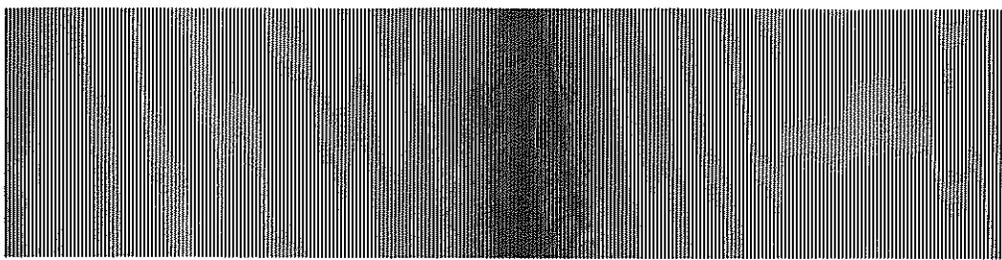


# MICRO WAVE NEWS



Vol. XIII No. 5

A Report on Non-Ionizing Radiation

September/October 1993

## INSIDE...

### EMF NEWS pp.2-7

#### Power Line Talk:

**CIRRPC Experts Flunk Out at NAS-NRC Workshop • Second Leukemia Case near Studholme Home in U.K. • Epidemiology Papers, Published and Forthcoming • Staff Changes at DOE, Energetech, EPA, EPRI and HEI**

#### Landowners Win Appeal in Marcy-South Case

**Reviews of Paul Brodeur's**

**The Great Power Line Cover-Up**

**Finnish Childhood Cancer Study: No Link Reported; Other Epidemiologists Unsure**

**Brain Tumors at St. Louis Newspaper**

**NHL Suit Set for Trial in November**

**Zuidema Case Closed**

**Effects of EMFs on Property Values:  
Four Noteworthy Cases**

### HIGHLIGHTS pp.7-12

**Federal Officials Boycott CTIA Meeting on the Health Effects of Cellular Phones**

**GAO Preparing Cellular Phone Report**

**Police Radar Suits After Bendure:  
Cases Dropped, Cases Filed**

**Table of Police Radar Cases**

**Phillips Lab Guidelines for RF/MW Exposures**

**Dr. Cletus Kanavy's White Paper on the Biological Effects of RF/MW Radiation**

### FROM THE FIELD pp.13-14

**JASONS on EMFs and Health**

### UPDATES pp.16-18

**Florida Health Department To Investigate ALS Cluster near Radar • U.K. Controversy over Phased Array v. Scanning Radars • VDT Health Research Center Holds EMF Workshop, Awards Research Grants**

### CLASSIFIEDS pp.15-20

## ANSI RF/MW Standard Challenged U.S. Air Force and Hughes Units Adopt Limits up to 100 Times Stricter

A research group at the Kirtland Air Force Base in New Mexico has adopted guidelines for human exposures to radiofrequency and microwave (RF/MW) radiation that are much stricter than those developed by the Institute of Electrical and Electronics Engineers (IEEE) and endorsed last year by the American National Standards Institute (ANSI). This follows a similar decision by a group at the Hughes Aircraft Co., a major military contractor and a subsidiary of General Motors Corp.

Taken together, these moves could undermine the dominance of the ANSI C95.1 standard, which, in the absence of official government limits, has been the de facto U.S. standard for more than 25 years. A loss of confidence in the ANSI/IEEE standard would have serious implications for the evaluation of the safety of cellular phones and towers, civilian and military radars, radio and television broadcast antennas and the many other sources of RF/MW radiation.

In June, Dr. Brendan Godfrey, the director of the Advanced Weapons and Survivability Directorate (AWS) at Kirtland's Phillips Laboratory, instituted a policy that limits exposures to  $100 \mu\text{W}/\text{cm}^2$  for 30 MHz to 100 GHz. The Phillips guidelines are similar to those adopted by the Johns Hopkins University Applied Physics Lab (JHU-APL) in 1984 (see *MWN*, D84). The 1992 ANSI limits are, by contrast, frequency-specific: They allow occupational exposures ten times greater between 100 MHz and 300 MHz and up to 100 times greater above 3 GHz.

(continued on p.10)

## U.S. Air Force v. U.S. Air Force: Labs at Odds over RF/MW Health Risks

The U.S. Air Force's Armstrong Laboratory in San Antonio has consistently maintained that electromagnetic radiation cannot cause nonthermal effects and has disputed all claims to the contrary. So it is surprising that one of the strongest challenges to this view has come from another group within the Air Force—the Phillips Laboratory at Kirtland Air Force Base in New Mexico.

Dr. Cletus Kanavy, a bioeffects researcher at the Phillips Lab, has no doubts that nonthermal effects occur. "It is absolutely 'shocking' to hear the Armstrong Laboratory ([Dr. David] Erwin) deny the existence of any biological effects which are not thermal," Kanavy wrote in a memo to his superiors last year. "Something is drastically wrong here."

To support his claims, Kanavy prepared a White Paper on the biological effects of RF/MW radiation in which he concluded that "a comprehensive search of [the] worldwide literature" found that "a large amount of data exists... to support the existence of chronic, nonthermal effects." He also stressed that

(continued on p.11)

## « Power Line Talk »

When the **National Academy of Sciences-National Research Council's** (NAS-NRC) new EMF committee invited three scientists to give tutorials on biological effects at its first public meeting in Washington, September 22-23, some observers were surprised that all three were members of the White House **CIRRPC** panel, which, in a report last fall, dismissed EMFs as a potential health risk (see *MWN*, N/D92). That all three—Dr. **Joseph Brady** of the Johns Hopkins University in Baltimore on behavior, Dr. **Robert Brent** of the A.I. duPont Institute in Wilmington, DE, on reproduction and Dr. **Gary Stein** of the University of Massachusetts, Worcester, on cellular growth and regulation—re-stated CIRRPC's conclusions was predictable. But what dismayed many members of the committee, as well as a number of others in the audience, was how little the three knew about EMFs. Practically every time they were asked to cite specifics on a particular study—the type and intensity of the exposure, for instance—they were at a loss. Stein, for one, was repeatedly stumped by the committee's questions. Brady and Brent peppered their talks with advice. "Keep your names and addresses out of the published literature," Brady suggested as a way of avoiding the calls and letters that EMFs inevitably prompt from the press and the public. Brent advised the committee not to worry about EMFs at the expense of "real" public health problems, such as alcohol consumption by pregnant women. When Brent flashed a slide showing the increase in power generation in the 20th century, with no parallel increase in the rates of birth defects over the same period, some of the epidemiologists on the committee grimaced. "This has become one of the myths of the EMF health debate—it's distracting and not helpful," one committee member commented privately afterwards. Brent raised the most eyebrows when, at the end of his talk, he interjected, "I have chosen not to be an advocate. I don't take a position." Later, one incredulous committee member countered: "He was the biggest advocate we heard." By the time Brent reached the end of his talk, patience was running short. The CIRRPC panel was "the most wonderful committee I have been on," Brent said, adding that, "If you have to disassociate yourself from us..." Before he could complete his thought, DOE's Dr. Imre Gyuk, the project officer for the academy committee, finished it for him: "Please do," he said. The following day, the committee met

### **NY Landowners Win Appeal**

As we go to press in early October, the New York state Court of Appeals, the state's highest court, has ruled that landowners should be compensated by the New York Power Authority (NYPA) for losses in property value due to power line EMFs, regardless of whether the health risk is real or simply perceived. "This decision could pave the way for the other claims against the NYPA," Michael Rikon, the landowners' New York City-based attorney, told *Microwave News*. The case has been sent back to the Court of Claims, where damages, if any, will be decided. (For more on the Marcy-South power line, see *MWN*, M/A87, S/O89, J/F90 and N/D92.)

in closed session and decided that they will seek others to fill in the gaps left by the CIRRPC crew, according to a number of those present. One member of the NAS-NRC committee sees a silver lining: "It was so obvious that they had no understanding of this body of research that it's clear that our committee has a contribution to make."

«« «»»

A neighbor of the **Studholme** family in the U.K., which filed a suit against a local utility, Norweb, alleging that EMFs caused their son's leukemia (see *MWN*, J/A93), also died of the disease, according to British news reports. Norman Schofield, of Manchester in northern England, lived three doors away from Simon Studholme, who died last year at age 13. The Schofields, whose home is identical to the Studholmes', slept in the same front bedroom as the boy—just one foot away from the household electricity meter, according to the August 26 *Bolton Evening News*. Schofield was 47 years old when he died of acute myeloid leukemia in 1989. His widow, Mavis Schofield, told the paper that she plans to watch the Studholme case carefully. The Studholmes believe that their claim will be strengthened by this new information, according to the September 1 *Daily Star*. Their case has already received considerable public attention and is credited with influencing a nearby town to reconsider a planned move of a substation. The August 28 *New Scientist* argues that Norweb is unlikely to lose the case since the link between EMFs and cancer is "tenuous" and the company operates within national guidelines. "But at the same time," the editorial states, "it is surely right to argue that they should inform their customers about the latest research." The BBC's Panorama program—which last ran a major piece on power lines in 1988 (see *MWN*, J/F88)—is also investigating the story.

«« «»»

Some eagerly awaited papers are now in print. Dr. **Anders Ahlbom** and **Maria Feychting's** childhood cancer epidemiological study appears in the October 1 issue of the *American Journal of Epidemiology*. The other Swedish report, the occupational study by Dr. **Birgitta Floderus** and coworkers, is in the September issue of *Cancer Causes and Control*. And the Danish childhood study by a team led by Dr. **Jørgen Olsen** is published in the October 9 *British Medical Journal (BMJ)*—the same issue also features the new Finnish study (see p.4). In an accompanying editorial in *BMJ*, Dr. Gerald Draper, director of the U.K. Childhood Cancer Research Group in Oxford, writes: "The possibility that magnetic fields associated with electricity transmission may cause some cases of childhood cancer cannot be dismissed, but the lack of consistency among published studies, and the absence of an accepted biological explanation for such a relation, means that we have to conclude that at present no causal relation has been established." In contrast, at the NAS-NRC workshop (see above), Ahlbom concluded that, on looking at all the studies together, "I personally find the results to be fairly consistent." (For our coverage of the two Swedish studies, see *MWN*, S/O92; for the Danish study, see *MWN*, N/D92)....But the waiting continues for the

## Reviews of Paul Brodeur's *The Great Power Line Cover-Up*

Excerpted below are reviews of Paul Brodeur's new book, *The Great Power Line Cover-Up: How the Utilities and the Government Are Trying To Hide the Cancer Hazard Posed by Electromagnetic Fields* (304 pp., \$21.95), published this September by Little, Brown and Co. in New York City.

This important, riveting exposé deserves an even wider audience than Brodeur's previous book on the subject, *The Zapping of America*.... This urgent book should be on Al Gore's desk as he tackles environmental health problems, and on Hillary Rodham Clinton's bookshelf as she reorders national health priorities.

—Publishers Weekly, July 12, 1993.

Perhaps EMFs, which emanate from power lines and electric appliances, are deadly. The problem is that many, many respected scientists believe that, at worst, EMFs probably pose a very low risk of increased disease. Yet even careful lay readers of Brodeur's book would not get that impression. Brodeur's is a rabid advocate's case against EMFs, to my mind just within the bounds of journalistic license. His is an attack so factually detailed, so relentless that the reader is almost battered into agreement.... His basic tactic is to emphasize the findings that suggest EMFs are a hazard, and to dismiss or ignore negative findings.... In his book, Brodeur flips aside with the ease of a judo master one renowned scientist after another who disagrees with him on EMFs.

—Joel Lang, *Hartford Courant*, September 9, 1993.

...Brodeur deserves credit for drawing the public's attention to another possible threat, but his work would be far more persuasive if it were less polemical and more evenhanded. In the Fresno case, for example, he gives no hint of having talked with the state health officials who were grappling with an emotional issue.... He also dismisses out of hand certain EMF studies by respected university researchers just because they were funded by [EPRI].... The very existence of such investigations would seem to refute Brodeur's assertion of an industry cover-up, since it's hard to imagine that academic scientists would risk their careers and reputations by publishing questionable data in professional journals to please a benefactor. Yet even if Brodeur doesn't make a convincing case for the cover-up, he is certainly right in one important respect: For too long we've accepted the presence of power lines and other EMF sources in our midst without really examining their possible influence on public health. Flawed though it is—by a lack of documentation, by too many repetitions, by the absence even of a really good explanation of EMF—Brodeur's book surely deserves to be read, carefully and skeptically.

—Frederic Golden, *San Francisco Chronicle*, September 19, 1993.

While Brodeur's arguments make for chilling reading, it's nonetheless hard to judge whether all the official dodging and weaving is a well-orchestrated conspiracy, or just more of the friendly regulation the power industry has often enjoyed. But that makes Brodeur's calls for preventive action no less compelling. In discussing the potential health risks of electromagnetic radiation, Brodeur draws a parallel to tobacco. It too is widely acknowledged to be an agent that causes cancer, even though no one knows exactly how. Whether magnetic radiation poses the same peril is still open to question. But if Brodeur's volume provokes more intense and honest questioning, it will have served its mission well.

—William Glasgall (senior writer at *Business Week*),  
*New York Newsday*, September 26, 1993.

After reading *The Great Power Line Cover-Up*, the only thing I am convinced of is that author Paul Brodeur truly believes that electromagnetic waves from power lines cause cancer.... Brodeur is understandably outraged at the authorities' cavalier behavior. However, his dismissals of scientific literature are even more cavalier as he builds a case against the power companies by fixating on a single part of a complicated technological situation—the magnetic fields.... [I]njured parties are beginning to bring their cases to court. He predicts an avalanche of such cases, and I hope he is right. We need to spend whatever is necessary to investigate with greater imagination and rigor the ramifications of living in an electrically powered world.

—Bettyann Kevles, *Los Angeles Times*, September 28, 1993.

[Brodeur] not only warns of a looming cancer epidemic, but also accuses government officials, utility executives, even the nation's top newspapers, of hiding the threat.... Well, don't head for the log cabin just yet. A little knowledge of the controversy, or even a close perusal of the book, turns up enough inconsistencies, dubious interpretations, and selective reporting to cast immense doubt on the whole argument—and to reveal Brodeur as a more zealot than journalist. That's too bad, because there's a need for an unbiased assessment of the dozens of often contradictory studies of power line exposure.... *The Great Power Line Cover-Up* repeatedly strains credulity. It's difficult to believe that any single factor can cause the long list of ailments Brodeur attributes to [EMFs].... Brodeur's charges of a cover-up are similarly unconvincing.... *The Great Power Line Cover-Up* is an odd beast. The new evidence it purports to present is too weak to have much impact on policy, and as an exposé, it's remarkably lame. What's left is merely a good read that needs to be approached with a sturdy dose of skepticism.

—John Carey, *Business Week*, October 4, 1993.

U.S. and Canadian-French occupational epidemiological studies, which were originally due at the end of this year. Dr. David Savitz now predicts that his study of U.S. workers will be released in March or April, with publication scheduled a week or two later. And Dr. Gilles Thériault said that his study is completed and that he submitted it for publication at the end of September. At last word, he was waiting to hear from the reviewers.

««« »»»

Dr. Charles Powers, the founder of the Health Effects Institute (HEI) in Cambridge, MA, who became acting president when

Dr. Andrew Sivak left in March 1992 (see *MWN*, M/J92), has resigned. Two senior staffers, Drs. Jane Warren and Kathleen Nauss, are now serving as acting co-executive directors. A search committee has been formed to select a new president.... Lynne Gillette has left EPA's Office of Radiation and Indoor Air to join DOE's Office of Energy Management, where she will continue to work on EMF issues.... Dr. Luciano Zaffanella has opened the East Coast office of Enertech Consultants in Lee, MA. Previously, Zaffanella was at the EPRI/GE High Voltage Transmission Research Center in Lenox, MA. Enertech's headquarters are in Campbell, CA.

## **Finnish Childhood Cancer Study: No Link Reported; Others Unsure**

Finnish researchers have concluded that they failed to find an excess cancer risk among children living near high voltage power lines. But other epidemiologists say that the Finnish results are consistent with past studies that show an EMF-cancer link.

"Our study shows no significant excess of leukemia, lymphoma or cancers overall in children exposed to residential magnetic fields," Dr. Pia Verkasalo of the department of public health at the University of Helsinki and coworkers wrote in their paper, published in the October 9 issue of the *British Medical Journal*.

Verkasalo's group investigated the incidence of cancer among children under 20 years of age who lived within 500 meters of 110, 220 or 400 kV overhead power lines between 1970 and 1989. Using a technique similar to the one used by Sweden's Maria Feychting and Dr. Anders Ahlbom (see p.2 and *MWN*, S/O92)—though developed independently—and data from the major Finnish power company, Imatran Voima Oy, the Finnish team calculated the magnetic fields in the children's homes for the years they were exposed.

Of the 134,800 children in the study, 140 had some type of cancer. Eleven of the children with cancer—five with nervous system tumors and three with leukemia—were exposed to 2 mG or more. These children had approximately double the rates of leukemia and nervous system tumors, but in each case the excess was not statistically significant. There was a 50% greater incidence of all cancers among those exposed to 2 mG or more, but here again, the result fell short of statistical significance.

"We think of this as a negative study," Verkasalo told *Microwave News*, but she added that she could not rule out the possibility of a small increased risk. A number of American and Swedish epidemiologists who heard Verkasalo present these results at the 5th Conference of the International Society for Environmental Epidemiology, held August 15-18 in Stockholm, Sweden, interpret her findings differently.

"It is clear to me that their results are fairly consistent with the other studies showing effects," Ahlbom, of the Karolinska Institute in Stockholm, said in an interview. When asked if there was a conflict between Verkasalo's findings and those he reported with Feychting last year, Ahlbom replied, "Not at all."

Similarly, Dr. David Savitz of the University of North Carolina, Chapel Hill, told *Microwave News* that, "The overall pattern is entirely consistent with the Swedish results."

Both Ahlbom and Savitz stressed that the lack of statistical significance could be due to the small number of cases—there were fewer than in the Swedish study. Savitz noted that, "The Finnish study is so small that to achieve statistical significance, [the EMF-cancer risk] would have to be a huge effect." Verkasalo responded that her study could have detected a two- to threefold relative risk.

Verkasalo said that she is aware of Ahlbom's and Savitz's arguments. But, she added, "No link between magnetic fields and childhood cancer has been confirmed in previous epidemiological or biological studies—I don't think our study changes this, though the basic question of magnetic fields and cancer is still open."

Ahlbom and Verkasalo are collaborating in an effort to combine their data sets to increase the reliability of their risk estimates. "There are some differences that may make it difficult," Ahlbom cautioned. He pointed out that he and Feychting had done a case-control study, while Verkasalo did a cohort study.

The Finn's method of estimating magnetic field exposures is described in a paper published in *Electricity and Magnetism in Biology and Medicine*, M. Blank, ed. (San Francisco: San Francisco Press, 1993), pp.426-430.

## **Brain Tumors at St. Louis Paper Prompt Requests for EMF Study**

The National Institute for Occupational Safety and Health (NIOSH) will do a preliminary investigation of a brain tumor cluster at the *St. Louis Post-Dispatch* in Missouri at the request of The Newspaper Guild (TNG). At least seven people, all of whom worked in the paper's fifth-floor newsroom, have been diagnosed with brain tumors since 1982; five of them have died, according to local guild officials.

"The brain tumor cluster at the *Post-Dispatch*—where high EMF readings have been reported—must be investigated," Dave Eisen, TNG's research and information director, in Silver Spring, MD, told *Microwave News*.

Investigations of previous cancer clusters in other office buildings have included the measurement of magnetic fields, but none determined that there was a connection between the two (see *MWN*, M/A93). The surveys were prompted by the more than 12 epidemiological studies that linked EMFs to brain tumors (see *MWN*, M/A90). Last year, an Australian study found that women who worked at cathode ray tube (CRT) computer monitors developed brain tumors at nearly five times the expected rate (see *MWN*, J/A92).

To date, there has not been a systematic survey of magnetic fields in the St. Louis newsroom. But Bill Allen, a *Post-Dispatch* science writer who did a special report on EMFs for the paper earlier this year, has taken a small sample of readings. He found telephone lines and power cables underneath the raised floor of the newsroom which he said are causing localized, high EMFs. For example, on the floor by the city desk, magnetic fields reached 80 mG. At lap level they measured 23 mG and at head level they were 11 mG, Allen said, noting that there were no video display terminals within five feet of where he took these measurements.

Meanwhile, tension at the paper has been growing over how to proceed. The local guild chapter has been seeking a government study of the cancer cluster for more than two years, but *Post-Dispatch* management has refused to cooperate. Recently, the publisher agreed to a study by a private group, according to the local's executive secretary, Herb Goodrick.

Published reports indicate that the *Post-Dispatch* has asked Washington University in St. Louis to investigate. Michael Hammett, the *Post-Dispatch*'s director of industrial relations, declined to comment, while Nicholas Penniman and Foster Davis, publisher and managing editor, respectively, did not return telephone calls seeking confirmation. Joni Westerhouse,

a spokeswoman for the Washington University School of Medicine, said that she could not say whether the university has an agreement with the paper.

NIOSH's Dr. Bruce Bernard, based in Cincinnati, said that the agency will most likely commit to a full-blown investigation but that it needs evidence that the majority of the *Post-Dispatch* staff members had primary brain tumors that were of a similar type. Bernard cautioned, however, that cancer cluster investigations generally do not yield answers when the study populations are small—as at the *Post-Dispatch*—and said that determining what EMF levels people were exposed to in the past could prove difficult. "If you measure today you may not show what was occurring 10 or 15 years ago," he said. The guild turned to NIOSH—which does not need permission from the paper to become involved—after *Post-Dispatch* management refused to agree to a study by the Missouri Department of Health.

"With the proportion of brain tumors of one sort or another, whether primary or not, I suspect that there is something that connects them; something in the workplace that creates this susceptibility," Jane Heitman, one of the two brain tumor survivors, told *Microwave News*. Heitman, who began working at the paper in the fifth-floor newsroom in 1973, was diagnosed with a brain tumor in 1982 at the age of 49. The other brain tumor survivor had been working there for ten years when he was diagnosed, while reports indicate that all five who died had worked at the paper for between 15 and 31 years.

## Second EMF—Cancer Suit Set for November Trial in Georgia

The argument that power line magnetic fields cause cancer will be tested once again when the second EMF personal injury suit goes to trial on November 29. Lawyers for a woman with non-Hodgkin's lymphoma (NHL) say that their case is very different from the Zuidema lawsuit, which involved Wilms' tumor and was rejected by a jury last spring (see box above and *MWN*, J/A91, N/D92 and M/J93).

Lawyers for Nancy and Larry Jordan and their children, who live in Douglasville, GA, will seek to prove that Oglethorpe Power Co. and Georgia Power Co. are responsible for Nancy's condition. The utilities operate 230 kV and 46 kV lines, respectively, which are strung on a pole within 45 feet of the Jordans' bedroom, according to one of the family's lawyers, Bruce DeBoskey of Silver & DeBoskey in Denver, CO.

"These utilities can no longer stick their heads in the sand and deny the existence of any adverse health effects, including Nancy Jordan's cancer," DeBoskey told *Microwave News*. The suit charges negligence, trespass, nuisance and fraud, and asks for \$5 million in compensatory and punitive damages. It was filed in Superior Court for Douglas County, GA, on July 24, 1991 (see *MWN*, S/O91, M/J92 and J/A92).

"Oglethorpe's position is that EMFs on the Jordans' property did not cause [Nancy's] disease or otherwise damage the Jordans' property," said James Orr of the Atlanta firm of Sutherland, Asbill & Brennan. Orr is representing Oglethorpe, which is based in Tucker, GA. Georgia Power's attorney, Robert Pen-

## Zuidema Request for New Trial Denied; Case Closed

Attorneys for the Zuidema family have failed to reopen their case against San Diego Gas & Electric Co. (SDG&E). On August 27, a California superior court judge in San Diego denied their request for a new trial. The deadline for an appeal to a higher court passed in late September and representatives for both sides now say the case is closed.

In a July 12 motion, Michael Withey, the Zuidemas' attorney, argued that the court had "committed several errors in law which prejudiced the plaintiffs' case, resulting in a verdict for the defendant." In an interview with *Microwave News*, Withey pointed, in particular, to the court's decision to bar his expert witnesses from discussing the scientific studies on which they based their opinions of an EMF—cancer link. The Zuidemas had claimed that their daughter's kidney cancer was caused by her exposure to power line EMFs (see *MWN*, J/A91, N/D92 and M/J93).

The court disagreed. In her written order, Judge Judith Haller said that the Zuidemas' attorneys had failed to show that the court had prejudiced the case against their clients.

SDG&E applauded Haller's order. "The judge's rejection of the motion confirms that the plaintiffs were given every opportunity at the trial to show that EMFs can make people sick, and the jury resoundingly rejected this in a very speedy verdict," said Greg Barnes, an SDG&E attorney.

nington of Troutman & Sanders in Atlanta, said that "the plaintiffs' case—that power line EMFs caused [Nancy's] cancer—will not be proven."

Magnetic fields in the Jordans' home range from 4 to 30 mG, DeBoskey said. Nancy moved into the house in 1983 and was diagnosed with breast cancer in 1986 and with NHL in 1989. Her lymphoma is now in an advanced state, according to her family. The breast cancer is in remission, DeBoskey said.

Several of the expert witnesses who testified in *Zuidema v. San Diego Gas & Electric Co.*—Drs. Bruce McLeod, David Ozonoff and Peter Wright—will also appear on the Jordans' behalf, as will Dr. David Carpenter, dean of the School of Public Health at the State University of New York in Albany, DeBoskey said. This marks Carpenter's first appearance as an expert witness in a trial. He was executive secretary of the New York State Power Lines Project's scientific advisory panel, which sponsored David Savitz's landmark study of childhood cancer and EMFs (see *MWN*, N/D86 and J/A87). The Jordans' other witnesses are Dr. Arthur Frank, chairman of the Department of Preventive Medicine and Environmental Health at the University of Kentucky School of Medicine in Lexington, Dr. Ben Johnson of Ben Johnson & Associates in Tallahassee, FL, and Roy Martin, an electrical engineer in Atlanta.

Neither Oglethorpe's Orr nor Georgia Power's Pennington would say who they will use as expert witnesses. DeBoskey said that their experts could include: Dr. Scott Baker, formerly of the Environmental Protection Agency; Dr. Richard Bland, a clinical radiation oncologist in Carrollton, GA; Dr. Edwin Carstensen of

the University of Rochester, NY; Dr. Philip Cole of the School of Public Health at the University of Alabama, Birmingham; Fred Dietrich of Electric Research and Management Inc. in Pittsburgh; and Dr. Saul Rosenberg of Stanford University Medical Center in Palo Alto, CA. Carstensen, Cole and Dietrich have testified on behalf of a number of utilities (see *MWN*, M/A93), while Rosenberg testified for Kustom Signals Inc. in the first police radar suit (see *MWN*, J/F93).

Last spring, Trial Lawyers for Public Justice, a public-interest legal group in Washington, drew attention to the Jordan case when it moved to block Oglethorpe's request for a protective order that would have permitted the utility to keep certain documents out of the public file. The utility later withdrew its request (see *MWN*, M/J92 and J/A92).

### **The Effect of EMFs on Property Value: Four Noteworthy Cases**

Across the country, utilities seeking rights-of-way (ROWs) for new power lines are faced with landowners who want compensation for losses in property value due to EMFs. In at least two cases, juries appear to have rejected the landowners' claims, deciding that the real estate market has not been affected by the EMF issue. But, in a third condemnation case, involving the Bonneville Power Administration (BPA), the property owners' attorney has claimed a victory. A fourth case is pending. (See also, p.2.) A review of these cases follows:

#### **Redding, CA**

The Transmission Agency of Northern California (TANC) will pay landowners Lewis and Mary Westlake, who live near Redding, CA, a total of \$540,000—less than they had requested for damages due to EMFs—to condemn 52 acres for an ROW for a new power line. The decision was reached on July 9 by a Superior Court jury in Shasta County.

The award includes \$300,000 for the land and \$240,000 for damages from the impact the power line will have on adjacent property, lawyers on both sides of the case told *Microwave News*. But neither of the attorneys could say if, or how much, the jury had compensated the Westlakes for the effects of EMFs.

At the trial to decide the compensation, the Westlakes' lawyer, Clement Glynn of Glynn, Cella & Lange in Walnut Creek, sought to show that the value of their property would be reduced because homes could not be built on property near the line. "A prudent developer would incorporate a 'setback' area to avoid placing residences within an elevated magnetic field," stated Cindy Sage, an environmental consultant based in Montecito, who testified for the landowners.

But Ivor Samson of the San Francisco firm of Marron, Reid & Sheehy, who represented the Sacramento-based agency, said that the jurors did not accept Glynn's approach. "The size of the verdict tells me that the jury didn't buy Sage's argument," he said. "If they had, the award would have been substantially higher." Samson said that his client was "quite pleased" with the decision. In settlement negotiations, TANC had offered to pay \$450,000 for the property, while the landowners said that they

wanted \$1.5 million.

The Westlake property falls in the path of TANC's California-Oregon Transmission Project, a 340-mile, 500 kV transmission line, which will stretch between southern Oregon and the San Francisco Bay Area (see *MWN*, J/F87). The condemned property is part of a 1,000-acre parcel that the couple plans to develop for residential use.

Glynn had wanted to introduce evidence on the health effects of EMFs, but was barred from doing so by the court after TANC's attorneys argued that it was not relevant. "Any evidence involving the merits or substance of the controversy, including that EMFs might cause certain types of biological injury, [should be] inadmissible," according to a motion by TANC. Samson said that the only issue in question in this case was whether "the controversy over the potential health effects of EMFs has an impact on fair market value due to buyer concern."

Samson said that he would be surprised if TANC chose to appeal, while Glynn said that his clients have not yet decided whether to do so.

#### **Overland Park, KS**

A Kansas jury has found that there was "not enough evidence to show that the real estate market is reacting to fear about EMFs," according to Greg Musil of the firm of Shughart, Thomson & Kilroy in Overland Park. Musil represented property owner Jim Grier in his case against Kansas City Power & Light (KCP&L), which wants to take over a 40-foot by 2,600-foot strip of land on 27 undeveloped acres Grier owns in Overland Park. The Kansas City, MO-based utility is planning a two-mile, 161 kV power line, said company spokesman David Martin.

On March 16, jurors at the Johnson County District Court in Olathe, KS, awarded Grier \$121,700 for the condemnation. KCP&L had initially offered \$60,000, and later agreed to pay "up to \$150,000" to settle, according to Martin. But Grier refused, Musil said, because he wanted about \$1 million from KCP&L, contending that EMFs from the proposed power line would reduce the amount of money potential buyers would pay for the adjacent property.

Musil said that at the trial he had argued that a potential buyer would react to the power line by not purchasing the land, or by offering a lower price for it, because the presence of EMFs would restrict full development of the property. He said that the jury's decision did not "properly reflect [the opinion] that is out there among sophisticated buyers" and that "the jurors didn't value the land the way a buyer would in the real world." Grier's 27 acres have been for sale "on and off" for a number of years, Musil said.

KCP&L's Martin said that even though the utility has been receiving a growing number of calls for information about EMFs, he does not believe that the Kansas City real estate market has been affected.

#### **Yakima, WA**

A jury in Yakima, WA, has awarded Lorne and Jeanne Dunning \$242,000 for part of their ranch in Ellensburg, where BPA wants to build a substation. Although the March 31 jury verdict does not specify the basis for the award, the couple's

---

lawyer said that it was due, in part, to EMFs. "The jury recognized that there is a stigma about power lines, as there is about other environmental hazards," said the Dunnings' lawyer, Arley Harrel of the Seattle firm of Williams, Kastner & Gibbs. The case was heard in federal court for the Eastern District of Washington.

On June 23, 1992, at the utility's request, the U.S. Attorney's office in Spokane sought to acquire 134 acres of the Dunnings' 2,500-acre ranch. BPA wanted to pay \$41,600 for the condemnation, but the Dunnings asked for \$342,000.

Harrel argued that the Dunnings should be compensated for the negative impacts of the substation, including: loss of view (the substation will stand 120 feet high); loss of access to prime cattle-grazing land; and EMFs—their effects both on health and on property value.

BPA's Dulcy Mahar said that although the jury may have felt that the Dunnings should be compensated for the effects of the substation—including EMFs—another reason might also have led to the decision. Jurors may have had a perception "that BPA has deep pockets," she said in a telephone interview. The substation will cost about \$35 million to build, she added. It will be one of the largest in BPA's system and is intended to upgrade the supply system for the Puget Sound area, the fastest growing region in the Pacific Northwest.

The Justice Department, on behalf of BPA, has made a motion for a new trial, contending that certain evidence—such as the cost of the substation—should not have been admitted, Mahar said.

### **San Clemente, CA**

The California Supreme Court has rebuffed San Diego Gas & Electric Co.'s (SDG&E) motion to dismiss an EMF lawsuit which charges loss of property value, trespass, nuisance and emotional distress. This is the third time a court has refused to grant an appeal by the utility to drop the case, which was brought by a group of homeowners in San Clemente. The case was returned to the Superior Court in Orange County on July 15. A trial date has not been set.

## **HIGHLIGHTS**

### **Federal Officials Boycott Cellular Phone Health Research Meeting**

The Cellular Telecommunications Industry Association (CTIA) sponsored a symposium on September 30 that was designed, according to the invitation, "to help us focus on the most appropriate research agenda" for CTIA's \$15 to \$25 million research initiative. But scientists from key federal agencies—including the Food and Drug Administration (FDA), the Federal Communications Commission (FCC), the Environmental Protection Agency (EPA) and the National Institute for Occupational Safety and Health—declined to attend. A second meeting has been scheduled for late October in the hope of involving some of these officials.

Who actually attended the symposium, which was held in Research Triangle Park, NC, remains a mystery. Dr. George

On November 13, 1992, Mark and Cheryl McCartin, along with 22 neighbors, filed a lawsuit charging that SDG&E failed to warn them about the presence of high EMFs from power lines adjacent to their land, that it "lulled them into a false sense of security" about potential EMF health effects and that it upgraded the power lines without notice. Magnetic fields on the properties now measure between 7 and 11 mG, the group's lawyer, Michael Withey of Schroeter, Goldmark & Bender in Seattle, told *Microwave News*.

On March 31, 1993, Superior Court Judge James Ross denied the utility's motion to drop the case, but he did agree to throw out the homeowners' request for compensation for medical monitoring. The McCartins and their neighbors had claimed that they would incur ongoing medical expenses for the "monitoring and detection of cancer, malignancies and other such life-threatening diseases" which have been linked to exposure to EMFs. Early detection is key in treating these diseases, they said.

SDG&E then argued that the issues raised in the claim should be debated before the Public Utilities Commission (PUC), but on May 25 the Court of Appeals rejected this argument, in effect supporting the idea that the case should be settled by a jury trial. One justice sided with the utility, however: "Like the proverbial bull in a china shop...the present lawsuit (and others which will inevitably follow) will undermine the PUC's efforts" to regulate the siting of power lines, he wrote, adding that the suit is "a preview of the festival of junk science about to embark on a tour throughout the courts of our state."

Withey disagreed with this minority view. "As a matter of public policy it's horrendous—it would remove the right of a jury trial for every EMF case in California," he said, adding that "the PUC is not set up to arbitrate or adjudicate claims between property owners and utilities."

"I don't think you can have a consistent policy of siting power lines if PUC policy can be second-guessed across the state," contended SDG&E's lawyer, Frank Rothrock of Palmieri, Tyler & Wiener in Irvine, CA. "It seems unreasonable and not even feasible."

---

Carlo, who organized the session and heads the CTIA program, declined to release any names or affiliations, saying only that 25 or 30 individuals from industry, government and academia came to the meeting.

In a September 14 letter to Carlo, Dr. Elizabeth Jacobson, deputy director for science at FDA's Center for Devices and Radiological Health (CDRH) in Rockville, MD, questioned whether the entire CTIA program will be "objective or credible," and she wrote that FDA researchers would not attend the symposium. (In a previous letter, dated July 19, Jacobson was sharply critical of CTIA officials, complaining that they were portraying FDA's role in the research program inaccurately; see *MWN*, J/A93.) She noted that the people planning the research are, "for the most part, known for their conviction that subthermal exposure to microwave energy cannot interact with biological systems in any adverse way." And she pointed out that, at an August 17 meeting with Carlo, CDRH's Dr. Mays Swicord had suggest-

### GAO Report Due Next Spring

The General Accounting Office (GAO) is preparing a report on the possible health risks posed by cellular telephones and plans to have it completed by next spring.

Paul O'Neill, who is in charge of the GAO investigation, said he could not comment because of the "especially sensitive" nature of the topic. He did say, however, that his researchers are focusing more broadly than the report's title—*FCC Standards for Human Exposure to RF Radiation from Cellular Telephones*—would suggest.

Indeed, GAO officials have asked a number of federal agencies, including the FCC, FDA, EPA and Department of Defense, to assess what risks hand-held cellular phones pose. They have also asked for descriptions of any ongoing research that addresses whether cellular phones could be linked to an increased cancer risk, according to a letter obtained by *Microwave News* that GAO sent to one of the agencies.

The investigation was requested last January by Rep. Ed Markey (D-MA), who is chairman of the subcommittee on telecommunications and finance of the House Energy and Commerce Committee (see *MWN*, J/F93).

ed that additional scientists were needed to ensure balance. "Judging from the list of participants for the September 30 meeting... this kind of broad scientific representation was not achieved."

Carlo countered that the decisions to decline his invitations were due to "confusion about the purpose of the meeting" that was the result of "bad information" from the FDA. Carlo, who is chairman of Health and Environmental Sciences Group, a consulting firm in Washington, told *Microwave News* that he sorted out the misunderstandings at a September 22 meeting with Jacobson. Indeed, in a more conciliatory letter to Carlo, dated September 23, Jacobson said the FDA would send representatives to an October 27 session in Washington. "Please understand that our desire is for this process to lead to a research program capable of yielding significant scientific data that will be helpful to FDA in establishing public health policy," Jacobson wrote.

The group charged with writing CTIA's research agenda consists of Carlo, Dr. Bill Guy, formerly of the University of Washington, Seattle, and Dr. Ian Munro, formerly of Health & Welfare Canada. A draft should be completed by mid-November, Carlo said, and it will then be given to the nine-member review panel he has established.

**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 Dietrich; Senior Editor: Hilary A. Macht; Assistant Editor: Lara Schoeberlein; Contributing Editor: Jennifer Goren; Copy Editors: Jim Feldman, Linda Carroll • Subscriptions: \$285.00 per year (\$315.00 Canada & Foreign, U.S. funds only); single copies: \$50.00 • Copyright © 1993 by Louis Slesin • Reproduction in any form is forbidden without written permission.

### Police Radar Injury Litigation After Bendure: An Update

Almost half of the injury claims filed by police officers against manufacturers of traffic radar guns have now been dismissed. No damages have been awarded by the courts, and no money has been paid by the manufacturers to settle cases.

Last January, in the first and only trial of a police radar-cancer case, a federal court jury in California rejected Officer Eric Bendure's claim that use of traffic radar caused his non-Hodgkin's lymphoma (see *MWN*, J/A92 and J/F 93). Since then, several other lawsuits have been abandoned, bringing to at least nine the number of cases resolved in favor of the manufacturers.

Four new cases have been filed this year, however, for a total of ten claims in five states that are still pending or being pursued. (A table of cases, showing how each was resolved or its current status, appears at right.)

The claim brought by Officer Thomas Malcolm of the Windsor Locks, CT, Police Department (see *MWN*, S/O91) could be the next case to go to trial. Malcolm, who has testicular cancer, is suing Kustom Signals Inc. of Lenexa, KS. "The odds are against us," explained his attorney, Stuart Rothenberg. "But we are still in the game and we will take it as far as it can go." Discovery is completed, Rothenberg said, and a trial date is expected this year.

John Wykoff, who is lead counsel for radar manufacturer MPH Industries Inc. of Owensboro, KY, predicts more dismissals soon. "I am seeing a pattern," he said. When cases reach the point at which experts must be selected—and paid—plaintiffs' attorneys seek dismissal, Wykoff said: "The plaintiffs are just not coming up with the experts to support their claims."

The claim brought by Officer William McGuigan, for example, was withdrawn just before a trial was to begin last May. "[O]ur office, and our clients, have concluded that there is not yet sufficient scientific information...to clearly produce a strong case that radar guns, as used by our client in particular, cause cancer," wrote McGuigan's attorney, James Thompson.

Others have cited lack of money, not lack of evidence, as the main difficulty in pursuing this litigation. Attorney John Sweeney, who filed the first police radar claims (see *MWN*, M/A91, J/A 91 and S/O91), including Bendure's, has now dropped all of his cases. "We put a fortune into the cases we did pursue," said Sweeney, who has previously estimated that Bendure's lawsuit cost his firm \$150,000 in direct expenses and as much as \$750,000 in attorney-hours.

#### Notes to Police Radar-Cancer Cases Table

- \* Names in bold denote active cases; some lawsuits name relatives or the estate of the police officer; police departments are for identification only; the department named is the most recent employer; dec. = deceased.
- ‡ MPH was named in the original complaint but was dropped prior to trial.
- ¶ Five insurance companies are also named as defendants.
- § Kustom and Decatur were named in the original complaint but were later dropped; General Electric Co. was added as a defendant prior to the entire case being withdrawn.
- † Two firms that serviced the units, Raytheon Service Co. and RF Communications Co., were also named as defendants.
- ‡ Decatur Electronics Inc. of Decatur, IL, denies it manufactured the unit in question in this case.

## Police Radar—Cancer Cases

<i>Plaintiff *</i>	<i>Date Filed/Court</i>	<i>Defendants</i>	<i>Type of Cancer</i>	<i>Status</i>
Hyman Rosen [A] U.S. Park Police (dec.)	March 12, 1991, Federal, N. District of CA	Kustom Signals Inc. [1]	Melanoma (back of neck); diagnosed 1986	Withdrawn by plaintiffs; dismissed without prejudice, Feb. 7, 1992
Eric Bendure [A] Petaluma (CA) Police Department (PD) (dec.)	April 18, 1991, Federal, N. District of CA	Kustom ‡	Non-Hodgkin's lymphoma (originated in right groin); diagnosed Feb. 1989	Jury decision for defendants, Jan. 20, 1993
Leo Hutchison [A] Petaluma (CA) PD (dec.)	April 18, 1991, Federal, N. District of CA	Kustom, MPH Industries Inc. [2]	Non-Hodgkin's lymphoma; diagnosed March 1985	Plaintiff died, April 25, 1992; case with- drawn; deadline for refiling has passed
Thomas Malcolm [B] Windsor Locks (CT) PD	April 1991, Federal, District of CT	Kustom	Testicular	Discovery completed; trial date expected later this year
Steven Cottini [A] Concord (CA) PD	Sept. 10, 1991, Federal, N. District of CA	Kustom, MPH	Testicular	Withdrawn by plaintiffs; dismissed with prejudice, July 1993
Arnold Sudbrink [A] [C] WI State Patrol (dec.)	Sept. 13, 1991, Circuit Court, Eau Claire County, WI	Kustom ¶	Melanoma (eye)	Withdrawn by plaintiffs, fall 1992; dismissed with prejudice, Feb. 1, 1993
David Berndt [A] [D] Grand Rapids (MI) PD	Nov. 8, 1991, Circuit Court, Kent County, MI	MPH §	Testicular; diagnosed Jan. 1988	Withdrawn by plaintiffs; dismissed with prejudice, July 1993
Richard Rein [E] Ft. Lauderdale (FL) PD	1991, Circuit Court, Broward County, FL	MPH	Testicular	Plaintiffs have missed deadline for disclosing expert witnesses
William McGuigan [F] Belmont (CA) PD	Jan. 16, 1992, Superior Court, San Mateo County, CA	Kustom	Myxoid liposarcoma (left thigh)	Withdrawn by plaintiffs, April 1993; dismissed with prejudice
Wayne Vessels Jr. [G] OH State Patrol (dec.)	March 23, 1992, Federal, S. District of OH	Kustom, MPH	Basal and squamous cell carcinoma; diagnosed 1977	Plaintiff died, Dec. 1992; case withdrawn; may be refiled as a wrongful death suit
Steven VanDerAa [H] IN State Police	March 27, 1992, Federal, N. District of IN	Kustom, MPH	Testicular	Discovery; trial not expected before 1994
Eric Vedborg [I] Santa Ana (CA) PD	April 14, 1992, Superior Court, Orange County, CA	Kustom, MPH †	Malignant melanoma (calf); diagnosed 1991	Withdrawn by plaintiff; dismissed with prejudice, Sept. 1993
Rory Coontz [J] CO State Police	June 1, 1992, Federal, N. District of IL	Kustom	Testicular; diagnosed May 1991	Case withdrawn due to jurisdictional problems, June 18, 1992
Vincent Casertano [B] Shelton (CT) PD	Aug. 1992, Federal, District of CT	MPH	Thyroid	Case dismissed by the court for procedural reasons; may be refiled
Cary Davis [H] IN State Police	Dec. 28, 1992, Federal, N. District of IN	MPH, Decatur Electronics Inc. ¥	Testicular	Early stages of discovery; trial not expected before 1994
Peter Fortunato [K] Broward County (FL) Sheriff	May 1993, Circuit Court, Broward County, FL	Kustom, MPH	Testicular	Early stages of discovery
James Edwards [L] Mason (OH) PD (dec.)	June 2, 1993, Court of Common Pleas, Warren County, OH	Kustom, MPH	Acute leukemia; diagnosed Jan. 1992	Early stages of discovery
Stewart Hauck [L] Mason (OH) PD	June 2, 1993, Court of Common Pleas, Warren County, OH	Kustom, MPH	Multiple myeloma; diagnosed June 1991	Early stages of discovery
Harold Moser [M] PA State Police (dec.)	Aug. 20, 1993, Federal, Middle District of PA	Kustom Decatur	Stomach	Discovery not yet begun

### Plaintiffs' Attorneys

- [A] John Sweeney; John Sweeney & Associates, 28230 Agoura Rd., 2nd Fl., Agoura Hills, CA 91301, (818) 706-8500.  
 [B] Stuart Rothenberg; Rothenberg, Rothenberg & Rothenberg, 843 Main St., PO Box 1404, Manchester, CT 06040, (203) 647-1117.  
 [C] Eric Wahl; Wiley, Wahl, Colbert, Norseng, Cray & Herrell, 1280 W. Clairemont Ave., Eau Claire, WI 54702, (715) 835-6171.  
 [D] William Bremer; Bremer, Wade, Nelson, Mabbitt & Lohr, 125 Ottawa Ave., NW, Ste. 250, Grand Rapids, MI 49503, (616) 774-2944.  
 [E] Walter Campbell; Krupnick, Campbell, Malone, Roselli, Buser & Slama, 700 SE 3rd Ave., Ste. 100, Ft. Lauderdale, FL 33316, (305) 763-8181.  
 [F] James Thompson; Wilhelm, Thompson, Wentholt & Gibbs, 600 Allerton St., 2nd Fl., Redwood City, CA 94063, (415) 365-7333.  
 [G] Michael Cassity; 107 East Main St., Box 478, Mt. Orab, OH 45154, (513) 444-2626.  
 [H] William Emerick; Stuart & Branigin, The Life Building, 300 Main St., Ste. 800, PO Box 1010, Lafayette, IN 47902, (317) 423-1561.  
 [I] Fred Adelman; Agnew & Brusavich, 20355 Hawthorne Blvd., 2nd Fl., Torrance, CA 90503, (310) 793-1400.  
 [J] Steve Ford; Kiesler & Berman, 188 W. Randolph, Ste. 1300, Chicago, IL 60601, (312) 332-2840.  
 [K] Darryn Silverstein; Silverstein, Silverstein & Silverstein, 20801 Biscayne Blvd., North Miami Beach, FL 33180, (305) 935-2500.  
 [L] Robert Peeler; Peeler, McGary & Zopff, 423 Reading Rd., Mason, OH 45040, (513) 398-4891.  
 [M] Lee Swartz; Hepford, Swartz & Morgan, 111 N. Front St., PO Box 889, Harrisburg, PA 17108, (717) 234-4121.

### Defendants' Attorneys

- [1] Mark Oium; O'Connor, Cohn, Dillon & Barr, 101 Howard St., 5th Fl., San Francisco, CA 94105, (415) 281-8888.  
 [2] John Wykoff; Cash, Cash, Eagen & Kessel, 432 Walnut St., Ste. 1000, Cincinnati, OH 45202, (513) 621-4443.

Godfrey's new policy was prompted by Dr. Cletus Kanavy, chief of the biological effects group at Phillips' Electromagnetic Effects Division. In an October 29, 1992, memo to Godfrey, Kanavy concluded, based on a survey of the scientific community engaged in RF/MW radiation bioeffects research, that there is a "consensus" that "nonthermal effects do exist and that the ANSI/IEEE standards are deemed inadequate to protect human health."

In an accompanying White Paper, which has been circulated within the U.S. Air Force, Kanavy noted that, "The literature published in the late 1980s is abundant with information on nonthermal effects which are produced at levels below the ANSI standards." In the ANSI/IEEE standard, he added, "The existence of nonthermal effects is essentially denied by omission." (The text of the White Paper appears on p.12.)

Kanavy reiterated the need for a more stringent standard in a September 1, 1993, letter to the Environmental Protection Agency (EPA). "We have long felt that the athermal effects were real and that a [continuous wave]/thermal standard was not sufficient for human exposure protection," he wrote. Kanavy is hospitalized with a grave illness and was unavailable for an interview.

A spokeswoman at the Phillips Lab's Office of Public Affairs noted that the new RF/MW limits, codified in "Standard Operating Instruction No.1-93," apply only to the AWS and not to other parts of the Air Force. A service-wide change would require a "Policy Directive," she said. She referred all other questions to the Armstrong Laboratory at Brooks Air Force Base (AFB) in San Antonio, which is responsible for the Air Force RF/MW exposure standards.

Neither John Mitchell, the director of the Occupational and Environmental Health Directorate, nor Dr. David Erwin, the chief of the RF Radiation Division, both at the Armstrong Lab, was available for comment, according to Lawrence Farlow of the Armstrong Office of Public Affairs.

Relations between the Phillips and Armstrong Labs have been strained since Kanavy began voicing concerns over the potential health threats to Phillips employees exposed to RF/MW radiation (see p.1).

In May 1991, the Ground Systems Group of the Hughes Aircraft Co. in Fullerton, CA, formally adopted the JHU-APL exposure standard. Eduardo Villaseca, until recently a senior scientist at Hughes' Fullerton RF/MW Laboratory, told *Microwave News* that the move was prompted by studies by JHU-APL's Henry Kues and the Food and Drug Administration's Jack Monahan on the effects of RF/MW radiation on the eyes. The Fullerton facility, where high-power military radars are developed and tested, had used the JHU-APL guidelines on an unofficial basis since 1988.

In a series of studies over the last ten years, Kues and Monahan have shown that RF/MW radiation at specific absorption rates below 4 W/Kg can cause persistent eye damage (see *MWN*, J/A83, S/O86, J/A87, J/A88 and S/O91). The ANSI/IEEE limits are based on the assumption that there are no adverse health effects of RF/MW radiation below 4 W/Kg. The IEEE subcommittee that drafted the 1992 standard largely ignored the Kues-Monahan work, as well as other research showing low-level effects (see *MWN*, M/A89).

Villaseca stressed that "the adoption of the Johns Hopkins rec-

## **Phillips Lab's Instruction on RF/MW Radiation Exposures**

*The following is excerpted from Standard Operating Instruction No.1-93, adopted on June 15, 1993, by the Advanced Weapons and Survivability Directorate at the Phillips Lab:*

All experiments will be conducted in a manner which insures personnel exposure to ionizing and non-ionizing radiation is minimal. Laboratory experiment directors will limit human exposure to ambient laboratory environments unless authorized in advance by the Safety Review Panel. The ambient environment is defined as 0.1 mW/cm<sup>2</sup> (averaged over six minutes) for continuous wave (CW) and pulsed narrow band sources. In special situations, the Safety Review Panel can authorize exposures up to the ANSI standard. Exposures above the ANSI standard can only be authorized by Armstrong Laboratory. Pulsed narrow band sources are defined as having pulse rise times longer than 10 nanoseconds. The human exposure limit for pulsed wide band sources (pulse rise times shorter than 10 nanoseconds) will be determined by Armstrong Laboratory for each source. In cases where no limit has been provided, a default value of 0.025 mW/cm<sup>2</sup> (10 V/m), averaged over six minutes, and with a peak value of less than 1 kV/m, will be used. These human exposure guidelines/regulations will be strictly observed.

ommendations has not resulted in any significant additional costs, while improving the personnel electromagnetic environment."

In an interview with *Microwave News*, Harvey Hall, the safety officer at JHU-APL, also said that the standard had not been hard to meet: "We can live with our operating standard." The lab's 100 µW/cm<sup>2</sup> limit can be exceeded under certain circumstances, he said, but it has never been necessary.

Late this summer, Villaseca was laid off by Hughes and it is not clear whether the 1991 standard will remain in place. "Things are changing," Eric Rowsey, a specialist in safety and environmental affairs at Hughes' Aerospace and Defense Sector in El Segundo, CA, said in an interview. "We are attempting to standardize exposure limits within our sector of the Hughes Aircraft Co." While he would not specify what the standard might be, he said that, "We may, by consensus, agree on a standard that is more stringent than the controlled environment guidelines adopted by the IEEE."

While many health standards specify different exposure limits for workers and for the general public, the IEEE standard takes a less conventional approach—it differentiates between "controlled" and "uncontrolled" environments.\* This distinction has generated some controversy as a result of the Federal Communications Commission's (FCC) proposal to adopt the IEEE/ANSI standard for its own use (see *MWN*, M/A93).

In comments submitted to the FCC, Gerald Markey, the manager of the Spectrum Engineering and Policy Division at the

\* The IEEE defines a "controlled environment" as a location where an exposure "may be incurred by persons who are aware of the potential for exposure as a concomitant of employment, by other cognizant persons or as the incidental result of transient passage through [certain] areas." For 100-300 MHz, the guidelines for uncontrolled exposures are five times more stringent than those for controlled environments. An "uncontrolled environment" is defined as a location "where there is the exposure of individuals who have no knowledge or control of their exposure."

Federal Aviation Administration (FAA) in Washington, said that he is refusing to apply the controlled environment limits to FAA employees, as would be stipulated by the ANSI/IEEE standard. In his August 20, 1993, letter, Markey wrote that, "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 the FAA's responsibility."

Staffers at the EPA will also be submitting written comments to the FCC (see *MWN*, J/A93), which, sources told *Microwave News*, will be sharply critical of the ANSI/IEEE standard. In early August, the FCC extended the comment period for its proposal until November 12, with reply comments now due by December 13.

In June, the city of Los Angeles adopted an ordinance limiting RF/MW radiation from satellite dishes owned and operated by the Fox Studios in West Los Angeles to  $10 \mu\text{W}/\text{cm}^2$  in publicly accessible areas. Shirley Linde, a founder of Citizens for Safer Electromagnetic Fields, had urged the Los Angeles Planning Commission to take a conservative approach in regulating RF/MW exposures, citing Villaseca's concerns over the inadequacy of the ANSI/IEEE standard. Linde now chairs the National EMF Advisory Committee (see *MWN*, M/A93 and J/A93).

### **U.S. Air Force v. U.S. Air Force** (continued from p.1)

these effects "are produced at levels below the ANSI standard." (See p.12 for the full text of the White Paper.)

In his memo, Kanavy said that a "consensus" of RF/MW researchers outside of Armstrong called for establishing a national program "to investigate the biological effects of electromagnetic radiation under the auspices of an independent committee" and for "seriously" reviewing a Department of Defense decision to locate the non-ionizing radiobiology research center at Armstrong Laboratory (see *MWN*, J/A92).

Erwin, the chief of the Radiofrequency Radiation Division at the Armstrong Lab, responded that his team had reviewed and attempted to replicate claims "concerning athermal and other unsubstantiated bioeffects" of RF/MW radiation. "Although we still accept the possibility, we have not yet seen any good evidence for athermal bioeffects...much less that they adversely affect health." To use claims of such effects to revise U.S. health standards "would be alarmist," Erwin added in a January 11, 1993, letter to Dr. Brendan Godfrey, Kanavy's superior at the Phillips Lab. Erwin was not available for an interview.

Erwin and coworkers' views are well known. The Armstrong group was very critical of the 1990 EPA report that linked non-ionizing radiation to cancer. In detailed comments, they argued that the observations on which EPA relied could be attributed to heat-induced stress. Erwin even suggested that EMF effects on the pineal gland were heat-related (see *MWN*, N/D90).

Even before Kanavy, others have criticized the Air Force, and the Armstrong group in particular, for refusing to accept data showing nonthermal interactions. For instance, in a letter published in the February 1991 *Health Physics*, Dr. Dennis Hjeresen of Los Alamos National Lab in New Mexico wrote that, "The U.S. Air Force [Armstrong Laboratory] has consistently sug-

gested to us that there are no effects of low-level microwave exposure despite evidence to the contrary presented in the peer-reviewed literature."

Dr. Ross Adey, a leading researcher at the VA Hospital in Loma Linda, CA, has also faulted the Air Force's views. At a hearing before a U.S. Senate subcommittee in August 1992, Adey testified that, "As a matter of policy, the Air Force denies existence of biological effects attributable to athermal fields. Nevertheless, evidence for athermal bioeffects is incontrovertible for both low-frequency and [RF] exposures" (see *MWN*, S/O92).

At the *1st World Congress for Electricity and Magnetism in Biology and Medicine*, held in Orlando, FL, in June 1992, Dr. Edward Elson of the Department of Microwave Research at the Walter Reed Army Institute of Research (WRAIR) in Washington also took on the Armstrong group. In the course of presenting a paper that challenged the adequacy of the ANSI/IEEE standard, Elson predicted that his research on high-power microwaves would be stopped if the responsibility for it were transferred to Erwin's lab in San Antonio—a move that is now under way (see *MWN*, J/A92).

Kanavy, the chief of the biological effects group at Phillips' Electromagnetic Effects Division, who holds both a medical degree and a doctorate, has been a major irritant to Erwin's group, at least in part because Kanavy knows his way around Washington. Over the last few years, Kanavy has briefed a number of U.S. Senate aides. One observer offered the following example of Kanavy's political clout: "A highly placed official at Kirtland tried to put Kanavy in a closet, but Kanavy went to his friends in the Senate and a message came back from a senior person at the Department of Defense to leave him alone."

Tensions between Kanavy and the Armstrong group reached a climax at a small seminar on the *Biological Effects of Microwave Radiation* held at the University of New Mexico, Albuquerque, on November 12, 1992. Only about 25 researchers were invited, including one representative of the Armstrong Lab. But when two members of Erwin's group, James Merritt and Johnathan Kiel, showed up instead, Kanavy insisted that they leave, according to a number of those present.

Dr. Michael Wilcox of the University of New Mexico School of Medicine, the organizer of the seminar, pointed out that Merritt and Kiel were able to hear essentially the same presentations at a classified briefing held the following day at the Los Alamos National Lab. Wilcox, who has been collaborating with Kanavy over the last three years, declined to reveal who from Armstrong had been invited originally.

Wilcox is working with Dr. Robert Kelley, the chair of the department of anatomy at the medical school, to establish a research consortium to study RF/MW bioeffects. "We want to clear the air about nonthermal effects," Wilcox said in a telephone interview, adding that, "I believe that they do exist." He said that preliminary experiments at the university support his view.

"There is no proof that the [ANSI/IEEE] standard is detrimental to health—if you want proof, you have to do the experiments," Wilcox said. He noted that he favored a conservative approach to protect health: "An ounce of prevention is worth a pound of cure."

One of the objectives of Kanavy's proposed national re-

## Biological Effects of Microwave Radiation: A White Paper

The White Paper reproduced below was written by Dr. Cletus Kanavy, the chief of the biological effects group of the Phillips Laboratory's Electromagnetic Effects Division at Kirtland Air Force Base, NM, in October 1992. The references at the end of Kanavy's paper are omitted here.

The biological effects of microwave radiation on living organisms have been the subject of extensive research for the past four decades. The most comprehensive programs were conducted by the Soviet and Eastern Bloc nations. The U.S. has lagged behind badly in this area of research. Initially, the principal concern for human exposure to microwave radiation was that of thermal heating of the tissues. Permissive exposure limits were based on such criteria. Since the 1970s this limit has been progressively set at lower levels of average field power density for the classical six-minute time average period. These limits, which are published as the American National Standards Institute (ANSI) microwave standards, are actually derived by the Institute of Electrical and Electronics Engineers (IEEE). Under IEEE, a blue-ribbon panel of experts periodically reviews the research database and assesses the need to revise the standards. Until 1991, these standards did not consider the possible biological effects of "pulsed" microwaves. The 1991 standards do address the pulse condition (rather shabbily, I believe), place restrictions on the number of pulses per six-minute time period as a function of pulse width, and continue to use the continuous wave time averaging technique for thermal criteria. The existence of non-thermal effects is essentially denied by omission.

The U.S. research community was aware of the Soviet findings of deleterious biological effects at exposures well below the ANSI standards. The Soviet findings were rejected for various reasons. The principal reason was that U.S. attempts to duplicate the Soviet results were reportedly not successful. It was not until the mid-1980s that U.S. researchers began to successfully duplicate Soviet experimental results and began a research program to expand upon and further test the Soviet nonthermal theories.

Since March 1991, we have been conducting a comprehensive search of worldwide literature on the results of experimentation regarding biological effects produced by microwave radiation. The results of this search have been consolidated into a computerized database which we have shared with the Armed Forces Medical Intelligence Center and the Central Intelligence Agency. We attempted to share the database with the Armstrong Laboratory. A list of the holdings in the database was presented to Dr. Dave Erwin of Armstrong who proceeded to "line-out" the publications of researchers he believed not to be credible. These were researchers who were reporting the positive existence of nonthermal effects.

The literature published in the late 1980s is abundant with information on nonthermal effects which are produced at levels below the ANSI standards. These are essentially chronic exposure effects at low levels of average field power densities. Researchers

stress the chronic, nonthermal nature of these effects as opposed to acute exposure thermal effects. Ample experimental evidence exists from credible researchers from well-established and highly regarded institutions, both government and university, to justify a national research program into the full spectrum of biological effects of electromagnetic radiation.

The principal electromagnetic biological effects of greatest concern are behavioral aberrations, neural network perturbations, fetal (embryonic) tissue damage (inducing birth defect), cataractogenesis, altered blood chemistry, metabolic changes and suppression of the endocrine and immune systems. The verification of blood-brain barrier suppression should have a high priority. The passage of normal blood-borne toxins into the brain could explain some previously observed early behavioral aberrations, loss of physical endurance and functional central nervous system and perceptual changes. A large amount of data exists, both animal experimental and human clinical evidence, to support the existence of chronic, nonthermal effects. The Soviet studies of humans under occupational conditions report marked functional changes, sometimes accompanied by histological and biochemical changes, under the chronic influence of microwaves at power densities ranging from fractions of microwatts to a few milliwatts per square centimeter. Research to date has concentrated on determining the psychological/physiological effects (changes) produced by electromagnetic fields of various power densities, carrier frequencies and modulation rates. These results are the macroscopic part of the issue. The microscopic part of the issue urgently needs to be addressed—namely the physical mechanisms behind the various observed biological effects. Various theories and interaction models exist to explain, in a limited way, some of these physical mechanisms for specific effects. None have yet been positively verified. This is believed to be a key issue which needs to be addressed as soon as possible....

Other areas of concern center on the uninvestigated human response to high peak, low average power, moderate to high pulse repetition frequency microwave fields. The relationships between these variables and specific human responses should be of prime importance to the directed energy weapon (DEW) development programs. The ability of certain modulation frequencies imposed on various carrier frequencies to affect (lock onto) circadian rhythms poses a formidable research problem. A principal question raised is the existence of "frequency windows" and resonances associated with certain physiological and psychological responses. The past several issues of *Bioelectromagnetics* have contained many articles by prominent U.S. researchers which report nonthermal effects. New concerns are also forthcoming, i.e., bioeffects of ELF and electromagnetic fields in close proximity to high voltage power lines and transformer banks. Thus the entire issue of human interaction with electromagnetic (RF & microwave) radiation is pushing forward as a major national population health concern.

search program is to monitor the health of Kirtland employees exposed to RF/MW radiation. Erwin, however, rejects this idea. In his January letter to Godfrey, Erwin appended four different memos—one from an epidemiologist, one from a lawyer and two from members of his research group—to counter Kanavy's arguments for a long-term health monitoring program of high-power microwave workers at the Phillips Lab. He concluded that, "The consensus opinion is that such a limited program

would yield no legal or scientific benefit to the Air Force and might even have a negative impact."

Despite all the criticisms, Erwin's plan to consolidate all Department of Defense research on non-ionizing radiation is proceeding. The microwave lab at WRAIR has closed down and the equipment has been shipped to the Armstrong Lab. The Naval Aerospace Medical Research Lab in Pensacola, FL, is scheduled to move to San Antonio next summer.

## JASONS on EMFs and Health

*In January 1992, at the request of the Department of Energy (DOE), a team of scientists called the JASONS—best known for their work on behalf of the Department of Defense—held a seminar on electromagnetic fields (EMFs) in La Jolla, CA (see MWN, J/F92). Following a second seminar in July 1992, Dr. Steven Koonin, a physicist at the California Institute of Technology in Pasadena, prepared a report for DOE's Dr. Robert San Martin in Washington. Microwave News obtained a copy of his October 15, 1992, report. It is reprinted below.*

Dear Dr. San Martin:

I am writing to convey to you the results of the JASON study on biological effects of EMFs. We heard one day of presentations on January 24 from Dr. D. Thomas (epidemiology), Dr. W.R. Adey (biological mechanisms) and Dr. T. Litovitz (whole animal experiments). On July 17, we heard from Dr. J. Kirschvink (magnetite in human brains), Dr. M. Walker (biomagnetic phenomena) and Dr. R. Adair (physical mechanisms). We have also done some reading in the original literature. Our thoughts on the subject follow. They should be read with the qualifications that we are almost all physical scientists (with no particular biological or epidemiological expertise) who are outsiders to the EMF community. It should also be clear that we have not, in any case, conducted an in-depth review.

Three conditions are required to establish that 60 Hz EMFs have a significant effect on health: A) A plausible coupling mechanism at the cellular level; B) The coupling must induce biochemical changes; and C) The biochemical changes must be detrimental (e.g., carcinogenic).

It is important to bear in mind that without all three of these conditions being satisfied, any scientific case for EMFs causing disease would be incomplete. Of course, significant positive results from well-controlled epidemiological or whole organism studies would provide a basis for action even in the absence of any or all of these three conditions; however, such results do not exist.

### Magnetite in Biological Systems

The coupling of EMFs at the cellular level is the necessary first step in this chain. Electric fields are well shielded by conducting fluids of the body and are reduced to insignificant levels in the cellular interior.<sup>1</sup> This is not true of magnetic fields.

Magnetic fields are part of the natural environment and it would be surprising if nature did not take advantage of them in directing organisms. The earth's magnetic field is about 0.5 G. Fields from common anthropogenic sources range from 100 G near small motors (hand-held appliances) to a few mG from residential electrical wiring. Sensitivity to this lower level would be required for significant widespread biological effects of the EMFs from the electrical distribution system. Geomagnetic storms and associated magnetohydrodynamic activity result in ELF (0-5 Hz) fluctuations, sometimes reaching several mG in the 1-100 mHz range. However, low frequency (50-60 Hz) magnetic field variations of more than about 1 mG are uniquely due to human sources.

Several coupling mechanisms have been suggested and properly dismissed as physically implausible.<sup>1</sup> However, the recent discovery of magnetite in the human brain could change the picture in a very significant way. The magnetic properties of this material, which are very different from those of typical cellular constituents, provide a physically plausible mechanism by which magnetic fields might perturb biological systems.

A number of biological systems employ magnetite and some are sensitive to magnetic fields.<sup>2</sup> These include chitons, who make teeth out of this hard material, magnetotactic bacteria, which use the field's inclination to sense up/down, and the ethmoid bones of fish (whose use of magnetite, if any, remains a mystery, although navigation of some

kind is a likely possibility).

The magnetite in bacteria and fish is in the form of magnetosomes. These are single-domain (50 nm) crystals arranged in long chains of 20-60 crystals. The magnetite is purer than any known geological material. Each crystal is encapsulated in a membrane and the magnetically easy axis (111) is consistent from crystal to crystal and oriented along the chain. Typical interaction energies of a single crystal with the earth's magnetic field are 5-10 times the characteristic thermal energy, kT.

There are also indications that magnetite crystals are present in human brains,<sup>3</sup> although there is, as yet, no independent confirmation. These look very much like the bacteria or fish magnetosomes. Concentrations in the brain are 100 ng/g and it is estimated that 0.1% of the cells contain such magnetosomes. It is plausible (but not yet established) that these human crystals are also encapsulated in membranes and organized into chains. Magnetite is also claimed to be in other human tissues (both normal and pathological), with similar high concentrations in meninges and some types of tumors.

There is considerable evidence that magnetosomes are coupled to the nervous system. Semm and Beason<sup>4</sup> have shown that units of the ophthalmic nerve and trigeminal ganglion of the bobolink are sensitive to changes in the magnetic field as small as 2 mG. Walker has some recent results on fish (brown and red trout) probing the firing of neurons in the anterior lateral line nerve passing by the ethmoid sinus.<sup>5</sup> There is a response to changes in the strength of the field (at the 1 G level), but not to the direction.

Magnetic fields have also been shown to influence behavior. The response of magnetotactic bacteria to applied magnetic fields is dramatic and well documented. More recently, Walker and Bitterman<sup>6</sup> and Kirschvink and collaborators<sup>7,8</sup> have performed a series of experiments claiming to demonstrate the effects of magnetic fields on the behavior of honeybees. The experimental controls were good, but not perfect. It appeared that bees can be trained reliably to associate the presence of a DC magnetic field (22 G) with sugar water. Better statistics and more variations in the experimental procedures would make the case for behavioral response to magnetic fields more convincing. It has been established that the magnetic sensor is in the bee's abdomen, where there is a known concentration of magnetite, and that small magnetic wires attached to a bee's abdomen make it untrainable.

Walker and Bitterman<sup>6</sup> explored the effects of decreasing the DC field intensity and showed that bees trained at high fields could be trained subsequently to respond to weaker fields. They claimed that bees could be trained to respond to fields as weak as 0.25 mG (some 0.1% of the earth's field!). Kirschvink et al.<sup>8</sup> explored the effect of AC fields and claimed that some bees could be trained to respond to 60 Hz fields. There has not been, as yet, a demonstration of response to magnetic fields that are simultaneously both weak and AC.

Kirschvink et al.<sup>8</sup> have constructed a simple model for the coupling of magnetosomes into the biochemistry. In this model, the AC torque associated with an AC field acting on a magnetite crystal in a static, background field is transmitted by the microtubules of the cytoskeleton to calcium channels in the cellular membrane. The Reynolds number of the intracellular medium is very small, so that viscous terms dominate inertial terms. The model shows a falloff of sensitivity with increasing frequency. In contrast to some other hypothesized coupling mechanisms—[as] summarized and criticized<sup>1,9</sup>—this model does not obviously contradict known physical or biological principles.

Adair has presented arguments that the ordinary perturbations of electric and magnetic fields at the cellular level are far smaller than the thermal noise.<sup>1</sup> However, magnetite changes the picture, and interaction energies for 1 G fields then become several times kT per magnetosome. Sensitivity to mG fields would require a signal averaging

mechanism to enhance sensitivity. Other sensory systems do exploit such averaging, but are highly specialized (e.g., the ear's cochlea). Adair admits to the possibility of such averaging, but asserts that it is highly unlikely. As discussed in a separate JASON report [JSR92-341], the nonlinear dynamics phenomenon of "stochastic resonance" could also increase the sensitivity of a single magnetosome.

The essential point to take away from all of this work is that a cellular-level coupling of magnetic fields to biological systems is physically plausible and does not violate any physical principles.

### Whole Organism Studies

Laboratory studies exploring the biological effects of weak, low frequency EMFs on cultures or whole organisms might appear to be a productive route. In contrast to cellular-level studies, a complex biological system is being probed, yet, in contrast to epidemiology, conditions and exposure are, in principle, under control. Perhaps surprisingly, there is no body of reliable and reproducible experiments. Litovitz claims some teratogenic effects of EMFs in chicken eggs when other influences are properly controlled for,<sup>10</sup> but these results have not been reproduced independently.

In work supported by many sponsors, including DOE, Adey has reviewed the literature on the possibility that EMFs can contribute to cancer in humans.<sup>11</sup> He concludes that there is little evidence that these fields (electric, magnetic or both together) acting alone, initiate cancers. However, he finds some evidence that low frequency and radio-frequency fields with low frequency modulation can enhance certain effects of chemical carcinogens on cells, particularly in cell membranes.

### Epidemiology

Epidemiological studies directly address the human health effects of EMFs. These studies have numerous pitfalls and drawbacks, and the work we have seen is of diverse quality. One must be careful to control for confounding variables (economics, proximity to other carcinogens, etc.). Samples are generally small and fields are rarely measured directly; a "wiring code" is often used as a surrogate, but it shows little correlation with measured fields. When fields are measured, other potentially important factors in addition to the magnitude of the electric and magnetic fields (such as direction, frequency or intermittency) are not measured.

The results of the best case-control studies are equivocal. (See, for example, [London, et al.].<sup>12</sup>) The multiplication of the risk due to EMF exposure (odds ratio) is typically 1-3, with a large uncertainty. (An odds ratio of 1 would imply no effect of EMFs.) Perhaps the most that can be said at present is that 60 Hz electromagnetic power use is not, by itself, a major factor in childhood leukemia.

### Recommendations

It is important to understand the biological effects (if any) of weak low frequency EMFs and the role that natural magnetic fields may play in life processes. The discovery of magnetite in human brains, if confirmed, could be a major change in the picture that needs to be followed up and elaborated. At the very least, there is an interesting basic research question; more significantly, it could bear on the health effects of 60 Hz EMFs. At the moment, only a handful of people around the world are working in this field, so it is important to involve more researchers.

Because the biomagnetic work is in its infancy, there should be a substantial amount of basic biophysics, biochemistry, physiology, etc. done on magnetite in living systems. We should also determine how widespread the presence of magnetite in living systems is and how prevalent is sensitivity to magnetic fields. Nature tends to be clever in making use of circumstances. We already have seen two distinct uses of magnetite in the biosphere, separately dependent upon its magnetic properties (magnetosomes) and its mechanical properties (teeth). It therefore would not be surprising to find it used in other ways as well, and such other uses might shed light on its interaction with weak magnetic fields.

The following lists a few concrete research questions/suggestions, but we expect that there are many more equally good or even better ideas that will be generated by experts in the field.

**I. Basic Studies Related to Biological Magnetite:** A) Is magnetite produced in virtually every living organism? (Kirschvink and Walker assert that magnetite has been found in every species tested so far, but very few species have in fact been tested.) B) Within a single cell: How are magnetosomes produced and in what form do they reside in higher species (e.g., are they lined up in long chains as in magnetotactic bacteria)? C) Multicell questions: How is the magnetite coupled to the central nervous system of those higher species that respond to B-fields? Are there nonlinear mechanisms that enhance their sensitivity? Do magnetosomes (or chains of them) in adjacent cells act in concert? D) Evolutionary questions: Identify the magnetic organ in trout or birds. Examine whether analogous organs and nerves exist in amphibians, reptiles and mammals. If so, do they also show a neural response to magnetic fields?

**II. Training Experiments:** A) The bee experiments should be replicated and pursued until all ambiguities are removed. The success in training with sinewave AC at varying frequencies will determine the relaxation times involved; additional studies with a square waveform would show if there is sensitivity to the rate of change of the magnetic field. Reducing the amplitude of the AC field to determine the threshold (presently being done by Kirschvink) is important. B) Similar training experiments should be tried with higher animals (e.g., rats or mice).

**III. General Recommendations:** Studies aimed at the possible connection between EMFs and cancer, particularly for frequencies up to 60 Hz, should continue.

A focused, peer-reviewed program of tissue culture and whole organism studies makes sense. Its major goal should be the demonstration of reproducible effects (if any) at the cellular level at low field levels. As a general remark, funding for replication of claimed results is very important and should not be slighted, and collaborations between skeptics and believers should be encouraged and supported.

Epidemiology is worth pursuing as it addresses the actual situation in the field (after all, this is what people are concerned about). However, it is unlikely to be definitive. There should be an effort to develop "black boxes" for field measurement of various EMF parameters (spectrum, strength, direction, intermittency) in support of the epidemiology, and to provide simple dosimeters for direct recording of the EMF exposures to individuals....

Yours sincerely,  
Steve Koonin

1. R.K. Adair, *Physical Review A*, 43, 1039, 1991; see also a comment on this paper, J.L. Kirschvink, *ibid.*, 46, 2178, 1992.
2. *Magnetite Biomineralization and Magnetoreception in Organisms: A New Biomagnetism*, J.L. Kirschvink, D.S. Jones and B.J. MacFadden, eds., New York: Plenum Press, 1985.
3. J.L. Kirschvink, A. Kobayashi-Kirschvink and B.J. Woodford, *Proceedings of the National Academy of Sciences*, 89, 7683, 1992.
4. P. Semm and R.C. Beason, *Brain Research Bulletin*, 25, 735, 1990.
5. M.M. Walker and J.C. Montgomery, Univ. of Auckland, preprint, April 1992.
6. M.M. Walker and M.E. Bitterman, *Journal of Comparative Physiology*, A157, 67, 1985; *Journal of Experimental Biology*, 145, 489, 1989; *Bioelectromagnetics*, 10, 261, 1989; *Journal of Experimental Biology*, 141, 447, 1989.
7. J.L. Kirschvink and A. Kobayashi-Kirschvink, *American Zoology*, 31, 169, 1991.
8. J.L. Kirschvink et al., *Journal of General Physiology, Supplement on Sensory Transduction*, D. Corey and S. Roper, eds., 225, 1992.
9. R.K. Adair, *Bioelectromagnetics*, 13, 231, 1992.
10. T. Litovitz, unpublished.
11. W.R. Adey in *Interaction Mechanisms of Low-Level Electromagnetic Fields in Living Systems*, B. Nordén and C. Ramel, eds., New York: Oxford University Press, 1992.
12. S.J. London et al., *American Journal of Epidemiology*, 134, 923, 1991.

The EMF Experts <sup>TM</sup> at ENERTECH Consultants

are pleased to announce that

Dr. Luciano Zaffanella

has joined us as Vice President - Research and Director of our East Coast Office

ENERTECH Consultants

300 Orchard City Drive  
Suite #132  
Campbell, CA 95008  
(408) 866-7266  
FAX : (408) 866-7279

East Coast Office - 17 Main Street  
P.O. Box 770  
Lee, MA 01238  
(413) 243-2800  
FAX : (413) 243-4620

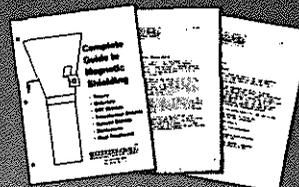
60Hz EMF SHIELDING SOLUTIONS

- Consulting, engineering and scientific support to utilities on EMF Management
- Room and Area shielding designed, fabricated and installed to reduce magnetic interference from power distribution equipment
- Shielded enclosures for Video Display Terminals

amuneal

MANUFACTURING CORP.  
4737 DARRAH ST., PHILADELPHIA, PA. 19124

215 535-3000  
FAX 215 743-1715



Call today for your free Complete Guide to Magnetic Shielding and EMF Information Bulletins

MICROWAVE NEWS

Subscribe Now!

1-Year Subscription—\$285.00 (Outside the U.S., \$315.00)  
6-Month Trial—\$150.00 (Outside the U.S., \$170.00)

Prepaid Orders Only.  
U.S. Funds or International Money Order, Please.

MICROWAVE NEWS • PO Box 1799 • Grand Central Station  
New York, NY 10163 • (212) 517-2800 • Fax: (212) 734-0316

RESOURCE  
EMF  
DIRECTORY

An indispensable listing of hundreds of EMF contacts—federal, state and local government, labor unions, research organizations, manufacturers, lawyers, legislators and citizens' groups.

Order your copy today!  
\$25.00 each + \$3.50 p&h  
(Outside the U.S., \$8.50 p&h)

U.S. Funds or International Money Order, Please.

MICROWAVE NEWS • PO Box 1799 • Grand Central Station  
New York, NY 10163 • (212) 517-2800 • Fax: (212) 734-0316

**ATTENTION PROFESSIONALS**

Get the convenience and accuracy of true 3-axis vector measurements with the Model 70 hand-held ELF milligauss meter.

- Ten-fold increase in productivity.
- Auto-ranging 0.1 - 1999 mG
- Low-cost... \$450.

Call or write for details

**TESLATRONICS**  
 1310 HOLLENBECK AVE. • SUITE C • SUNNYVALE, CA 94087  
 408-522-3770 • FAX 408-522-3771



**WHEN ACCURACY IS NEEDED**  
**ELF Survey Meter — FD1**  
 by **COMBINOVA**

- measures both magnetic and electric fields
- 3 axis meter gives reliable results
- holds peak value; compare to next reading
- covers ELF range 15-1000Hz
- Gauss or Tesla readout scale available

Available in the U.S. through



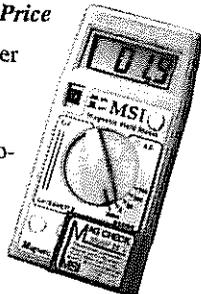
P.O. BOX 964 • SOUTHAMPTON, PA 18966 • (215) 357-5124 / FAX (215) 364-7582

**msi** ELF Magnetic Field Meters

Professional Accuracy at an Affordable Price

MSI-25 for reliable measurements of power frequency fields including harmonics and non-sinusoidal waves. \$215.00.  
 MSI-20/25 for frequency information on harmonics. Displays wave forms on oscilloscope; outputs to data logger. \$250.00.

For ordering or for information write or call  
**Magnetic Sciences International**  
 475 Gate Five Road, Suite 216  
 Sausalito, CA 94965 (415) 331-2976



**EMF LITIGATION: THE NEXT ASBESTOS?**

A seminar by Andrews Continuing Education Institute  
 November 11-12, Fairmont Hotel, Chicago  
 The faculty will include:

- Paul Brodeur — noted environmental author
- Michael Withey & Duncan Barr — *Zuidema* trial rivals
- John Gilleland — jury consultant — will present a videotaped mock EMF trial

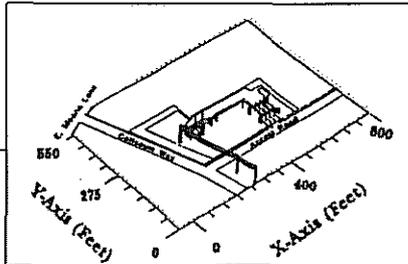
For information, contact: Kathy MacLeod  
 Andrews Continuing Education Institute  
 P.O. Box 1000, Westtown, PA 19395  
 (800) 345-1101, in PA (215) 399-6600

**ALS Cluster Prompts Study, Meeting...** Dr. Richard Hopkins, an epidemiologist with Florida's Department of Health and Rehabilitative Services in Tallahassee, plans to investigate the apparent cluster of amyotrophic lateral sclerosis (ALS) in South Patrick Shores and adjacent neighborhoods, near a powerful FAA radar. In September 1992, Hopkins completed a study of a Hodgkin's disease cluster in this small residential area, finding that the incidence of the disease was as much as three times the expected rate (see *MWN*, J/F92). He told *Microwave News* that he will now try to determine "whether the incidence of ALS is indeed elevated." The cases of ALS, also known as Lou Gehrig's disease, and the possible link to the radar were first reported last April in a series of articles in *Florida Today*, a newspaper based in Melbourne (see *MWN*, M/J93). The investigation by reporter Marilyn Meyer, which uncovered eight people who had developed ALS since 1980, was "a valuable service," Hopkins said. But he cautioned that, "Our criteria for identifying a case of ALS are going to be quite different than a newspaper reporter's." He emphasized that there is no known cause for ALS and that any discussion of possible causes would be premature until the existence of a cluster is verified. Hopkins announced plans for the study, which will begin by next spring, at a September 16 community meeting in South Patrick Shores organized by Rep. Jim Bacchus (D-FL). Bacchus has since asked the FAA to shut down the radar sooner than the end of 1994, when it is scheduled to be replaced by a new radar at a different location. The replacement of the radar is part of a nationwide upgrade of the air traffic control system. "I believe we share the view that the relocation of the radar dome from close proximity to a residential community would be in the best interest of public health," Bacchus wrote in a September 27 letter to Ted Beckloff, FAA regional administrator in East Point, GA. The purpose of the meeting, according to Brian Faith, an aide to Bacchus, was to bring in government experts who could address community concerns over radiation from the radar. Several hundred people attended, Faith said, and they heard from a panel that included Ed Mantiply of the Environmental Protection Agency in Montgomery, AL, and Daniel VanderMeer of the National Institute of Environmental Health Sciences in Research Triangle Park, NC. Bacchus held a similar meeting later the same day in nearby Vero Beach, where residents are concerned about a proposed power line that would run through their community.

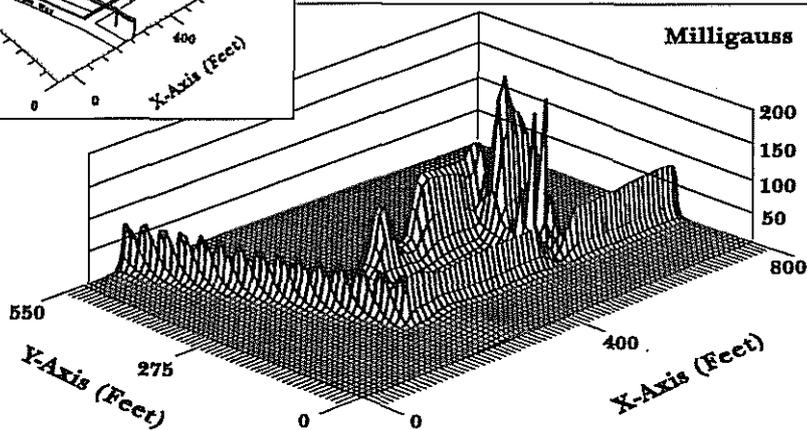
**Phased Array v. Scanning...** Replacement of a powerful military radar on the Yorkshire moors in the U.K. has added to the controversy surrounding the site. A new survey shows that, in some areas close to the Fylingdales facility, the new phased array radar has resulted in sharp increases in radiation exposures when compared with exposures from the scanning radar system used previously. Indeed, at Saltersgate Inn, the residence closest to the pyramid-shaped transmitter, average field strengths are now 0.5 V/m, with peak fields as high as 4.0 V/m, according to measurements taken by Elmac Services for the Nuclear Free Local Authorities (NFLA). In an area accessible to hikers, just under 1 km from the radar, the average and maximum fields are 1.74 and 10.0 V/m, respectively. The new radar operates at about 420

# RESICALC™

## State-of-the-Art EMF Software



Developed for EPRI by the EMF experts at Enertech, this CAD-type software allows the user to "draw" three-dimensional transmission and distribution lines and substation buswork and feeders. The software calculates and displays magnetic field as a 2-D contour map or 3-D field plot that can be rotated to view results from any angle. RESICALC is a popular multi-purpose Windows 3.1 application.



view results from any angle. RESICALC is a popular multi-purpose Windows 3.1 application.

***Go to the Source :***

**ENERTECH Consultants**  
 300 Orchard City Drive  
 Suite #152  
 Campbell, CA 95008  
 (408) 866-7266  
 FAX : (408) 866-7279

# EMF METERS

**Full Range of ELF & VLF Measurements Comply with:**

- SWEDAC MPR 1990:10 • ACGIH TLV
- ANSI C95 .1-1992 • IEEE P-1140

### MAGNETIC FIELDS

ELF                      VLF  
**HI-3627              HI-3637**

- Isotropic (3-Axis) Probes
- True RMS Detection
- Recorder Output
- Readout in Gauss, Tesla, or A/M

### ELECTRIC FIELDS

ELF & VLF  
**HI-3638**

- Fiber Optically Isolated
- Single-Axis Sensor
- True RMS Detection
- Recorder Output

For 28 years, Holaday Industries' only business is electric and magnetic field test equipment.



Call or fax your request for further information.  
**HOLADAY INDUSTRIES, INC.**

14825 Martin Drive  
 Eden Prairie, MN 55344  
 612/934-4920 Fax 612/934-3604

**Don't spend a fortune to get accurate EMF measurements**

The ELF Milligauss series of meters permits accurate, low-cost measurement of ELF/power frequency magnetic fields. Five models cover a wide range of applications including 3-axis and VLF.

- Digital LCD display with resolution to 0.1mG.
- Hand-held, light-weight, self-contained.
- Models from \$119.95 to \$450.00.



**TESLATRONICS**  
 1310 HOLLENBECK AVE. • SUITE C • SUNNYVALE, CA 94087  
 408-522-3770 • FAX 408-522-3771

**VDT NEWS**

1-Year Subscription (6 issues)—\$127.00  
 (Outside the U.S., \$150.00)

2-Year Subscription (12 issues)—\$225.00  
 (Outside the U.S., \$265.00)

Prepaid Orders Only. U.S. Funds, Please.

PO Box 1799 • Grand Central Station • New York, NY 10163  
 (212) 517-2802 • Fax: (212) 734-0316

**DETECT ELECTROMAGNETIC RADIATION "HOT SPOTS"**



For people choosing to exercise "PRUDENT AVOIDANCE" to electromagnetic fields generated by most electric appliances & equipment.

Determine "Electromagnetic Hot Spots" in your home or workplace with a low cost Walker Scientific ELF Monitor (Gaussmeter). Choose from the most comprehensive line of electromagnetic field radiation monitors available on the market today. Send for FREE Catalogue.



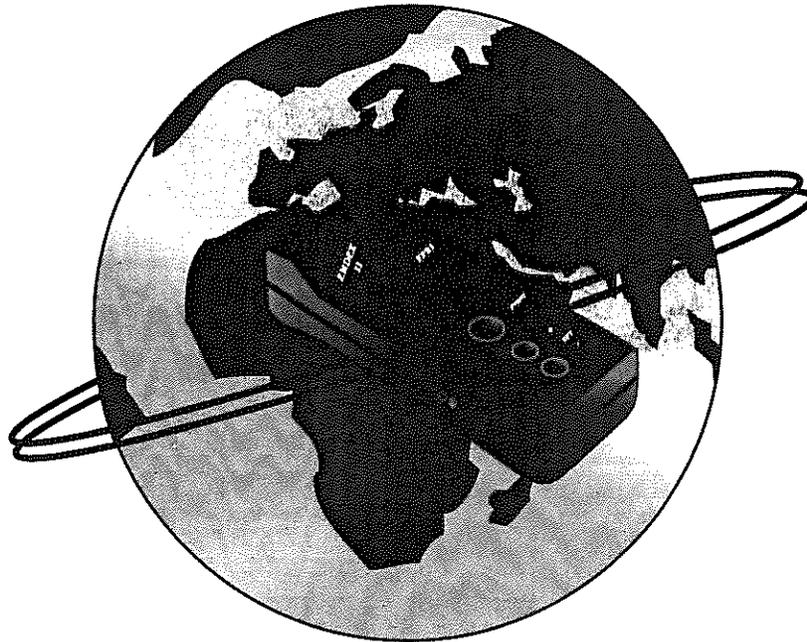
Rockdale Street • Worcester, MA 01606 U.S.A.  
 Tel: (508) 852-3674 / 853-3232  
 Toll Free: 1-800-962-4638 • Fax: (508) 856-9931

MHz. A 1991 NFLA survey (see *MWN*, J/A91) did not include measurements taken at the Saltersgate site because radiation levels at that time were too low to be recorded accurately, the new report states. NFLA, a Manchester-based group that monitors the British military, warned at the time that the phased array system would increase exposures. This prediction was borne out by the recent survey, which showed as much as a tenfold increase in places where the old radars were not visible but where the new radar, in a slightly different location, is not blocked. At most measurement points, however, average field strengths are little changed and peak field strengths are lower than those found in 1991. A key concern raised previously was that peak fields posed an interference threat to the electronic components of automobiles on a highway about 1 km from the transmitter; that threat has "been reduced though not eliminated," according to the report. Fylingdales is part of the Ballistic Missile Early Warning System, which also has sites in Greenland and Alaska. NFLA suggests that, with the breakup of the Soviet Union, there is no justification for this powerful radar and that it should be shut down. For a copy of the report, which is dated August 2, 1993, contact: Stewart Kemp, Nuclear Policy and Information Unit, Town Hall, Manchester, M60 2LA, U.K. (44+61) 234-3324.

**VDTs**

**EMF Workshop and Research Grants...**Leading researchers from North America and Europe gathered in Baltimore on July 27 to exchange ideas for improving VDT EMF exposure assessments. Participants at the workshop, which was sponsored by the Center for VDT and Health Research, included Gert Anger of the Swedish Radiation Protection Institute in Stockholm, Dr. Maila Hietanen of the Institute of Occupational Health in Helsinki, Finland, Dr. Michele Marcus of Emory University in Atlanta and representatives from Apple Computer Inc., Compaq Computer Corp., IBM Corp. and Ontario Hydro. The goal of the meeting was to develop common approaches to assessing VDT EMF exposures, according to Dr. Patrick Breyse, associate director of the center, which is located at the Johns Hopkins University School of Hygiene and Public Health in Baltimore. He said that discussions focused on three areas: what to measure; how to assess exposures when VDTs are not the only source of EMFs; and how to use the data in the context of an epidemiological study. Breyse said that the center will submit a paper on the workshop for publication. Meanwhile, the center has funded three studies on VDT EMFs and cancer or reproductive risks—the same three it reviewed earlier this year (see *MWN*, M/A93). The projects will each receive about \$50,000 a year for at least two years, Dr. Ronald Gray, director of the center, told *Microwave News*. The center has already received 70 preliminary requests for funding for next year and has asked for detailed proposals for 12 of them, Gray said. Final selections are expected by December. The center's research interests have not changed, but the nature of the proposals has, Gray said, noting that there have been more requests for ergonomics research than anticipated. The center, which plans to provide grants next year totaling \$500,000, is funded by the VDT Health Research Foundation, which was set up by Apple, Compaq and IBM (see *MWN*, M/A92 and S/O92).

# Used Around The World for EMF Measurements



Australia - Canada - Denmark - France - Germany - Greece - Hong Kong  
Italy - Japan - Mexico - New Zealand - Republic of China - Saudi Arabia  
South Africa - Spain - Sweden - Switzerland - United Kingdom - United States

The popular **EMDEX II**<sup>TM</sup>, with its on-board computer, rich data analysis and graphics features, and 3-D magnetic field mapping capabilities, was developed for EPRI by the EMF Experts<sup>TM</sup> at ENERTECH. We think it is the most flexible EMF instrument available for all your measurement and analysis needs.

**Standard : 0 - 3 Gauss (0.3 mT)**  
Resolution : 0.1 mG (0.01  $\mu$ T)

**High Field : 0 - 120 Gauss (12 mT)**  
Resolution : 4 mG (0.4  $\mu$ T)

(Note : Special versions up to 3 kHz also available)

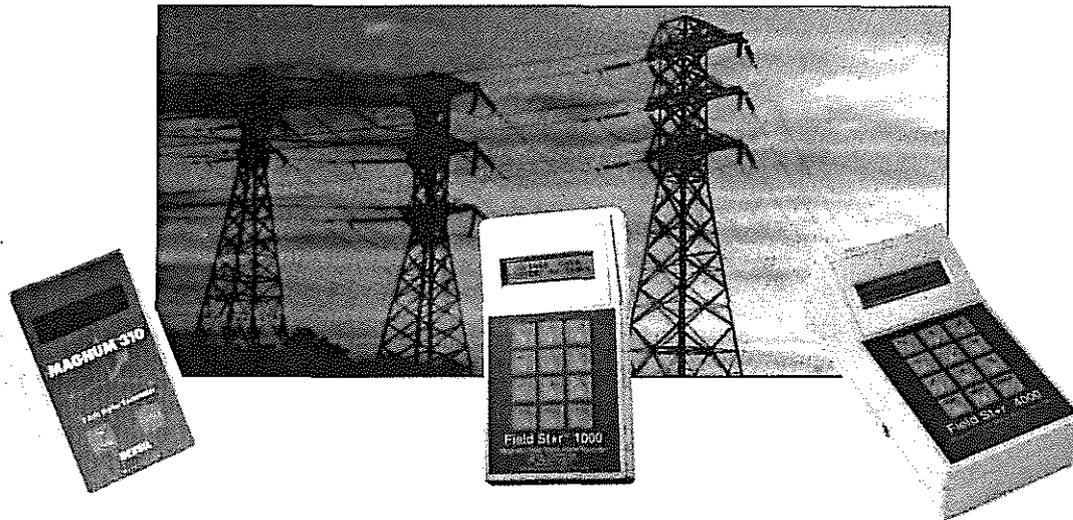
*Go to the Source :*

**ENERTECH Consultants**  
300 Orchard City Drive, Suite 132  
Campbell, California 95008  
Telephone : (408) 866-7266  
FAX : (408) 866-7279

*When People Ask About Magnetic Fields*

## *Can you provide the answer?*

The growing concern over the effects of electromagnetic fields has placed electric utilities and industrial safety engineers in a difficult position. Dexsil offers you three ways to address these concerns.



### **Magnum™ 310**

Dexsil's Magnum 310 is an affordable, 3-axis, 10-Gauss digital meter that provides fast, accurate readings of AC magnetic field strength with three switchable filter settings.

The Magnum 310 is ideal for site surveys and requires no setup or calibration. The three filter settings for 60 Hz, 180 Hz or broadband analysis can be selected with the push of a button, isolating the primary and third harmonic from the broadband value.

Other features of the Magnum 310 include: a 2x16 alpha-numeric readout with two display modes—resultant only or resultant-with-vector-components, a resolution of .04 mG, a durable membrane keypad, auto shut off to save battery power, and a low battery indicator.

### **Field Star™ 1000 & Field Star™ 4000**

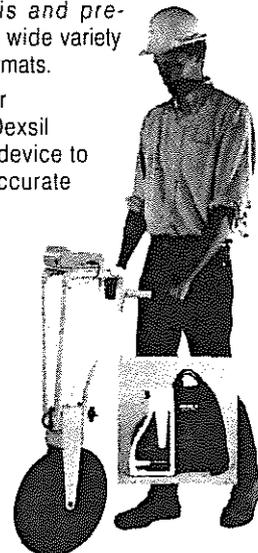
Both Dexsil's Field Star 1000 and Field Star 4000 are full function data loggers for AC magnetic fields. The Field Star 1000 has a full scale range of 1000 mG with a resolution of .04 mG and the Field Star 4000 has a full scale range of 4000 mG for higher current environments.

Each device has three orthogonal sensing coils to measure the vector field components. Both devices can be used as either survey instruments or data loggers to record data as a function of time, distance or position. In the survey mode, the resultant and vector components can be displayed in real time and can be used to locate magnetic field sources. The time-data sampling mode allows the user to store field readings at intervals of seconds or minutes for exposure measurements

or dosimetry. With the use of the mapping wheel, straight line profiles or complete 2-D maps of field strength can be made. Event markers and turns can easily be entered from the keypad.

Software provided with each unit allows the user to upload data easily to any PC compatible computer for data analysis and presentation in a wide variety of graphics formats.

Whatever your application, Dexsil has the right device to provide the accurate information you need.



For more information contact Dexsil.

# DEXSIL®

One Hamden Park Drive, Hamden, CT 06517  
Phone (203) 288-3509 Fax (203) 248-6523

Magnum 310, Field Star 1000 and Field Star 4000 are trademarks of the Dexsil Corporation.