MICRO WAVE NEWS

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## INSIDE...



# Microwaves Break DNA in Brain; Cellular Phone Industry Skeptical

Low-level microwave radiation can cause DNA breaks in the brains of experimental animals, according to studies carried out in the U.S. and in India. The new results, which have attracted a lot of interest within the cellular phone industry, suggest that microwaves could act as a cancer-causing agent.

Drs. Henry Lai and Narendra Singh of the University of Washington, Seattle, have found that a single two-hour exposure to 2.45 GHz radiation at levels currently believed to be safe can increase the number of single-strand breaks in the DNA of the brain cells of rats. "DNA damage is related to the initiation of cancer—if there is an error in the repair process, it could lead to a problem," Lai told *Microwave News*.

"We have a long way to go before we can reach any definitive conclusions," Lai added, pointing out that, "DNA breaks may stimulate DNA repair mechanisms, which could in fact have a beneficial effect." The Lai–Singh paper has been accepted for publication in *Bioelectromagnetics*. It should appear by the spring, according to Dr. Ben Greenebaum, the editor of the journal. (See p.12 for details of the study.)

A second animal study, by a group led by Dr. Soma Sarkar of the Institute of Nuclear Medicine and Allied Sciences in New Delhi, India, found that the DNA in the brains and testes of mice had undergone "rearrangement" following microwave exposure at the same frequency and approximately the same intensity as in the Lai–Singh study. Sarkar and coworkers concluded that a reevaluation of the mutagenic potential of microwave radiation "seems imperative." Sarkar's results were published in *Mutation*

*(continued on p.11)*

# Hydro-Québec Bars Further Work on Transient Data by McGill University

Hydro-Québec (HQ), a Canadian electric utility, is refusing to allow researchers at McGill University the opportunity to analyze further the data collected in the $3 million Canadian–French epidemiological study released earlier this year (see *MWN*, M/A94). "I can't use the data anymore," said Dr. Gilles Thériault, who led the research project and is the chair of the Department of Occupational Health at McGill University's medical school in Montreal. "It's in the contract that the data belong to the utility and so I can't use them."

Dr. Claude Cardinal, HQ's electromagnetic field (EMF) program manager, confirmed that the utility is barring further access to the data. "All the data belong to the utilities and there is no mandate to start a new analysis," Cardinal told *Microwave News*. Dr. Michel Plante, an HQ medical adviser in Montreal who has been a utility liaison to the McGill team, said: "We

*(continued on p.5)*

## « Power Line Talk »

Almost nine months after President **Bill Clinton** said he would ask the **EPA** to report to him on EMF health risks, the White House has not responded with any formal statement—and don't expect one. Last March, during an **ABC News** special featuring schoolchildren at the White House, Clinton fielded a question about whether EMF exposures could be lowered to help prevent childhood cancer. He responded that EPA Administrator Carol Browner would review this issue and "make a report to me in the near future to try to make a decision about what we should do" (see *MWN,* M/A94). The report from the EPA, according to agency staffers, described the work the agency planned to pursue as part of its revived NIER program (see *MWN,* M/A94 and S/O94). "The White House seemed to feel that the stepped-up effort the EPA has undertaken, together with the EMF RAPID program [the $65 million federal research program], formed a sensible response to the issue," explained **Eugene Durman**, deputy director of EPA's Office of Radiation and Indoor Air in Washington. Officials in the White House Office of Environmental Policy did not respond to repeated questions from *Microwave News* on whether any other follow-up was planned. **Julie Larm**, whose son Kevin has leukemia and whose son Patrick posed the EMF question to the President, said she was disappointed that the White House had not done more, "especially since children's lives are at stake." Several days after the question-and-answer session, the President met privately with Julie Larm, who is a cofounder of Omaha Parents for the Prevention of Cancer, and her two sons. She asked for an executive order establishing a buffer zone between EMF sources such as power lines and substations and any new homes, schools or hospitals. "I was hoping they would move on it, or at least do something," she said.

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Dr. **David Savitz**'s epidemiological study of cancer among utility workers will be published in the January 15, 1995, issue of the *American Journal of Epidemiology*. No details will be available until then, Savitz said.

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The **DOE** bioeffects research program, apparently sentenced to oblivion by the U.S. Senate (see *MWN,* M/A94 and S/O94), is having, if possible, even more troubles. **Marvin Gunn** was recently named director of the Office of Management and Resources, leaving an empty slot at the helm of the research program that he has been running. It is not clear who will take over and whether the replacement will have the political clout to convince the Congress to keep the DOE effort going beyond the end of the 1995 fiscal year, the current deadline. Researchers with DOE contracts, already worried about their future, were not pleased to find out at their annual meeting in Albuquerque, NM, in early November that, due to a planning snafu, they would have to go to Washington at the end of the month for peer review by a group of outside experts, most of whom were also in Albuquerque. To make matters worse, none of the contractors can get any of their 1995 money until the future of the DOE program is decided. And finally, a report that was to serve as the rationale for the program and which was supposed to be released in Albuquerque is still unfinished. Some staffers say it is being edited; others say that the delays are being caused by undue striving to satisfy the utilities and other concerned parties.

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The **EPA**'s new toll-free EMF hot line is getting mixed reviews. Two major utilities—**United Illuminating Co.** (UI), based in New Haven, CT, and **San Diego Gas & Electric Co.** (SDG&E)—are objecting to operators' "ill-informed" and "evasive" responses to random calls made by their employees. United Illuminating prepared a list of answers that it thought were off-base, including one suggestion that utilities probably are biased when measuring EMFs near transmission lines because of customer concerns about property devaluation. UI Environmental Issues and Audit Manager Kathleen Shanley also said hot-line staff members had no knowledge about the Swedish EMF–cancer study and did not know what the EMF RAPID program was. At SDG&E, EMF Project Manager Angela Dawson encountered similar responses with her telephone call, but noted that the hot-line operator handled a question about safe magnetic field levels well by explaining that "no safe or unsafe levels have been established." The EPA is taking the criticism seriously. "We decided to go back and really reexamine what the hot line is about and how we can better serve the public, while staying within the technical and training capabilities of our contractor," said **Dennis O'Connor**, a policy analyst at EPA's Office of Radiation and Indoor Air. O'Connor said there already has been a change in procedures: Hot-line operators will offer to send two question-and-answer booklets to callers, one from the Bonneville Power Administration (see *MWN,* M/A94), and another from the EMF RAPID program. "Now that we have follow-up materials, they will be a principal mechanism by which we inform people. So instead of a 20-minute free-ranging phone call, it will be a short, five-minute call to deal with immediate concerns, and then we'll send information," O'Connor said. From its launch in mid-May until September 30, the hot line had received 900 calls in which people mentioned 1,500 concerns in a variety of categories, including: health effects (22%), regulations and acceptable levels of EMFs (19%), power lines and wiring (18%), effects on real estate values (14%) and appliances and other equipment (6%), according to O'Connor. EPA's hot-line number is (800) EMF-2383. It is staffed weekdays from 9 am to 5 pm, eastern time....People seeking information about EMFs have another option. They can call the **NIEHS Enviro-Health Clearinghouse**'s number: (800) NIEHS-94, staffed weekdays from 9 am to 8 pm, eastern time.

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Utilities have been receiving a large number of customer requests in recent years to survey EMFs in their homes and their children's schools and on their property. In responding

to the demand, the measurements have been carried out mostly on an ad hoc basis, varying widely in their sophistication. Now, under the sponsorship of three Washington-based utility trade associations—the American Public Power Association (**APPA**), the Edison Electric Institute (**EEI**) and the National Rural Electric Cooperative Association (**NRECA**)—the **National EMF Measurement Protocol Group** (NEMPG) has developed its own procedure: *Power Frequency Magnetic Fields: A Protocol for Conducting Spot Measurements in Residential Settings*. "This protocol is *not* intended to be a standard of any sort," the NEMPG notes in the 24-page booklet, but is offered for voluntary use by utilities who may not have the in-house technical staff and for those who want their procedures to be consistent with others. The two-part booklet provides instructions, background information and sample data forms. The NEMPG is chaired by **Kate Brown Maracas**, supervisor of environmental affairs at the Salt River Project in Phoenix, who said, "The protocol will help customers put EMF issues into perspective through learning about what the sources of EMFs are and the relative levels of EMFs from those sources." Maracas and three others—Mike Rossler, EEI's manager of environmental programs, Madalyn Cafruny, APPA's director of communications, and Paul Wesslund, NRECA's associate director for communications services—synthesized data, assimilated comments and put together the final draft, Rossler said. "I think the value of the protocol is that it will ensure consistency among utilities throughout the U.S. in measuring magnetic fields," he added. Copies are available to members of the three trade associations for $30 and to nonmembers for $60 from: APPA, (202) 467-2926; EEI, (800) EEI-5453; or NRECA, (202) 857-9590.

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**EPRI** and the **EEI** are sponsoring a national teleconference on EMF occupational health on February 6, 1995. **Jack Sahl** of Southern California Edison Co., Dr. **David Savitz** of the University of North Carolina, Chapel Hill, and Dr. **Gilles Thériault** of McGill University in Montreal, each of whom has recently completed an epidemiological study of utility employees, will be interviewed by Lee McEachern, a science reporter, and **Martha McNeil**, EMF issue manager at Pacific Gas & Electric Co. Then, the three epidemiologists will answer questions from those tuning in. The two-hour event is open only to electric utilities and related organizations—and only those with deep pockets. The cost is $1400 per site and $7000 for a company that wishes to redistribute the program on its own network. For more information on *Occupational Health & Electric Utility Workers: An Update on EMF Research,* contact: Mind•Link International Inc., 18 Crow Canyon Court, San Ramon, CA 94583, (510) 838-2654.

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The families of three northeast London children have lost their bid to force Michael Heseltine, the U.K. Secretary of State for Trade and Industry, to limit EMFs from six 275 kV underground power lines that run through their neighborhood. **Martyn Day**, an attorney with Leigh, Day & Co. in London, had argued that Heseltine was obliged, under the "precautionary principle" of the Maastricht Treaty, to ensure that magnetic fields in houses adjacent to the lines did not exceed 2 mG. The treaty, which created a European Union giving common citizenship to all European Community members, was signed by the U.K. in 1992. The High Court ruled that Heseltine does not have to order the National Grid Co. to control EMFs unless there is a significant health risk, according to the October 4 *Independent,* a national newspaper. Day had originally planned to bring suit on behalf of 50 children from northeast London and had obtained legal aid from the government to do so (see *MWN,* M/A94). Day told *Microwave News* that he trimmed the number to three "representative actions" at the suggestion of the Legal Aid Board. He is now asking the Court of Appeal in London to refer the case to the European Court of Justice in Luxembourg. If the case is decided in his clients' favor, "it would have an implication not just for Britain but for all of the European member states," Day said. There is little official support in the U.K. for the proposition that there are health risks associated with EMFs. Earlier this year, the National Radiological Protection Board updated a 1992 report and concluded that "there is no persuasive biological evidence that ELF [EMFs] can influence any of the accepted stages in carcinogenesis" (see *MWN,* J/A94). And the Institution of Electrical Engineers (IEE), in a June 1994 supplement to its 1992 report, *The Possible Biological Effects of Low-Frequency Electromagnetic Fields,* wrote that epidemiological evidence remains "inconclusive" and animal and cellular studies "have failed to elucidate any mechanism or consistent trend in results." This does not differ significantly from the IEE's earlier findings (see *MWN,* J/F92). Nevertheless, EMF lawsuits are of increasing concern in the U.K., as evidenced by an October 27 conference in London, chaired by Sir **Richard Doll** of the Imperial Cancer Research Fund in Oxford. Addressing both scientific and legal concerns, featured speakers included Dr. **Ross Adey** of the VA Hospital in Loma Linda, CA, Dr. **Gilles Thériault**, Dr. **Bengt Knave** of Sweden's National Institute of Occupational Health in Solna and **Mark Warnquist** of the Denver law firm of LeBoeuf, Lamb, Greene & MacRae. In its coverage of the conference, the November 6 *Sunday Telegraph,* noting the large number of lawsuits in the U.S. dealing with EMFs, had a last word on the Day case: "Here in Britain, however, we have no need of such legal nannying....While the judge [in the Day case] accepted the possibility of a hazard, he declared that [Heseltine] was under no legal obligation to take any notice of it."

# Transients and Lung Cancer: A "Strong" Association and a "Remarkable" Exposure–Response

The long-awaited results of the McGill University analysis of high frequency transients (HFTs) show up to a tenfold increased risk of developing lung cancer among highly exposed utility workers and a "very clear" exposure–response relationship.

The epidemiological study of electric utility workers at Hydro-Québec (HQ) and Electricité de France (EDF) found that the 10% most exposed to HFTs had a statistically significant greater-than-threefold increased risk of developing lung cancer. Most of the highly exposed workers—specifically linemen and splicers—were at HQ. When the analysis was limited to this group, the risk was 6.67 times greater than expected and rose to 9.87 times greater than expected when adjusted for smoking, socioeconomic status and other occupational exposures—both were highly significant findings. There was no association for the French workers, which the researchers explained "by the much lower levels of exposure [to HFTs] at EDF."

The most highly exposed workers, at both HQ and EDF, who were first employed more than 20 years prior to diagnosis, had a significant sevenfold increased risk of lung cancer.

## McGill Abstract

"The authors report the association between exposure to pulsed electromagnetic fields (PEMFs) [also called high frequency transients] and cancer in a nested case–control study of electric utility workers in Québec, Canada (follow-up, 1970-1988), and France (follow-up, 1978-1989), among whom 2,679 cases of cancer were identified. Exposures were assessed through a job-exposure matrix based on about 1,000 person-weeks of measurements from exposure meters worn by workers. Exposures were considerably higher in Québec than in France. No association was found between PEMFs and cancers previously suspected of association with magnetic fields (leukemia, other hematopoietic cancers, brain cancer, or melanoma). However, there was a clear association between cumulative exposure to PEMFs and lung cancer, with odds ratios rising to 3.11 (95% confidence interval (CI) 1.60-6.04) in the highest exposure group (84 cases). This association was largely confined to Québec, where there was a monotonic exposure–response relation with an odds ratio of 6.67 (95% CI 2.68-16.57) in the highest exposure group (32 cases). The association is substantial and was not explained by smoking or other occupational exposures. However, several factors limit the strength of the evidence for a causal relation: lack of precision in what the meters measured; little previous evidence for this association; and no elevated risk for lung cancer in the utility workers overall in comparison with the general population." Benedict Armstrong et al., "Association Between Exposure to Pulsed Electromagnetic Fields and Cancer in Electric Utility Workers in Québec, Canada, and France," *American Journal of Epidemiology, 140,* pp.805-820, November 1, 1994.

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The new results, which appear in the November 1 issue of the *American Journal of Epidemiology,* are sure to focus more attention on transient EMFs, which have already emerged as a hot new research area (see *MWN,* M/A94). The abstract of the paper appears below.

In a November 10 presentation at the annual review of EMF research, held in Albuquerque, NM, McGill's Dr. Gilles Thériault called the HFT–lung cancer link "an unusually strong association," which he had seen only once before—for bladder cancer in the aluminum smelting industry. Throughout his talk, Thériault repeatedly called the exposure–response relationship "remarkable" (see table on p.5). He noted that, "It is very unlikely that our results can be explained by confounders." McGill University is in Montreal, Canada.

Last March, when Thériault announced the first set of results of his study of Canadian and French utility workers that linked 50/60 Hz magnetic fields to leukemia and brain cancer, some observers downplayed them because of a lack of an exposure–response relationship (see *MWN,* M/A94).

Following Thériault's presentation in Albuquerque, many other epidemiologists said they found the observed exposure–response relationship compelling. "It's astonishing," said Dr. Nancy Wertheimer. Dr. Tore Tynes of the Cancer Registry of Norway in Oslo called it a "very dramatic trend," and Dr. Anders Ahlbom of the Karolinska Institute in Stockholm, Sweden, said that he was "intrigued" by the lung cancer association and that he was "very impressed with the data."

Utility representatives were more cautious, however. Dr. Michel Plante, an HQ medical adviser, told *Microwave News* that, "It's most likely that this is a random result or the direct result of smoking," although he did concede that, "It's quite rare to see this kind of dose–response." The Electric Power Research Institute (EPRI) in Palo Alto, CA, is also not ready to discount "residual confounding by cigarette smoking," but allowed, in a prepared statement, that "the suggestion of an association with EMF exposure needs to be taken seriously."

The Edison Electric Institute, based in Washington, cited the fact that "smoking data was incomplete across the study population." Indeed, no data on smoking habits by the French workers were available and some were missing for the HQ population.

The McGill researchers cautioned that uncertainties about what types of exposures were actually measured, little past indication of an EMF–lung cancer link and the absence of an overall elevated lung cancer risk among utility workers all act to limit the argument for a causal link. "It was an unexpected finding of a previously unsuspected association," McGill's Dr. Ben Armstrong, the lead author of the new paper, told *Microwave News*. He acknowledged that the new result could be a chance finding.

EPRI noted that, "Perhaps the most serious limitation of the interpretation of the results is the incomplete (and apparently incorrect) characterization of the [Positron dosimeter's]

***Adjusted† Odds Ratios (ORs) and Confidence Intervals (CIs) for Lung Cancer Among Hydro-Québec Workers by Cumulative Exposure to High Frequency Transients (HFTs)***

| *Exposure Group (Index*)* | *No. of Cases/ Controls* | *OR (95% CI)* |
|---|---|---|
| 0-0.049 | 41/57 | 1.00 |
| 0.05-0.099 | 2/0 | |
| 0.10-0.24 | 2/3 | |
| 0.25-0.49 | 0/5 | |
| 0.5-0.99 | 5/11 | 1.84 (0.33-10.4) |
| 1.0-2.4 | 7/25 | 0.62 (0.19-2.16) |
| 2.5-4.9 | 36/20 | 5.64 (1.51-21.0) |
| 5.0-9.9 | 34/28 | 5.09 (1.26-20.6) |
| 10.0-24.9 | 62/48 | 7.13 (1.85-27.7) |
| ≥25.0 | 11/3 | 16.6 (2.58-107) |

†Adjusted for socioeconomic status. *A cumulative weighted index: the product of HFT intensity and number of years of exposure.

performance" (see p.6).

Nevertheless, the Canadian–French team argued that, "The association observed met several criteria considered suggestive of causality: It was strong; it was largely specific to lung cancer; adjusting for potential confounders, including smoking (at HQ), did not essentially change it; a very clear monotonic exposure–response relation was present; and the association was independent of the particular summary of [HFT] exposure used."

Thériault told *Microwave News* that the HFT results are "the first epidemiological data to support the promotion hypothesis," explaining that the transients may be interacting with the carcinogenic chemicals in cigarette smoke. Indeed, Thériault and colleagues also found a weak link to stomach cancer. In his presentation in Albuquerque, Thériault said that this result supports the lung cancer finding: "You swallow the chemical and you get the same phenomenon in the GI tract, but at a lower rate." He added that the fact that there was no generalized increase in lung cancer among the utility workers as compared to the general population could indicate that only a small proportion of the HQ work force is highly exposed to HFTs.

In support of their findings, the Canadian–French researchers point to the similarities between HFTs and pulsed electromagnetic fields (PEMFs), which are used to heal nonunion fractures and which have been associated with a large number of biological effects. In addition, they cite studies showing chromosomal effects among substation workers (see *MWN,* J/F85).

In 1989, Dr. Genevieve Matanoski of the Johns Hopkins University School of Hygiene and Public Health in Baltimore reported an increased risk of lung cancer, as well as many other types of cancer, among New York Telephone Co. workers (see *MWN,* N/D89).

have a contract problem that has to be solved and there will be no new mandate until it is solved."

HQ officials are furious about the November release of a paper by the McGill team that shows an up-to-tenfold increased risk of lung cancer for exposures to high frequency transients (HFTs) (see p.4). "We never planned to collect the HFT data and there is no mention of HFTs in the specifications of the study," Cardinal said. Plante argued that by publishing the HFT results, Thériault had violated an agreement with the utilities. Thériault countered that, although he was under intense pressure not to work on transients, "It has always been clear that I would analyze the HFT data and that if I found something, I would inform everybody."

No lawsuits have yet been filed by either side, both Thériault and Plante said. But Thériault did say that, "Both parties have consulted lawyers." Plante said that talks to resolve the disagreement are continuing between HQ and McGill.

Thériault told *Microwave News* that he felt a professional obligation to release the transient findings because of their potential significance. "The HFT observation deserves the attention of my scientific colleagues." He said that, "This is the first epidemiological data to support the promotion hypothesis," referring to the possible synergy between HFTs and the carcinogenic chemicals in cigarette smoke. "My interpretation is that the HFT data may turn out not to be important, but, at this point, we don't know—we *should* find out."

In its paper, published in the *American Journal of Epidemiology,* the McGill team explained that if the association between lung cancer and HFTs is causal, it "would have substantial implications for public health." Dr. Anders Ahlbom of the Karolinska Institute in Stockholm, Sweden, echoed this concern: "Clearly, if the HFT–cancer link is true, it makes a big difference to public health because lung cancer is a very common disease."

In addition to measuring 50/60 Hz EMFs, the Positron dosimeter used in the study also measured HFTs. The meter was originally designed by Dr. Paul Héroux while he was working at IREQ, the research arm of HQ. Héroux is now at McGill and collaborates with Thériault. "HQ sponsored the development of the meter and at the beginning they were very pleased to have the HFT data," Thériault said. "But in the middle of the study they did not want to use it anymore."

News of HQ's decision to block further analysis of the HFT data stunned many of those at the Department of Energy's (DOE) annual EMF research review, held in Albuquerque, NM, November 7-10, though it was never formally acknowledged. Most of those interviewed at the meeting were incredulous that the HFT finding was not being actively pursued.

Dr. Samuel Milham, an epidemiologist and consultant based in Olympia, WA, said that the contrast between the 50/60 Hz links to brain cancer and leukemia in previous studies and the HFT link to lung cancer in the McGill study is "like black and white." "Clearly there is something different about HFT exposures that needs to be followed up."

"It's unfortunate for the sake of science," said Dr. David Savitz of the University of North Carolina, Chapel Hill. "There's a lot of work that can be done with the data." And Dr. Jerry Williams, the director of Johns Hopkins University's

Radiobiology Laboratory in Baltimore, said, "I cannot understand anyone not wanting to pursue this."

Both Dr. Nancy Wertheimer, based in Boulder, CO, and Dr. Richard Stevens of the Battelle Pacific Northwest Labs in Richland, WA, commented that limiting access to the data was "outrageous." Wertheimer said that, "The results should be out there so that others can work on them." And Stevens added that, "The utility is shooting itself in the foot. The cover-up will draw much more attention than the results." Dr. Raymond Neutra, who runs the California EMF research program (see p.8), said that, "I think it's very counterproductive if sponsors of research attempt to control its dissemination."

Dr. Kelly Gibney of BC Hydro in Burnaby, Canada, is sympathetic with HQ's view that the McGill team should not have published the HFT results as long as there is uncertainty over what the Positron dosimeter is measuring (see box at right). He said that, "The paper that has come out does not reflect good science—it's a bad piece of research." Most at the DOE meeting sided with the McGill group, however.

"It's not unusual not to know what an exposure index means," Savitz said, pointing to the wire codes developed by Wertheimer and Ed Leeper as a classic example. "The uncertainty over what it means does not negate the association," he added.

The transient analysis published by the McGill team is based only on the HFT data collected by HQ and Electricité de France. The third participating utility, Ontario Hydro (OH), did not share its HFT data with the McGill group. Dr. David Agnew, an OH senior safety scientist in Whitby, Canada, said that the HFT results "warrant further investigation" and that a proposal has been submitted to OH management to analyze its exposure data. He said that approval for this work has not yet been given.

Over a year-and-a-half ago, Dr. Ben Armstrong, who led McGill's analysis of the HFT data, submitted a proposal to HQ asking for support to do further research on what the meter is measuring and on the HFT data set in general. The request is still pending, according to HQ's Plante, who noted that the utility had decided to test the meter on its own. "This is the kind of result that must be followed up with further work," Armstrong told *Microwave News*. "I hope Hydro-Québec will agree."

## Positron HFTs: Transients or RF from Mobile Radios?

What could be good news for electric utilities could spell trouble for mobile communications companies.

Three different papers presented by utility researchers at the November DOE meeting in Albuquerque showed that the Positron dosimeter used by Thériault's group to measure HFTs (as well as 50/60 Hz) responds to signals from hand-held and other types of mobile communications devices to a greater extent than previously thought.

According to its specifications, the Positron dosimeter captures radiofrequency (RF) radiation signals in the 5-20 MHz band, but all three utility groups found that it registered signals at least as high as 400 MHz. In addition, it can pick up signals that are weaker than the 200 V/m cutoff specified by the manufacturer.

"The dosimeters responded to walkie-talkies at a distance of approximately one meter and to car/truck radios up to a distance of ten meters," concluded a team from Enertech Consultants in Campbell, CA, and the Electric Power Research Institute in Palo Alto, CA. Similar findings were presented by IREQ, HQ's research arm.

A group from Ontario Hydro Technologies in Toronto, Canada, found that the Positron meter responded differently to high and low frequencies: Motorola walkie-talkies operating at 50 MHz had "little or no effect," but 461 MHz Motorola units could have "large effects."

In a fourth presentation, Dr. Paul Héroux of McGill University, who designed the prototype of the Positron dosimeter when he was at IREQ, reported "uncertainty" over the "actual contribution of radiotelephones" as compared to other sources. Nevertheless, in an interview, he maintained that, "The utilities are emphasizing the contribution of radiotelephones, but at this point nobody can be sure of the precise contribution of radios and switching transients."

Whatever HQ decides, Thériault said, "I will keep working in the field," he said. "I will find money from other sources."

# Epidemiology Roundup: Leukemia, Brain and Breast Cancer

### Peak Fields of Appliances May Be Critical

Battelle researchers are challenging the assumption that exposures to short, intense EMFs are unimportant. Dr. Richard Lovely of the Battelle Seattle Research Center created a stir at the 1992 annual EMF review when he announced that he and his colleagues at the Pacific Northwest Lab (PNL) in Richland, WA, had found an association between acute nonlymphocytic leukemia (ANLL) and the use of electric razors (see *MWN,* N/D92). The findings were featured by the *Wall Street Journal* the next day and were widely reported elsewhere.

Now the results have been published in the September 15 issue of the *American Journal of Epidemiology (140,* pp.510-517, 1994). Lovely and coworkers reported a nonsignificant 30% increase in ANLL among men who used electric razors as compared to those who did not, with a dose–response relationship between leukemia risk and time spent shaving. They also found that electric massage units significantly increased the risk of ANLL, while the use of electric hair dryers entailed no leukemia risk. No dose–response was seen for massage units.

Lovely told *Microwave News* that he considers the new paper "hypothesis-generating," adding that, "The peak field is an exposure parameter worthy of study."

In a separate paper *(Bioelectromagnetics, 15,* pp.439-446, 1994), another Battelle group, led by PNL's Dr. Bary Wilson, described the unique exposures from appliances. These in-

clude frequency components reaching the low MHz band, flux densities of up to 5 G and time-rates-of-change over $10^7$ G/s.

Wilson and coworkers contend that the use of electric appliances does not necessarily constitute "an inconsequential contribution to the TWA [time-weighted average] metric." Someone using an electric shaver with a flux density of 1 G for three minutes, they pointed out, would have a TWA exposure similar to that of someone who was exposed to 2 mG fields for 24 hours. In a letter published in the May/June 1993 *Microwave News,* Lovely and Wilson described the drawbacks of limiting exposure metrics to TWAs.

The researchers noted that the data set—drawn from the residential adult leukemia study begun by Dr. Richard Severson, and completed by Dr. Richard Stevens, for the New York State Power Line Project (see *MWN,* N/D86 and M/J88)—has some limitations, including proxy reporting of appliance use and a small number of cases. The Electric Power Research Institute commented that an "examination of the potential influence of appliance use on adult leukemia must await a more focused and rigorous study."

### No Link Between EMFs and Brain Tumors

In a study of 600 children in Los Angeles County, researchers at the University of Southern California (USC) in Los Angeles found no association between central nervous system tumors and residential exposure to magnetic fields as assessed by spot and 24-hour measurements, as well as by the Wertheimer–Leeper wire codes.

Speaking at the annual EMF research review in Albuquerque, NM, USC's Dr. Susan Preston-Martin, who led the study, spoke of a "perplexing" finding: Living in houses with underground wiring was significantly associated with a nearly fourfold increased cancer risk.

In a preliminary report, Preston-Martin wrote that, "We do not have a convincing explanation" for the link. But she noted that when she and her coworkers considered only those children who lived in their homes for at least half the time between conception and diagnosis, the association was no longer significant. She said that this "argues against a causal relationship."

Dr. Nancy Wertheimer commented at the meeting that the wire codes she developed with Ed Leeper were a "poor way to estimate high exposures" in Los Angeles, since the code was developed for Denver, where different wiring practices exist.

M.A. Stevenson of the California EMF Program (see p.8) said that the state Department of Health Services (DHS), which sponsored the study, "will wait for the final external peer review before commenting in detail." She added that the DHS continues to favor low-cost avoidance of power-frequency EMFs.

The final progress report, *Epidemiologic Study of Brain Tumors in Children and Exposure to Magnetic Fields,* is available for $10 (U.S. and Canada) or $15 (Europe), including postage, from: Copy Central, Attn: Mark, 5801 Christie Ave., Suite 100, Emeryville, CA 94608, (510) 547-5222.

### USC Breast Cancer Study Ready To Begin

A five-year study of breast cancer and its possible link to EMF exposures among African-American and Latino women in Los Angeles will begin early next year with Dr. Stephanie London of USC as co-lead investigator. The effort is being funded by the National Institute of Environmental Health Sciences and the Department of Defense's Breast Cancer Research Program.

London and colleagues will use questionnaires to gather information on both residential and occupational EMF exposures, and will include questions on whether subjects are exposed to light-at-night. They will follow the protocols devised by Dr. Scott Davis of the Fred Hutchinson Cancer Research Center in Seattle and Dr. Richard Stevens of PNL for their study of breast cancer and light-at-night so that the two sets of data may later be pooled.

Other indices of EMF exposures will include: wire codes, 60 Hz levels in the home and at work and DC fields at home. London and Dr. William Kaune, who will be a consultant on exposure assessment, would also like to measure harmonics of 60 Hz fields and transients. Kaune, whose firm, EM Factors, is in Richland, WA, has designed a new transient meter and is seeking funding for its development.

Kaune's interest in the harmonics of 60 Hz fields stems in part from the "Back-to-Denver" study, in which he and his co-

## EPRI Seeks Fabrics To Shield Magnetic Fields

The Electric Power Research Institute (EPRI) has contracted with SRI International in Menlo Park, CA, to develop materials for clothing that will protect wearers from 60 Hz magnetic fields. The same materials may also be used to shield sources of magnetic fields.

EPRI's Richard Lordon, based in Palo Alto, CA, told *Microwave News* that the effort is a simple application of known shielding principles—but with its own special challenges. He said SRI researchers plan to embed ferromagnetic particles in a latex material to create a fabric that will generate its own magnetic field. This field will tend to cancel the ambient fields, according to Lordon. SRI estimates that such shielding materials could attenuate applied fields up to one hundredfold.

At a presentation during the November EMF annual review in Albuquerque, NM, Lordon said that clothing made from such fabrics could do a lot to lower occupational exposures. But Dr. Luciano Zaffanella of Enertech Consultants in Lee, MA, cautioned that reduction of 60 Hz magnetic fields would also reduce the earth's magnetic field. And that might cause its own biological effects. In an interview, Zaffanella said, "I would not recommend dressing workers in such a suit." He added that he thinks it is preferable to "shield the source, not the subject."

The SRI contract began in early 1994 and runs for two years. According to the statement of work, SRI's objective is to "demonstrate feasibility." Applications will come later. "Right now, we are just trying to see if the whole thing is possible," Lordon said. He added that early results were encouraging enough to continue the project.

workers observed a relatively strong association between the 180 Hz component (the third harmonic) of the magnetic field and both wire codes and childhood cancer. Kaune presented the results at the EMF research review in Albuquerque.

London's case–control study will be part of a larger breast cancer and diet study being led by Dr. Brian Henderson, a professor of preventive medicine at USC, who will be a coinvestigator on the EMF study.

## California Health Department Begins $7 Million EMF Program

The California Department of Health Services (DHS) has launched a four-year, $7 million EMF research and education program. The program, which follows closely the directive laid out last year by the California Public Utilities Commission (CPUC) (see *MWN,* N/D93), is being funded by the CPUC, with administrative and technical support from the California Public Health Foundation, a nonprofit research group.

The DHS will give top priority to EMF problems in schools. In January 1995, the agency will issue two requests for proposals (RfPs): one to assess the relative contributions of internal sources and external power lines and substations to EMF levels in schools; and a second to develop general policies for dealing with such exposures. Dr. Geraldine Lee, a DHS epidemiologist, told *Microwave News* that the state's five utilities have already begun to compile a database on how close all schools are to power lines—they will share this information with the DHS. In addition to exposure assessment and policy analysis, the DHS will also sponsor research on epidemiology and EMF mitigation.

The DHS will choose projects in consultation with the Stakeholders' Advisory Consultant Group (SACG), which was established "as a forum where concerned citizens as well as professionals can express their concerns." The DHS will have the final say, however, and there will be "no required consensus and no voting" by SACG members, according to the EMF program's ground rules, issued by the DHS.

At the first SACG meeting, held on September 30, the group suggested that a third RfP for a geographic information system on land use adjacent to power lines be rejected as too costly. In an interview, M.A. Stevenson, a public health specialist with the EMF program, said that the DHS has accepted the SACG's recommendation and withdrawn the RfP for the time being. All proposals received will be reviewed by panels of consultants assembled by the program.

Dr. Raymond Neutra, DHS's acting program chief, said that he personally favors: an epidemiological study on childhood cancer in schools near power lines; reanalyses of existing studies, particularly the Swedish study; an investigation of how average residential exposure has changed in the U.S. as electricity use has increased; an assessment of exposures in office buildings; and measurements of transients and other types of EMFs to provide a "real world" exposure assessment that lab researchers could use in their work. Neutra said that more RfPs will be issued in the future.

### Florida Power Puts 500 kV Power Line on Hold

The 44-mile Lake Tarpon-Kathleen power line—which was at the center of a dispute leading to the adoption of the first power line magnetic field standards in the country—has been put on hold by the Florida Power Corporation (FPC). The St. Petersburg-based utility plans to ask the state Public Service Commission (PSC) to review the need for the project now that costs have ballooned to $80 million from the original $23 million estimate.

FPC spokesperson Karen Raihill told *Microwave News* that, "The economics for the project have gone beyond the point of being reasonable." She added that the utility still believes "this line is the best solution to averting a widespread outage."

The state Siting Board denied a permit for construction of the line in 1986 until the Department of Environmental Regulation (now the Department of Environmental Protection, or the DEP) could develop EMF standards (see *MWN,* M/A86). DEP's Buck Oven said that Lake Tarpon was "the line that gave us our rules."

Nancy Flemming of the Citizens Coalition for Responsible Power Inc. said that her Tampa-based organization, which has fought the power line for many years, was "celebrating cautiously."

The EMF program will have a separate component on public education and technical assistance. Besides publicizing research results, the unit will also respond to public concerns on disease clusters thought to be related to EMFs.

Two years ago, Neutra, who is on leave from his position as acting chief of DHS's environmental health investigations branch, was embroiled in a controversy surrounding the investigation of a cancer cluster at the Slater School in Fresno, CA (see *MWN,* J/F93 and M/A93). He said that once the EMF program is in place, the DHS will be able to avoid acrimony in similar situations. "We will have the resources to respond more quickly and to communicate with people more continuously," he said. He added that the EMF program will enable the DHS "to take a position on the basis of more information. We will be able to make decisions based on fact."

## San Diego Utility Seeks Dismissal of Devaluation Case

Undaunted by the dismissal of their neighbors' EMF–property devaluation suit, a San Clemente, CA, couple are pursuing their own case against San Diego Gas & Electric Co. (SDG&E). But their case may never come to trial. The California Court of Appeals reversed a lower court decision against the utility and let SDG&E present arguments on November 16 to have the case dismissed. SDG&E contends the California Public Utilities Commission (CPUC) should have exclusive jurisdiction over health and safety issues related to power lines.

If the case is dismissed, "it would mean an end to power line EMF litigation in the state of California," said Michael Withey, who is representing the plaintiffs, Martin and Joyce Covalt. Withey, who is with the Seattle-based firm of Schroeter, Goldmark and Bender, said SDG&E "is trying to strangle EMF litigation in California and if the court were to agree to dismiss, it would have serious constitutional implications because it would violate the Covalts' right to due process." The case could be appealed to the state's Supreme Court.

The Covalts filed suit in 1993 against the utility, claiming property losses and damages from fear of EMFs. Their complaint is similar to that brought by Mark and Cheryl McCartin and two other couples in the Covalts' neighborhood. A California Superior Court judge dismissed the McCartin complaint in May (see *MWN,* M/J94). It is being appealed.

The cases center on a 1990 upgrade of power lines above an existing right-of-way near dozens of homes. SDG&E added a 12 kV circuit to two existing 12 kV lines. Magnetic fields exceed 4 mG in significant portions of the McCartins' home and 12 mG in the Covalts'.

SDG&E Assistant General Counsel Greg Barnes said a dismissal would mean the Covalts could go before the CPUC and "challenge CPUC's regulations, challenge the way SDG&E built its lines and seek to have them moved or put underground." They could not, however, recover monetary damages.

Meanwhile, buoyed by the success last year of the landmark Criscuola decision, two more property owners in New York are suing utilities for property devaluation. The two new cases bring to seven the number of similar lawsuits being handled jointly by the New York City law firms of Sive, Paget & Riesel and Goldstein, Goldstein & Rikon. Attorney Michael Rikon represented the Criscuolas when the state's Court of Appeals ruled that they could recover damages without linking EMFs to health problems (see *MWN,* N/D93, J/F94 and J/A94).

In one case, a Suffolk County couple is suing Long Island Lighting Co. (LILCO) for $285,000 in compensation for the value of their property, plus damages, attorneys' fees and costs. A couple in Westchester County is suing Consolidated Edison Co. (Con Ed) for $239,000, also in compensation for the value of their property, plus damages, attorneys' fees and costs.

Elaine Davis, a LILCO spokesperson, said she could not comment directly about the case. But she pointed out that the housing market on Long Island is depressed because of the recession, which would affect the value of any property. Con Ed spokesperson Martin Gitten said Con Ed does not comment about lawsuits while they are being litigated.

# HIGHLIGHTS

## « Cellular Phone Notes »

The litigation against cellular telephone manufacturers continues to grow, with at least two new cases filed recently—bringing the total to seven—and more to come. Brain tumor claims are "popping up everywhere now," said attorney Bruce Goodhart of Holstein, Mack & Klein in Chicago. His firm filed a lawsuit against **Motorola** Inc. and **NEC** Corp. for a Connecticut man, **Todd Hoffman**, on October 28 and was preparing a claim for an Arizona resident as we went to press in late November. Separately, **Richard Ward** of Fayetteville, GA, sued Motorola on October 7, alleging that the hand-held phone he used was responsible for the right frontal astrocytoma with which he was diagnosed in February 1991. Goodhart told *Microwave News* that he knows of possible cases being weighed by lawyers in California, North Dakota and Oregon. The new cases are similar to the other brain tumor claims that have been filed in the last three years (see *MWN,* J/A93, J/F94 and J/A94). Ward and Hoffman used the phones for a year-and-a-half and three years, respectively, prior to the diagnoses of their cancers. Ward argues in his complaint that his tumor "was caused by, exacerbated and/or made inoperable" by radiation from the phone. Hoffman's complaint mentions only "aggravation or acceleration of an existing tumorous condition." **Norman Sandler**, a spokesperson for Motorola in Schaumburg, IL, declined to discuss specifics of the new cases, but he called the allegations in all the lawsuits against Motorola "speculative." Ward's case was filed in Georgia state court and later moved to U.S. District Court in Atlanta by the defendants, according to **Ronald Polly** of Dennis, Corry, Porter & Gray in Atlanta, one of Ward's attorneys. Hoffman's suit and three other claims being handled by Holstein, Mack & Klein are all in state court in Chicago. The first lawsuit to allege injury from a hand-held cellular phone was brought in 1992 by a Florida man, David Reynard, whose wife died of a brain tumor (see *MWN,* M/J92 and J/F93). No case has, as yet, gone to trial.

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Calculations by Drs. **Peter Dimbylow** and **Simon Mann** of the U.K.'s National Radiological Protection Board show that a 0.6 W generic transceiver, when used in "the most typical position"—2 cm from the body—produced maximum SARs in the head of 1.4 and 2.9 W/Kg at 900 MHz and 1.8 GHz, respectively, when averaged over 1 g of tissue. The calculations showed that the SARs would rise to 2.8 and 4.6 W/Kg at 900 MHz and 1.8 GHz, respectively, if the transceiver was placed in front of an eye. The maximum SARs in the eye would be somewhat lower. (The researchers found that up to 44% of the output power of the unit was absorbed in the head.) These levels are in general agreement with those reported by Dr. **Niels Kuster**'s group at ETH in Zurich, Switzerland (see *MWN,* J/F94), but are higher than the revised estimates reported by Dr. **Om Gandhi** of the University of Utah, Salt Lake City, at last summer's Bioelectromagnetics Society meeting (see *MWN,* J/A94 and S/O94). Dimbylow and Mann conclude

that applying the ANSI/IEEE standard for an uncontrolled environment of 1.6 W/Kg in 1 g of tissue "results in maximum [output] powers of 0.34 and 0.21 W at 900 MHz and 1.8 GHz," respectively. Their paper appears in *Physics in Medicine and Biology (39,* pp.1537-1553, 1994) and includes color diagrams of the SAR distributions.

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Germany's **Research Association for Radio Applications** — Forschungsgemeinschaft Funk, or **FGF**—has announced that it has found no cancer risk from exposures to microwave radiation like that used in mobile communications. In 1993, FGF began a research program on the "Biological Effects of High Frequency Electromagnetic Waves to Man and Environment," consisting of twelve different projects. Six have now been completed and the results of three studies—from the Technical University of Braunschweig, from the Free University of Berlin and from the University of Bonn—were announced in Germany in mid-November. FGF's **Gerd Freidrich** told *Microwave News* that these findings "did not hint at cancer-causing or cancer-promoting effects." FGF was established in September 1992 as a nonprofit group. Its members include Ericsson Mobile Communications, German Telekom, Motorola, Nokia and Siemens, as well as two broadcast networks, ARD and ZDF, and the German Federal Ministry of Posts and Telecommunications. (See box at left.)

## German Telekom Cellular Phone Studies

*The following research projects on the health effects of cellular telephone, primarily digital (GSM), radiation have been funded by German Telekom over the last three years. Locations are in Germany unless otherwise noted. German Telekom's Dr. Thomas Damboldt, based in Darmstadt, did not respond to repeated requests to provide further details. Completion dates could not be confirmed.*

| | |
|---|---|
| **Dr. Eduard David**<br>Institute of Physiology,<br>University of Witten/<br>Herdecke, Witten | Long-term effects on complex biological systems (animals, tissues, cells). |
| **Dr. W. Dimpfel**<br>Pro Science<br>Linden | Effects on human electro-encephalograms (EEGs) of Mega-Wave therapy equipment and digital phones. |
| **Dr. Jürg Kohli**<br>Institute of General Microbiology,<br>University of Bern,<br>Switzerland | Effects on living cells. |
| **Dr. Uwe Kullnick**<br>Institute of Zoology,<br>Technical University of Braunschweig | Neurophysiological effects;* effects on the human nervous system of pulsed and non-pulsed radiation. |
| **Dr. Niels Kuster**<br>Institute of EMF and MW Electronics,<br>Swiss Federal Institute of Technology (ETH), Zurich | Energy absorption by human tissue (dosimetry).† |
| **Dr. Joachim Röschke**<br>Department of Psychiatry,<br>University of Mainz | Effects on EEGs (sleep patterns)—two contracts.*† |
| **Dr. Peter Semm**<br>Institute of Zoology,<br>University of Frankfurt | Effects on the optic nerve of the zebra finch and pigeon and on the visual neurons of other birds and insects;* effects on the synthesis of melatonin in birds and humans;* literature review.* |
| **Dr. Franz Thoss**<br>Carl-Ludwig Institute of Physiology,<br>University of Leipzig | Effects on the human central nervous system.* |
| **Dr. Lutz Vollrath**<br>Institute of Anatomy,<br>University of Mainz | Biological effects.* |

* Study completed.

† For more on Kuster's dosimetry studies, see *MWN,* J/F94; for more on Röschke's sleep pattern research, see *MWN,* M/J94.

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Both epidemiological and laboratory studies are needed to determine whether cellular telephones pose any health risks, concluded a **General Accounting Office** (GAO) report released in late November. The report, which was commissioned by Rep. **Edward Markey** (D-MA) two years ago (see *MWN,* S/O93 and S/O94), noted that some recent biological and behavioral animal and cellular experiments indicate possible health effects from low-level RF/MW radiation, although none has specifically looked at the frequencies used by cellular telephones. The GAO also recommended that the **EPA**, **FCC** and **FDA** work with the Cellular Telecommunications Industry Association's (CTIA) Scientific Advisory Group (SAG) on Cellular Telephone Safety "to maximize the usefulness, independence and objectivity of [the group's] planned research initiative." On November 21, after reviewing the report, Markey wrote to President **Bill Clinton** suggesting that the President designate a government representative to ensure that this interagency issue is addressed promptly. "It is not appropriate to uncritically rely on affected industries to assess the health consequences of the use of their products or services," Markey explained. The same day CTIA President **Thomas Wheeler** wrote to Markey expressing his disappointment over Markey's statements. Wheeler argued that the "tone" implied incorrectly that the GAO had linked cellular phones with health effects. The GAO report was virtually ignored by the press, except for a story on CNN's *Moneyline*. Copies of *Status of Research on the Safety of Cellular Telephones* (GAO/RCED-95-32) are available from: U.S. GAO, PO Box 6015, Gaithersburg, MD 20884, (202) 512-6000. The first copy is free and additional copies are $2.00.

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The **European Community** (EC) is concerned over possible radiation hazards from wireless devices. Researchers at the Center for Personkommunikation at Aalborg University in Aalborg, Denmark, led by Professor **Jørgen Bach Andersen**, have begun a study for the EC on health issues related to the

growing use of wireless devices for voice and data communications. Both thermal and athermal (low-level) effects will be reviewed, Andersen told *Microwave News.* The study was requested by the telecommunications directorate of the European Commission. A report should be available next spring, Andersen said.

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**CTIA**'s **SAG** sponsored an *RF Exposure and Dosimetry Workshop on Small Animal and* in vitro *Exposure Systems* in Los Angeles, December 2-3. Among the agenda items was a discussion of head-only versus whole-body exposure systems. "We are trying to simulate exposures from the phones," SAG's Dr. George Carlo told us. "We must be able to define what the exposure is." The Los Angeles meeting follows SAG's October 28 *National Symposium on Wireless Transmission Base Station Facilities,* held in Philadelphia.

## Fetal Loss Found Among Rats Exposed to DC Magnetic Fields

Pregnant rats exposed to 30 mT (300 G) static magnetic fields had significantly fewer live fetuses than unexposed rats, according to a new study by Drs. Meike Mevissen, Siegfried Buntenkötter and Wolfgang Löscher. The researchers cautioned, however, that more work is needed before the relevance of this finding for humans is known.

Writing in the September 1994 *Teratology (50,* pp.229-237), the researchers, from the School of Veterinary Medicine in Hannover, Germany, reported that fetal resorptions—similar to miscarriages in humans—were 13.9% among exposed rats as compared to 3.9% among controls. They did not observe any serious malformations in the live fetuses.

In an interview with *Microwave News,* Löscher said that his interest in static fields grew out of concern in Germany that magnetic resonance imaging (MRI) technicians have higher-than-average rates of spontaneous abortions. He said this was the first study to use an exposure comparable to field levels to which technicians are exposed.

There were no significant effects on the number of live fetuses in rats exposed to 30 mT 50 Hz magnetic fields. Exposed fetuses had significantly more minor skeletal anomalies than unexposed fetuses, however.

Both groups (DC and AC) of exposed fetuses showed increased skeletal ossification, which the German team said might indicate accelerated prenatal development. In another experiment, the birth weight of rats born to mothers exposed to DC fields was significantly higher than that of the offspring of unexposed rats.

The researchers concluded that exposing pregnant rats to magnetic fields like those in which MRI technicians work "does not induce any major teratogenic effect but seems to slightly increase fetal loss."

*Research* earlier this year.

The cellular phone industry is concerned about the new results. Representatives from Motorola and from the Cellular Telephone Industry Association's (CTIA) Scientific Advisory Group (SAG) on Cellular Telephone Research have visited Lai and Singh's lab a number of times over the last few months.

Despite all the attention, however, the industry is taking a skeptical and dismissive view of the experiments and their implications—and the SAG has angered Lai and Singh. "The validity of the Lai–Singh experiment has yet to be established and, even if it is validated, the effects it purports to show may be inconsequential," Dr. Quirino Balzano, a Motorola corporate vice president, told *Microwave News*. In August, Balzano, accompanied by Dr. Asher Sheppard, an independent consultant to Motorola based in Redlands, CA, went to Seattle to meet with Lai and Singh.

Dr. Ian Munro of CanTox Inc. in Mississauga, Canada, one of the three SAG members, commented that the results of the assay are of "unknown and unclear public health significance." And Dr. George Carlo, the chairman of the SAG, who is setting up a research program on cellular phone health risks for the CTIA (see *MWN,* S/O94), has written that, " It is unclear what relevance [the Lai–Singh data] has to our program."

The third member of the SAG is Dr. Bill Guy, a professor emeritus at the University of Washington and a longtime collaborator of Lai's at the university's Bioelectromagnetics Research Laboratory. Guy designed the microwave exposure system used by Lai and Singh. In an interview, Guy said that he had a "strong conflict of interest" and that, "For the present, I'm reserving my judgment."

One of the industry's key concerns is whether the assay used by Lai and Singh is a reliable and reproducible indicator of DNA damage. The assay—formally called alkaline microgel electrophoresis, but better known as the "comet" assay because it causes the broken-down DNA to spread out like the tail of a comet—was originally developed by Singh and others in the 1980s. Singh stands by the new microwave results: "The data are very impressive and are very interesting," he told *Microwave News*.

The SAG convened an expert panel in Bedminster, NJ, on October 19 to assess the comet assay and the Lai–Singh work. The panel, which was chaired by Dr. Richard Setlow, the associate director for life sciences at Brookhaven National Lab in Upton, NY, "found a number of uncertainties and inconsistencies in the Lai–Singh data," according to Carlo. Setlow refused to comment on the meeting.

In a November 16 memo to Carlo, Munro reported that the expert panel "recommended that the experiment be repeated" as long as "numerous limitations" are corrected. But in the same memo, Munro concluded that, "It is our position that from both a scientific and a priority perspective it may be premature to repeat and extend the Lai–Singh work." Munro said that he would prefer to wait on an international group of researchers that is planning to examine the validity of the assay. "It is probably inappropriate to spend a lot of money to repeat the experiment when we are not sure it is producing a valid result," Munro said.

Last spring, approximately 50-60 scientists held a work-

shop in England to review research on the comet assay, including its use in genetic toxicology, according to Dr. Ray Tice of Integrated Laboratory Systems in Research Triangle Park, NC, who attended both the comet workshop and the October 19 SAG meeting. On March 12, many of the same scientists will resume these discussions at the *Annual Meeting of the Environmental Mutagen Society* in St. Louis. On the agenda is a plan to set up a validation study for the assay, which, once under way, would take about a year to complete, Tice said.

The question of when the SAG will replicate the Lai–Singh study will now be presented to the Harvard Center for Risk Analysis peer-review group on cellular phones (see *MWN,* J/A94). In a November 17 letter to Dr. John Graham, the director of the Harvard center in Boston, Carlo asked: "Should a repeat of the *in vivo* comet assay be deferred until the international validation is completed and we have a more thorough understanding of this assay technique?"

On December 1, Dr. Susan Putnam, a research associate at the Harvard center, said that as soon as she receives complete background information from the SAG, she will forward it to a subset of her peer-review group. She declined to predict when she would have a response for Carlo.

Many of those who know about the Lai–Singh data believe that replication studies should move forward now. "Results like these deserve a follow-up," Dr. Elizabeth Jacobson told *Microwave News*. Jacobson is the deputy director for science at the Food and Drug Administration's (FDA) Center for Devices and Radiological Health (CDRH) in Rockville, MD.

"My opinion as a scientist is that it should be pursued and should be replicated in other labs," Tice said in an interview, adding that, "The data from the validation study will be useful in interpreting these results." And Sheppard, Motorola's consultant, commented, "I think that the work needs to be replicated and explored further."

Early this year, Lai and Singh asked the SAG for $240,000 (of which $50,000 would have been for lab equipment) from the $15-25 million research fund set up by the cellular phone industry (see *MWN,* J/F93 and J/A93). But in early November, they became so frustrated that they withdrew their proposal. "They are moving too slowly," Lai said. He added that he could not understand the delays over validation since many labs are using the comet assay and at least three other labs have used it to examine DNA breaks in brain tissue. A group led by Dr. Luc Verschaeve at VITO, the Flemish Technological Research Institute, in Brussels, Belgium, reported effects of mobile telephone radiation on blood lymphocytes as determined by the comet assay, at last June's *Annual Meeting of the Bioelectromagnetics Society* in Copenhagen, Denmark.

The relationship between Lai and Singh and the SAG has been tense since Lai and Singh were not allowed to attend the October 19 panel workshop. "They invited us twice, but then they forgot about us," Lai said. Singh remains bitter about this episode: "When you are executing a person, you should have a fair trial," he said.

Carlo responded that a decision was made that attending the workshop "would not be the best use of Lai and Singh's time." Munro said that it was common practice not to invite researchers to a peer review of their own work. Both Carlo and Munro noted that Lai and Singh continue to serve as consultants to the SAG, attending workshops and other meetings.

Guy, a colleague of both Lai's and Carlo's, said that Lai should expect some controversy. "I told Henry that 'You've got dynamite in your hands—if it turns out to be a real effect, the implications are tremendous,'" Guy told *Microwave News.* If Lai and Singh are correct, their results will have implications far beyond the cellular phone industry because of the low exposure levels implicated. "These are levels that could stimulate a reevaluation of the ANSI/IEEE standard," Sheppard said.

Lai wants to continue his studies: "We did not ask for a lot of money—we should be doing science instead of all this politics," he said.

On September 30, the SAG signed a letter of intent with Dr. Martin Meltz for *in vitro* studies of DNA damage using the comet assay. The proposal from Meltz, who is the director of the Center for Environmental Radiation Toxicology at the University of Texas Health Sciences Center in San Antonio, TX, has not yet been considered by the Harvard peer-review panel. Carlo said that no "definitive experiment" would begin until it wins Harvard approval, which he anticipates getting by the beginning of 1995. Meltz requested $95,000, which includes $13,000 for lab equipment.

While a decision on when to replicate the Lai–Singh experiment is pending, Dr. Jerry Phillips in Dr. Ross Adey's lab at the VA Hospital in Loma Linda, CA, is gearing up to repeat the Indian study but at cellular phone frequencies. "We are going to look at DNA damage in brain tissue exposed *in vivo* and in brain tumor cells exposed *in vitro* using the Sarkar method," Phillips said. He pointed out that the comet assay requires sophisticated and expensive equipment to which he does not have access.

Lai and Singh are not the first to report that microwaves can cause breaks in DNA. In the mid-1980s, FDA's Drs. Jose-Luis Sagripanti and Mays Swicord, working with Dr. Christopher Davis of the University of Maryland, College Park,

## The Lai–Singh Experiment

Rats were exposed for two hours to either continuous wave (CW) or pulsed (500 2 μsec pulses per second) 2450 MHz radiation at a power density of 2 mW/cm$^2$, corresponding to a specific absorption rate (SAR) of 1.2 W/Kg. The researchers used the comet assay to measure DNA breaks.

Four hours after exposure to the pulsed signals, Lai and Singh found a significant increase in single-strand DNA breaks in the hippocampus, as well as in the rest of the brain of the rats. But no significant effect was observed immediately after a two-hour exposure. A similar effect was also seen for 1 mW/cm$^2$ (SAR = 0.6 W/Kg) and there appeared to be a dose–response relationship.

For CW exposures, a significant increase in DNA breaks in the rats' brains was found both immediately after exposure and four hours later.

Lai told *Microwave News* that there were approximately 20% and 30% more DNA breaks after exposure to CW and pulsed microwaves, respectively, as compared to controls.

# FROM THE FIELD

## Clippings from All Over

Early research did raise legitimate concerns about the health effects of [EMFs]. Since then, most studies have found no association, but there are occasional chance findings—blips—that keep the issue on the table. No study, of course, can ever *prove* that EMFs (or anything else) are safe. But none of the 30 to 40 studies done in the last 10 years has provided any convincing evidence that EMFs cause birth defects, childhood cancers, breast cancer in women, or other problems.

**—Dr. Patricia Buffler, University of California, Berkeley, quoted in "A Clear Point of View: Patricia Buffler on EMFs," *University of California at Berkeley Wellness Letter,* p.2, November 1994**

To those physicists and biologists who understand the fundamental science, Jamie Robins, a Harvard epidemiologist, observes, EMF-induced cancer seems almost as implausible as, for instance, ESP-induced cancer. Because epidemiologists don't understand physics as well as physicists do, or biology as well as biologists do, they are not constrained by a strong prejudice toward the "null hypothesis"—the assumption that the phenomenon in question is nonexistent. As a result, Robins says, epidemiologists will gladly give credence to dubious studies of EMF in a way they never would to similar studies of ESP, the implausibility of which they understand.

**—Gary Taubes, "Fields of Fear," *Atlantic Monthly,* pp.102, 108, November 1994. The article ran with the following subhead: "People want to believe that [EMFs] are bad for them, and so they do. A study in how the selective reporting of scientific evidence—by researchers as well as journalists—can generate anxiety at the expense of reality."**

"If you're sick, do you go to a physicist?" [Professor Dan Wartenberg of Rutgers University] said that he is very careful not to speak about physics questions outside his field—like how to minimize EMF fields. Physicists should do the same, he said. The debate is one of argument and counter-argument—with the public's health riding on the final score. The Edison Electric Institute, an industry group, argues that there has been "no established biological mechanism" to explain the EMF–cancer link, and so cancer in the studies must have other causes. Wartenberg responds that the National Cancer Institute officially recommends eating fresh fruits and vegetables to reduce cancer risk, although they admit ignorance of exactly why those foods help. EMF studies are no different, he said—the results are still persuasive, even if the exact mechanism[s] are not well understood.

**—David Newhouse, "Sparks Continue To Fly in Debate Over EMFs," *The Times* (Trenton, NJ), p.8, November 21, 1994**

Craig McCaw [is] the kind of man who...once suggested in all apparent seriousness—as color drained from the face of a PR man in attendance—that the Federal Communications Commission should reserve spectrum for telepathic communications to be made possible by brain implants he thinks will exist some day.

**—Andrew Kupfer, "AT&T's $12 Billion Cellular Dream," *Fortune,* p.102, December 12, 1994**

The worst thing that utility systems could do would be to dismiss EMF health risk findings. But I also believe that there is danger in according to the EMF riddle the status of a probable health risk requiring enormous amounts of study. If the utility industry in its zeal to be responsive creates too large an issue over EMF, it runs the risk of reaching a kind of problematic critical mass which will continue to generate a long series of relatively expensive studies. These will never prove what is going on or definitively disprove it either....The time is coming to take a harder line against the small industry of people who are attempting to use litigation to extract payoffs from utility companies by convincing a jury that the utilities have known of EMF dangers but have done nothing about them.

**—Cyrus Noë, "EMF Health Effects Update: It's Time To Take a Harder Line," *Clearing Up: Northwest Energy Markets,* a newsletter based in Seattle, pp.1-6, November 21, 1994**

The presence of high-power transmission lines is like a double-edged sword of Damocles affecting perhaps the physical health, but surely the economic health, of landowners. It hangs over the heads of the utilities as well. In their own economic self-interest, if not concern for the public, utilities should press the appropriate state and federal authorities to study the problem and come up with definitive answers to the EMF puzzle before utilities and customers suffer severe, dire consequences.

**—Dr. Sharlene McEvoy, "Double-Edged Sword of Damocles: Utility Companies' Liability for Diminution of Property Values Due to Electromagnetic Fields," *Real Estate Law Journal, 23,* p.122, 1994**

found that microwave radiation acts synergistically with copper to cause single- and double-strand breaks (see *MWN,* M/J87). In a recent interview, Swicord, the chief of the molecular biology branch at FDA's CDRH, commented that, "The speculation is that this is a possible mechanism for causing DNA damage that could have significant health effects."

SAG's Munro pointed out that he does not put as much emphasis on single-strand breaks as on mutations. "Stable mutations are a much more serious matter," he said.

Dr. Kenneth Tindall, the head of the molecular mutagenesis group at the National Institute of Environmental Health Sciences (NIEHS) in Research Triangle Park, NC, said that, "The jury is still out on the biological significance of single-strand breaks," explaining that, "The classic view is that they are not important, but more recent research suggests certain types of breaks may not be easily repaired and could lead to a biological effect." The NIEHS is a sponsor of Lai's work on the search for a possible mechanism to explain microwave interactions with neurological function.

Indeed, Lai argues that the microwave radiation does not cause direct damage to the DNA. "I would bet that an enzyme repair mechanism is being affected," he said.

Nor are Lai and Singh the first to show that microwaves can transform DNA. Drs. Elizabeth Balcer-Kubiczek and George Harrison of the University of Maryland School of Medicine in Baltimore found that 2.45 GHz radiation, modulated at 120 Hz, causes cells to become cancerous if they are later treated with a tumor promoter (see *MWN,* J/A89). "We unequivocally showed neoplastic transformation after microwave irradiation followed by the application of the tumor promoter TPA," Harrison told *Microwave News*. And in a series of studies, a group of Croatian researchers found that radar radiation can lead to chromosomal aberrations (see *MWN,* M/J92).

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Elizabeth Balcer-Kubiczek and George Harrison, "Neoplastic Transformation of C3H/10T½ Cells Following Exposure to 120 Hz Modulated 2.45 GHz Microwaves and Phorbol Ester Tumor Promoter," *Radiation Research, 126,* pp.65-72, 1991.

Vera Garaj-Vrhovac, Durda Horvat and Zlatko Koren, "The Effect of Microwave Radiation on the Cell Genome," *Mutation Research, 243,* pp.87-93, 1990 (for references to related Croatian studies, see *MWN,* M/J92).

Henry Lai and Narendra Singh, "Acute Low-Intensity Microwave Exposure Increases DNA Single-Strand Breaks in Rat Brain Cells," *Bioelectromagnetics, 16,* 1995 (in press).

Jose-Luis Sagripanti, Mays Swicord and Christopher Davis, "Microwave Effects on Plasmid DNA," *Radiation Research, 110,* pp.219-231, 1987.

Soma Sarkar, Sher Ali and J. Behari, "Effect of Low-Power Microwave on the Mouse Genome: A Direct DNA Analysis," *Mutation Research, 320,* pp.141-147, 1994.

N.P. Singh, R.E. Stephens and E.L. Schneider, "Modifications of Alkaline Microgel Electrophoresis for Sensitive Detection of DNA Damage," *International Journal of Radiation Biology, 66,* pp.23-28, 1994.

# CONFERENCES

## 1995 Conference Calendar

January 3-7: **National Radio Science Meeting,** University of Colorado, Boulder. For Commission K, Electromagnetics in Biology and Medicine, contact: Dr. James Lin, University of Illinois, 851 South Morgan St., Chicago, IL 60607, (312) 413-1052, Fax: (312) 413-0024.

January 25-26: **EMI/EMC Metrology Challenges for Industry Workshop,** National Institute of Standards and Technology (NIST), Boulder, CO. Contact: Ann Bradford, NIST, 813.07, 325 Broadway, Boulder, CO 80303, (303) 497-3321, Fax: (303) 497-6665.

January 29-February 2: **1995 IEEE Power Engineering Society (PES) Winter Meeting,** Hilton Towers, New York, NY. Contact: Nancy Heitmann, IEEE-PES Special Services, 445 Hoes Lane, PO Box 1331, Piscataway, NJ 08855, (908) 562-3881, Fax: (908) 562-1571.

February 15-18: **1st Regional Conference of the IEEE Engineering in Medicine and Biology Society** and **14th Annual Conference of the Biomedical Engineering Society of India,** New Delhi, India. Contact: Sujoy Guha, Center for Biomedical Engineering, Indian Institute of Technology, New Delhi 110016, India, (91+11) 685-7785, Fax: (91+11) 686-2037.

February 21-23: **Waipuna RF Meeting,** Waipuna Lodge International Hotel, Auckland, New Zealand. Contact: Dr. David Black, PO Box 26-105, Epsom, Auckland 1030, New Zealand, Fax: (64+9) 256-3969.

March 5-9: **1995 Society of Toxicology (SOT) Meeting,** Convention Center, Baltimore, MD. Contact: SOT, 1767 Business Center Dr., Suite 302, Reston, VA 22090, (703) 438-3115, Fax: (703) 438-3113.

March 7-9: **11th International Zurich Symposium & Technical Exhibition on Electromagnetic Compatibility,** Federal Institute of Technology, Zurich, Switzerland. Contact: Dr. Gabriel Meyer, ETH Zentrum-IKT, CH-8092 Zurich, Switzerland, (41+1) 632-2790, Fax: (41+1) 262-0943.

March 12-16: **26th Annual Meeting of the Environmental Mutagen Society,** Union Station Hyatt Regency, St. Louis, MO. Contact: Ray Tice, Drohan Management Group, 11250-8 Roger Bacon Dr., Suite 8, Reston, VA 22090, (703) 437-4377, Fax: (703) 435-4390.

March 19-22: **1995 EPRI EMF Seminar,** Marriott Hotel, San Jose, CA. Contact: Vicki Prock, Robert S. Banks Associates Inc., 2701 University Ave., SE, Suite 203, Minneapolis, MN 55414, (612) 623-4600, Fax: (612) 623-3645.

March 26-31: **1995 Electricity Conference,** Hyatt Regency Hotel, Vancouver, BC, Canada. Contact: Canadian Electrical Association, 1 Westmount Sq., Suite 1600, Montréal, PQ H3Z 2P9, Canada, (514) 937-6181, Fax: (514) 937-6498.

March 29-31: **T&D World Exposition '95,** Convention Center, New Orleans, LA. Contact: Stuart Lewis, Intertec Publishing Corp., 9800 Metcalf Ave., Overland Park, KS 66212, (913) 967-1745. Fax: (913) 967-1905.

April 4-6: **American Public Power Association (APPA) Engineering & Operations Workshop & Trade Show,** Convention Center, Philadelphia, PA. Contact: APPA, 2301 M St., NW, Washington, DC 20037, (202) 467-2965, Fax: (202) 467-2990.

April 9-13: **Experimental Biology '95,** Georgia World Congress Center, Atlanta, GA. Contact: Experimental Biology '95, 9650 Rockville Pike, Bethesda, MD 20814, (301) 530-7010, Fax: (301) 530-7014.

April 9-13: **1995 Conference and Exhibition of the National Association of Broadcasters (NAB),** Convention Center, Las Vegas, NV. Contact: NAB, 1771 N St., NW, Washington, DC 20036, (800) 342-2460, Fax: (301) 216-1847.

April 12-13: **31st Annual Meeting of the National Council on Radiation Protection and Measurements (NCRP),** Crystal City Marriott, Arlington, VA. Contact: NCRP, 7910 Woodmont Ave., Suite 800, Bethesda, MD 20814, (800) 229-2652, Fax: (301) 907-8768.

May 7-11: **27th Annual National Conference on Radiation Control,** San Antonio, TX. Contact: Conference of Radiation Control Program Directors Inc., 205 Capital Ave., Frankfort, KY 40601, (502) 227-4543, Fax: (502) 227-7862.

May 8-10: **International Conference on Electromagnetic Energy,** Loews L'enfant Plaza Hotel, Washington, DC. Contact: Electromagnetic Energy Association, 1255 23rd St., NW, Suite 850, Washington, DC 20037, (202) 452-1070, Fax: (202) 833-3636.

May 8-11: **Radar '95: IEEE International Radar Conference,** Radisson Plaza Hotel, Alexandria, VA. Contact: Randy Belote, ITT Defense & Electronics, 1650 Tysons Blvd., Suite 1700, McLean, VA 22102, (703) 790-6336, Fax: (703) 790-6365.

May 11-13: **Hyperthermia in Clinical Oncology,** Delft, The Netherlands. Contact: Inge Dijkstra, Dept. of Radiotherapy, Groene Hilledijk 301, PO Box 5201, NL-3008 AE Rotterdam, The Netherlands, (31+10) 439-1798, Fax: (31+10) 486-4596.

May 16-19: **MTT-S International Microwave Symposium,** Orlando, FL. Contact: Keith Huddleston, Martin Marietta, MP 200, PO Box 555837, Orlando, FL 32855, (407) 356-7201, Fax: (407) 356-0933.

May 20-26: **1995 American Industrial Hygiene (AIHA) Conference & Exposition,** Roe Bartle Hall, Kansas City, MO. Contact: AIHA, 2700 Prosperity Ave., Suite 250, Fairfax, VA 22031, (703) 849-8888, Fax: (703) 207-3561.

May 22-23: **2nd Copenhagen Conference on Electromagnetic Hypersensitivity,** Copenhagen, Denmark. Contact: Jyrki Katajainen, Dept. of Computer Science, University of Copenhagen, Universitetsparken 1, DK-2100 Copenhagen East, Denmark, Fax: (45+1) 35321401.

June 18-22: **17th Annual Meeting of the Bioelectromagnetics Society (BEMS),** Park Plaza Hotel, Boston, MA. Contact: Dr. William Wisecup, BEMS, 7519 Ridge Rd., Frederick, MD 21702, (301) 663-1915, Fax: (301) 371-8955.

June 18-23: **1995 IEEE AP-S International Symposium and USNC/URSI Radio Science Meeting,** Newport Beach, CA. Contact: 1995 IEEE AP-S Symposium, Jet Propulsion Lab T-1703, 4800 Oak Grove Dr., Pasadena, CA 91109, (818) 354-3835.

June 22-24: **28th Annual Meeting of the Society for Epidemiologic Research (SER),** Snowbird, UT. Contact: Stacey Norin, SER, 111 Market Pl., Suite 840, Baltimore, MD 21202, (410) 223-1600, Fax: (410) 223-1620.

July 9-12: **30th Annual Microwave Symposium,** Hyatt Regency Hotel, Denver, CO. Contact: International Microwave Power Institute, 10210 Leatherleaf Court, Manassas, VA 22111, (703) 257-1415, Fax: (703) 257-0213.

July 23-27: **40th Meeting of the Health Physics Society (HPS),** Hynes Convention Center, Boston, MA. Contact: HPS Administrative Services, 1313 Dolley Madison Blvd., Suite 402, McLean, VA 22101, (703) 790-1745, Fax: (703) 790-2672.

July 23-27: **1995 IEEE PES Summer Meeting,** Portland, OR. Contact: See IEEE-PES, January 29-February 2, above.

July 24-28: **Progress in Electromagnetics Research Symposium (PIERS),** University of Washington, Seattle. Contact: 1995 PIERS, UW Engineering Professional Programs, 3201 Fremont Ave. North, Seattle, WA 98103, (206) 543-5539, Fax: (206) 543-2352.

August 14-18: **1995 IEEE International Symposium on Electromagnetic Compatibility,** Marriott Marquis, Atlanta, GA. Contact: See IEEE-PES, January 29-February 2, above.

August 19-25: **1995 Meeting of the Society of Magnetic Resonance (SMR),** Acropolis Center, Nice, France. Contact: Cordie Miller, SMR, 2118 Milvia, Suite 201, Berkeley, CA 94704, (510) 841-1899, Fax: (510) 841-2340.

August 31-September 1: **4th Nordic Workshop on Biological Effects of Low Frequency EMFs,** University of Kuopio, Finland. Contact: Dr. Jukka Juutilainen, Dept. of Environmental Sciences, University of Kuopio, PO Box 1627, 70211 Kuopio, Finland, (358+71) 163226, Fax: (358+71) 163230.

September 5-7: **International Conference on 100 Years of Radio,** Contact: Institution of Electrical Engineers, Savoy Pl., London WC2R 0BL, U.K., (44+71) 344-5477, Fax: (44+71) 497-3633.

September 11-14: **17th Annual Electrical Overstress/Electrostatic Discharge Symposium,** Hyatt Hotel, Phoenix, AZ. Contact: Electrostatic Discharge Association, Fleet Bank Bldg., 200 Liberty Plaza, Rome, NY 13440, (315) 339-6726, Fax: (315) 339-6793.

September 20-23: **17th Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBS)** and **21st Canadian Medical and Biological Engineering Conference,** Montréal, Canada. Contact: Coplanor Congrès Inc., 511 Place d'Armes, Suite 600, Montréal, PQ H2Y 2W7, Canada, (514) 848-1133, Fax: (514) 288-6469.

September 26-28: **1995 International Aerospace and Ground Conference on Lightning and Static Electricity,** Williamsburg, VA. Contact: Sam Frazier, Naval Air Warfare Center, Aircraft Division, PO Box 928, Patuxent River, MD 20670, (301) 826-3868, Fax: (301) 826-3871.

October 2-4: **EMF National Debate & Summit Meeting,** Sheraton National Hotel, Arlington, VA. Contact: Betsy Norberg, Intertec Publishing Corp., PO Box 12901, Overland, KS 66282, (913) 967-1865, Fax: (913) 967-1898.

October 6-9: **15th Annual Meeting of the Society for Physical Regulation in Biology and Medicine,** Hyatt Regency, Crystal City, VA. Contact: Dr. Kenneth McCleod, Dept. of Orthopaedics, Health Science Center, T-18 Room 030, State University of New York, Stony Brook, NY 11794, (516) 444-2215, Fax: (516) 444-7671.

October 29-November 3: **7th IEEE PES International Conference on Transmission & Distribution Construction, Operation & Live-Line Maintenance,** Hyatt Regency, Columbus, OH. Contact: Tai Wong, American Electric Power Service Corp., 1 Riverside Plaza, Columbus, OH 43215, (614) 223-2235, Fax: (614) 223-1823.

# UPDATES

### ELECTROMAGNETIC HYPERSENSITIVITY

**European Notes...**Sweden's highest insurance court has rejected a claim brought by Marianne Berg, a bank manager, that her skin condition was caused by video display terminal (VDT) EMF exposure at work. This could put at risk more than 30 other electrical hypersensitivity cases that are pending before the court, along with hundreds of regional and local claims, according to a report in *TCO-Tidningen,* the newspaper of the Swedish white-collar union TCO, based in Stockholm. The court found, "It is indisputable that many people experience a connection between VDT work and skin conditions, but there is still a lack of sufficient evidence that it is the screen that is the cause," the newspaper reported. Berg's case had been pending for a decade....Whether EMFs are linked to the skin complaints and such neurological symptoms as headaches, faintness, fatigue and sleep disorders experienced by those who say they are hypersensitive to electricity is still hotly debated. Dr. Olle Johansson and Peng-Yue Liu of the Experimental Dermatology Unit at the Karolinska Institute in Stockholm, Sweden, outlined preliminary research at the *Workshop on Electromagnetic Hypersensitivity,* held in Graz, Austria, September 26-27, indicating that VDT operators with electromagnetic sensitivities have dramatically different skin biopsies than controls. After a similar presentation at last June's *16th Annual Meeting of the Bioelectromagnetics Society* in Copenhagen, Denmark, Johansson told *Microwave News* that some of the skin biopsies were "so abnormal that I had a difficult time believing it." He added that, "While we don't know the cause, it's very hard to believe that only psychological factors are at work." But at the same meeting, Sheila Galt and Dr. Yngve Hamnerius of the Chalmers University of Technology in Göteborg, Sweden, and colleagues reported that none of 30 sub-

jects could accurately detect whether they were being exposed to electric and magnetic fields. In contrast to Johansson's research, Dr. Bengt Arnetz of the Karolinska Institute and Drs. Mats Berg and Sture Lidén of the Karolinska Hospital argued at the *Work with Display Units '94 (WWDU'94)* conference held in Milan, Italy, October 2-5, that the main differences between those workers who say they are hypersensitive and other employees are that the former are more stressed at work and tend to feel underused. Dr. Ulf Bergqvist of the Swedish National Institute of Occupational Health in Solna, who opened a round-table discussion on electric hypersensitivity at *WWDU '94,* concluded that no clear causes have been identified but noted that a range of factors are currently being studied, including EMFs, chemicals, light, allergies and personality types. Dr. Stanislaw Szmigielski of the Center for Radiobiology and Radiation Safety in Warsaw, Poland—one of approximately 70 participants at the Graz meeting, sponsored by the European Community's project on biomedical effects of EMFs, known as COST 244—noted that while none of the research presented there objectively demonstrated that EMF hypersensitivities exist, a number of the studies found that 2-4% of the subjects showed measurable, though generally not significant, responses to weak 50 Hz fields. A study by Szmigielski and Dr. Marek Szuba of the Technical University of Wroclaw, Poland, found that 70 healthy volunteers had a statistically significant lengthening in reaction times to acoustic and visual signals when exposed for three minutes to high electric fields (10.9 and 13 kV/m)....The next major meeting will be the *2nd Copenhagen Conference on Electromagnetic Hypersensitivity* in Denmark, May 22-23, 1995; see p.14. (For more on electromagnetic hypersensitivity, see *MWN,* M/A87 and M/J91.)

### *EXPOSURE ASSESSMENT*

**Job Titles Can Be Misleading...**Epidemiological studies that rely on job titles to gauge EMF exposures for certain jobs are apt to lump together workers with wide-ranging exposures, according to a study led by Dr. Patrick Breysse. Breysse and coworkers at the Johns Hopkins University (JHU) School of Hygiene and Public Health in Baltimore and Dr. William Kaune of EM Factors in Richland, WA, found that exposures of some "telephone lineworkers," presumed to be higher than those of other workers, were similar to those of "non-lineworkers." When exposure maxima were measured, only one category of linemen—cable splicers—could be distinguished from non-linemen. Cable splicers had average peak exposures of 99.2 mG compared to non-linemen's average of 29.1 mG. Splicers also had the highest average mean and median exposures, 4.3 and 3.2 mG, respectively. Central office technicians, who are also called lineworkers, had the second highest average means and medians (2.5 and 2.2 mG, respectively). But the average means and medians of the remaining two lineworker categories were indistinguishable from those of non-lineworkers (1.5 and 1.2 mG, respectively). The team concluded that using one "telephone lineworker" job category is "not appropriate" and that future studies should focus on cable splicers. The analysis, published in the November 1994 issue

of the *American Journal of Industrial Medicine (26,* pp.681-691), is an offshoot of JHU's Dr. Genevieve Matanoski's case–control study of leukemia among telephone workers, which found increasing leukemia mortality with increasing EMF exposures (see *MWN,* J/A91, M/A93 and M/J93). In a separate study, Matanoski reported that young cable splicers who worked for the New York Telephone Co. had higher rates of leukemia and other types of cancer (see *MWN,* N/D89 and J/A91). Breysse's study follows soon after a report by Dr. Birgitta Floderus that made a similar point. In a reassessment of a previous study, Floderus, of the National Institute of Occupational Health in Solna, Sweden, uncovered an excess risk of leukemia among railway workers when she took account of their changing levels of exposure from one decade to the next (see *MWN,* M/J94).

### PEOPLE

Dr. **Andrew Bassett**, a pioneer in the use of PEMFs for the treatment of nonunion bone fractures, died of a brain tumor on November 14. Bassett founded Electro-Biology Inc., which markets PEMF devices that he developed with Drs. Art Pilla and Jack Ryaby....**Margo Oge** has become Director of the Office of Mobile Sources dealing with air pollution at the EPA, leaving open the position of Director of the Office of Radiation and Indoor Air. **Steve Page**, who has been running EPA's radon program, has been named acting director....Dr. **Michel Coleman**, the director of the U.K.'s Thames Cancer Registry, has been appointed professor of epidemiology and vital statistics at the London School of Hygiene and Tropical Medicine, effective next April. He will also hold the post of deputy chief medical statistician at the Office of Population Censuses and Surveys....Dr. **Patricia Buffler**, the dean of the School of Public Health at the University of California, Berkeley, has been elected a member of the national Institute of Medicine....**James Cunningham**, the former head of the public affairs department at the New York Power Authority (NYPA), has assumed the same position at the Long Island Lighting Co., better known as LILCO. And **Anne Strauss** of NYPA's department of public affairs has announced that she will retire in January....**Kenneth Griffing**, formerly of Southern California Edison Co., has joined NoRad's Field Management Services in Carson, CA, to work on active and passive mitigation techniques....**Larry Mansueti** has left the American Public Power Association to become the deputy director of the National Bioenergy Industries Association, also in Washington. **Curry Hagerty**, an attorney, is the new EMF contact at the APPA....Dr. **Jan Walleczek** has left Dr. **Ross Adey**'s lab in Loma Linda, CA, to work at the Department of Radiation Oncology at Stanford University's Medical School in Stanford, CA.

### STANDARDS

**EEA Plans To Classify EM Products...**In its formal application to the American National Standards Institute (ANSI), the Electromagnetic Energy Association (EEA) states that it will develop radiation standards for specific products, includ-

ing cellular phones and VDTs, based on general safety standards set by other organizations. Standards for cellular phones would rely on the 1992 ANSI/IEEE C95.1 guidelines but would be expressed in simpler terms—output power and current, for example, rather than field strength or SAR. Though the EEA's application is meant to be a generic one for setting up an accredited standards committee that could examine any product that emits electromagnetic radiation in the 0-300 GHz range, the EEA's description of the committee's scope makes specific reference to C95.1, which only covers 3 kHz-300 GHz. In a plan that has obvious applications to cellular phones, in particular, this section states: "Products that cannot produce exposures in excess of the provisions of ANSI/IEEE C95.1 during intended use will be designated 'Class 1' and will be exempt from all controls and warnings." Products that can produce exposures that exceed C95.1 will be designated Class 2 or Class 3 "based on the potential exposure of the user." For these, "appropriate controls, including user information, will be described." The proposed Accredited Standards Committee for Product Performance Relative to the Safe Use of Electromagnetic Energy will "serve the public interest by eliminating misunderstandings about the public health impact of certain electric/electronic products that use or generate electromagnetic energy," according to the application. The EEA announced last spring that it was reorganizing its activities and launching work on product performance standards (see *MWN,* M/J94). The deadline for comments on the application was November 30, and the EEA's executive director, Dinah McElfresh, said that "a handful" of comments had been submitted. Once the EEA responds to these, ANSI will rule on the application—probably next spring at the earliest, McElfresh said.

### *TECHNOLOGY*

**Microwave Light Bulbs...**Fusion Lighting Inc. in Rockville, MD, with support from the DOE, has developed a lighting system for large commercial and industrial spaces that uses MW radiation to excite sulfur encased in a small quartz sphere. The MW generators are "very similar" to those used in MW ovens, according to Kirk Winkler, spokesperson for Fusion Lighting. But they are much more powerful. In a prototype installed at DOE headquarters in Washington, a pair of 5.9 kW MW generators illuminate golf ball-sized sulfur bulbs. The intense light from these two bulbs—the setup replaces 240 conventional 200 W mercury vapor street lamps—is then diffused through a 240-foot-long plastic tube, or "light pipe." A similar prototype is in use at the Smithsonian's National Air and Space Museum. Winkler noted that the company will do "whatever it takes to insure that there is no leakage" of MW radiation, but he said he could not provide more specific information about shielding until a commercial product is actually ready for market, which is at least a year away. The prototypes were developed with the help of a $2 million grant from the DOE, which is interested in the technology's energy-saving potential. The installation at DOE headquarters, for example, cuts energy consumption by 72%, according to the agency, while providing more light.

# CLASSIFIEDS