indicated by the Wertheimer-Leeper and Savitz studies. The letter was addressed to a homeowner living next to a power line which the State Power Board is planning to upgrade from 220 kV to 400 kV.

Nõu also urged a "strategy of caution" for residential construction over the next two years, recommending that areas furthest away from power lines be developed first, with additional work contingent on the results of ongoing studies.

Several epidemiological studies on the link between power line magnetic fields and cancer are now under way in Sweden (see *MWN*, M/J87 and N/D89).

New Jersey Drafts 200 mG Power Line ROW Limits

The New Jersey Commission on Radiation Protection is considering the adoption of standards to limit power line electromagnetic fields (EMFs) and to prohibit the siting of new playgrounds in their right-of-ways (ROWs).

"My goal is to get the power companies to take health concerns seriously when they put up new power lines," Dr. Fred Sterzer told *Microwave News*. Sterzer, of MMTC, Inc. in Princeton, NJ, is the chairman of the commission's Non-Ionizing Radiation Advisory Committee, which is drafting the standards. He advocates making power line EMFs "as low as is reasonably achievable," a strategy better known by its acronym, ALARA. Sterzer does research on biomedical applications of non-ionizing radiation.

Dr. Max Weiss, the chairman of the commission and a former staffer at AT&T Bell Labs, told *Microwave News* that the commission is "not far away from adopting some rules." Action could come at the commission's next meeting on September 19, or, more likely, at its October 17 session. The commission can accept or reject the advisory committee's recommendations.

If adopted, the standards would require that EMFs at the edge of a new power line's ROW not exceed 200 mG. The magnetic field strength of existing power lines would be

Public Exposure Limits for ELF Magnetic Fields

Regulatory Body	Magnetic Field Limit (mG)	MWN References
International Radiation Protection Association (1989)	1,000	M/J89
New York (1990) Public Service Commission	200*	M/A90
New Jersey (1990) Commission on Radiation Protection	200* (draft)	See story below
Florida (1989) Department of Environmental Regulation	150-250*	M/A89

* Along power line right-of-ways

(The Wertheimer-Leeper and Savitz studies indicated an increased cancer risk in children at 2-3 mG.)

limited to "the maximum current rating." The draft standards are similar to those in Florida and to one proposed in New York state (see table above).

Electric field strength would be limited to 3 kV/m along the ROWs of all power lines.

John Karcher of Jersey Central Power & Light (JCP&L) in Morristown, a member of the committee, said that he is in basic agreement with the 200 mG limit.

The proposed standards have already drawn fire from citizens who point to epidemiological studies which have found an increased risk of cancer at levels one hundred times weaker than the proposed limit. "The power companies couldn't ask for anything more," said Melvin Greenberg, a lawyer for Middletown Township, which is opposing a new JCP&L 230 kV power line through the town (see *MWN*, J/A89).

Mary Cashen Purcell, one of the founders of Residents Against Giant Electric (RAGE), a group opposing the new line, criticized the composition of the drafting committee. "The foxes are guarding the chickens," she said. She characterized the controversy as a struggle of "industry against citizens, profits over common sense."

One of the options being considered for the new rules would prohibit the construction of new playgrounds in ROWs. Weiss said that there is "general agreement" on this provision.

How the state will treat those playgrounds already in ROWs is not clear. Sterzer said that there are playgrounds under power lines all over the state and that he favors their removal, but he acknowledged that this is probably not politically feasible.

Sterzer stressed that in keeping with the ALARA policy, power companies would have to show that they have taken "reasonable measures to minimize the fields" from new power lines. The proposed standards would require that new or upgraded power lines be built so that they would generate lower EMFs:

> The new line must be constructed using the following methods: (1) underground burial in pipe-type cable; (2) transmission of power via direct current; (3) high phase order; (4) if the line is a double circuit, use compact configuration, reverse phasing and raise the conductors ten feet higher than standard construction; or (5) if the line is a single circuit, vertically configure the conductors and raise the conductors 10 feet higher than standard construction.

Before they could be adopted, the standards would be reviewed by lawyers from the state Department of Environmental Protection and a public hearing would be held. According to Weiss, the process could take from six months to a year.

EPA To Test Gaussmeters

The Environmental Protection Agency (EPA) will evaluate ELF gaussmeters. Edwin Mantiply of EPA's Office of Radiation Programs (ORP) in Las Vegas, NV, who is leading the project, is limiting the tests to relatively inexpensive, non-recording meters.

In June, Mantiply asked more than 20 manufacturers to loan EPA their meters. The tests will include measurements of accuracy, sensitivity, frequency response and susceptibility to radiofrequency interference. The results, which are due by the end of the year, will be made available to the public.

Until now, no government agency has tested the growing number of ELF gaussmeters on the market. For a list of available meters, see *MWN*, J/F90 and M/J90.

For more information, contact: Edwin Mantiply, EPA, ORP, PO Box 98517, Las Vegas, NV 89193, (702) 798-2476.

Alexandria, Virginia, Moves To Reduce Power Line EMFs

The city council of Alexandria, VA, has voted to endorse a plan to reduce power line electromagnetic field (EMF) levels on several blocks in the densely populated Old Town section of the city. The plan, proposed by a task force made up of representatives from the city council, citizens groups and Virginia Power, would require that the lines be either buried, relocated or upgraded from 4 kV to 34.5 kV.

Distribution lines crisscross Old Town, running very close to buildings on the narrow streets. Magnetic fields of up to 45 mG have been measured inside some of the houses.

Though the council's endorsement is not a formal approval of the plan, Thomas O'Kane, Alexandria's director of transportation and environmental services, told *Microwave News* that the city is presently looking into underground routes for the lines. Estimates of the cost of burial run as high as $3 million.

Negotiations with Virginia Power over funding for the project are still under way. Coincidentally, Virginia Power's 30-year franchise agreement with the city runs out this year, and the utility is in the process of negotiating to maintain its exclusive rights to supply Alexandria with electricity. Though the city previously paid for burying lines in Old Town, John Oyenart, Virginia Power's customer service manager, told *Microwave News* that Alexandria's mayor, Jim Moran, has proposed that the utility pay for the project as a condition of the franchise agreement.

Although Oyenart refused to endorse or to reject the task force's proposal, he was skeptical about the merits of the plan. "The jury is still out as far as any possible EMF health risks," he said, adding that he "is pretty sure that undergrounding won't get rid of the fields."

Since the utility does not acknowledge any EMF health risks, the project may be billed as "historic undergrounding," intended to preserve the aesthetic beauty of Old Town, O'Kane said.

PSE&G Makes a Promise

"You have a right to know the facts and we pledge our best efforts in getting them to you," Public Service Electric and Gas (PSE&G), New Jersey's largest electric utility, promises in an ad running in 15 daily New Jersey newspapers. The ad is part of a $70,000 publicity campaign on EMFs which began in June and which will conclude in August.

The ads—titled "What you should know about EMF"; "What is being done about EMF"; and "A promise about EMF"—stress PSE&G's commitment to the Electric Power Research Institute's (EPRI) research program on bioeffects and to keeping customers informed.

The ads do not acknowledge EMF health hazards: "It is PSE&G's belief, based on the latest...evidence, that EMF does not represent a threat to the health and safety of its customers and employees." EMF health effects are termed "rare, difficult to detect and quite subtle, if they exist at all," though the utility admits that there are "valid concerns."

According to Neil Brown, a company spokesman, PSE&G had received 100 requests for more information by mid-July.

HIGHLIGHTS

Abnormal Immune Systems Among Aluminum Workers

Aluminum workers who were routinely exposed to very high magnetic fields and toxic chemicals had abnormal immune systems, according to a new study by Drs. Robert Davis and Samuel Milham Jr. of the Washington state Department of Health in Olympia.

In their pilot study, Davis and Milham selected 23 apparently healthy volunteers, aged 35-54, from a group of 350 workers and found that 15 of the 20 who worked in the "potrooms" had elevated levels of T8 suppressor lymphocytes (white blood cells) compared to the three who worked in other parts of the plant. The large number of T8 cells lowered the ratio of T4 to T8 lymphocytes—an indicator of abnormal immune function. Two of the three non-potroom workers also had low T4/T8 ratios, though these were due to low T4 counts.

"These workers definitely had abnormal immune profiles," Milham told *Microwave News* in a telephone interview. "Now we must find out whether their immune functions are impaired." Potroom workers were employed on an average of 18 years at the plant—13 years in the potrooms.

Those suffering from AIDS also have low T4/T8 ratios, making them very susceptible to pathogens which the immune system could otherwise fight off. In AIDS patients, however, the ratio is low because of an abnormally low number of T4 helper lymphocytes.

Potroom workers are exposed to very high magnetic fields, intense heat and a host of toxic chemicals, including benzene and polycyclic aromatic hydrocarbons. Aluminum ions are reduced into the metal in large steel pots.

Although Davis and Milham did not measure the electromagnetic fields (EMFs) in the potrooms, they cited a study by Dr. Tom Tenforde—now at the Battelle Pacific Northwest

Lab in Richland, WA—indicating that magnetic fields greater than 100 G can be generated in the electrolytic reduction of aluminum. Whether the magnetic fields were static or time-varying was not specified.

The new study was prompted by Milham's observation of a cluster of five cases of B-cell lymphoma among aluminum plant workers between 1978 and 1985. Previous studies of occupational mortality among Washington state aluminum workers had also shown higher-than-expected rates of lymphoma. Although Davis and Milham point out that the observed immune system changes may have no bearing on the increased lymphoma rate, they note that immunodeficiency is a "known risk factor" for B-cell lymphoma.

The researchers were also careful to point out that, "The cause of these findings is unknown." Nevertheless, they cited experiments by Dr. Dan Lyle, working with Dr. Ross Adey at the VA Hospital in Loma Linda, CA, showing that EMFs can alter the immune response of exposed cells (see *MWN*, My83).

In addition, Dr. Jerry Phillips, who recently joined Adey's lab, has reported that human cancer cells exposed to EMFs are less susceptible to attack by lymphocytes (see *MWN*, J/A86).

Milham is the author of a number of landmark studies on the link between EMFs and cancer (see *MWN*, J/A82, My85, J/A85, M/A86, N/D87 and J/F89).

Davis and Milham's paper, "Altered Immune Status in Aluminum Reduction Plant Workers," appears in the *American Journal of Industrial Medicine, 18*, pp.79-85, July 1990.

Swiss Advisory Group Endorses IRPA's RF/MW Limits

An advisory committee to the Swiss Federal Office for Environment, Forests and Landscape (known by its German acronym, BUWAL) has endorsed the International Radiation Protection Association's (IRPA) standards for human exposure to radiofrequency and microwave radiation in the 100 kHz–300 GHz frequency band.

The IRPA standards, adopted in 1984 and revised in 1988, are based on a specific absorption rate (SAR) of 0.08 W/Kg for the general public—equivalent to 200 $\mu W/cm^2$ at 10-400 MHz (see *MWN*, Mr84 and J/F88).

The BUWAL will use the committee's recommendations to set federal safety standards.

In its June 1990 report, the advisory group, chaired by Dr. H. Krueger, a professor at the Swiss Federal Institute of Technology (ETH) in Zurich, concludes that the threshold for ill effects, based on animal studies, is in the range of 2-4 W/Kg and recommends the application of a safety factor of 50. It also notes that, at frequencies below 50 MHz, shock and burn hazards occur at SARs "well below 2 W/Kg."

Though Krueger's committee indicates that modulated fields and specific frequencies may be responsible for non-thermal effects, it decided that, without knowing the responsible mechanisms of interaction, it was impossible to set standards for non-thermal effects.

A future report will address health risks from exposures to frequencies below 100 kHz.

For a copy of *Biological Effects of Non-Ionizing Electromagnetic Radiation on Human Beings and the Environment—Part 1: Frequency Band 100 kHz to 300 GHz*, Environmental Protection Document No. 121, contact: Dokumentationsdienst, Bundesamt für Umwelt, Wald und Landschaft (BUWAL), Hallwylstrasse 4, 3003 Bern, Switzerland, (031) 61-69-64.

The title of the document in German is: *Biologische Auswirkungen Nichtionisierender Elektromagnetischer Strahlung auf den Menschen und seine Umwelt—1. Teil: Frequenzbereich 100 kHz bis 300 GHz*, Schriftenreihe Umweltschutz Nr.121.

RF Link to New York Cancer Cluster Under Study

An investigation is under way of a cluster of non-Hodgkin's lymphomas (NHL)—a rare cancer of the lymph system—among workers at the University of Rochester, NY. Since 1980, there have been at least ten—some say eleven—cases reported among those who now work, or used to work, at the school's Lattimore Hall, according to the Rochester *Times-Union*. No cause for the cluster has been identified, though some have pointed to the campus's 1,000-watt FM radio (WRUR) antenna, located 100 feet from Lattimore Hall.

"It's a striking cluster," Dr. James Melius, director of the division of occupational health and environmental epidemiology at the state Department of Health (DOH), told *Microwave News*. Melius, who is following the university's investigation for the DOH, added that radiofrequency (RF) radiation is a "legitimate concern."

There are, however, opposing views on whether RF radiation may be a factor in the cluster. In an interview, Dr. Clifford Reifler of the University of Rochester's Medical Center said that RF radiation has been dismissed as a possible cause, along with asbestos, radon, ionizing radiation, water contamination and building materials. "It doesn't appear to be a problem with the environment," he added. Reifler is coordinating the university's investigation with the DOH.

A June 9 RF radiation survey of Lattimore Hall and nearby buildings by Galson Technical Services, Inc., a Rochester-based consulting firm, found no detectable levels. The report, commissioned by the university, concluded that the RF levels are not hazardous because they are far lower than the guidelines specified by the American National Standards Institute (ANSI) and by the American Conference of Governmental Industrial Hygienists (ACGIH).

Galson's failure to detect RF radiation may be due to the meter used: the HI-3002 manufactured by Holaday Industries in Eden Prairie, MN. Holaday's Dave Baron told *Microwave News* that, "The low end of the sensitivity range of the HI-

3002 is 250 μW/cm². To detect levels in the microwatt range one should use one of our more sensitive meters."

Dr. Robert Becker, a consultant based in Lowville, NY, who has been following the cluster investigation, doubts that the ANSI and ACGIH standards are appropriate for assessing cancer risks: "These 'safe' levels have little justification in reality, they are rather arbitrary and have been questioned for some time," he said. "The RF survey in no way proves that there is no relation between the cancer cluster and the radio signals."

The university was first alerted to the Lattimore Hall cluster in 1986 when three women in their 30s developed cancer: two were diagnosed with NHL, one with breast cancer. Since then, nine more cases of NHL have been identified. One of these cases is not officially considered part of the cluster, since it involves a student who was at the university for only 18 months before the cancer was diagnosed.

"Our plan is to follow up and see if there are any more cases [of NHL]," Melius told *Microwave News*. The DOH is now going over health records of current and former university employees to see if some cases have been overlooked. Mary Ellin Arch, who is covering the cluster for the *Times-Union*, said that she has been inundated with calls from people who say that they are part of the cluster but haven't been counted.

There have been additional cases of breast cancer since the first report, though the investigators are not considering these, because there is "no suggestion that breast cancer has ever been caused by environmental factors," Reifler said.

Lattimore Hall housed chemistry labs until it was renovated in 1974, prompting some to question whether some leftover toxic substance might be responsible for the cluster. Reifler dismisses this, however: "Anything that was in the building before 1974 is gone," he said.

Makeup of IEEE Committee on NIER Under Fire

The membership of the Institute of Electrical and Electronic Engineers' (IEEE) committee developing standards on non-ionizing electromagnetic radiation (NIER) is being criticized because of its lack of biological and medical expertise and because the majority of its members represent the U.S. military.

The dispute threatens to delay the revision of the 1982 American National Standards Institute (ANSI) safety guidelines for radiofrequency and microwave (RF/MW) radiation and to hinder the committee from developing exposure standards for extremely low frequency (ELF) electromagnetic fields (EMFs). IEEE Standards Coordinating Committee 28 (SCC28), the new incarnation of ANSI Committee C95, has been working on revising the RF/MW standard since 1983 (see *MWN*, J/A83).

Fletcher Buckley, a member of the IEEE Standards Board, who works for General Electric (GE) in Moorestown, NJ, raised the issue of the IEEE's lack of expertise in bioelectromagnetics in a May 16 memorandum to Marco Migliaro of Impell Corp. in Melville, NY, the chairman of the IEEE Standards Board. "It is not clear that the IEEE by itself can come to an authoritative conclusion on the long-term dangers of cancer from long-term exposure to low-level [EMFs]," Buckley wrote.

"Where is the competence to determine low-level effects? We at the IEEE are not in the field nor do we publish epidemiological studies or other literature on cancer," he told *Microwave News* in a telephone interview. Buckley explained that he is concerned about the IEEE's expertise in both ELF EMFs and RF/MW biological effects. He also made clear that he was not speaking on behalf of GE.

Buckley's memo touched off a letter-writing campaign in support of the committee's work by a number of its members, including: Dr. Jay Brandinger of SRI International on behalf of the Electromagnetic Energy Policy Alliance, a trade group based in Washington, DC; Dr. Bill Guy of the University of Washington in Seattle; Dr. Don Justesen of the VA Medical Center in Kansas City, MO; John Mitchell of the Air Force School of Aerospace Medicine in San Antonio, TX; Dr. Elliot Postow of the National Institutes of Health (NIH) in Bethesda, MD; and Dr. Sol Michaelson of the University of Rochester in Rochester, NY.

Indeed, in his letter to Migliaro, Justesen raised "the question of the appropriateness of [Buckley's] membership on the

ELF-Shielded VDTs Expected in 1991

Sigma Designs, Inc. will market high-resolution video display terminals (VDTs) that are shielded to reduce ELF fields in the first quarter of 1991—the first U.S. company to make such a commitment for cathode ray tube monitors.

Only monochrome and gray-scale VDTs with reduced ELF emissions will be available, according to Sigma's Charlie Waters. In a telephone interview, he told *Microwave News* that all color monitors sold in the U.S. are manufactured overseas. "We are dependent on the Japanese for a color solution," he said. Sigma's color terminals are made by Sony Corp.

Following the lead of IBM (see *MWN*, N/D89), Sigma announced in late July that it would immediately start selling VDTs shielded to meet Swedish guidelines for very low frequency (VLF) fields. Sigma has been selling low VLF computer terminals in Sweden since 1988.

Sigma, which is based in Fremont, CA, did not specify the emission levels of its ELF-shielded VDTs, saying only that it would meet the Swedish ELF guidelines expected later this year.

Sigma is a major supplier of VDTs and other hardware for IBM, Macintosh and compatible systems. Last year, its sales were over $75 million. The company sells tens of thousands of VDTs each year, according to Waters.

Standards Board." Migliaro could not be reached for comment.

At the last meeting of SCC28, held in San Antonio, TX, on June 9, NIH's Postow expressed concern over the predominance of military interests on the committee, pointing out that 17 of the 31 members are associated with the Department of Defense (DOD), as are 8 of 13 liaison members. The DOD's role in the redrafting of the standard was also raised at last year's SCC28 meeting in Tucson, AZ (see *MWN*, S/O89).

"I am not happy with the process," Postow said in an interview. Similarly, Dr. Om Gandhi of the University of Utah in Salt Lake City, the cochairman of the subcommittee that is revising the 1982 ANSI standard, told *Microwave News* that the SCC28 committee "is not going to sit well with the public." Gandhi said that the committee needs new members, adding that, "I think it should be a balanced committee."

SRI's Brandinger, the chairman of SCC28's membership subcommittee, has been asked to investigate how to achieve balance. In an interview, he predicted that two of the military members would step down from the committee.

At the June meeting, the members of SCC28 voted to set up a new subcommittee to study the possibility of issuing a standard for exposures to ELF EMFs. The only dissenting votes came from Dr. Dave Erwin of the Air Force School of Aerospace Medicine and Lt. Col. H.F. Kerschner of the U.S. Naval Medical Command in Washington, DC. SCC28 Chairman Dr. Tom Budinger of the Lawrence Berkeley Lab in Berkeley, CA, deferred selecting the members of the new subcommittee.

"The IEEE will probably investigate ELF frequencies," John Woods, the institute's staff liaison with SCC28, told *Microwave News*, but he pointed out that a number of other IEEE groups have an interest in the subject.

Interestingly, both issues—the committee's membership and the desirability of setting ELF standards—have been raised before. In 1984, Dr. Nicholas Steneck, a professor of history at the University of Michigan in Ann Arbor, charged that the committee did not represent the public interest (see *MWN*, O84), and in 1986, a subcommittee issued a report on the question of ELF standards—but the idea was never pursued (see *MWN*, J/F86).

It is not clear how long the resolution of these issues will delay the approval of the revised RF/MW standard and whether the IEEE will allow SCC28 to address ELF EMFs. While a clear majority of the members of the subcommittee that revised the 1982 standard favor the proposed draft, the questions of membership expertise and balance will have to be resolved before the standard can be adopted.

Male Breast Cancer Again Tied to EMFs *(continued from p.1)*

exposure to EMFs increases the risk of breast cancer in men, and perhaps, in women," Dr. Richard Stevens of the Battelle Pacific Northwest Lab in Richland, WA, said in a telephone interview. Three years ago, Stevens published a paper suggesting that the higher incidence of breast cancer among women in industrialized countries is related to increased EMF exposures and/or increased "light-at-night" (see *MWN*, J/F87).

Demers's case-control study was based on 227 cases of male breast cancer occurring over a three-year period and 300 controls. Exposures were characterized by occupational history.

Demers pointed out that his results are "consistent" with the few available details on the JHU study. Last November, Drs. Genevieve Matanoski, Patrick Breysse and Elizabeth Elliott reported that they had found at least two cases of breast cancer among male central office technicians where none were expected. Furthermore, there were three or four more cases which did not fit the study's case definition, according to Breysse (see *MWN*, N/D89).

Matanoski told *Microwave News* that after analyzing her data, she contacted the Hutchinson researchers—who were already investigating male breast cancer risk factors—and suggested they take a look at the potential EMF connection.

The JHU team has suspended work on the New York study pending the completion of their nationwide case-control study of telephone workers (see *MWN*, N/D88 and M/A90).

Like the JHU researchers, who focused on active—hence, younger—workers, Demers observed a higher risk among men who were first exposed before they turned 30. Workers who were first exposed 30 or more years prior to diagnosis made up a second high risk group, Demers said: "If we had limited our study to ten-year exposures, we may not have seen anything." He noted that there was a great deal of overlap between the two groups. Duration of exposure, for the most part, was not related to risk, however.

Demers announced his findings at the *23rd Annual Meeting of the Society for Epidemiologic Research*, held June 12-15 at the Snowbird Resort near Salt Lake City, UT. He expects to submit a paper for publication in the near future. Demers's study is part of the larger investigation of male breast cancer by Thomas and coworkers being conducted at the Hutchinson center.

A second study of male breast cancer, which was also presented at the Utah meeting, concluded that there was no association with on-the-job EMF exposures. Paula Rosenbaum, who works with Dr. John Vena at the State University of New

MICROWAVE NEWS is published bimonthly • ISSN 0275-6595 • PO Box 1799, Grand Central Station, New York, NY 10163 • (212) 517-2800; FAX (212) 734-0316 • Editor and Publisher: Louis Slesin, PhD; Senior Editor: Jennifer Goren; Assistant Editors: Matthew Connelly, Barton Biggs; Contributing Editor: Mark A. Pinsky; Copy Editors: Jim Feldman, Peter Pullman • Subscriptions: $250.00 per year ($285.00 Canada & Foreign, U.S. funds only); single copies: $50.00 •

York in Buffalo, declined to discuss her findings with *Microwave News*. Vena was unavailable for comment.

The male breast cancer cases in the JHU study were among "central office technicians" who were exposed to complex EMFs with transient pulses generated by the on-off switching of equipment, JHU's Breysse told *Microwave News* last November. At that time, he suggested that the on-off pattern may be more significant for biological activity than constant 60 Hz field exposures. Those with the highest risk in the Demers study—electricians, telephone linemen and electric power workers—may also have been exposed to complex EMF waveforms.

Are EMFs Risk Factors for Breast Cancer in Women?

As the link between electromagnetic fields (EMFs) and male breast cancer grows stronger, researchers are asking whether EMFs may also play a role in the development of breast cancer among women.

Dr. Richard Stevens of the Battelle Pacific Northwest Lab has long maintained that the link between EMFs and female breast cancer requires a full-scale investigation (see p.1).

Actually, while there have been no studies of EMFs and female breast cancer, many experts say that male and female breast cancers are essentially the same disease.

"There are many more similarities than there are differences among male and female breast cancer," Dr. David Blask of the University of Arizona College of Medicine in Tucson told *Microwave News*.

Similarly, Dr. David Thomas of the Fred Hutchinson Cancer Research Center in Seattle, WA, said that male and female breast cancers "look the same histologically under the microscope."

When asked about the EMF-female breast cancer connection, Blask replied, "I don't know if there is enough to sound the alarm, but it's something worthy of study." Thomas

Is the Pineal the Key to the Mechanism of Interaction?

Dr. Russel Reiter of the University of Texas Health Science Center in San Antonio, a pioneer researcher on the effects of light and ELF fields on the pineal gland, may have an explanation for how magnetic fields might lead to cancer.

It has long been known that the pineal's production of the hormone melatonin—which inhibits the growth of certain cancers—can be suppressed by EMFs, as well as by light (see *MWN*, M/J88). Now Reiter suggests that fast magnetic field pulses are responsible for this EMF effect.

By examining the nocturnal pineal rhythms of rats exposed to a 400 mG static magnetic field which was periodically inverted, Reiter and coworkers have narrowed down the cause of the effect to abrupt changes in the field. They propose that the electric currents induced by these changes create magnetophosphenes in the retina, which are interpreted as light by the brain. This in turn causes melatonin levels, which are elevated at night, to drop.

The ability of ELF fields to trigger magnetophosphenes has long been known, but the effect has generally been considered benign.

Reiter emphasizes that relatively steady magnetic fields do not affect pineal rhythms. "A short, quick pulse is what clearly induces the change by inducing the electrical currents necessary to create visual impressions of light," Reiter told *Microwave News*. Shifting position while sleeping, for example, wouldn't interrupt the pineal-melatonin cycle, but turning on a hair dryer might, he said.

In a recent paper published in *Biochemical and Biophysical Research Communications*, Reiter and colleagues conclude that the observed pineal effects are most likely explained by "induced currents in the nervous system caused by the on- and off-transients of the...magnetic field...."

What is not clear is whether magnetic field exposures during the day—when melatonin levels are normally low—affect nighttime levels. Reiter's team is currently working on this question.

"Clearly, there may be some adverse effect of electric and magnetic field exposure," Reiter said, but added, "We don't know if these exposures change melatonin levels enough to cause cancer."

Dr. David Blask of the University of Arizona College of Medicine in Tucson and Dr. Steven Hill of the Abilene Christian University in Abilene, TX, reported in 1988 that melatonin concentrations similar to levels present in the bloodstream caused a 60-78% inhibition of *in vitro* human breast cancer cell proliferation, but that lower and higher levels had no effect. More recently, Blask has been working with researchers at the Battelle Pacific Northwest Lab in Richland, WA, who have done trailblazing work on ELF field effects on pineal rhythms and cancer.

Much more work is needed to fill in all the pieces of the puzzle. Indeed, the Environmental Protection Agency's current draft report on EMFs and cancer (see *MWN*, M/J90 and p.11) calls for more research on the EMF-pineal-breast cancer link: "The suppressive effects of ELF on pineal melatonin production and the general oncostatic properties of melatonin in several endocrine-stimulated tumors provide indirect evidence for the hypothesis that ELF exposure may be a risk factor in the growth of these tumors. Studies which incorporate all three parameters, ELF exposure, melatonin production and breast cancer induction, are needed for further evaluation of this hypothesis."

said that until more results on EMF effects were in, he would not be willing to "make the jump" from male to female breast cancer.

The results of his ongoing study of risk factors for male breast cancer may provide leads for further study of breast cancer in women, Thomas concluded in a paper presented at the *Annual Meeting of the American Epidemiological Society*, March 22-23, 1990, in Baltimore, MD.

Due to the prevalence of the disease, the impact of an EMF-female breast cancer link, if it exists, would be considerable. The American Cancer Society estimates that in 1990 breast cancer will account for 29% of all cancers—and 18% of all cancer deaths—among women.

Men account for about 1 of every 150 cases of breast cancer per year in the U.S., according to the National Cancer Institute (NCI). In 1988, there were only about 900 cases among men, compared with 143,000 among women. Between 1982 and 1986, there was a 15% increase in the incidence of female breast cancer; during this period, male breast cancer decreased 10%; similarly, breast cancer deaths increased among women and decreased among men.

From 1960 to 1985, breast cancer incidence among women in Portland, OR, rose 45%, according to a new analysis in the *Journal of the National Cancer Institute*. Kaiser Permanente's Dr. Andrew Glass and NCI's Dr. Robert Hoover note that the incidence of the disease "has been rising steadily in the United States for at least 50 years."

Some of the risk factors for men observed by Thomas include a history of breast cancer among close family relations (male or female), exposure to ionizing radiation and testicular pathology and dysfunction. The first two are also risk factors for women. Other risk factors for women include early menarche, advanced age at birth of the first child and late menopause.

Approximately 60% of female breast tumors and 80% of male breast tumors are estrogen receptor-positive, according to Blask, who added that melatonin can block the stimulatory effect of estrogen on these tumors. And Glass and Hoover recently reported that between the mid-1970s and -1980s, the incidence of estrogen receptor-positive tumors among women increased an average of 131%—compared to a 22-27% increase for estrogen-receptor negative tumors—"perhaps implicating hormonal factors in the rising incidence of breast cancer." Blask pointed out that, "No one is really certain about hormonal changes in men with breast cancer. It hasn't been studied very much at all."

Breast Cancer and EMFs: References

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FROM THE FIELD

Sitting on Transformers

To the Editor:

Based on observations and a few measurements, I would like to add a piece to the 60 Hz magnetic field exposure puzzle. At least in the Las Vegas area, ground-mounted transformers are used in residential areas as part of the underground power distribution system. These transformers are housed in hinged steel boxes on concrete pads adjacent to sidewalks. The boxes have horizontal dimensions of about 0.9 by 0.9 meter and are about 0.6 meter high.

The magnetic field (or more properly flux density) near these boxes decreases rapidly with distance; the field is typically less than 0.1 μT or 1 mG at horizontal distances of more than 1 meter from the transformer. However, the apparent common use of the transformers for seating by the public requires us to consider field strengths near and at the surface of the steel container of the transformer.

During periods of high power consumption (which occur here in the summer), I have measured maximum 60 Hz magnetic fields at the surface of the transformer boxes of approximately 40 μT or 400 mG. This measurement was made at the side of a box. Surface field values vary at different locations on the surface and change in time as the power load changes. The maximum field on the upper horizontal (seating) surface of the transformer box is usually found near the center of the box or along the hinge. These values varied from about 10 to 30 μT or 100 to 300 mG.

Measurements during the fall when power consumption is low indicated the fields were decreased by about a factor of three. Some data were acquired on the field strength variation with height above a transformer box. For example, at the surface the field was 7.3 μT, at 10 cm above the box the field decreased to 3.1 μT and at 20 cm the field was 1.1 μT.

The use of ground-mounted transformers as seating would seem to be an easily avoidable source of exposure.

Sincerely,
Edwin D. Mantiply,
Office of Radiation Programs
U.S. Environmental Protection Agency
Las Vegas, NV

EPA on Guy Chronic MW Exposure Study

In its new report on the potential carcinogenicity of electromagnetic fields[1] (EMFs), the Environmental Protection Agency (EPA) analyzes the results of Dr. Bill Guy's long-term exposure study[2] at the University of Washington in Seattle, in which rats were exposed to modulated 2450 MHz microwave (MW) radiation over their lifetimes. Reprinted below is an excerpt from EPA's assessment of the Guy study, which appears on pp.4-40–4-42 of the report. Note that EPA refers to 2450 MHz as radiofrequency (RF) radiation.

The University of Washington study, done at a power level carefully calibrated to simulate human exposure at the maximum continuous level allowed by the [American National Standards Institute] standard, showed the induction of benign adrenal pheochromocytomas in the exposed group and no statistically significant elevation at any other site. There is a slight elevation of carcinomas in each of several other glandular organs (pituitary, thyroid, adrenal cortex, pancreas, testes and liver), which is statistically significant if they are all considered as a single group. This apparent induction of malignant tumors occurs without an increase in benign tumors of those sites. There is also statistically significant elevation in the incidence of carcinomas, but not sarcomas, at all sites.

Combining tumors across these glandular organs is justifiable on the generalized hypothesis that [EMFs] affect all tissues in the body and that these glands, being specialized to respond to small amounts of specific circulating hormones, have cell membrane-bound receptors whose function could be affected by ion currents induced by the external fields. Although this concept is consistent with recent research on the mechanism of tissue interaction with low frequency fields, there are at least two reasons why the combining of glandular organ tumors of all sites may not be appropriate. These are:

a. The proposed mechanism is based on low frequency field phenomena, whereas RF radiation accounts for most of the energy in the applied field.

b. This proposed mechanism, though plausible, has not been empirically established.

The combining of carcinomas of all sites is a different issue than the combining of carcinomas of the glandular organs alone. The former can be justified on the basis that all organs are more or less equally exposed to the same fields and induced currents without specifying the nature of the biological response to the fields, whereas the latter requires an additional specific hypothesis of how biological tissue responds to these fields. Combining of carcinomas at all sites is considered to be more valid than combining of glandular organ carcinomas alone because the additional incompletely tested hypothesis is not necessary.

The clear positive findings of Szmigielski et al.[3] show that RF fields without low frequency components stimulate the growth of tumors and indicate that they may act as a tumor promoter, or a modifying factor in the development of tumors. The role of tissue heating as a mechanism for this effect is not clear.

In summary, the University of Washington long-term animal study provides evidence that pulsed [EMFs], in the absence of an appreciable tissue heating effect, induce carcinomas generally across all tissues of the body without being localized to any single site. The same generalized carcinoma response also appears in the glandular organs as a group. The exposure also induces benign adrenal medulla tumors without any evidence of adrenal hormone imbalance. This lesion is typically of a low degree of malignancy.

Under the plausible but unproven hypothesis that either all tissues or the endocrine glands in particular interact with the fields by way of a common carcinoma-induction mechanism, the University of Washington study can be said to demonstrate that pulsed RF fields are carcinogenic. It is not known whether the RF or the low frequency components or both acting together are responsible for the effects. The finding in the Szmigielski et al. study that unmodulated 2450 MHz RF radiation accelerates the development of both spontaneous and chemically-induced tumors indicates that the RF component has carcinogenic activity, but the possibility of whole-body heating as a contributory factor in their study cannot be ruled out.

If, in fact, only the RF component produces the effect, then the rationale for considering the glandular organs as a target disappears, since it is based on the idea of an EMF-activated plasma membrane phenomenon in the glandular tissue. However, in this case, all rat tissues are still exposed more or less equally to the radiation, so there

is still a valid reason for combining carcinomas at all sites.

Therefore, regardless of which range of frequency components is biologically effective, there is a valid rationale for combining the tumor sites as we have done, and the University of Washington study can be said to have demonstrated the carcinogenic action of this type of pulsed RF radiation.

1. EPA, *Evaluation of the Potential Carcinogenicity of Electromagnetic Fields*, Workshop Review Draft, No. EPA/600/6-90/005A, June 1990. Contact: Dr. Robert McGaughy, Office of Health and Environmental Assessment (RD-689), EPA, 401 M St., SW, Washington, DC 20460, (202) 382-5898. See *MWN*, M/J90.

2. A.W. Guy et al., *Effects of Long-Term Low-Level Radiofrequency Radiation Exposure on Rats*, Nine Volumes: Report Nos. USAFSAM-TR-83-17, 83-18, 83-19, 83-42, 83-50, 84-2, 84-31, 85-11 and 85-64; issued between September 1983 and August 1985. See, especially Volume 8 (TR-85-11): "Evaluation of Longevity, Cause of Death and Histopathological Findings," April 1985. For more information, contact: Dr. David Erwin, [RZP], USAF School of Aerospace Medicine, Aerospace Medical Division (AFSC), Brooks Air Force Base, TX 78235, (512) 536-2576; Dr. Bill Guy, Bioelectromagnetics Research Lab, RJ-30, University of Washington, Seattle, WA 98195, (206) 543-1071. See *MWN*, J/A84, Mr85 and N/D86.

3. S. Szmigielski et al., "Accelerated Development of Spontaneous and Benzopyrene-Induced Skin Cancer in Mice Exposed to 2450 MHz Microwave Radiation," *Bioelectromagnetics*, 3, pp.179-191, 1982. See also *MWN*, My81.

Congressional Support for EMF Research Funding (continued from p.1)

about our uninterrupted level of exposure to EMFs." Scheuer and ranking minority subcommittee member Rep. Claudine Schneider (R-RI) endorsed the Pallone measure, almost assuring its passage out of committee.

The subcommittee may act on the bill in the remaining few weeks of the current congressional session or may hold further hearings to prepare for action in 1991, according to a top subcommittee aide. She noted that it is still possible that Scheuer will offer a funding amendment on the floor of the House in the current session if a Senate cosponsor can be found.

In contrast to past congressional hearings on EMFs, which have been poorly attended by congressmen (see *MWN*, N/D87 & M/A90), Scheuer's hearing drew nine members of congress. A standing-room-only audience packed the committee room.

The changed perception of the EMF issue was further evidenced by the virtually unanimous backing for the Pallone legislation. Both Democrats and Republicans on the subcommittee expressed support for the bill, as did the Edison Electric Institute (EEI), the Electric Power Research Institute (EPRI) and the American Public Power Association (APPA).

Indeed, some witnesses asked for more than the $3 million Pallone recommended for fiscal 1991. Dr. Robert San Martin, deputy assistant secretary for utility technologies at the Department of Energy (DOE), said that $6 million would be preferable—$5 million for research and $1 million for public information. APPA recommended an annual funding level of $12 million.

James Cunningham, representing the New York Power Authority (NYPA) and the Large Public Power Council (LPPC), restated the LPPC's proposal for an industry-funded, government-coordinated $15 million research effort. He first announced the proposal at a congressional hearing in March (see *MWN*, M/A90).

The most reluctant endorsement of Pallone's funding proposal came from Dr. William Farland, director of the Environmental Protection Agency's (EPA) Office of Health and Environmental Assessment. As Farland read from his prepared text, Scheuer interrupted abruptly, charging that Farland was not "addressing the question" of whether the EPA supports Pallone's bill. Farland attempted to explain EPA's past work on EMFs, but Scheuer interrupted again. Under Scheuer's prodding, Farland conceded the agency's support. "We support the draft as it was presented to us. We think there are ways to improve it," he said.

Dr. David Nagel, vice president of Apple Computer's Ad-

Scheuer To Pursue Case of NCI Scientists

Rep. James Scheuer plans to investigate the National Cancer Institute's (NCI) response to alleged misconduct by three NCI scientists who testified on behalf of electric utilities concerning EMF health risks.

His subcommittee will seek an explanation as to why NCI officials allowed the scientists to serve as expert witnesses dismissing EMF risks when the institute was embarking on a multimillion-dollar cancer study, a senior Scheuer aide told *Microwave News*. Altogether, the three received nearly $125,000 for appearing for the New York Power Authority at the Marcy-South transmission line trial (see *MWN*, N/D88 and J/F89).

At the July 25 congressional hearing, Scheuer interrupted Dr. Ross Adey as he was reading excerpts from his prepared testimony. "Wait a minute," Scheuer said. "There is a very important part of your testimony that you didn't read. Do you want to read it or should I?"

Adey then read the following:

> It is a matter for public outrage that scientists employed by the [NCI]... received large personal fees for court appearances in behalf of electric power companies by declaring in an issue far beyond their individual or collective competence that there are no mechanisms by which [EMFs] could play a role in cancer. And this they did in the very month that NCI put forth a national request for proposals to study the epidemiology of childhood leukemia in relation to [EMF] exposures. What should the public's expectation be for the credibility of such a study?

Scheuer responded that, "It looks to me like a clear dereliction of duty on behalf of NCI leadership and scientists" in not preventing such a conflict of interest from occurring.

vanced Technology Group, also said that $3 million is insufficient. Apple recently joined the public debate on EMF health risks after *MacWorld* ran a cover story in July titled "Could Your Computer Be Killing You?" The magazine reported that its laboratory tests showed that an Apple color display monitor had produced extremely low frequency (ELF) EMFs as high as 15 mG 12 inches from its right side.

Earlier this year, the committee approved an amendment allocating $1 million for fiscal 1991 to EPA for EMF research. Under the amendment, which was sponsored by subcommittee member Rep. George Brown (D-CA), the funding would increase to $2 million annually for fiscal years 1992 and 1993 (see *MWN*, M/J90).

If Pallone's legislation is enacted, the DOE will maintain its leading role in EMF research, with EPA and the National Institute of Environmental Health Sciences (NIEHS) playing roles in setting EMF research priorities (see *MWN*, M/J90).

At the hearing, several witnesses emphasized the need for uninterrupted funding. Dr. Ross Adey of the VA Hospital in Loma Linda, CA, told the subcommittee that, "The pace of our acquisition of needed knowledge has been far from optimal."

Adey countered longstanding concerns that researchers are unable to explain how EMFs might cause ill effects: "Studies at the cell and molecular level have built, and continue to build, a series of critically important bridges between laboratory science and human epidemiology; so that it is no longer possible to say that mechanisms mediating interactions of electromagnetic fields with biomolecular systems remain unknown with respect to potential health problems."

The DOE's endorsement of H.R.4801 was an about-face from its stand at the March congressional hearing, when San Martin defended the agency's research program as "rational and reasonably satisfactory at this time" and rejected suggestions that the DOE might do more.

This reversal is consistent with a widespread shift in attitudes about EMF research, which observers attribute to the June release of EPA's cancer review (see *MWN*, M/J90), Paul Brodeur's widely publicized article on cancer clusters near power lines and electrical substations in the July 9 *New Yorker* and Brodeur's article on video display terminal EMFs in the July *MacWorld*.

Mitigation Controls?

Scheuer and ranking minority member Schneider both emphasized the need for study of how to mitigate EMF exposures. They both criticized the DOE for opposing the provision in Pallone's bill which would authorize such work.

"Since no health effects arising from EMF exposure have been established," San Martin said, "we believe that extensive concurrent work on mitigation is not appropriate."

Schneider suggested that a possible step for controlling exposures would be to set federal limits on field levels at the edge of transmission line right-of-ways (ROWs). James Cunningham of the NYPA noted that several states are attempting to do so but cautioned against federal rules. "What is needed now is not regulation, but research," he said.

EPA's Farland also told the subcommittee that, "At this time, the agency is not making any recommendations to the general public in the report or as a direct consequence of the report. There are many uncertainties which remain about the degree or extent of any hazard posed by exposure to EMFs."

Most of the witnesses supported a federal information program as called for in H.R.4801. Testifying on behalf of EPRI's Dr. Leonard Sagan, Dr. Stanley Sussman said that, "There is an important need for a federal EMF information center, as well as for an EMF mitigation research effort."

UPDATES

COMMUNICATIONS

AM Broadcast X-Rays... Certain types of AM broadcast transmitters may produce X-radiation at much higher levels than previously believed, according to Bruce Hunter of the Voice of America. Hunter found that transmitters using efficient pulse-width modulators require 20-30 kilovolts, "which greatly enhances the production of ionizing radiation in the form of x-rays." He recommends greater worker awareness of ionizing radiation risks and closer monitoring of x-radiation levels in his paper, "X-Ray Emission from Broadcast Transmitters," which appeared in *IEEE Transactions on Broadcasting, 36*, pp.14-23, March 1990.

COMPATIBILITY & INTERFERENCE

Protecting Avionics... The FAA's specifications for protecting electronic flight systems against high-power RF/MW radiation are "excessive" and do not "represent the actual threat levels," according to the General Aviation Manufacturers Association (GAMA), a group based in Washington, DC. In an April 30 position paper, GAMA asked the FAA to reduce its current shielding specifications for critical functions from 100 V/m to 20 V/m. Previously, the FAA's shielding requirement had been pegged to 200 V/m in the 10 kHz-18 GHz band (see *MWN*, N/D89). The FAA is most concerned about 1-400 MHz signals, GAMA noted. "There is no documented evidence of incidents or accidents involving civil airplanes caused by exposure" to high-energy RF/MW radiation, GAMA maintained. GAMA is running its own tests and plans to issue a report. For its part, the FAA expects to issue proposed rules to protect against the RF/MW threat this October. The agency is also identifying "unique high-power transmitters on flight charts so that aircraft operating in the vicinity of these transmitters can avoid the specified locations," according to a May 7 RF/MW program plan.

Satellite Signals Muscle Out Astronomy... The growing

number of military radionavigational satellites is taking a toll on radioastronomy research. In a letter to *Nature* (June 7, 1990), John Galt of the Herzberg Institute of Astrophysics in British Columbia, Canada, states that the U.S. Navstar global positioning system and the parallel Soviet system, GLONASS, emit "sidebands" at 1660-1670 MHz that interfere with signals from hydroxy (OH) radicals. Galt judges that this satellite "pollution" has already "seriously curtailed radio studies of important classes of stars." He urges that, in the future, satellites be designed to be compatible with radioastronomy and that existing systems that cause interference be phased out.

EMP LITIGATION

Expert Witnesses in Strom Suit... Depositions are being taken prior to the *Robert Strom and Barbara Strom v. The Boeing Co.; Boeing Medical Services Co.; The Lovelace Biomedical and Environmental Research Institute; and EG&G, Inc.* trial (see *MWN*, J/A88). Robert Strom, a former Boeing electronics technician, alleges that his leukemia is a result of extensive exposure to electromagnetic pulse (EMP) radiation during his work at Boeing, and that the company was aware that EMP radiation was a potential hazard but continued to expose him while monitoring his health. Lists of expert witnesses have been filed with the court by both sides. On behalf of the ***Stroms***, the experts are: Dr. Frank Barnes, University of Colorado, Boulder; Dr. Robert Becker, Becker Biomagnetics, Lowville, NY; Dr. Ralph Coates, Emory University, Decatur, GA; Dr. John Huff, The Mason Clinic, Seattle, WA; Dr. Robert Levine, Yale University School of Medicine, New Haven, CT; Dr. Abraham Liboff, Oakland University, Rochester, MI; Dr. Samuel Milham, Department of Health, State of Washington, Olympia; Dr. Richard Parks, Seattle, WA; Dr. Peter Wright, Polyclinic, Seattle, WA. On behalf of ***Boeing***, the experts are: Dr. Robert Adair, Yale University, New Haven, CT; Dr. Philip Cole, University of Alabama, Birmingham; Frank Cranny (affiliation unknown); Col. John Cutting, Department of Defense, Washington, DC; Dr. Bruce Dickerson, Environmental Research Information, Inc., New York, NY; Roy Ellis (affiliation unknown); Dr. David Erwin, School of Aerospace Medicine, Brooks AFB, TX; Dr. William Godden, Blanco, TX; Dr. Arthur Guy, University of Washington, Seattle; Dr. Mark Israel, University of California, San Francisco; B.K. Kwon, National BioSystems, Inc., Rockville, MD; Gordon McHenry (affiliation unknown); John Mitchell, School of Aerospace Medicine, Brooks AFB, TX; Dr. Gilbert Omenn, University of Washington, Seattle; Dr. John Pickering, Albuquerque, NM; Dr. David Savitz, University of North Carolina, Chapel Hill. On June 11, Boeing's attorneys advised the court that Omenn and Savitz "may not be available to testify at the trial." The expert witnesses for ***Lovelace*** are: Dr. Albert Jonsen, University of Washington, Seattle; Dr. Don Justesen, VA Medical Center, Kansas City, MO; Barbara Mishkin (tentative), Hogan & Hartson, Washington, DC; Dr. Paul Mossman, Albuquerque, NM. The attorneys representing the Stroms are Michael Withey, J. Murray Kleist and Leonard Schroeter, of Schroeter, Goldmark & Bender in Seattle, WA; Arthur Bryant of Trial Lawyers for Public Justice in Washington, DC; and Herbert Newberg of Philadelphia, PA. Representing Boeing are John Dillow and V.L. Woolston, of Perkins Coie in Seattle, WA. Representing Lovelace are William Squires III and Stuart Dunwoody, of Davis Wright Tremaine in Seattle, WA.

MEDICAL APPLICATIONS

Placebo as Good as TENS... Transcutaneous electrical nerve stimulation (TENS) is ineffective in treating lower back pain, according to a study in the June 7, 1990 issue of the *New England Journal of Medicine* (*322*, pp.1627-1634). Dr. Richard Deyo of the Seattle, WA, Veterans Affairs Medical Center and colleagues found no statistical difference between the reported improvements in back pain from one group of 36 patients using EMPI Corp.'s EPIX 982 TENS unit and from another group of 36 patients using a sham unit. In contrast, one month of exercise led to a statistically significant improvement. The research team notes that the use of TENS to treat lower back pain is based on the theories that high frequency TENS counterstimulates the nervous system to modify the perception of pain and that low frequency, high-amplitude TENS raises endorphin levels in the spinal fluid. In an interview with the *Wall Street Journal* (June 7), Michael Connoy, the president of EMPI Corp. of St. Paul, MN, criticized the one-month treatment period used by the researchers as too short and the intensity of the pulses as too weak. According to Deyo, the VA spent nearly $2 million on TENS units in 1986.

Electrical Repair... The FDA has issued an *Overview of the Literature on Electrical Bone Repair and Growth Stimulation* (FDA 90-8277). Clinical, animal and in vitro studies on both PEMF and DC treatments are addressed. The report, which was edited by Dr. Mays Swicord, is available for $17.00 from: NTIS, Springfield, VA 22161, (703) 487-4650. Order No. PB90-167255/AS. Though dated July 1989, it was only recently released. See *MWN*, M/A89 for the AMA's assessment of PEMF therapy.

RF and Menstruation...A team of U.K. researchers has found that 27 MHz RF energy can be useful for the treatment of excessive menstruation (menorrhagia). Three different doses were tried: 330, 445 and 660 kJ—the best results were obtained with the highest dose. The researchers note that the "procedure is easy and quick to do" and that it is inherently safe "since the electromagnetic radiation is unable to penetrate deeply...." Their report appears in *The Lancet, 335*, pp.374-376, February 17, 1990.

MEETINGS

VDT Proceedings... Papers from the National Institute of Child

Health and Human Development (NICHD) November 4, 1988 workshop on *Reproductive Effects of VDT Use* (see *MWN*, N/D88) have been published in a special issue of *Reproductive Toxicology*. Among them is a comprehensive survey of research on PMFs and reproductive risks by EPA's Dr. Ezra Berman, who concludes that the weight of evidence supports the contention that PMFs have detrimental effects on the embryonic development of animals. Dr. Michele Marcus emphasizes the need for a prospective epidemiological study with accurate measures of exposure to risk factors such as stress and radiation. After the workshop, NICHD approved funding for the Mount Sinai study Marcus is now leading (see *MWN*, S/O89). NIOSH's Dr. Teresa Schnorr outlines the protocol of her ongoing epidemiological study (see *MWN*, S/O87). And Dr. Marilyn Goldhaber of Kaiser Permanente rebuts some of the criticisms of her 1988 study which showed that women who used VDTs more than 20 hours a week had more than twice as many miscarriages as other office workers (see *MWN*, M/J88). Goldhaber dismisses the possibility that confounders such as pesticide spraying or poor drinking water quality significantly affected her findings. A copy of *Reproductive Toxicology, 4*, No.1, 1990, is available for $48.00 plus $2.00 for postage and handling from: Pergamon Press, Inc., Maxwell House, Fairview Park, Elmsford, NY 10523, (914) 592-7700.

BRAGS Proceedings Offer... In anticipation of its tenth anniversary, the Bioelectrical Repair and Growth Society (BRAGS) is offering a set of the transactions of its first nine annual meetings for $100.00 plus postage. In recent years each volume has cost $45.00. All orders must be prepaid. Contact: Ethel Pollack, BRAGS, PO Box 64-K, Dresher, PA 19025, (215) 659-5180.

PEOPLE

John Villforth, the director of the FDA's Center for Devices and Radiological Health (CDRH), is retiring in August after 29 years in public health service. Villforth will join the Food and Drug Law Institute in Washington, DC, as executive director. ...**Howard Bassen**, the associate chief for engineering in the Department of Microwave Research at the Walter Reed Army Institute of Research, is returning to CDRH after a four-year absence. Bassen will be joining the center's electrophysics branch, but will continue to work for the Army one day a week on EMP measurement and modeling....Dr. **John Dennis**, the assistant director for physical sciences at the U.K.'s National Radiological Protection Board (NRPB), has retired. It is not yet clear who will take over Dennis's work on NIER....**Paul Gailey**, a former EPA engineer more recently with the EC Corp. in Knoxville, TN, has gone back to school. He has joined the doctoral program at the University of Utah's Department of Electrical Engineering, where he will be a student of Professor **Om Gandhi's**. Gailey plans to continue to do free-lance consulting....**Jerry Hellmuth**, the neighborhood organizer and director of the Bucklin Hill School for mentally handicapped children on Bainbridge Island, WA, died on May 10 at the age of 79. In the early 1980s, Hellmuth led a citizens group that blocked a proposed RCA satellite station on the island (see *MWN*, O81 and J/A82).

RESOURCES

Issues in EMFs... Dr. Andrew Bassett, professor emeritus of orthopedic surgery at Columbia University in New York City and a pioneer developer of PEMF therapies, is promoting a major federal research effort on the biological effects of EMFs—with an annual budget on the order of $100 million a year. "Before we start regulating, we need better information on which to base policy," he wrote in the Spring 1990 *Issues in Science and Technology*, in an article titled "Premature Alarm Over Electromagnetic Fields." The editors of the quarterly magazine, which is published by the National Academy of Sciences, asked a number of those participating in the EMF debate to respond to Bassett's article. The Summer 1990 issue features replies from: Dr. Carl Blackman of EPA, Paul Brodeur of *The New Yorker*, Dr. Granger Morgan of Carnegie Mellon University, Congressman Frank Pallone (D-NJ), Dr. Robert Park of the American Physical Society, Dr. Louis Slesin of *Microwave News*, Dr. Thomas Tenforde of the Battelle Pacific Northwest Lab and Morton Winston of NoRad Corp.

STANDARDS

ANSI and CISPR Actions...ANSI recently published an ISM standard on *Recommended Practice for the Measurement of [RF] Emission from Industrial, Scientific and Medical (ISM) Equipment Installed on User's Premises*, ANSI/IEEE 139-1988. Copies are available for $45.00 each from: Sales Department, ANSI, 1430 Broadway, New York, NY 10018....CISPR has issued an IEC draft international standard on *Radio Interference Characteristics of Overhead Power Lines and High Voltage Equipment—Methods for Derivation of Limits for HVDC Lines*, CISPR/C(Central Office)35, September 15, 1990. Copies are available for $18.00 from: ANSI (see above).

VDTs

EEC Regulates VDT Radiation... The Council of the European Communities, which regulates the 12 member states of the European Economic Community (EEC), adopted a directive on May 29 setting minimum health and safety requirements for work with VDTs. The directive specifies that, "All radiation with the exception of the visible part of the electromagnetic spectrum shall be reduced to negligible levels from the point of view of the protection of workers' safety and health." New workstations will not have to comply with the directive until December 31, 1992, and workstations designed before this date will have an additional four years to meet the new standards. Council Directive 90/270/EEC appears in the *Official Journal of the European Communities, 33*, L 156, pp.14-18, June 21, 1990.

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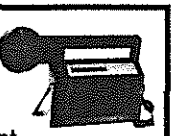

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