MICRO WAVE NEWS

Vol. XIV No. 3 A Report on Non-Ionizing Radiation May/June 1994

INSIDE...

Utilities Win Three in a Row: Two Cancer Claims, Property Case

Three key power line electromagnetic field (EMF) lawsuits were decided in favor of electrical utilities in recent weeks, dealing a blow to plaintiffs who claim that EMFs are harmful.

"In my opinion, the plaintiffs' bar should look long and hard before bringing another one of these cases," said Robert Pennington, an attorney for Georgia Power Co. in the case brought by Nancy Jordan, who alleged that her non-Hodgkin's lymphoma (NHL) was caused by power lines belonging to Georgia Power and to a second defendant, Oglethorpe Power Co. On May 11, a jury in Douglasville, GA, rejected Jordan's claim. Pennington did not predict that these cases will now vanish, however: "I'm sure there will be more cases." Pennington is with the Atlanta firm of Troutman Sanders.

Bruce DeBoskey, one of Jordan's attorneys, also said there will be more cases, and he added that ultimately the plaintiffs will succeed. "It's only a matter of time," he told *Microwave News*. "I feel we really moved the ball forward dramatically with this case." Calling the jury's decision "disappointing but not discouraging," he said, "I think we can win these cases and will win these cases." The jury would have decided in favor of the plaintiffs, he asserted, had the suit involved childhood leukemia.

The Jordan trial marks the second time an EMF–cancer claim has failed. A year ago, Ted and Michelle Zuidema's allegations that EMFs from San Diego Gas & Electric Co. (SDG&E) power lines caused their daughter to develop a rare kidney cancer also were rejected by a jury (see *MWN,* M/J93).

Shortly before the decision in *Jordan v. Georgia Power,* another cancer

(continued on p.7)

New Clues on Leukemia and Breast Cancer Risks Among Railway Workers

A series of Scandinavian occupational studies indicates that railway workers aboard electrified trains face an elevated risk of leukemia and breast cancer, while track or station workers do not appear to have an increased risk of cancer.

In a new analysis of previously published data, Swedish researchers led by Dr. Birgitta Floderus found that engine drivers had a significant threefold increased risk of chronic lymphocytic leukemia (CLL) compared with other workers. These results, which appear in the March 1994 issue of *Cancer Causes and Control,* agree with those in Floderus's well-publicized case–control study, announced in 1992 and published in 1993, which showed a similar risk of CLL for those in jobs with the highest EMF exposures (see *MWN,* S/O92 and S/O93). While Floderus did not cite specific occupations in her 1992-93 study, she noted that railway workers had extremely

(continued on p.9)

« Power Line Talk »

One of the key features that distinguishes **Maria Feychting** and Dr. **Anders Ahlbom**'s study of childhood cancer and EMFs from previous epidemiological efforts is that they estimated past magnetic field exposures from historical loads on power lines (see *MWN,* S/O92). Nevertheless, many observers maintain that there really was not much new about the Swedish team's methodology. For instance, in his overview of the EMF problem at the April 6-7 meeting of the National Council on Radiation Protection and Measurements, Dr. **Thomas Tenforde** of the Battelle Pacific Northwest Labs in Richland, WA, characterized the Feychting–Ahlbom study as one that investigated risks as a function of distance from a power line—and noted that they had failed to find a link with recently measured fields. He did not mention their calculation of historical fields. In a letter that will appear in the July 1 *American Journal of Epidemiology (AJE),* Dr. **Richard Stevens**, also of the Battelle Labs, raises the issue directly, questioning whether the calculated field means anything more than simply the distance to a power line: "The calculated historical field is a function of distance to the line, load on the line at the time of diagnosis and configuration of the line. Do load and configuration contribute much, or is the calculated field really just distance?" Feychting and Ahlbom respond that a further analysis of their data shows that distance explains only 62% of the variation in calculated magnetic fields—approximately the level that Stevens said would persuade him that the Swedish results "add new support for an association between magnetic field exposure...and the risk of leukemia in children." Stevens told *Microwave News* that he is now convinced that there is more to the Swedish study's estimate of risk than just distance to the power line. Before the Feychting–Ahlbom study, wire codes or spot measurements, or a combination of the two, were used to estimate past magnetic field exposures. In several studies, including Dr. **David Savitz**'s 1988 study, childhood leukemia showed a stronger association with wire codes than with spot measurements. This has been widely used as an argument against any causal relationship between EMFs and leukemia. In another letter to *AJE,* which appeared in the April 15 issue, Savitz, of the University of North Carolina School of Public Health, Chapel Hill, takes on a number of "reviewers of [the EMF] literature [who] persist in erroneously attributing a different pattern of association [between wire codes and measured fields] to a failure of the gold standard (measured fields) to show stronger relations with childhood leukemia than a proxy (wire codes)." After all, gaussmeters only take a "relatively brief sample in time during the wrong historical period," writes Savitz. Who are these reviewers? Savitz cites Dr. Richard Doll and others at the U.K. National Radiological Protection Board, Drs. James Jauchem and James Merritt of the U.S. Air Force, the late Dr. Sol Michaelson of the University of Rochester (NY), Dr. Leonard Sagan of EPRI and Harvard University's Dr. Dimitrios Trichopoulos and his colleagues on the CIRRPC panel.

«« »»

"It is my opinion that the dangers to human health from low-level ELF fields have been exaggerated beyond reason. I base this conclusion on considerations ranging from the underlying physics to the inconsistent epidemiological data and lack of concrete biological results. It is appalling that close to a billion dollars has already been spent on this problem. I by no means conclude that no further research should be conducted on biological interactions with ELF fields; however, nothing in the available data suggests the need for any sort of crash program. There are far more urgent things to support in the present national concern over the economy, and unwarranted hysteria could end up trivializing concern over legitimate dangers to health such as cigarette smoking and the AIDS epidemic." These are the words of Dr. **William Bennett Jr.**, a physicist at **Yale University** in New Haven, CT, in an article on "Cancer and Power Lines," which was published in the April issue of *Physics Today.* At about the same time, Bennett's colleague in the Yale physics department, Dr. **Robert Adair**, offered a similar view in a press release announcing the publication of his new paper in the April *Proceedings of the National Academy of Sciences (91,* pp.2925-2929): "I think the fear of power lines springs from the human need to find an explanation for everything bad that happens. Cancer and leukemia happen for many reasons that we do not now understand. But power lines are not among the possible reasons." Adair limits his new analysis to the action of ELF fields on biological magnetite, while Bennett presents a more general argument against weak field interactions. Both are well-known critics of those who express concern over low-level EMF health threats. Bennett was a member of the CIRRPC White House panel, which dismissed EMF health risks (see *MWN,* N/D92) and is the author of a new book, *Health and Low-Frequency Electromagnetic Fields,* published by the Yale University Press. Adair has written and spoken widely to convince people not to be concerned about EMFs.

«« »»

An **Australian epidemiological study** of EMFs and childhood cancer, sponsored by the Electricity Commission of New South Wales, has been shelved (see *MWN,* J/A91). The scientific committee that was planning the study has been disbanded. Dr. **Michael Repacholi** of the Royal Adelaide Hospital, who was coordinating the $1.2 million study at the Australian Radiation Laboratory in Yallambie, explained that the study would not go forward because of "our inability from

MICROWAVE NEWS is published bimonthly • ISSN 0275-6595 • PO Box 1799, Grand Central Station, New York, NY 10163 • (212) 517-2800; Fax: (212) 734-0316 • Editor and Publisher: Louis Slesin, PhD; Managing Editor: Robert Dieterich; Senior Editor: Gail Roberts; Associate Editors: Teresa Moogan, Lara Schoeberlein; Copy Editors: Jim Feldman, Roy Thomas Jr.; Production Coordinator: Joe Mungioli; Circulation Assistant: Diana Cooper • Subscriptions: $285.00 per year ($315.00 Canada & Foreign, U.S. funds only); single copies: $50.00 • Copyright © 1994 by Louis Slesin • Reproduction in any form is forbidden without written permission.

present evidence to define our concept of 'dose.'" Repacholi also pointed to methodological problems associated with minimizing bias in the selection of controls, which would have forced the development of a surrogate similar to wire codes. "This was seen as unsatisfactory, since we could not improve on the Scandinavian studies," he said. Others at the lab regret the decision not to move forward. They see the loss of an opportunity to test the wire code hypothesis in a country outside the U.S. Repacholi said that he too is "disappointed," but that he understands "the sponsors' reluctance to produce another epi study that will be put in the pile and not contribute significantly to our knowledge." Repacholi, who has been in Geneva, Switzerland, consulting with the World Health Organization on the development of a non-ionizing radiation program, will be returning to the Royal Adelaide Hospital in July.

«« »»

The first study to link EMF exposures with **breast cancer in women** will appear in the June 15 issue of the ***Journal of the National Cancer Institute*** (see *MWN,* N/D93). Dr. Dana Loomis, Dr. David Savitz and Cande Ananth's paper, "Breast Cancer Mortality Among Female Electrical Workers in the United States," will also be featured in the news section of the journal. Meanwhile, Loomis said that he is still seeking funds to pay for EMF exposure assessments for a group of women who are the subjects in an ongoing study of breast cancer.

«« »»

James Cunningham, head of the public affairs department at the **New York Power Authority** (NYPA), resigned in April amid questions about his department's expenses. A new chief executive, S. David Freeman, took over the NYPA earlier this year after newspaper reports about lavish executive perks and other management problems prompted NYPA's chairman to resign. "The NYPA is in the midst of a reorganization," Cunningham told *Microwave News.* "I felt it was time for a change." Cunningham denied a report in *New York Newsday* (April 20) that his position was going to be downgraded or eliminated. The newspaper criticized the department's spending practices and reported that Cunningham's staff had run up large bills for meals, travel and consultants. The paper also stated that Cunningham himself had "quietly repaid" several hundred dollars in personal expenses. Cunningham defended his expenses, however, telling the newspaper that many of his trips were made to promote utility industry EMF research. Indeed, Cunningham lobbied hard for passage of the national EMF research program. As early as 1990, Cunningham, testifying before Congress, argued that utilities should commit money to a government research program to avoid a "perceived bias" in the utility industry's own research (see *MWN,* M/A90 and J/A90).

«« »»

In the coming weeks, two new collections of papers by a veritable who's who of the EMF research community will be published. ***Biological Effects of Electric and Magnetic Fields*** is a two-volume set edited by Drs. **David Carpenter**, the dean of the School of Public Health at the State University of New York, Albany, and **Sinerik Ayrapetyan** of the Armenian Academy of Sciences in Yerevan. The first volume addresses "Sources and Mechanisms," and the second is on "Clinical Applications and Therapeutic Effects." Published by Academic Press in San Diego, each volume runs more than 350 pages and costs $99.00. To order, call (800) 321-5068, or fax (800) 336-7377. Dr. **Allan Frey**, a consultant based in Potomac, MD, edited the second collection, ***On the Nature of Electromagnetic Field Interactions with Biological Systems,*** which will be published by CRC Press in Boca Raton, FL. The 184-page volume costs $89.95 ($108.00 outside the U.S.). To order, call (800) 272-7737, or fax (800) 374-3401. And later this year or in early 1995, CRC Press will release the second edition of the ***CRC Handbook of Biological Effects of Electromagnetic Fields,*** edited by Dr. **Charles Polk** of the University of Rhode Island, Kingston, and Dr. **Elliot Postow** of the NIH in Bethesda, MD.

Call 800-EMF

The full number is (800) EMF-2383. That's the new, toll-free hot line established in mid-May by EPA as part of its return to non-ionizing electromagnetic radiation (NIER) issues (see *MWN,* M/A94). Hot line operators provide "down the middle, straightforward information on what we do know and what we don't know" about hazards from ELF and RF radiation, according to Dennis O'Connor of EPA's Office of Radiation and Indoor Air (ORIA) in Washington. The hot line was clearly needed, O'Connor explains, "to relieve our office and the regional offices of the incredible burden of answering EMF questions all the time."

O'Connor notes that the hot line already receives about ten calls per day: "And that's without the number being advertised at all." ORIA had previously estimated that EPA fields thousands of calls per year on NIER hazards (see *MWN,* J/A93), but O'Connor says that the actual volume has never been monitored carefully. The hot line, which is being operated by an outside contractor, is open from 9 am to 5 pm, eastern time.

«« »»

The effect of power lines on **property values** is clearly a hot topic of late—probably due to the *McCartin* trial (see p.8). An April 30 ***Washington Post*** item focused on one new home purchase that fell apart when the buyer found that large Virginia Power Co. transmission lines ran within 300 feet of the property. And a story in some editions of the April 26 ***Los Angeles Times*** quoted real estate agents, appraisers and utility officials: "Right now, we don't have hard market data showing that buyers pay less for property near a power line," Mike Poizner of the Los Angeles Department of Water and Power told the paper. Utility publications have also tackled the topic. The May/June issue of the Edison Electric Institute's (EEI) ***Electric Perspectives*** ran a long piece with a detailed discussion of two reports, which were commissioned by EEI and published in 1992, on how power lines affect public attitudes.

Swedish EMF Limits Unlikely; Analysis of Options Continues

Sweden is now unlikely to set exposure limits for power frequency magnetic fields, government officials report. Taken together with a new government booklet that downplays possible EMF health risks, this development marks a retreat from the position Sweden took in 1992, after the completion of two major epidemiological studies of EMFs and cancer.

The National Electrical Safety Board (NESB), which is responsible for developing EMF rules, continues to work on an analysis of the costs associated with various regulatory options, according to Jaak Noü, the board's technical director. This effort has suffered substantial delays, and no final decisions will be made until it is completed. Specific, firm guidelines rather than numerical limits are the "probable result," Noü told *Microwave News*.

The NESB has warned previously that new day-care centers, schools and playgrounds should not be built where magnetic fields exceed 2-3 mG. The agency stands behind these guidelines and could go still further—perhaps by proposing regulations for children's facilities, according to Noü.

Research results in the coming years could affect government policy, Noü said. If future findings show a link between EMFs and breast cancer, for example, "Then we will have to consider limits again." For now, however, while "a lot of studies point to a relationship between magnetic fields and cancer," substantial uncertainty remains.

The informational booklet, released in May by the NESB and three other agencies, states that uncertainties in current scientific knowledge leave "no basis for establishing limits." It was primarily written by the NESB, Noü said, with assistance from the National Board of Health and Welfare, the National Board of Housing, Building and Planning and the Swedish Radiation Protection Institute. "It represents the positions of all four agencies together," Noü said.

Dr. Lars-Erik Paulsson of the Radiation Protection Institute in Stockholm concurred that the booklet reflects a "consensus" of the four agencies. He added, however, that the only formal government policy is a January 1993 statement from the institute. When the costs are "reasonable," according to this document, steps should be taken to reduce magnetic field exposure (see *MWN,* M/J93). "My personal view is that an exposure limit is hard to implement as long as we don't know what physical quantity we should limit," Paulsson said.

Vattenfall, the state power company, took a cue from the new EMF booklet and predicted in a May 19 press release that "no limit values are likely to emerge in the foreseeable future in Sweden." In a telephone interview, Vattenfall's Rolf Lindgren added that the NESB faces pressure from other agencies to avoid limits.

In September 1992, prompted by the results of the residential EMF exposure study by Maria Feychting and Dr. Anders Ahlbom and of the occupational study by Dr. Birgitta Floderus and coworkers, the Swedish government announced that it would begin drafting regulations for new construction near power lines and for all new electrical facilities (see *MWN,* S/O92). At the time, Noü said that the regulations would take six months to complete.

After more than a year had passed, the NESB released an interim report and said that its analysis of the costs associated with 2, 5 and 10 mG limits, along with any proposed rules, would not be ready until this spring (see *MWN,* J/F94). The NESB's Henric Nilsson now expects the final report and proposals will not be completed until the end of 1994, at the earliest. Problems with a computer analysis designed to examine the locations of existing electrical facilities are a primary cause of the delays, he said.

In 1992, the National Board for Industrial and Technical Development's electrical safety department—the predecessor to the NESB—announced that it would "act on the assumption of a link between EMFs and cancer, particularly childhood cancer." "That has changed a bit," Nilsson conceded. "The other agencies don't want to go that far yet," he explained.

The 16-page booklet, which was written as a series of questions and answers, stresses the uncertainties around possible EMF health effects. It notes, for example, that: "The majority of investigations have not shown any increased risk for adults. But this needs more study before one knows for sure."

The booklet makes no mention of specific EMF levels that might be considered unsafe, avoiding language that is worded as strongly as the NESB's earlier recommendations. It cautions that new homes, schools and day-care centers should not be sited close to existing electrical equipment "that gives rise to significant magnetic fields." But it qualifies this advice by adding, "if alternative locations are available."

The thrust of the comments on childhood cancer is that only a small number of children are potentially affected:

> The normal annual risk for childhood leukemia is four cases per 100,000—or about 70 cases in Sweden every year. Seven of ten children survive. Certain study results suggest that the risk is almost doubled for children who live near power lines....This would therefore mean that two children in Sweden get leukemia every year due to magnetic fields from power lines.

In an interview with *Microwave News* following the release of his and Feychting's study in 1992, Ahlbom made a similar point, estimating that two leukemia cases occur each year among children living near power lines in Sweden and that one of those could be attributed to EMF exposure, based on his findings (see *MWN,* N/D92).

DOE–EPRI Meeting in El Paso, TX

The annual review of EMF bioeffects research, sponsored by the DOE and EPRI, is set for November 6-10 in El Paso, TX. The meeting, which is open to the public, will be held at the Camino Real Paso del Norte Hotel; call (800) 769-4300 or (915) 534-3099 for reservations.

For those wishing to present papers, abstracts are due September 10; a call for abstracts will be available in June. For more information, contact: W/L Associates, 120 West Church St., Suite 4, Frederick, MD 21701, (301) 663-1915.

The booklet concludes that, since "the cost of eliminating these possible [childhood leukemia] cases is very large," money would be better spent elsewhere — on reducing the cancer risk from radon, for example, or on cutting the number of traffic accidents. *Magnetfält och Eventuella Halsorisker Utifrån Vad Vi Vet i Maj 1994 (Magnetic Fields and Possible Health Risks Based on What We Know as of May 1994)* is available from: NESB, PO Box 1371, S-11193 Stockholm, Sweden, (46+8) 453-9700. There is no charge for single copies. An English translation of the text is also available.

Blackman–Blanchard Offer Ion Parametric Resonance Model

First there was Liboff–McLeod ion cyclotron resonance, then Lednev's parametric resonance, and now Dr. Carl Blackman and Janie Blanchard are proposing an ion parametric resonance model to explain how EMFs cause biological effects.

Blanchard and Blackman's model seeks to show how certain specific combinations of static and time-varying magnetic fields can affect biologically important ions. And, although they cannot readily explain how such changes are translated into observable responses, they have experimental data from Blackman's lab at the Environmental Protection Agency's Health Effects Research Lab in Research Triangle Park, NC, which show that the mix of AC and DC magnetic fields dictated by the model distinctly affects neurite outgrowth from PC-12 cells, a well-established line of nervous system cells.

"Our model predicts a unique, nonlinear response," Blanchard told *Microwave News* from her office at Bechtel Corp. in San Francisco, "and we are excited about the remarkable consistency we found when we tested it in Carl's lab."

In two companion papers which will take up more than 40 pages of the next issue of *Bioelectromagnetics (15,* pp.217-238 and pp.239-260, 1994), Blanchard and Blackman spell out, complete with thorough mathematical details, the theoretical underpinnings of their model and then show how it was successfully applied to the PC-12 cells. In one particular case, the model explains 94% of the variation in response of the cells to a 45 Hz signal over a range of different strengths of static and time-varying fields.

A number of close observers are impressed. "It is a sheer tour de force to have successfully fitted this complicated set of data," Dr. Abe Liboff of Oakland University in Rochester, MI, said in an interview. And Dr. Charles Polk of the University of Rhode Island, Kingston, commented that it is "important and interesting work." Over the last ten years, Liboff and Blackman have championed the idea that the Earth's magnetic field is a key variable for understanding EMF bioeffects (see *MWN,* S84, N84, J/F87 and M/A92).

In a third, forthcoming paper, Blanchard and Blackman speculate more freely on how magnetic fields can cause subtle shifts in the conformation of proteins and enzymes. "It is possible that a critical ion may be bound in a protein cavity that shields it from collisions with other...molecules and precludes the hydration of that ion." After all, they write, "Changes in protein function or enzyme activity [are] presumably a function of various minor structural or conformational states assumed by the protein, represented by changes in energy levels of the reaction sites." Their paper, "A Model of Magnetic Field Effects with Confirming Data from a Cell Culture Preparation," is a chapter in *On the Nature of Electromagnetic Field Interactions with Biological Systems,* soon to be published by CRC Press (see p.3).

"Overall, this is another indication that the Earth's static magnetic field may play a role," Polk said. But he added that, "I am surprised that they got such good agreement." Polk also said that he would like to see if the model is as successful when applied to a different experimental system.

"This is the first time that there is a detailed theory and an extensive test of that theory," Blackman said. "It is essential that it be independently replicated."

Swedish Trade Union Group Demands EMF Safeguards

A special working group on "Electric and Magnetic Fields" of the Swedish Trade Union Confederation—representing blue-collar workers—issued the following list of demands as part of an informational booklet, Cancer and Magnetic Fields at the Workplace. *Citing epidemiological studies that show links between EMFs and cancer, the union writes that, "The fact that it is not yet regarded as proved that a link exists must not prevent the trade unions from trying to protect our members' health." The booklet is available from the confederation, Barnhusgatan 18, S-10553 Stockholm, Sweden.*

- That the principle of caution be applied as regards exposure to magnetic fields;
- That all unnecessary exposure be avoided;
- That new places of work be designed and equipped in such a way that the exposure to magnetic fields is minimized;
- That the manufacturers of electrical equipment aim to minimize the magnetic fields;
- That manufacturers give details of the levels of magnetic fields in connection with the sale of such equipment;
- That no employee be exposed to an average exposure exceeding 2 mG per working day;
- That temporary high exposures be minimized as far as possible;
- That the employer maps out the existing levels of magnetic fields and, when necessary, draws up plans of action in accordance with the internal control regulations;
- That the staff in question be informed and trained;
- That practical measures to reduce exposure be taken without further delay, such as indication of areas with high exposure, reduction of magnetic fields, transfer of work sites and changed work organization;
- That the distribution of responsibilities between the different authorities be clarified;
- That Swedish laws and ordinances reflect a viewpoint corresponding to the principle of caution mentioned above;
- That stray currents be eliminated by the introduction of five wire systems;
- That the National Board of Occupational Safety and Health, pending the draft for a hygienic limit, issues a regulation in accordance with the views above;
- That the research on electric and magnetic fields be continued and intensified.

New from the Electric Power Research Institute (EPRI)

Reports

B. Clairmont, ***Handbook of Shielding Principles for Power System Magnetic Fields, Vol.1: Introduction and Application, and Vol.2: Methods and Measurements*** (TR-103630-V1–2), April 1994, 312 pp. and 516 pp., respectively. Price: $200.00 each. A compilation of available data on low-frequency magnetic field shielding. Volume one includes a basic introduction to the principles of active and passive shielding. Volume two introduces more complex numerical techniques to determine the efficacy of high-conductivity or high-permeability shielding materials. The roles of harmonics and transients are also discussed. Volume one includes a detailed glossary as well as contacts for shielding materials and services.

R. Goodman and A. Henderson, ***The Effects of Electric and Magnetic Fields on Transcription in Cultured Human Cells*** (TR-102860), December 1993, 76 pp. Price: $200.00. A summary of Drs. Reba Goodman and Ann Henderson's experimental studies, showing that human cell lines exposed to EMFs respond by increasing the messenger RNA transcripts of certain genes, including the c-*myc* oncogene. Goodman, who is at Columbia University, and Henderson, who is at Hunter College, both in New York City, observed the greatest increase using a 45 Hz sine wave with a magnetic field of 57 mG (rms) and an electric field of 10 μV/m. The response became apparent in less than ten minutes. They were not able to determine whether it was the electric field, the magnetic field or some combination that was responsible. The report includes extensive experimental details of their setup. (See also, *MWN,* S/O85, N/D86 and M/A87.) (Goodman and Henderson recently identified a specific region of the c-*myc* promoter that responds to EMFs; see *MWN,* M/A94.)

R. Kavet, ***Proceedings: EPRI Cancer Workshop II on Laboratory Research*** (TR-101749), September 1993, 84 pp. Price: $200.00. A review of research sponsored by EPRI between July 1988 and September 1991, when the workshop was held in Washington. Topics include the mouse skin tumor model, C3H/10T 1/2 cells, the nude mouse model, pineal research and recommendations for new research projects. Kavet is an EPRI project manager.

J. Kirschvink et al., ***Magnetite-Based Magnetoreceptors in Animals: Structural, Behavioral, and Biophysical Studies*** (TR-102008), September 1993, 58 pp. Price: $200.00. Dr. Joseph Kirschvink of the California Institute of Technology in Pasadena and coworkers were unable to pinpoint the location of magnetite in salmon and honeybees, but succeeded in training bees to respond to a 22 G magnetic field at frequencies from 1 to 60 Hz. Kirschvink previously identified magnetite in human brain tissue (see *MWN,* M/J92). Based on biophysical modeling of how magnetite might interact with magnetic fields at the cellular level, this research team concludes that the magnetic fields "produced by electrical appliances are well within the range for potential effects," but, due to the small amount of magnetite in human tissue, ELF EMFs below 50 mG are unlikely to have effects.

J. McCann, F. Dietrich and A. Martin, ***A Critical Review of the Genotoxic Potential of Electric and Magnetic Fields*** (TR-102115), December 1993, 76 pp. Price: $200.00. Although the authors conclude that "the overwhelming preponderance of evidence" does not suggest that static or ELF EMFs damage DNA, they consider a number of exceptions among their review of 55 published studies. Based on these exceptions, they single out two categories of exposure that merit further investigation: simultaneous exposure to EMFs and chemical mutagens or ionizing radiation; and very high electric fields associated with "spark discharge, transient electrical shocks and corona." In an appendix, the authors include a less exhaustive survey of 37 studies on the genotoxicity of RF/MW radiation exposure. Of the 15 studies that reported positive results, the authors discount the results of 12 because of possible thermal effects. (This same team published a review article with the same title in *Mutation Research, 297,* pp.61-95, 1993.)

R. Patterson and F. Dietrich, ***Small Animal Electric and Magnetic Field Exposure Systems*** (TR-103194), October 1993, 120 pp. Price: $200.00. A technical report describing 60 Hz experimental exposure systems.

D. Robertson and F. Dietrich, ***Pilot Study of Magnetic Fields in Electric Vehicles*** (TR-103275), January 1994, 149 pp. Price: $200.00. EMF measurements on two vehicles—the Conceptor Electric G-Van and the Chrysler/EPRI Phase II TEVan—using protocols similar to those used for electric mass transit systems (see *MWN,* J/A93). The maximum 5 Hz-3 kHz magnetic fields ranged from 1.8 to 50.8 mG inside the vehicles. The means at various interior locations ranged from 1.4 to 9.9 mG. The researchers, both with Electric Research and Management Inc., write that the "combination of variable DC and AC current within the wiring and load devices on board the [vehicles] created a very complex magnetic environment."

Resource Papers

Electric and Magnetic Field Fundamentals (BR-103745), March 1994, 28 pp. Price: $5.00. A primer that covers the physics of electricity and magnetism as well as basic considerations in designing studies on EMF health effects.

Meta-Analysis: Introduction to Its Use in Epidemiology (BR-103744), March 1994, 24 pp. Price: $5.00. Concentrates on how to pool the results of several epidemiological studies to increase overall statistical power. Outlines the process of designing and carrying out a meta-analysis and reviews possible drawbacks.

Occupational EMF Exposure Assessment (BR-103743), February 1994, 24 pp. Price: $5.00. A survey of the methods used to estimate on-the-job exposures, from job titles to personal dosimetry. Touches on the thorny issue of what characteristic of EMF exposures should be measured—transients, intermittency, geomagnetic resonances, time spent above a certain threshold or "something else entirely."

Brochures

EMF Laboratory Studies (BR-103714), May 1994. Price: Free for first copy, $3.00 for additional copies. A brochure describing a selection of EPRI-sponsored research projects on the role of EMFs as cancer promoters and on basic cellular processes.

EMF Research (BR-102833), 1993. Price: Free for first copy, $2.00 for additional copies. Companion brochure to *EMF Laboratory Studies. EMF Research* describes EPRI's ongoing projects and the rationales behind them.

EPRI publications are free to members. Call the EPRI Distribution Center at (510) 944-0510 for information on special rates and quantity discounts.

claim—this one in the Washington State workers' compensation system—was defeated when an administrative law judge found that the evidence was insufficient to support the charge that on-the-job EMF exposure was a cause of the leukemia that killed Seattle utility worker Robert Pilisuk.

And, in May, a property value case in San Clemente, CA, again involving SDG&E, was dismissed following a month-long jury trial.

"This is a trend," said SDG&E legal counsel Greg Barnes. EMF cases "simply don't make sense" to jurors, he added. The contention that EMFs cause health problems "is a losing proposition," he told *Microwave News*.

But Michael Withey, who represents the San Clemente property owners and Pilisuk's widow—and represented the Zuidemas—said that any rumors of the demise of this litigation "have been greatly exaggerated." He said he will appeal both cases.

Jury Rejects Evidence for Lymphoma Link

Pointing out that the claim of an EMF–cancer link has now been rejected in "a string of cases," Oglethorpe Power's attorney, James Orr, argued that the jury's decision in *Jordan* "is consistent with the opinion of the overwhelming majority of the scientific community."

Orr, who is with the firm of Sutherland, Asbill & Brennan in Atlanta, also pointed out that this case was decided on the issue of causation—whether EMFs actually caused Nancy Jordan's lymphoma. In *Zuidema v. SDG&E,* the jury was instructed to consider first whether SDG&E had a duty—as of 1987, when the Zuidemas' child was exposed to EMFs *in utero*—to warn customers about possible health risks. Only if the jurors had found for the plaintiffs on that issue would they have considered the specific cause of the girl's cancer. The process was reversed in *Jordan,* with the jury being instructed to consider the cause of Jordan's cancer and to rule on whether the utility was negligent only if they found for the plaintiffs on the first question.

To decide in favor of Jordan, the jurors had to find that a preponderance of the evidence supported the existence of a causal link between EMFs and her cancer, according to DeBoskey. "I think they basically felt that the adult lymphoma evidence was not as compelling as the childhood leukemia evidence," he admitted. DeBoskey, of the Denver firm of Silver & DeBoskey, interviewed half of the jurors following the trial. He said the forewoman told him that if the trial had concerned childhood leukemia the jury would have had a plaintiff's verdict in 15 minutes. DeBoskey said he likely will appeal. Jordan was also represented by Robert Shields of Doffermyre, Shields, Canfield & Knowles in Atlanta.

Jurors' comments reported in newspapers immediately after the trial support DeBoskey's account. The forewoman, Sara McKoy, told the Associated Press that scientific studies "show there is something there, but we weren't convinced it caused this case." Another juror said that the utilities "may have won this battle, but the war is not over. None of us like the decision. But the law was the law, and our hands were tied. I fully believe that EMFs cause cancer."

Asked about these comments, Orr noted that the jury's decision was unanimous, adding, "We think it was a strong verdict." Pennington argued that, "The plaintiffs failed to present any credible scientific evidence that there was a causal link between EMFs and Nancy Jordan's cancer." He said that he had not talked to any jurors but that the decision "was not close at all."

Jordan learned she had NHL in 1989, and her doctors have said the cancer is progressing. The home she lived in with her family from 1983 until after she was diagnosed with cancer is less than 50 feet from power transmission and distribution lines operated by the two utility defendants (see *MWN,* S/O 93). Magnetic fields in the house range from 4 to 30 mG, according to DeBoskey.

The witnesses called during the trial included a number of experts who had testified before—some quite frequently—and a few who had never appeared. The defendants retained Dr. Saul Rosenberg of Stanford University Medical Center in Palo Alto, CA, a leading expert on NHL. He was a key defense witness in the police radar–cancer claim brought by Officer Eric Bendure, which was rejected by a jury in early 1993 (see *MWN,* J/F93). They also called: Dr. Philip Cole of the University of Alabama, Birmingham, an epidemiologist who has done extensive work for utility clients; Dr. Richard Bland, a local radiation oncologist who had done no work on EMF issues until he was hired by the defendants to review the literature; and Fred Dietrich, an engineer with Electric Research and Management Inc. in Pittsburgh, who provided estimates of Jordan's power line EMF exposure.

Dr. David Carpenter of the School of Public Health at the

Florida Judge Refuses To Dismiss Leukemia Lawsuit

A judge in Miami has denied a motion by Florida Power & Light Co. (FP&L) to dismiss the lawsuit brought by Leonard Glazer of Coral Gables, who alleges that EMFs from the utility's power lines caused him and his late wife to develop leukemia.

In her May 19 decision, Circuit Court Judge Maria Korvick rejected FP&L's argument that the court lacked jurisdiction because the state's Department of Environmental Protection (DEP) is responsible for regulating EMF exposure. But she did direct the plaintiffs and defendants jointly to request that the DEP prepare "an opinion and/or an update on the issues raised in the complaint." This will be used as additional evidence, said Howard Talenfeld, a Ft. Lauderdale lawyer, who is Glazer's cocounsel. "It will be like having another witness in the case," he told *Microwave News*. In 1989, Florida set the first power line magnetic field limits in the U.S. (see *MWN,* M/A89).

Stacey Shaw, a spokeswoman for FP&L, which is based in Palm Beach, said that the utility has asked the judge to reconsider issues other than jurisdiction that were raised in its motion for dismissal, including arguments that the plaintiffs' claims are barred by the statute of limitations. "We felt that the court primarily addressed the jurisdictional issue," Shaw said.

FP&L is represented by Alvin Davis of the Miami firm of Steel, Hector & Davis and by Carlos Alvarez of Hopping, Boyd, Green & Sams in Tallahassee. In addition to Talenfeld, Glazer is represented by Lawrence Marrafino of Boca Raton. The case was filed in January (see *MWN,* J/F94).

State University of New York, Albany, testified for the plaintiffs. This is the first time Carpenter, who led the New York State Power Lines Project, has been used as an expert in a trial. Dr. David Ozonoff of Boston University also appeared, and testimony from the late Dr. Peter Wright of the Poly Clinic in Seattle was presented on videotape. Both Ozonoff and Wright testified for the plaintiffs in *Zuidema*.

Causal Link Not 'Probable' in Widow's Claim

A judge in Washington State found no "probable" link between on-the-job exposure to EMFs and Robert Pilisuk's leukemia. Judge Linda Williams of the Board of Industrial Insurance Appeals affirmed an earlier decision denying Mimi Handlin Pilisuk her husband's pension. In her 40-page decision, entered April 14, the judge acknowledged a "possibility" of a connection, however, and wrote that the theory of an EMF–leukemia link is "plausible."

"The surviving spouse must show that the claimant's employment probably, as opposed to possibly, caused his leukemia," Williams wrote. "While the theory that EMF promotes or copromotes leukemia is plausible, it is not probable." (She also noted that even if one accepts that EMF exposure promoted Pilisuk's cancer, it still would not be considered "a proximate cause" of his disease and would not be compensable; for an excerpt of her decision, see p.16.)

Pilisuk died five years ago of complications from acute lymphocytic leukemia. He was 44 years old and had worked for Seattle City Light for seven years (see *MWN,* M/A91, M/J92 and J/F94). His average daily exposure to 60 Hz magnetic fields at work was 12.6 mG, but occasionally he was exposed to fields as high as 150 mG, according to Williams's decision.

"Judge Williams drew a very, very important distinction between 'possible' and 'probable.' That's what these cases are all about," said Mark Warnquist of LeBoeuf, Lamb, Greene & MacRae in Denver, who, with city attorneys, represented the utility. "This case is one of the first that squarely addresses the distinction, but it's not inconsistent with many previous cases."

As an apprentice and as an electrician-constructor, Pilisuk's exposure to high levels of EMFs was in fact a condition of his employment, Williams wrote. However, although epidemiological studies show an association between electrical occupations and leukemia, there are several reasons why this association alone does not prove that Pilisuk's leukemia "was proximately and naturally caused by his exposure"—a legal burden for a decision in the plaintiff's favor. The association is "extremely weak," she noted, adding that laboratory studies have not scientifically proved that it is indeed a result of EMF exposure, and that EMFs are not involved in the initiation of leukemia.

"The preponderance of the evidence suggests that EMF is neither an initiator nor a promoter of leukemia....Although there were many studies which showed that EMF caused cancerous cell proliferation, none of these studies involved leukemia cells," she stated. Therefore, "Applying these results to reach a conclusion that Mr. Pilisuk's [leukemia] was caused by EMF exposure is too speculative."

Withey told *Microwave News* that he will continue to pursue Pilisuk's claim. He has asked the three-person Board of Industrial Insurance Appeals to review the decision, though this board is unlikely to reject Williams's proposed order. If the board upholds the decision, Withey said, he will seek a trial in state Superior Court: "I'm confident that we will be successful before a jury." Pilisuk is represented by Withey and Sydney Royer, both of Schroeter, Goldmark & Bender in Seattle. Dr. Richard Piccioni, another Seattle lawyer who has worked on Pilisuk's case, said that the new Canadian–French epidemiological study led by Dr. Gilles Thériault "would no doubt have strengthened the case" (see *MWN,* M/A94).

Pilisuk's claim was initially rejected by the Department of Labor and Industry in March 1992 (see *MWN,* M/J92 and J/F94).

Property Owners' Claim Against SDG&E Rejected

On May 16, a Superior Court judge in Fullerton, CA, dismissed a case involving three couples who alleged that the value of their homes in San Clemente fell sharply due to EMFs from a power line built and operated by SDG&E. Judge James Ross based his opinion on the findings of an advisory jury, which rejected the homeowners' contention that their property had been "taken or damaged" without just compensation.

Plaintiffs' lawyers have tried to "promote the notion that power lines are unhealthy," SDG&E's Greg Barnes said, "and then turn around and collect money based on the fear they have created." This idea "is lunatic," he argued.

Withey, who represents Mark and Cheryl McCartin and two other couples with homes near the line, called the trial "frustrating," but he also maintained that the case is far from over. "There are solid grounds for an appeal, and we will appeal," he said. This case and other similar actions have already had an impact on how utilities site new power lines, he added: "I don't think any utility would do today what SDG&E did to the McCartins and their neighbors in 1990."

The McCartins' claim concerned a 1990 upgrade of power lines in an existing right-of-way near dozens of luxury homes. SDG&E added a new 12 kV circuit to two existing 12 kV lines. According to the plaintiffs' court papers, the utility's own calculations showed that magnetic field levels near the line "had significantly increased" as a result of the changes. Initially 24 plaintiffs were part of the lawsuit, but most dropped out prior to the trial after finding out that their properties were not directly affected by EMFs from the power line upgrade.

Magnetic fields exceed 4 mG in significant portions of the remaining plaintiffs' homes, according to court papers, effectively ruining the value of the properties as sites for single-family residences. Withey told *Microwave News* that the need for a setback near power lines is well established, noting as an example an ordinance adopted in Irvine, CA, which limits new residential construction near a Southern California Edison power line. He also argued that real estate developers have avoided property where fields exceed 1-2 mG.

The plaintiffs wanted SDG&E to move the line or buy their homes, said Barnes, adding that this all-or-nothing approach was clearly "overreaching." He said the utility had tried to settle the suit before going to trial by offering to rephase

the lines. Since the plaintiffs rejected this and lost the case, they can now be held responsible for the legal expenses the utility incurred after making the offer. "This could easily reach six figures," he said.

The plaintiffs maintained that, regardless of whether EMFs are a proven health risk, current controversy lowers property values, but this reasoning was rejected by the judge. He found that the plaintiffs had to present evidence to the jury showing that EMFs are indeed a health hazard. His ruling runs contrary to a recent decision by New York State's highest court, which found that public perceptions of EMF risks could form the basis for property value claims (see *MWN,* N/D93), and this will be a primary issue for the appeal, according to Withey. Restrictions the judge placed on the testimony of expert witnesses, limiting their comments to their own work and personal conclusions, will also be challenged, he said.

The Pitfalls of Using Job Titles To Assess EMF Exposures

The reanalysis of Siv Törnqvist's data (see p.1) illustrates how the use of job titles to assess EMF exposures can lead to misclassifications that could mask a cancer risk.

In 1992, when Dr. Birgitta Floderus completed her major case–control epidemiological study of EMF-exposed workers (see *MWN,* S/O92), she noted that her results did not agree with those of Törnqvist's 1991 cohort study. Unlike Törnqvist, Floderus found indications of a larger-than-expected number of railway workers with cancer.

Working together, Floderus and Törnqvist learned that work practices had changed over the 1960-1980 study period, resulting in only one railway engine driver per train, instead of two. With the elimination of double-manning, many workers were transferred "from highly exposed to less exposed jobs and to early retirement," while keeping the same job titles they had prior to the changes. The researchers concluded that, "[T]his structural change of the industry...could dilute a potential effect."

Floderus and Törnqvist found support for their hypothesis when, on dividing the study period into two parts—1961-69 and 1970-79—they observed higher CLL risks among engine drivers in the first, but not the second, decade.

They cautioned, however, that an alternative explanation is possible. EMFs may do their damage "within a comparatively short time and...people exposed for several decades may be more or less resistant." In addition, if, as Floderus and others have reported, younger workers are more susceptible, they may become less and less represented in the cohort as they age over time.

Nonetheless, in an interview with *Microwave News,* Floderus said she believes that, "The inconsistencies among studies are, to a large extent, explained by the enormous difficulties in making accurate exposure assessments."

Floderus's team presents "pretty good circumstantial evidence that exposures changed over time," Dr. David Savitz of the University of North Carolina School of Public Health, Chapel Hill, told *Microwave News*. The results are a "reminder of how fallible inferences [based] on job titles can be."

Dr. Anders Ahlbom of the Karolinska Institute in Stockholm, who was a coauthor on the 1991 Törnqvist paper, called the new analysis "very interesting," adding that the results now support "the hypothesis of an association between magnetic fields and cancer."

Railway Worker Cancer Risks *(continued from p.1)*

high exposures, and that these workers, although very few in number, seemed to be overly represented among the cases.

In addition, the new analysis by Floderus and her fellow researchers at the National Institute of Occupational Health (NIOH) in Solna found an eightfold increase in male breast cancer among engine drivers and a fivefold increase for drivers and conductors combined. The number of cases was small, however, with only two cases among the drivers and one among the conductors. They also observed three times more pituitary gland tumors than expected among drivers and conductors combined. The researchers noted that, taken together, these results lend support to "the hypothesis of EMF acting on hormonal-dependent organs."

In a December 1990 letter to the *Lancet,* Dr. Tore Tynes reported a higher-than-expected incidence of male breast cancer among railway engine and tram drivers (see *MWN,* J/F 91). The nearly fourfold excess was also based on a small number of cases. The Floderus study is the fifth to show an association between occupational EMF exposure and male breast cancer (see also, *MWN,* N/D89, J/A90, M/A91 and J/A92).

But in a new study published in the April 1, 1994, *American Journal of Epidemiology,* Tynes, who is with the Cancer Registry of Norway in Oslo, and his coworkers found no association between leukemia or brain tumors and railway employees who worked in stations or maintained tracks or electrical lines—that is, those who did not work on board trains. Tynes did not include engine drivers in the study.

The variation in risks between the two types of railway workers may be explained by differences in EMF exposures in their work environments. According to Fred Dietrich, those on trains are exposed to magnetic fields all the time. In contrast, track workers are only exposed to magnetic fields when a train is running nearby, though they are exposed continuously to electric fields. Dietrich, who is with Electric Research and Management Inc. in Pittsburgh, told *Microwave News* that, "The track workers are exposed to the same peak fields as the engine drivers, but because they are exposed to the magnetic fields for shorter periods, their time-averaged exposures are lower." Dietrich cautioned that he has surveyed the EMFs associated with electrified rail systems in a number of European countries, as well as in the U.S., but not those in Scandinavia (see *MWN,* J/A93).

Tynes told *Microwave News* that the distinction between railway employees aboard trains and those on the ground is more complicated because the former may be shift workers.

In addition, he noted that in populated areas where many trains are running, track workers may also be continuously exposed to magnetic fields.

The new NIOH paper is a reanalysis of a 1991 study by Siv Törnqvist and colleagues, which did not find an elevated leukemia or brain tumor risk among railway workers. When Floderus and Törnqvist, working together, divided the 19-year follow-up period of the original study in two, they found cancer risks that had not been apparent before (see p.9). The original study and the new analysis both relied on job titles reported by Swedish men between the ages of 20 and 64 in the 1960 census. No further exposure assessment or job analysis was done.

Floderus and Törnqvist observed a nonsignificant association between railway work and brain tumors for younger workers. They found that workers under 40 had a two-and-a-half-times higher risk, while workers under 30 had a twelvefold increased risk, though this was based on only two cases among conductors.

The absence of EMF–cancer risks in Tynes's 1994 study is seemingly at odds with the results of a study he completed in 1992, in which he found a significant doubling of the risk of brain tumors among railway track walkers who had worked for at least ten years. Tynes said that the "unexplained excess risk may be related to one or several unknown factors." In his paper, Tynes suggested three possible risk factors: creosote, solvents and herbicides.

In addition to the Nordic studies, a Swiss study also found an increased cancer risk among railway workers. Researchers led by Dr. M. Balli-Antunes found a significant 60-70% increased risk for cancers of the blood and lymph among engine drivers (see *MWN,* S/O90). Railways in Norway, Sweden and Switzerland operate at 16.6 Hz.

M. Balli-Antunes, D. Pfluger and C. Minder, "The Mortality from Malignancies of Haematopoietic and Lymphatic Systems (MHLS) Among Railway Engine Drivers," *Environmetrics, 1,* pp.121-130, 1990.

Birgitta Floderus et al., "Occupational Exposure to Electromagnetic Fields in Relation to Leukemia and Brain Tumors: A Case–Control Study in Sweden," *Cancer Causes and Control, 4,* pp.465-476, September 1993.

Birgitta Floderus, Siv Törnqvist and Carin Stenlund, "Incidence of Selected Cancers in Swedish Railway Workers, 1961-79," *Cancer Causes and Control, 5,* pp.189-194, March 1994.

Siv Törnqvist, Bengt Knave, Anders Ahlbom and Tomas Persson, "Incidence of Leukemia and Brain Tumors in Some 'Electrical Occupations,'" *British Journal of Industrial Medicine, 48,* pp.597-603, 1991.

Tore Tynes and Aage Andersen, "Electromagnetic Fields and Male Breast Cancer," *Lancet, 336,* p.1596, December 22/29, 1990.

Tore Tynes, Aage Andersen and Frøydis Langmark, "Incidence of Cancer in Norwegian Workers Potentially Exposed to Electromagnetic Fields," *American Journal of Epidemiology, 136,* pp.81-88, July 1, 1992.

Tore Tynes, Henrik Jynge and Arnt Inge Vistnes, "Leukemia and Brain Tumors in Norwegian Railway Workers, A Nested Case–Control Study," *American Journal of Epidemiology, 139,* pp.645-653, April 1, 1994.

HIGHLIGHTS

U.S. Military Plans Powerful RF 'Heater' for Ionospheric Studies

Plans to modify the ionosphere with powerful radiofrequency (RF) radiation are attracting attention, as a prototype transmitter nears completion in Alaska. Opponents are raising concerns over whether the transmitter and a full-scale facility planned for the same location could interfere with communications and whether they might pose danger to people and to wildlife. The opponents are also challenging the premise that it is useful or wise to meddle intentionally with the Earth's upper atmosphere.

The demonstration project is the first phase of the U.S. military's High Frequency Active Auroral Research Program, known as HAARP. Construction of the $26 million prototype began last fall at a remote site in southeastern Alaska. It will consist of a phased array antenna covering four acres and transmitters with a combined power of up to 320 kW.

The full-scale "ionospheric research instrument" (IRI) called for in HAARP plans would be more than ten times this size. If built, it would have total transmitter power of 3,600 kW and an effective radiated power of 1.7 GW—or 1.7 billion watts—making it three times as powerful as any similar facility, according to John Heckscher of the Air Force's Phillips Laboratory at Hanscom Air Force Base, MA. The IRI is designed to operate at various frequencies from 2.8 MHz to 10 MHz.

HAARP will be used for "studying fundamental physical principles" of the Earth's ionosphere, according to a fact sheet prepared by Phillips Laboratory and the Navy's Office of Naval Research, which together manage the program. The possible applications for this research are subject to considerable debate, however.

A 1990 military report on HAARP describes ways that "ionospheric heaters," as these facilities are called, might be used to modulate atmospheric currents in order to communicate with submerged submarines. This process "in effect, produces a virtual antenna in the ionosphere" for generating ELF and VLF signals. The Navy currently uses the Project ELF transmitters in Michigan and Wisconsin for its submarine communications; these have been the subject of considerable controversy themselves (see *MWN,* Mr84 and J/F90). Other potential applications outlined in the 1990 report include methods to disrupt or enhance surveillance and communications systems and to disable missiles and satellites.

"When you are talking about billions of watts," explained Clare Zickuhr, an Anchorage resident and the leader of a group called No HAARP, "you begin thinking, what can it do to people?" Zickuhr told *Microwave News* that his loose-knit organization has more than 150 members. Many of the local opponents are radio operators who are worried over potential interference, he said. The group is seeking support from environmental organizations and is emphasizing the possible

risk HAARP poses to migratory birds.

Zickuhr admitted, however, that his main interest in trying to stop HAARP stems from worry over possible damage to the atmosphere. "They don't know what it will do," he explained. The project sponsors want to "kick the atmosphere real hard and watch what happens," he said.

Fears about damage to the atmosphere are "unfounded," according to Heckscher. "It's not unreasonable to expect that something three times more powerful than anything that's previously been built might have unforeseen effects," Heckscher said in a telephone interview. "But that's why we do environmental impact statements [EIS]."

HAARP has completed a full environmental review. The final EIS, dated July 1993, concludes that while HAARP transmissions would be "of sufficient intensity to cause measurable changes in the ionosphere's electron density, temperature and structure," these would be insignificant "when compared to changes induced by naturally occurring processes." Heckscher pointed out that similar ionospheric heaters have been operating for years. Facilities in Tromso, Norway, and in the former Soviet Union operate with an effective radiated power of 1 GW, he said. Less powerful U.S. facilities are located in Arecibo, Puerto Rico, and near Fairbanks, AK.

Atmospheric heaters have created controversy before, however. In 1988, when Dr. Bernard Eastlund, an engineer in Spring, TX, patented a device that is similar to, but more powerful than, the HAARP IRI, some criticized the technology as a "serious threat to the atmosphere" (see *MWN,* M/J88). At the time Eastlund said this technology could be used to create "total disruption" of radio communications around the world. Eastlund is a former employee of Arco Power Technologies Inc. in Los Angeles, which is the prime contractor for the HAARP demonstration project.

Eastlund recently told *Microwave News* that the technology also has potential as a "Star Wars" weapon for destroying satellites and ballistic missiles. In an unclassified report that is based on secret research for the Defense Advanced Research Projects Agency, Eastlund describes a "full, global shield" of accelerated electrons created with RF transmitters. The HAARP project "obviously looks a lot like the first step toward this," Eastlund said. He noted, however, that the applications he has described would require a significantly more powerful device with a much larger antenna—perhaps 20 square kilometers—than even the full-scale HAARP IRI.

Heckscher denied that HAARP is "based on anything that Eastlund has patented." He also pointed out that it would take "thousands of times" more power to create the effects he has described.

Whether the full-scale HAARP IRI actually will be built remains to be seen. Money for completion of the demonstration project is in place, Heckscher said, but the larger facility would require additional funding from Congress. The prototype is scheduled to begin operation this fall. Construction of the larger transmitter facility is scheduled to run from the summer of 1995 to the end of 1997. HAARP has been designed so that the transmitters, antenna structures and support facilities installed for the demonstration project would become part of the full-scale IRI.

Police Radar Class Action Suit Seeks Medical Monitoring

Attorneys representing a group of police officers with cancer have filed a class action lawsuit asking for the manufacturers of police radar equipment to fund regular health assessments for anyone who has used their products. Attorney Norman Rifkind, who is representing the officers, told *Microwave News* that he hopes to establish a fund, "either by a settlement or a judgment," to pay for medical monitoring and for new research into the possible link between police radar use and cancer.

This marks a change of course for police officers who claim their cancers are related to traffic radar. At least 19 individual claims have tried to show a causal link between radar use and the development of cancer, but none of these has been successful (see *MWN,* S/O93). Only one case, brought by a California police officer, Eric Bendure, went to trial, and it was rejected by a jury in January 1993 (see *MWN,* J/F93). Attorneys for the radar manufacturers now say that none of these personal injury cases is active.

The plaintiffs' attorneys in the new class action decided against filing personal injury claims, explained Rifkind, who is with the Chicago firm of Biegel, Schy, Lasky, Rifkind, Goldberg & Fertik. "We were sufficiently concerned that no one so far has been able to make these allegations stick." He declined to estimate the size of the class or how much money he might seek. Kustom Signals Inc., MPH Industries Inc. and Decatur Electronics Inc., among others, are named as defendants. Six police officers from around the country are named as plaintiffs "on behalf of all others similarly situated." All six have cancer, Rifkind said, but he declined to identify what types of cancer.

Attorneys for the defendants have filed motions to dismiss the lawsuit and to deny certification of the class. They predict that the plaintiffs will not be successful if they cannot show a link between police radar use and an officer's cancer. "What they are saying is, 'I don't want to carry the burden of proof because I can't,'" argued Mark Oium of the San Francisco firm of O'Connor, Cohn, Dillon & Barr, who represents Kustom. He predicted that the class action will be no more successful than the individual claims.

Among the questions that must be resolved in this litigation, according to the plaintiffs' complaint, is whether "the class suffer[s] a significantly increased risk of contracting or developing a serious illness or injury as a result of their exposure." The defendants argue that this claim has no legal basis. "You cannot sue for an increased risk of something," said Oium. "Most states do not allow it. Certainly Illinois does not allow it." To receive damages, Oium told *Microwave News,* actual harm or injury must be demonstrated, and a "causal link" to an event or exposure must be shown.

One previous related case, brought by Robert Strom, who alleged that exposure to a Boeing Co. electromagnetic pulse (EMP) simulator caused his leukemia, resulted in the establishment of a fund for medical monitoring (see *MWN,* S/O90). Oium noted, however, that this case was settled out of court

and set no legal precedent. Oium said that the new case is more like *Verb et al. v. Motorola et al.,* a class action lawsuit which alleged that cellular telephone manufacturers had failed to warn users that the devices were not safe. This case was rejected by an Illinois judge last year (see *MWN,* J/A93).

VDT–Cancer Claim Dismissed; Zaret Testimony Rejected

In one of the first tests of the *Daubert* rule for admissible evidence, an appeals court has dismissed a case brought by two former KLM reservations clerks, who claimed that radiation from video display terminals (VDTs) made by Raytheon caused their cervical cancer.

The April 21 ruling by the U.S. Court of Appeals for the Seventh Circuit in Chicago affirmed a lower court's November 12, 1992, decision of summary judgment for Raytheon Co. and Raytheon Service Corp. A panel of three judges wrote that the evidence from the plaintiffs' only expert witness, Dr. Milton Zaret, lacked the "rigor and objective support" needed under the rule set last year by the U.S. Supreme Court in *Daubert v. Merrell Dow Pharmaceuticals.*

In *Daubert,* the court concluded that evidence does not have to be generally accepted by the scientific community to be admissible, but it must be relevant and reliable. Further, the decision leaves it up to the court to assess "whether the reasoning or methodology underlying the testimony is scientifically valid...."

The plaintiffs, Carol Sampson and the estate of Cyndee Hayes, who died in 1980 of cervical cancer, sued Raytheon for product liability, negligence and wrongful death. Sampson had abnormal cervical cell growth and cataracts, according to court papers. Both Hayes and Sampson worked as ticketing agents for the Dutch airline in Chicago. Hayes began working for KLM in 1977, two years before being diagnosed with cervical cancer. Sampson worked in the same office from April 1979 to December 1980. She began seeing Zaret, an ophthalmologist based in Scarsdale, NY, in February 1981. In 1984, he prepared a report which concluded that she suffered from cataracts induced by exposure to radiant energy from VDTs.

In supporting the lower court decision, the judges wrote that Zaret contradicted himself about acceptable levels of radiation, saying on the one hand that "there was no known level at which radiant energy is either safe or harmful," and, on the other, that "the level of acceptable radiant energy is somewhere below 0.1-10 nW/cm^2."

Zaret also did not support his key premise that the source of the radiation was the workplace, according to the decision. He acknowledged that other sources, such as televisions, radar and commercial radio broadcasts, can be harmful.

Finally, the court found "equally important...the lack of trustworthy evidence in the record regarding the level of radiation to which the plaintiffs were exposed in the course of their employment with KLM." Zaret simultaneously relied on the findings of Eli Port of Radiation Safety Services Inc. in Evanston, IL, who tested radiation levels at KLM's office, and rebutted the reliability of Port's report.

"Each of these gaps in Dr. Zaret's chain of reasoning leads us to conclude that his opinion lacks the rigor and objective support required to distinguish admissible scientific opinion from inadmissible speculation," stated the decision.

In an interview with *Microwave News,* Zaret, now based in Rye Brook, NY, stood by his original findings, saying that harmful radiation was emitted by the VDTs. He said the equipment used by Port to survey the emissions was not sensitive enough to capture the nature and extent of the women's exposures and that Port did not understand the subtleties of the measurement task.

The VDTs emitted very short bursts of intense energy, Zaret said, adding that Port's "finding that there was a *spurious* response—*intermittent off-scale readings*—indicated that further study was required."

Hand-Held Cellular Telephones Affect Sleep Patterns

Exposure to microwave radiation emitted by the digital signals from hand-held telephones shortens the duration of rapid eye movement (REM) sleep, reduces the time it takes to fall asleep and changes brain waves during REM, according to researchers at the University of Mainz, Germany.

Drs. Klaus Mann and Joachim Röschke also found that nighttime microwave exposure does not affect a person's alertness the next morning. These results will be presented by Mann on June 6 at the *8th Annual Meeting of the Associated Professional Sleep Societies* in Boston.

With a grant from German Telekom, Mann and Röschke studied the effects of pulsed microwaves on 12 men, ages 21 to 34. For eight hours during one night of the three-night experiment, a digital mobile radio telephone was positioned 40 cm from the top of each subject's head. The subjects did not know on which night the phone was activated. The telephone emitted 900 MHz radiation with a peak power of 8 W, a pulse repetition rate of 217 Hz and a pulse width of 580 μs. The signal corresponds to that used in the European TDMA (time division multiple access) cellular phone system, known as GSM.

The observed reduction in REM was statistically significant. Also, sleep onset latency was shortened from 12.25 to 9.50 minutes, and "a qualitative alteration of the EEG signal during REM periods" was detected. None of the subjects, however, reported any side effects, although they did say they felt calmer the day following the exposure.

"REM sleep plays a special physiological role for information processing in the brain, especially concerning consolidation of new experiences," the researchers said. "Thus, the effects observed possibly could be associated with alterations of memory and learning functions."

Mann and Röschke told *Microwave News* that they have also studied the effects of pulsed microwaves on people who are awake, and are planning to study the effects on the production of nighttime melatonin.

The appeals court decided not to publish its decision, an action which prevents attorneys from citing it in other cases. "That's unfortunate," said Raytheon's attorney, John Burke Jr. of Burke & Associates in Chicago. "I receive calls about this every day from attorneys around the country handling EMF and other cases....I suspect the court didn't publish it because it doesn't want to publish a lot of different interpretations of *Daubert*."

Sampson and Hayes were represented by William Harte and Erik Gruber of the Chicago firm of William Harte Ltd. Harte said he will not appeal the case to the U.S. Supreme Court.

Industry Urges FCC Adoption of ANSI/IEEE C95.1-1992

Communications companies, among others, are urging the Federal Communications Commission (FCC) to adopt the revised American National Standards Institute/Institute of Electrical and Electronics Engineers (ANSI/IEEE) radiofrequency and microwave (RF/MW) standard, known as ANSI/IEEE C95.1-1992. Last year, the FCC proposed using the ANSI/IEEE standard to evaluate RF/MW radiation hazards to satisfy its responsibilities under the National Environmental Policy Act (see MWN, *M/A93). The comments excerpted below were filed in response to the FCC's proposal.*

Many of the industry comments stand in contrast to those filed by the Environmental Protection Agency (EPA), which was sharply critical of the ANSI/IEEE standard, calling it seriously flawed (see MWN, *J/F94). The National Institute for Occupational Safety and Health (NIOSH) has also raised objections to the ANSI/IEEE guidelines for basing exposure levels solely on body heating (see below).*

The Food and Drug Administration's Center for Devices and Radiological Health recommended adoption of the standard (see MWN, *J/F94).*

A number of companies asked the FCC to preempt local RF/MW regulations that are inconsistent with the ANSI/IEEE standard. But Dr. Robert Cleveland of FCC's Office of Engineering and Technology, who is writing the new rules, told Microwave News *the federal preemption issue would most likely have to be addressed in a separate rulemaking because the commission had not raised it in last year's proposal. In 1986, the National Association of Broadcasters petitioned the FCC to preempt state and local RF/MW rules (see* MWN, *M/J86); the commission denied the request four years later.*

Over 100 sets of comments and reply comments were filed with the FCC before their respective January 25 and April 25 deadlines. Cleveland said that the earliest the commission would reach a decision on whether to issue final rules or to seek additional public comments would probably be by the end of the calendar year. He pointed out that the original FCC rules governing RF/MW radiation exposures took the better part of a decade to complete and that the current proposal is "much more complex" (see MWN, *Ap85).*

...There is ample basis for concluding that the proposed 1992 ANSI/IEEE standard is arbitrarily delineated, and is not the proper basis for evaluating communications facilities. The commission should terminate this proceeding without action....There is in the ANSI/IEEE 1992 standard no stated justification for the standard for the "uncontrolled" environment, or for the decision to utilize a safety factor of 50....—***American Radio Relay League Inc.,*** January 25.

AT&T supports the proposal to adopt the 1992 ANSI/IEEE standard....Because the evidence shows that radiation from common carrier microwave stations, cellular base stations and vehicle-mounted cellular terminals does not exceed the new limits, commission action regarding such equipment should remain categorically excluded from environmental processing. On the other hand, because emissions from some Part 15 devices and hand-held terminals of various kinds may exceed the new limits, categorical exclusion of these types of equipment would not be appropriate....—***American Telephone and Telegraph Co.*** (AT&T), January 25.

...The widespread consumer use of personal computers, and the expected development of PCS [personal communications systems], underscore the importance of ensuring that data and voice PCS devices do not pose any health risk to users. To this end, Apple has worked within IEEE and the industry on the development of the 1992 ANSI standard, and believes that the adoption of this standard, as proposed by the commission, is in the public interest....—***Apple Computer Inc.,*** January 25.

...We urge the commission to adopt the ANSI/IEEE's dichotomy between controlled and uncontrolled environments in applying the new higher standard of protection, rather than applying a distinction based merely on whether a particular area may ever be "accessible" to the public....ANSI/IEEE concluded that exposure to the levels of RF radiation permitted by the controlled standard should be "safe for all." The more stringent, uncontrolled standard is therefore prophylactic in nature, providing an extra margin of safety in those areas where prolonged exposure of members of the general public to RF radiation is likely to occur. While such an extra measure of protection is, in our view, appropriate, it clearly goes beyond what has been shown to be necessary for the protection of human health; therefore, we believe it should be applied with due regard for its likely practical impact on broadcasters....[B]y recognizing that the mere transient passage of members of the general public through an area exposed to an RF field need not invariably result in application of the higher standard, the ANSI/IEEE controlled/uncontrolled dichotomy reasonably takes the practical needs of broadcasters into account....[We] urge the commission to specify clear, technically reliable and economically reasonable procedures for determining compliance with the new standards. Consistent with past practice, the FCC should allow broadcasters to assess compliance through the use of established calculation methods. In this regard, [we] are particularly concerned about demonstrating compliance with the new standards for induced and contact currents....Finally, in adopting the new RF radiation standards, the commission should ensure that federal policies are not undermined by inconsistent state or local regulation. Prompted by unsubstantiated fears, several states and municipalities have already prevented commission licensees from fully deploying their systems and services in the manner contemplated by their FCC licenses....—***CBS Inc., Capital Cities/ABC Inc., Greater Media Inc., Tribune Broadcasting Co. and Westinghouse Broadcasting Co.,*** January 25.

...CTIA supports the commission's proposal because the newly adopted 1992 ANSI/IEEE standards are sound and scientifically based and provide the basis for the safe use of the vast array of radio products that increasingly are becoming commonplace....CTIA believes that SAR compliance can best be accomplished by incorporating it as a requirement of the commission's radio type acceptance process. This should not be burdensome to manufacturers, since measuring a unit's SAR is a parameter which manufacturers must

measure as part of the unit's design and development cycle, and is in essence simply another characteristic of the radio. CTIA recommends that the commission require only that the type acceptance applicant indicate affirmatively that the SAR was measured in accordance with approved procedures, and that the unit meets the commission's requirement. It is not necessary or appropriate to require manufacturers to submit detailed data relative to this measurement since if a unit meets the applicable standard, it meets all applicable health and safety requirements....—***Cellular Telecommunications Industry Association (CTIA),*** January 25.

...Another difference [compared to ANSI/IEEE] noted is that NCRP [National Council on Radiation Protection and Measurements] requires use of the general population criterion even for the workplace if the exposure is to carrier frequencies modulated at a depth of 50% or greater at frequencies between 3 and 100 Hz. This is a requirement that has no practical application. Broadcast transmitters are not modulated at these frequencies at a depth of 50% or greater except for very short intervals. Consequently, the circumstances do not arise that would trigger the requirement to use the stricter standard in a controlled environment....—***Jules Cohen & Associates,*** January 25.

...EEPA believes that the large and diverse membership of the IEEE committee reflects a more accurate consensus of the scientific community compared with smaller panels of selected experts such as Scientific Committee 53 of the [NCRP] and (IRPA/INIRC)....In adopting a revised RF radiation regulatory scheme, EEPA urges the commission to adopt a rational interpretation of the "controlled" and "uncontrolled" environment provisions of the revised ANSI/IEEE standard and to incorporate reasonable and practical approaches to the regulation of human exposure to "contact" and "induced" currents....—***Electromagnetic Energy Policy Alliance*** (EEPA), now the Electromagnetic Energy Association (see p.19), January 25.

...The FAA objects to the establishment of two standards for the management of exposure to RF radiation and will continue to use the more conservative "uncontrolled environment" criteria for all areas within FAA's responsibility. FAA will make no distinction between "controlled" and "uncontrolled" environments in the application of permissible exposure limits for [RF] protection.—***Federal Aviation Administration*** (FAA), August 20, 1993.

...Ford supports [the] adoption [of the ANSI/IEEE] standard.... Nevertheless, before the agency can require compliance with the new policies, licensees and other entities that will be obliged to meet the new standard must know with particularity how to comply with the rules. This, in turn, will require clarification from the commission on two issues of particular concern to the automotive industry. First, as the IEEE itself acknowledges, further clarification is needed on techniques for measuring electric and magnetic fields within 20 cm of any object. Measurements degrade when probes are placed near antennas or reradiating structures, and the inside of an automobile has many such areas....Under the standard as drafted, the sole method for determining compliance with the guidelines for areas within 20 cm is through calculation of [SARs]. However, as the IEEE and ANSI stress, measuring SARs is "a challenging task."...Until the commission adopts standards for measurement technology and compliance methodology, it would be virtually impossible to demonstrate compliance with the new guidelines....—***Ford Motor Co.,*** January 25.

...The power limit prescribed in ANSI/IEEE C95.1-1992 under exclusions for the uncontrolled environment is certainly quite conservative for the present-day cellular telephones operating at 820-850 MHz.—***Dr. Om Gandhi, University of Utah,*** October 22, 1993.

...GTE believes that its wireless operations, as well as the industry more generally, have been and continue to be in compliance with the newly proposed RF guidelines. However, due to recent "press scares and media hype," consumers have become confused regarding the safety of exposure to RF radiation caused by wireless services. Agency action to formally adopt the new guidelines will foster public understanding by providing an official record regarding the substantial margin of safety as well as providing assurances for consumers of wireless technologies....—***GTE Service Corp.,*** January 25.

...Unjustified state and municipal restrictions could have particularly severe consequences in the area of mobile services. The FCC's farsighted efforts to encourage the development of cellular, PCS and other mobile services could be derailed by state regulations more onerous than scientific data warrants, inflamed by "press scares and media hype." Accordingly, GTE recommends that the commission promptly issue a further notice of proposed rulemaking to examine such inconsistent policies, with a view toward preempting those that interfere with the development of "a rapid, efficient, nationwide and worldwide wire and radio communications service...."—***GTE Service Corp.,*** reply comments, April 25.

...The 1992 ANSI/IEEE guidelines contain new recommendations regarding the maximum permissible exposure from induced and contact RF currents. This is an important topic that was not addressed in the former ANSI guidelines. However, I believe that a) there is bias favoring one type of instrument; b) limiting current measurements to the point of entry on the human body is not appropriate; c) the upper frequency limit for current measurements is not appropriate; and d) there is a relevant conflict of interest in the leadership of IEEE [SCC] 28....—***Dr. Mark Hagmann, Florida International University,*** January 10.

...[A]doption is recommended with four important conditions: 1) The commission should preempt, albeit on a limited basis, the promulgation by nonfederal agencies of RF standards that are more restrictive. 2) The commission should specify threshold distances for all classes and services of stations, beyond which no consideration of RF radiation effects need be made, but within which account must be taken of every such station. 3) The commission should standardize the measurement device interface and the minimum observer effective height for induced body current measurements. 4) The commission should hold in abeyance any requirement for measuring induced or contact body currents above 30 MHz until such time as reliable measurement devices are commercially available....—***Hammett & Edison Inc.,*** January 21.

...It should be recognized that there exists no credible evidence of harm to human beings resulting from exposure at levels specified in ANSI C95.1-1982....The ANSI/IEEE standard must be considered a "living document" because it is continuously under review....—***IEEE Committee on Man and Radiation*** (COMAR), undated.

...Any interpretation of the guideline that equates controlled environment with occupational exposure and uncontrolled environment with general population exposure is a distortion of the standard and should be avoided....[W]hen an excluded device meets the requirement of the controlled environment for the user/controller, who can be expected to be aware that the device emits an RF signal, the device also *ipso facto* satisfies the uncontrolled specification for the neighboring/adjacent nonuser....—***IEEE Standards Coordinating Committee (SCC) 28,*** undated.

...Apart from the fact that it is unknown whether certain subgroups of the population may be more at risk than others, it is our view that use of the "occupational" and "general population" designations provides even less certainty than use of "controlled" and "uncon-

trolled" environments. For example, under the uncontrolled category, ANSI/IEEE-1992 includes office workers in an industry that employs [RF] radiation as an important element of its business. Indeed, the definition of the uncontrolled environment specifies that the exposure may be in a workplace as well as in living quarters.... Virtually all hand-held communications devices operate in the range of 0.1 to 5 watts, which is well within the ANSI/IEEE low power exclusion limit for the controlled environment. An imposed restriction of the power of such devices, which members of the general population use by choice, could result in diminished communications range and increased risk to the general public, especially following criminal activities, accidents or natural disasters. As do the NCRP guidelines, the ANSI/IEEE-1992 guidelines also recognize the need for those who knowingly choose to operate hand-held radio transceivers to be classified as belonging to the controlled environment. It is important to note that both the NCRP and ANSI/IEEE guidelines would classify the use of a cellular telephone to be governed by the guidelines of the upper tier. Like the hand-held transceivers, the cellular telephone has become important to the safety and well-being of the public in emergency situations and many people buy them only for that purpose....The EPA comments to the FCC assert many times that the ANSI/IEEE-1992 guidelines ignore athermal biological effects and are based only on harmful thermal effects. However, it is clearly stated in the standards document that in the literature review that preceded the establishment of the guidelines, no preconceived assumptions were made concerning mechanisms, thermal or athermal....—***IEEE SCC28,*** reply comments, April 21.

...The commission should carefully balance the burden of preparing extensive unnecessary compliance showings against the remote possibility that facilities will actually exceed the standard. The record shows that such balancing strongly supports retaining the categorical exclusion for paging and cellular base stations and microwave relay stations. These facilities operate at low power levels and are subject to a number of engineering and practical constraints that severely limit the possibility of exceeding the ANSI/IEEE safety standard....The results of a recent study by Dr. Om Gandhi, a leading researcher in this field, demonstrate typical cellular hand-held phones in use today radiate at levels far below the requirements of the ANSI/IEEE standard. These results should reassure the public and the FCC that cellular hand-held phones are safe....McCaw requests the commission to initiate further proceedings in this docket to preempt state and local oversight over RF exposure from cellular facilities....—***McCaw Cellular Communications Inc.,*** January 25.

...The exposure limits applicable to the "uncontrolled environment" should be applied to users of cellular telephones, as well as to any members of the general public who may be near radio transmitters. Other similar services, such as a future [PCS], should likewise be included in the uncontrolled category. Those users included within the FCC Part 90 Private Land Mobile Radio Services, however, with the exception of certain [specialized mobile radio] users, should be governed by the limits applicable to the "controlled environment." The ANSI low-power exclusion provisions should be adopted by the commission. It may be necessary in some cases, such as for cellular telephones, to routinely measure the [SAR] because the 2.5 cm spacing requirement for application of this exclusion is not met. However, this exclusion will be applicable to other radio types, such as those used in the private land mobile radio services....—***Motorola Inc.,*** January 25.

...[I]n revising its rules, NAB urges the FCC to adopt implementation procedures and to interpret the revised standard...in a fashion that will minimize burdens on broadcasters (and other regulatees) yet still adhere to the standard's provisions....[W]e urge the FCC to continue the "three-prong" approach whereby stations generally will be able to avoid making actual measurements to assess and certify compliance. Instead, the majority of broadcasters should be able to determine their compliance through the use of charts and graphs....In adopting a revised RF radiation regulatory scheme, NAB urges the commission to adopt a rational interpretation of the "controlled" and "uncontrolled" environment provisions of the revised ANSI/IEEE standard and to incorporate reasonable and practical approaches to the regulation of human exposure to "contact" and "induced" currents....Also, and due to the difficulties—caused by the intervention of nonfederal authorities—that many broadcasters and other FCC regulatees are having in siting and employing FCC-authorized facilities, we believe that now is the time for the commission to confront squarely the need to adopt a lawful and effective policy of federal preemption. Absent such a policy, the frustration now experienced by many existing communications companies will be eclipsed by the effects of nonfederal opposition to the introduction of new communications technologies such as high definition television and the [PCS]. Indeed, the very implementation of such new technologies may be threatened unless the commission takes near-term action....—***National Association of Broadcasters*** (NAB), January 25.

...NIOSH is concerned about the lack of participation by experts with a public health perspective in the IEEE RF standards-setting process. For example, epidemiology studies were categorically rejected as not useful in the process of setting the ANSI/IEEE C95.1-1992 limits. This lack of public health perspective creates a weakness in the ANSI/IEEE C95.1-1992 standard that should be acknowledged by the FCC in adopting these guidelines for regulating occupational and environmental exposures to RF radiation....The provision of a two-tier standard based on "controlled" versus "uncontrolled" environments is problematic. The designation of controlled versus uncontrolled depends, in part, on the worker's knowledge of both the exposure level and the related health effects. It is extremely difficult to assess the level of a worker's "knowledge" and it is especially so when the standard does not provide any guidance on training programs or worker notification procedures. Therefore, the conservative public health approach would be to adopt only the more restrictive "uncontrolled environment" limits for all exposed workers and the general public. The exposure levels that would be set by the standard are based on only one dominant mechanism—adverse health effects caused by body heating. Nonthermal biological health effects have been reported in some studies and research continues in this area....The standard should note that other health effects may be associated with RF exposure and that exposure should be minimized to the extent possible. In general, the standard provides minimal guidance on control measures, appropriate medical surveillance, training, or hazard communication....—***National Institute for Occupational Safety and Health*** (NIOSH), January 11.

...With respect to the discussion on "controlled" vs. "uncontrolled" environment, Raytheon concurs with the standard as written which is based [on] the concept of "control" and not "type of population." Raytheon believes that the new standard is correct in rejecting the thesis that "certain subgroups of the population are more at risk than others" since that thesis has no basis in the scientific studies.... Raytheon believes that the FCC should continue its "categorical exclusions," particularly for applications such as marine radar which are unlikely to expose users at or above the guidelines of the new standard....Raytheon believe[s] the proposal to use more conservative guidelines in the presence of "modulation" should be rejected. There was no scientific rationale for this practice in the referenced NCRP guidelines authored in 1986 by a small group....—***Raytheon Co.,*** November 5, 1993.

Clippings from All Over

Fairly high fields are not terribly unusual. You get them on elevators, on subway trains; anything that has electrical machinery has electromagnetic fields associated with it. Using a hair dryer for three minutes, you could get as much EMF exposure as you would get... living in a house near a high power line.

—Dr. Imre Gyuk, program manager for electromagnetic research at the DOE, quoted in *Shape,* the magazine of "Mind and Body Fitness for Women," p.44, June 1994

It's interesting that at least in occupational studies, we seem to be showing a trend toward negative results—that is, that no significant problem is being proven.

—Robert McCourt, EMF issues manager for Public Service Electric & Gas (PSE&G), on the Thériault study, quoted in *PSE&G News* (NJ), an internal newsletter, April 15, 1994

An analysis combining the results of the three recently published Nordic studies taken together supported the link between magnetic fields and childhood leukemia. The emphasis should no longer be on blaming exposure misclassification for having decreased the observed relative risks but on further serious attempts to comprehend the effects of magnetic fields on human health.

—Dr. Pia Verkasalo of the Finnish Department of Public Health et al., reply to a letter from Alasdair Philips of the Scientists for Global Responsibility, U.K., *British Medical Journal, 308,* p.1163, April 30, 1994

Taken together, the occupational and residential studies done to date suggest that exposure to stronger-than-average magnetic fields may slightly increase the risk of developing some types of leukemia. The evidence for an association with other types of cancer is far less clear.

—"Electromagnetic Fields," *Consumer Reports,* p.356, May 1994

Many [home] buyers have begun predicating their purchase decisions on the results of EMF surveys conducted by independent engineers, environmental consultants and representatives of local utility companies. In the past year, for example, four local consultants provided more than 200 EMF surveys, while the Washington area's electric utilities—Pepco, Virginia Power and Northern Virginia Electric Cooperative—conducted nearly 1,100 EMF readings.

—"Magnetic Fields Are No Dreams to Some Buyers," *Washington Post,* p.E16, April 30, 1994

Our position is that we should stay with the protections against known hazards unless we receive conclusive proof [that EMFs pose a hazard as well].

—Jim Dushaw of the International Brotherhood of Electrical Workers, quoted in *EMF News,* a publication of the Edison Electric Institute, p.4, April 18, 1994

While the theory that EMF promotes or copromotes leukemia is plausible, it is not probable. Even if one assumes that EMF is capable of acting as a promoter, it is impossible to conclude that the exposure naturally and proximately caused Mr. Pilisuk's leukemia. Although Dr. [Peter] Wright believed that the claimant's initiated cells would not have progressed into leukemia "but for" his exposure to EMF, the doctor also admitted that a promoter alone could not cause cancer. According to the model set forth by Dr. Wright, the genetic damage caused in the initiation phase is essential to the development of cancer. While Ms. Pilisuk is not required to show that the exposure was the *sole* cause of her spouse's occupational disease, she must still show that EMF is *a* proximate cause of the claimant's leukemia.

—Linda Williams, industrial appeals judge, Board of Industrial Insurance Appeals, Washington State, *In re: Robert Pilisuk,* p.38, April 14, 1994

The first thing consumers should do when they look at numbers is ask themselves if they seem right. Persi Diaconis, a professor of mathematics at Harvard University, had this reaction when he heard about a study suggesting an association between electric razors and leukemia: "Aw, come on." It does not take a scientist to decide that some research makes sense and some does not.

—"If It Doesn't Make Sense, It Probably Isn't Sense," *Wall Street Journal,* p.B7, May 17, 1994

Federal case law [as in New York State] also supports the argument that the statute of limitations would not run in an electromagnetic field case until the full property value loss occurred.

—"Power Lines of Litigation," *New York Law Journal,* p.S12, March 14, 1994

In conclusion, the present knowledge from experimental and epidemiological research gives some support to the hypothesis that increased use of electrical power may increase breast cancer risk....If the increased risk of female breast cancer is due to some aspects of electric power use, it could have a large impact due to the prevalence of the exposure and the magnitude of the disease.

—Dr. Tore Tynes of the Cancer Registry of Norway, "Electromagnetic Fields and Male Breast Cancer," *Biomedicine & Pharmacotherapy, 47,* p.426, 1993

The Earth's magnetic field could have influenced the outcome of reactions that led to life, so that one form of essential molecules was favored over the other.

—Dr. Philip Kocienski of the University of Southampton, U.K., quoted in *Science, 264,* p.908, May 13, 1994

And most [of] the evidence has shown that questions have been raised, that there is at best a weak and inconsistent association with some forms of leukemia and EMFs. Association, that's all that has been shown. These are simply some of the associations that have been connected with lymphoma. We are not suggesting that hair dye causes non-Hodgkin's lymphoma. We are not suggesting that being a schoolteacher causes non-Hodgkin's lymphoma, nor the fact that one is a health insurance clerk or a bank cashier. These are simply associations which have been developed over the years by scientists. And if you'll look at the odds ratios here, you'll see some of them, messenger, just a messenger in the food business has got a 4.3 risk ratio. Health insurance clerk, 3.2...risk ratio, high consumption of milk, 3.4. Compare those with the associations on EMFs and leukemia and you'll see that the EMF leukemia risk is lower. If you compare it with those studies on non-Hodgkin's lymphoma, you'll find that those studies really come up to about 1.0 or null. At best, as I say, questions have been raised which the plaintiffs want this jury in this courtroom to resolve, whereas the best minds in the scientific world haven't been able to do so. This is a challenge that's been thrown at you, and I submit it is an unfair challenge.

—Robert Pennington of Troutman Sanders, closing argument for Georgia Power in *Jordan v. Georgia Power Co.,* May 9, 1994

CANCER CLUSTER

Newsroom EMF Assessment... After a brief investigation, NIOSH has concluded that a cluster of brain tumor cases at the editorial offices of the *St. Louis Post-Dispatch* is "unlikely" to be related to the newspaper's physical environment. NIOSH measured EMFs in the paper's fifth-floor newsroom, finding magnetic fields of 3.23-9.79 mG in the middle of the room. Gene Moss, a NIOSH industrial hygienist who coordinated the measurements, told *Microwave News* that these fields were "obviously" due to a cable running through the middle of the newsroom. In other parts of the room, the fields were lower—0.88-1.90 mG. In its final report, NIOSH noted that these levels were "relatively low" but added that the "exposure of building occupants could be reduced." Bill Allen, a *Post-Dispatch* science writer, performed a preliminary EMF survey in the newsroom last year, finding levels as high as 80 mG near the floor in some places. After NIOSH released its findings, Allen told *Microwave News* that he still hopes "the company will do something to reduce the fields, as a measure of prudent avoidance." Similarly, Dave Eisen, the Newspaper Guild's research and information director in Silver Spring, MD, urged that "steps be taken to eliminate" the source of the EMFs. In a telephone interview, Michael Hammett, the director of industrial relations at the *Post-Dispatch,* said that NIOSH had given the paper a "clean bill of health" and that he did not plan to do anything further. NIOSH noted in its report that the newspaper's management had indicated that older VDTs were being replaced by newer, low-emission terminals and called this effort "appropriate." At least seven people, all of whom had worked in the newsroom, have been diagnosed with cancer (see *MWN,* S/O93). Contrary to initial reports, however, NIOSH found in a review of medical records that not all the cases were primary astrocytomas. The NIOSH report did not indicate whether the number of cancer cases identified at the paper was larger than would normally be expected. Dr. Bruce Bernard, the NIOSH epidemiologist who wrote the report, told *Microwave News* that there were not enough cases to do such an analysis. Copies of *Health Hazard Evaluation Report, HETA 93-0969-2389, St. Louis Post-Dispatch, St. Louis, Missouri,* February 1994, are available from: NIOSH, 4676 Columbia Parkway, Cincinnati, OH 45226, or National Technical Information Service, 5285 Port Royal, Springfield, VA 22161, (800) 553-6847. In 1992, NIOSH performed an investigation of a brain cancer cluster at the Ford House Office Building in Washington and the possible link to building EMF exposure, publishing a report with very similar conclusions (see *MWN,* M/A93).

MEETINGS

Euro Electromagnetics... The *International Symposium on Electromagnetic Environments and Consequences,* to be held in Bordeaux, France, May 30-June 4, will feature a number of papers on high-power microwaves (HPMs). A special plenary session on "EMP and HPMs in Russia" will have presentations by three members of the Russian Academy of Sciences, including Dr. G.A. Mesyats, a vice president of the academy. At another session on HPM sources, Dr. A.B. Prishche-

penko of the Russian Institute for Central Scientific Research will speak on the role of RF weapons on the battlefield of the future (see also, *MWN,* N/D93). Dr. Ted Litovitz of Catholic University in Washington will give a plenary lecture on "Do Weak EMFs Cause Bioeffects? Why Is There Such Skepticism? What Are the Possible Answers?" and Dr. Bernard Veyret of the University of Bordeaux is organizing a number of talks on bioeffects by researchers from India, Israel, Japan, Poland, Russia, Switzerland and Taiwan. For more information, contact: Délégation Générale pour l'Armement, Direction des Recherches, Etudes et Techniques, Centre d'Etudes de Gramat, 46500 Gramat, France, (33) 65105432, Fax: (33) 65105433.

OCCUPATIONAL HEALTH

ELF and VDT EMF Booklets... The International Labor Organization (ILO) has published two EMF exposure protection guides, prepared by the International Radiation Protection Association's International Non-Ionizing Radiation Committee (INIRC). The first, *Protection of Workers from Power Frequency Electric and Magnetic Fields: A Practical Guide* (1994, 81 pp., $16.00), a thorough and technical discussion of how electric and magnetic fields can affect humans, is intended for utility workers. Topics range from the ability of strong ELF magnetic fields to cause magnetophosphenes (the perception of flickering lights) to the potentially lethal shocks that can occur in strong electric fields. The possibility of an elevated risk of cancer from long-term magnetic field exposure is covered in a few pages, and there are no recommendations about avoiding low-level fields. According to the booklet, increased risks of leukemia and brain tumors due to EMF exposure "have been considered," but studies are inconsistent. "The current state of knowledge does not permit an estimate of the risk...." Though the booklet was published this year, the 1992 Swedish epidemiological studies (see *MWN,* S/O92) and other, more recent efforts are not included. Specific numerical values for EMF exposure are taken from the guidelines the INIRC completed in 1989 (see *MWN,* M/J89 and J/F90). These were reaffirmed in 1993 by the successor to the INIRC, the International Committee on Non-Ionizing Radiation Protection, which was created in 1992 (see *MWN,* J/A92 and M/J93). The working group that wrote the booklet included Drs. Jürgen Bernhardt and Martino Grandolfo (cochairs), Annette Duchêne and Jan Stolwijk. The second booklet, *Visual Display Units: Radiation Protection Guidance* (1994, 53 pp., $12.00), is a shorter report for those who use VDTs. It was written by a working group that included Drs. Bengt Knave (chair), Ulf Bergqvist, Michael Repacholi, Jan Stolwijk and Maria Stuchly. Health research regarding possible adverse effects on pregnancy, skin and the eyes is discussed, along with other topics such as musculoskeletal disorders. On pregnancy, the group states: "Experimental studies, while showing a diverse outcome, have as a whole failed to demonstrate an effect on reproductive processes in magnetic field situations resembling those around [VDTs]." Both booklets are available from: ILO Publications Center, 49 Sheridan Ave., Albany, NY 12210, (518) 436-9686; all orders must be prepaid,

including postage and handling charges of $3.00 for the first booklet, 50¢ for each additional booklet.

OVENS

***Salmonella* Survives Uneven Heating...**A group of Alaskans who used microwave ovens to reheat roast pork that they had brought home from a community picnic became ill with salmonellosis, while those who used conventional ovens did not, according to a study in the May 1 *American Journal of Epidemiology (139,* pp.903-909, 1994). Most people who ate the meat without reheating it also fell ill. Dr. Bradford Gessner of the CDC in Atlanta and Dr. Michael Beller of the Alaska Department of Health and Social Services in Anchorage identified the pork as the source of the illness with both case–control and cohort studies. Although they could not determine how the meat had first become contaminated, they concluded that the *Salmonella* had proliferated because the meat was underdone when first cooked and had been left unrefrigerated for at least 17 hours during preparation and shipping from a Seattle restaurant. Gessner and Beller speculate that conventional ovens have a "protective effect" because they heat food more evenly than microwave ovens. Meat cooked in a microwave oven may be underheated in places, particularly on the surface, allowing bacteria to survive, they note. Others have warned about the risks from incomplete cooking in the past (see *MWN,* Jun81, Ap82, S/O88, M/A89 and M/J90). Gessner and Beller recommend that health officials "consider the role of microwave ovens when investigating outbreaks of salmonellosis or other illness caused by enteric pathogens." The FDA recommends that when using a microwave oven meat should be cooked to an internal temperature 25˚F higher than when using a conventional oven. The Department of Agriculture (USDA) has often referred to the tendency of microwave ovens to leave cold spots in food. The USDA offers advice on how to use a microwave oven safely on its meat and poultry hot line: (800) 535-4555.

TRADE ASSOCIATIONS

EEPA Drops the P... In May, the Electromagnetic Energy Policy Alliance changed its name to the Electromagnetic Energy Association (EEA) and announced a "new organizational focus." In addition to the lobbying efforts it has undertaken since its founding in 1984 (see *MWN,* Mr84), EEA now intends to develop safety standards for non-ionizing electromagnetic radiation emissions from products such as cellular telephones and VDTs. The organization has applied to the American National Standards Institute (ANSI) for accreditation, according to Dinah McElfresh, EEA's executive director. EEA also plans to begin "an extensive public education effort in support of EMF safety." The new activities "are a response to a barrage of negative publicity in 1992 and 1993," McElfresh told *Microwave News,* citing the controversy over cellular phone safety in particular. "We have seen the effect the opposition can have when supported by the media," she said. EEA's current chair is Jesse Russell of AT&T Bell Labs. Other companies represented on its board include: Apple Computer, General Electric, GTE, Motorola and Raytheon.

CLASSIFIEDS