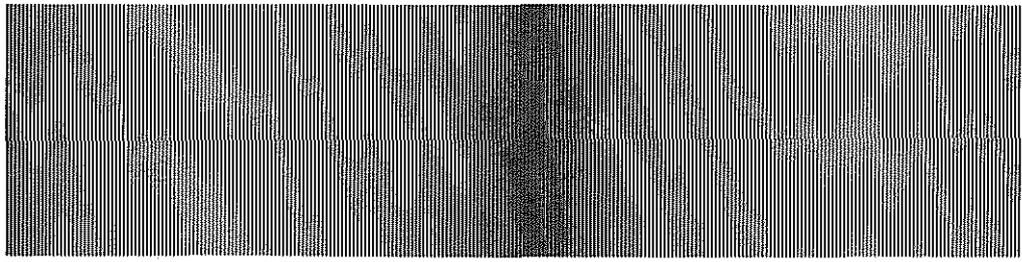


# MICRO WAVE NEWS



Vol. XIII No. 4

A Report on Non-Ionizing Radiation

July/August 1993

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## German Animal Studies Support EMF-Breast Cancer Link

### A Boost for the Melatonin Hypothesis

German scientists have found strong support for the proposition that electromagnetic fields (EMFs) can promote breast cancer. In a series of animal experiments, they have shown that magnetic fields can magnify the action of a chemical carcinogen, increasing the incidence of breast tumors. They have also thrown some light on a possible mechanism by showing that the EMFs reduced the animals' melatonin levels.

In a paper that appears in the July 30 issue of *Cancer Letters*, Dr. Wolfgang Löscher and coworkers at the School of Veterinary Medicine in Hannover report that long-term exposure to 50 Hz magnetic fields "promotes the growth and increases the incidence of mammary tumors." This finding, they say, "strongly [indicates] that magnetic field exposure exerts tumor-promoting and/or co-promoting effects."

Löscher continuously exposed 99 rats that had been treated with DMBA, a known carcinogen, to a 1 G magnetic field for three months and found that 50% more rats developed tumors than did others who were only treated with DMBA. The increase is statistically significant. Löscher is in the process of repeating the study using 100 mG. "If we find something, we'll try 10 mG," he told *Microwave News*.

(continued on p.13)

## EPA Scales Back Cancer Review, To Eliminate EMF & RF/MW Programs

The Environmental Protection Agency (EPA) will not revise its 1990 report on the possible cancer risks associated with electromagnetic fields (EMFs). Instead, the agency will prepare a 30-page summary of the scientific data. This is scheduled for release at the end of 1993 or early in 1994.

At the same time, EPA's Office of Radiation and Indoor Air (ORIA) is proposing to phase out practically all work on non-ionizing electromagnetic radiation (NIER)—including both EMFs and radiofrequency and microwave (RF/MW) radiation—as part of the President's plan to reduce the budget deficit. If the ORIA budget is adopted, by fiscal year 1995, which begins on October 1, 1994, there will be only one staff position in the entire agency for these programs. They are vulnerable to budget cuts, according to EPA managers, because they are discretionary, with no specific congressional mandate.

"We thought it would be a duplication of effort to revise the cancer document," Dr. Robert McGaughy, a senior scientist at EPA's Office of Health and Environmental Assessment (OHEA) responsible for the report, told *Microwave News*. He cited the similar efforts under way by the National Council on Radiation Protection and Measurements and by the National Academy of

(continued on p.14)

## « Power Line Talk »

What will it take to convince skeptics that there is indeed an EMF-cancer connection? Dr. **David Bates**, a highly regarded Canadian epidemiologist, says that only a prospective occupational study will do the trick. Countering the popular opinion that animal studies are the missing link, Bates points to Sir Richard Doll's prospective study of smokers as having turned the tide against cigarettes. In his opening address to the **Bioelectromagnetics Society's** annual meeting, in Los Angeles in June, Bates said that the current EMF evidence is not strong enough to shift the burden of proof for establishing safety onto the electric utilities. On the other hand, he argued that it is entirely proper to take protective steps before understanding the mechanism of action. One should not have to wait until all the data is in hand, he said — after all, no one yet knows why cigarettes and asbestos act synergistically to magnify cancer risks. Bates, an emeritus professor of medicine at the University of British Columbia in Vancouver, Canada, recalled that he advocated taking the lead out of gasoline as early as 1972, long before this view became the prevailing public policy. He also urged people to be wary of those who sum up the epidemiological evidence with phrases such as “no scientific proof that...” or “no objective evidence of...” Whenever one hears such phrases, Bates advised, it is a good idea to seek some clarification. In an interview with *Microwave News*, Bates endorsed a policy of prudent avoidance—citing as an example a hospital in Seattle where exposures reached 100 mG. “That’s too high,” he said; he suggested converting the area into a store-room. But, on further questioning, he declined to specify a level that he would consider safe. Bates said the epidemiological data have gained consistency and are more biologically plausible than in 1990 when the EPA released its EMF-cancer assessment. Bates was the vice chair of the committee that reviewed the document for the Science Advisory Board (see *MWN*, J/F 91). Bates cautioned that a prospective study of EMF-exposed workers would take a long time, but, he said, there really is no other choice because “no animal study can tell you enough.” (Much of Bates’s speech was drawn from a series of lectures he gave at the University of Washington, Seattle, last March, which will be published later this year by the University of Washington Press.)

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Somewhere in the budget process, the national EMF research and communications program (NERP) lost \$5 million and no one seems to know how or why. Last year’s Energy Policy Act mandated \$13 million a year, for five years, for the NERP, but that amount has now shrunk to \$8 million—and it could easily shrink further in the budget battles to come. When details of the President’s 1994 budget first leaked out earlier this year, we were told that the NERP would get \$12 million: \$6 million from Congress, to be matched by \$6 million from industry. At the same time, DOE’s ongoing research effort was to get \$4 million. When the House passed its appropriations bill in June, the NERP and DOE figures were switched. Cutting \$2 million from the NERP budget will cost the program another \$2 million in industry matching funds. Last November, at the annual DOE EMF research review in San Diego, DOE’s Robert Brewer told us

emphatically that there would only be one EMF research effort, the NERP (see *MWN*, N/D92). The DOE program appears to have made a surprising comeback. It is now bigger than the much-touted national program. DOE officials say there never was a switch and that now nothing can be done to reallocate the money. After all, they argue, if anyone rocks the boat at a time when budgets are being slashed, they risk losing everything. In an interview, **James Cunningham** of the New York Power Authority, who lobbied hard to enact the NERP, expressed frustration over the budget cuts and the slow progress. “The intent of Congress was clear,” he said. “The program should be fully funded.” He warned that, “The public wants answers and wants them soon.” Nothing is certain until the Senate acts and the House and Senate agree on a compromise. The Senate may in fact be sympathetic to the need for the NERP. Last August, 15 senators signed a joint letter calling the NERP “imperative.” They also specifically supported the designation of NIEHS as the lead agency for carrying out EMF research. The new NERP advisory committee is writing a letter to the Senate Appropriations Committee stressing the need for a full program. At its first meeting on August 5-6, **Shirley Linde** of Citizens for Safer EMFs, in Los Angeles, was elected chair of the committee and **John Coughlin**, a commissioner at the Wisconsin PSC, was elected vice chair. The committee’s next meeting is scheduled for November 4-5 in Savannah, GA, following the DOE contractors’ review (see *MWN*, M/A93).

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A British couple has filed a suit alleging that their 13-year-old son’s leukemia was caused by EMFs from a nearby substation, buried power lines and household wiring, according to British news reports. If brought to trial, this case would be the first of its kind in the **United Kingdom**. In mid-August, the family won legal aid to pursue the case—legal aid is provided to those who can demonstrate an economic need and can show that their claim has merit. **Simon Studholme**, who died last year, was diagnosed with leukemia 19 months after the family moved into a home near Manchester, in northern England. A survey of the family’s home by Alasdair Philips, an electronics engineer, indicated that the magnetic fields in the boy’s bedroom were “ten times the level[s] American and Swedish studies had linked to an increased risk of childhood leukemia,” according to the August 23 *Daily Telegraph*. (Roger Coghill of Coghill Research Labs in Gwent, Wales, has also done measurements in the Studholme home.) Simon’s father, Ray Studholme, is also seeking damages for his 12-year-old daughter’s epilepsy, and he wants Norweb, the local electricity company, to reduce the EMFs in his home. On August 22 the *Sunday Times* reported that Norweb denies liability and refuses to mitigate the EMFs. Ray Studholme, who is being represented by attorney **Martyn Day** of the London firm of Leigh, Day & Co., argues that if his family had been warned, their son would not have slept so close to the household electric meter, which was located on the other side of the wall next to the boy’s bed. In the past, Day has worked on ionizing radiation cases. The Studholmes’ argument is similar to the

claim made by the Zuidema family in the U.S. The Zuidemas—whose daughter developed a rare kidney cancer—argued unsuccessfully that San Diego Gas & Electric had had a duty to warn its customers about the potential health effects of EMFs (see *MWN*, M/J93). On August 23 the *London Times* speculated that, “The case could lead to scores of similar claims, forcing electric-ity companies to monitor thousands of homes and eliminate any risk from pylons and substations, at huge expense.”

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The DOE has declined to initiate a nationwide EMF survey of schools near power lines, as was requested by New York State Attorney General **Robert Abrams**. Instead, the question will be left to NERP policymakers. “Decisions to conduct nationwide surveys of particular field sources, such as transmission line fields near schools, will be made a part of this national effort,” wrote DOE’s Dr. **Robert San Martin**, acting assistant secretary of energy efficiency and renewable energy, in a July 7 reply to Abrams. The attorney general had written to Energy Secretary **Hazel O’Leary** on June 22, asking that she “use the power and influence” of her office to urge utilities across the country to conduct EMF surveys at schools. “The time is ripe for the DOE to take a strong national lead on this issue,” Abrams wrote. The call for a national effort came as New York was finishing its own schools survey—a similar effort is under way in New Jersey and another has been proposed in Maryland by state Delegate **Joan Pitkin**. The California Department of Education’s EMF-schools task force is considering a proposal by Dr. **Raymond Neutra** of the Department of Health Services and utility representatives to identify schools that are near transmission lines. Of the more than 6,000 schools in New York, 115 are near high voltage overhead power lines, and 24 are thought to have EMFs in excess of 2 mG, according to a report released by Abrams on July 22. The levels were calculated with computer models—on-site measurements have not yet been taken. The highest peak levels, 35 mG and 33 mG, were found at schools in Westchester and Erie Counties, respectively. School officials now have the option of requesting on-site measurements by the utilities that operate the lines, “so that the public may be fully informed about the potential for EMF exposure,” according to Abrams. The majority of the 24 schools are located near power lines operated by Consolidated Edison Co., Long Island Lighting Co. or Niagara Mohawk Power Corp. (For more on New York’s EMF survey, see *MWN*, N/D92, M/A93 and M/J93; for more on California and EMFs in schools, see *MWN*, M/J88 and M/J93.)

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An ad in the July/August issue of *E Magazine*, an environmental bimonthly, introduces a new, bimonthly “consumer newsletter for electric and magnetic fields.” Our interest piqued, we decided to find out who is behind the new publication, which has the provocative name *EMF: Between the Lines*. Subscription inquiries are directed to the Center for Energy Information in Augusta, ME. At the bottom of the ad is this statement: “*EMF: Between the Lines* does not accept any form of advertising, endorsement, or sponsorship.” It turns out that, such a statement of independence notwithstanding, the Center for Energy Informa-

### “It’s the Wires”

*The following is excerpted from an article, “The Devil in Long Island: What’s possessed this once-somnolent suburban realm and turned it into a tabloid pandemonium of spouse-slayers, serial killers and demented dungeon-builders?” It was written by Ron Rosenbaum and appeared in The New York Times Magazine on August 22. Parts of New York City as well as Nassau and Suffolk Counties are on Long Island.*

Why is this Island different from all other islands? And why are so many Long Islanders suddenly running amok?

The question of Long Island uniqueness was posed in a particularly acute way by one of the characters on one of those three Amy Fisher-Joey Buttafuoco made-for-TV movies.

The scene: The interior of Joey’s Complete Auto Body Shop. One of Joey’s employees is theorizing about the deep, underlying source of the love triangle shooting. He’s obviously given some thought to the vexing question, attributing it to “Mid-Island Syndrome.”

“It’s the wires,” he declares. “The wires weren’t buried underground like in other parts of the country, so with all this electricity in the air, it fries some people’s brains.”

Now there are some practical objections to this theory. A Lilco spokeswoman, after checking with the Long Island power company’s electric service operations department, insisted that Long Island does not differ from the rest of the nation in the way it deploys its high-tension lines and that, in fact, more are buried than exposed. Still, the power line explanation at least attempts to offer a unified field theory of Long Island mania. And even the Lilco spokeswoman, perhaps attempting to divert attention from the power lines, offered an implicit endorsement of the quest for *some* explanation.

“Now the water—that’s another story,” she said.

tion is a division of **Central Maine Power Co. (CMP)**. The utility’s name does not appear anywhere in the ad. It does appear, however, in a smaller ad that ran in the September/October issue of *E*. “It took us a while to put two and two together that it was CMP,” the magazine’s associate publisher, Deborah Kamrani, told *Microwave News*. But when payment for the first ad arrived, the check was from CMP, and Kamrani asked *EMF: Between the Lines* to name CMP in any future advertising. Judy Franke, editor of the newsletter, asserts that the utility was not mentioned in the initial ad because “the management of CMP has no say whatsoever in what we do.” Franke described the Center for Energy Information, which also publishes a biweekly industry newsletter, *EMF Keeptrack* (see *MWN*, J/F92), as “an independent information brokerage company.” CMP will probably not be mentioned anywhere in the newsletter itself, Franke said, though a final decision has not been made. The first issue will come out in September. If you read carefully—between the lines, one might say—there is a clue in the original ad in *E* that a utility is involved: the address for the Center for Energy Information is on Edison Drive.

## Rhode Island Governor Vetoes Bills To Bury Power Lines

Rhode Island nearly became the first state to prohibit the construction of overhead transmission lines near homes and schools. At the last minute, the state senate reversed itself and decided not to override a veto by Democratic Governor Bruce Sundlun.

A bill introduced by Sen. Mike Lenihan (SB570) would have forced new power lines of at least 69 kV near residences and schools to be built underground. A companion measure in the house, sponsored by Rep. Russell Bramley (HB6882), would have required that *all* new lines of at least 69 kV be buried.

In his veto messages for both bills, Sundlun said that evidence of an EMF-cancer link is "weak, inconsistent and inconclusive," and that "most scientific studies do not support the findings that would be recognized and adopted" if the bills were to become law. He argued that high voltage transmission lines represent "a small fraction" of public exposure to EMFs, that the measures would not significantly reduce such exposure and that burying power lines would increase electricity costs in the state. Bramley's bill passed the house 78-7 and was vetoed on July 21. Lenihan's measure was vetoed on July 13, about a month after it had passed the senate 25-19.

On July 19, the senate voted 28-16 to override the veto of Lenihan's bill. But later that day, after a motion was made to reconsider, the senate fell short of the three-fifths majority necessary for an override and the veto held. Lenihan said that he thinks the reversal was unconstitutional and he attributed the switch to aggressive lobbyists "who got five or six people to change their minds" during a break after the first session. Ed Seiler of Rhode Islanders for Safe Power, which actively supported the bills, called the move "Rhode Island corruption at its worst," adding that opponents of the bill "didn't win [the decision], they stole it."

The Providence-based Narragansett Electric Co. does not claim credit for the override. After losing the first vote, its lobbyists went home, according to the utility's associate counsel, Ronald Gerwatowski. "But we were delighted with the result," he said, adding that the legislation is "unnecessary because the science to date doesn't support the conclusions that there are adverse health effects from power line EMFs, and [burying the lines] would add to the costs of electricity in Rhode Island, which are already high."

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Kevin Brubaker, an environmental policy analyst for the governor, said that Sundlun's legislative director and staff were present during both override votes, and that it would be "fair to conclude that they were communicating the governor's views on the issue." He argued that the switch was not unconstitutional.

On July 22, the house overrode Sundlun's veto of Bramley's bill, but the session ended before the senate could vote on it. The house bill was thought to have much less of a chance than Lenihan's, because it was the more far-reaching of the two bills. Bramley and Lenihan, both of whom are Democrats, said that they will introduce similar measures again next year. "We're going to keep knocking at the door until someone opens it," Lenihan said.

## California PUC Judge Issues Long-Awaited EMF Proposal

After two and one-half years of workshops, meetings and paperwork, a California administrative law judge has decided that EMFs from new power lines should be reduced by at least 4%—as long as the cost of doing so is no more than 4% of a project's total budget.

The July 12 proposal by Public Utilities Commission (PUC) Judge Michael Galvin still must be approved by the four-member commission, which could elect to adopt all, part or none of the plan. The commissioners are scheduled to meet on September 17.

Galvin's 57-page decision is based, in part, on a set of proposals for a state EMF policy devised by a PUC consensus group made up of utility representatives, government health officials, ratepayers, environmentalists and union members. The plan was presented to the PUC on March 20, 1992 (see *MWN*, N/D91 and M/A92).

Galvin also recommended the following:

- A \$5.6 million, four-year "nonexperimental" state research program to review policy options and mitigation strategies;
- A maximum \$4.1 million contribution to the national EMF research and communications program;
- A \$1.6 million, four-year California education program;
- An EMF "Stakeholder Advisory Committee" to monitor and report on the state research program.

Overall, the proposal received mixed reviews from members of the consensus group. But Galvin's plan to reduce EMFs by 4% faces widespread opposition.

Southern California Edison's Jack Sahl supports the decision to cap the cost of EMF reduction measures at 4%, but said that mitigating EMFs by at least 4% would be "administratively unwieldy, because of the burden of having to determine what 4% is." Sahl also criticized what he called a "cookbook" approach to controlling power line EMFs, advocating instead project-by-project evaluations, which would put greater emphasis on community input when deciding on reduction levels.

Ellen Stern Harris of the Fund for the Environment in Beverly Hills opposed the selection of the 4% cost and reduction thresholds, saying that they "make no sense" and represent

"tokenism at its worst." Harris also said that she was "shocked" that the proposal does not order retrofits to reduce EMFs on existing power lines.

The PUC's Division of Ratepayer Advocates (DRA) called Galvin's proposal to cut magnetic fields by 4% "confusing" because "there is no cost-benefit analysis in the record to support this number," according to its formal comments to the PUC. The DRA also recommended a policy that "explicitly requires the utilities to reduce EMF fields as much as possible, but at least by the adopted minimum."

DRA's Diana Brooks endorses Galvin's decision to deny the utilities' request that the PUC approve the way they choose to implement EMF reduction measures. "The bottom line is that the onus is still on the utility," she said, explaining that without validation by the PUC, utilities will have to answer to their local communities.

Galvin's order states that utilities will decide how to carry out the "low-cost" EMF reduction measures, and that they will be able to choose which projects should be exempt—for example, a new power line built in a rural area.

## **Fresno School EMF-Cancer Case Dropped, But More May Follow**

The family of a former teacher at the Slater School in Fresno, CA, has dropped its suit against Pacific Gas & Electric Co. (PG&E), but another EMF-cancer case against the utility is pending and more may soon follow.

The Slater School was first put in the spotlight by Paul Brodeur in a December 7, 1992, article in *The New Yorker*. Brodeur drew a connection between a high rate of cancer among teachers and EMFs from power lines outside the school and criticized the cluster investigation by the California Department of Health Services (DHS) (see *MWN*, N/D92, J/F93 and M/A93).

The first suit, which was filed by the family of Katie Mae Alexander, a former teacher at the school, was dropped amid a shuffling of lawyers. Alexander died in April 1991 at the age of 53 from a brain tumor her family says was caused by EMFs from PG&E power lines. The teacher had worked in classrooms on the south side of the school, nearest the 115 and 230 kV lines.

The suit was filed on April 21, 1992, by Haskell Shapiro, now of Shapiro & Hickman in Los Angeles. But the family replaced Shapiro after learning that he had not prepared for the case and had missed several appointments and deadlines, according to Tommie Nellon, Alexander's son. The family also asked for a continuance while it searched for a new attorney. Shortly before the July 26 trial date, after a Fresno County Superior Court judge denied the request, the family accepted PG&E's offer to waive legal expenses in return for their dropping the suit permanently.

A second claim, filed by Shapiro in February 1993, was taken over by Joe Davis of the Los Angeles firm of Davis & Winston on August 6. This suit was brought on behalf of former assistant principal Curtis Hurd, who joined Slater in 1986 and died of colon cancer in February 1992 at the age of 43. In a telephone interview, Davis said that several more Slater staff, students and

## **Danish Government Finds No Need for EMF Exposure Limits**

The Danish Ministry of Health has decided that there is "no scientific reason" to set standards limiting exposure to power line EMFs, according to a report published in May.

A group of experts convened by the ministry determined that while the Swedish and Danish epidemiological studies completed last year (see *MWN*, S/O92 and N/D92) "support the hypothesis of previous studies that children living near high-current [facilities] have an increased frequency of cancer," they do not provide strong enough evidence of an EMF-cancer link to merit setting exposure standards. "Neither the earlier nor the latest studies offer sufficient documentation to characterize 50 Hz magnetic fields in homes adjacent to high-current electricity supply [facilities] as a cancer-inducing factor among children," the report states, noting that the observed increased risk might be due to chance.

These conclusions stand in contrast to those reached by the Swedish government. Last fall, Sweden's National Board for Industrial and Technical Development, NUTEK, announced that it would "act on the assumption that there is a connection between exposure to power frequency magnetic fields and cancer." Officials are now in the process of drafting a proposal for a national magnetic field exposure limit for new power lines and substations (see *MWN*, S/O92 and M/J93).

In reaching its decision, the Danish group also focused on the review by the U.K.'s National Radiological Protection Board (see *MWN*, M/A92).

The group of experts was chaired by Professor Carl Wandel of Aarhus University in Aarhus, Denmark. To order a copy of the report, *Rapport om Risiko for Kraeft hos Born med Bopael Eksponeret for 50 Hz Magnetfelter fra Hojspaendingsanlaeg [Report on the Cancer Risk for Children in Homes Exposed to 50 Hz Magnetic Fields from High-Voltage Power Systems]*, contact the expert group at the health ministry at: Sundhedsstyrelsens 1. Afdeling, Amaliegade 13, 1012 Copenhagen, Denmark, fax: (45) 33 93 15 63.

community members want to file similar suits against PG&E, and that their actions will most likely be consolidated with the Hurd case.

PG&E's lawyer, Roger Rizzo of Sedgwick, Detert, Moran & Arnold in San Francisco, said that the Alexander and Hurd claims are without merit, and that similar future cases will have little chance. "I don't think that anyone will be any more successful than Alexander was," he told *Microwave News*. Rizzo maintained that Alexander's claim was "completely inaccurate" and said that the utility's twelve expert witnesses were prepared to testify that EMFs do not cause cancer. PG&E had also taken depositions from four "neutral, unpaid" physicians who treated the teacher and who stated that her cancer was not caused by EMFs, Rizzo said.

With respect to Hurd's case, Rizzo said that the assistant principal had worked about twice as far away from the power lines as Alexander did. He was exposed to "very, very low levels of EMFs, not unlike what people across the country are exposed to every day," Rizzo said.

Early in 1991, the DHS was asked to evaluate a possible cancer cluster at the Slater School, after teachers there had raised concern about power line EMFs. The DHS released a report this June which concluded that 13 cases of different types of cancer among Slater School staff—about twice the expected number—were probably due to chance. "Past experience has been that in suspected cancer clusters for which a probable cause has been found, the cancers have all been of the same kind...[and] there was a large excess of cancer cases, twenty to thousands of times higher than the expected number," the report states. It also notes that there have been no reported cases among Slater staff of leukemia or lymphoma, "the types of cancer most commonly reported associated with EMFs." Eleven of the 13 staff members with cancer worked in classrooms on the south side of the school, near the power lines.

Davis argues that the DHS may have underestimated the number of cancer cases at the school because researchers failed to locate or contact half of the 195 teachers, aides and administrators who worked at Slater between 1972—when the school opened—and 1993. He also said that additional cancer cases have been reported in the short time since the study was published.

The report answers this criticism by stating that even if more cancer cases came to light, "there would still not be the 20 to thousandfold excess" characteristic of clusters with a known cause. In August, Dr. Eva Glazer of DHS's cancer surveillance section, who cowrote the report with Dr. Raymond Neutra, chief of the department's Environmental Health Investigations Branch, did confirm a 14th cancer case.

Investigators found that in the section of the building closest to the power lines, magnetic fields did not exceed 2 mG on most days and reached a long-term average of about 1 mG, according to the report. The study noted that there are "periods of time" when fields can reach up to 5 mG in these rooms. In the single classroom nearest the lines, levels were estimated to have been above 2 mG 29% of the time.

## FROM THE FIELD

### **SCE Cancer Study of Electric Utility Workers: An Exchange**

Earlier this year, a team of researchers led by Jack Sahl of Southern California Edison Co. (SCE) in Rosemead published an epidemiological study—J.D. Sahl, S. Greenland and M.A. Kelsh, "Cohort and Nested Case-Control Studies of Hematopoietic Cancers and Brain Cancer Among Electric Utility Workers," *Epidemiology*, 4, pp.104-114, 1993—which found no consistent association between on-the-job EMF exposures and mortality from leukemia, brain cancer or lymphoma (see MWN, M/A93). Dr. Sam Milham has voiced concern over certain aspects of the study. His detailed argument is reprinted below, together with a response by Sahl and coworkers.

### **HEI Completes Research Plan**

In June, the Health Effects Institute (HEI), based in Cambridge, MA, released its much-delayed EMF research plan. The 131-page document outlines a five-to-seven-year program with a price tag of about \$60 million, detailing specific research areas.

"HEI is prepared to do the research," according to a statement from the HEI board included in the document. "But the important thing is that a carefully formulated strategy for five to seven years of interdisciplinary research be carried out under some central direction," the board concluded. HEI does not currently have any funding for EMF research. "If people say that the folks who put that research plan together ought to be the ones to carry it out, I guess they'll come to us," explained Dr. Charles Powers, founder and acting president of the institute.

HEI began developing this plan in 1990, with funding from the Environmental Protection Agency, the Large Public Power Council, the Los Angeles Department of Water and Power and Seattle City Light. A draft of the plan completed in 1990 was rejected by HEI's board, which asked for a revision with broader context and "clear expressions of priority," according to Andrew Sivak, then president of the institute (see MWN, N/D91).

For a copy of *Do Electric or Magnetic Fields Cause Adverse Health Effects? HEI's Research Plan to Narrow the Uncertainties*, contact: HEI, 141 Portland St., Cambridge, MA 02139, (617) 621-0266.

The following expert witnesses had been scheduled to testify for the Alexanders: Dr. Samuel Milham, formerly of the Washington State Department of Health in Olympia and Dr. Peter Wright of the Poly Clinic in Seattle. PG&E's expert witnesses were to have included: Dr. Edwin Carstensen of the University of Rochester, NY, Dr. Philip Cole of the University of Alabama, Birmingham, Dr. Mark Mandelkern of the University of California, Irvine, and Michael Silva of Eneritech Consultants in Campbell, CA.

To the Editor:

In the course of my recent EMF expert witness work, I have been questioned at length about the "negative" EMF-cancer study of the SCE utility workers cohort. There are a number of findings in the report which make me question its negativity.

1) On p.107, the last sentence of the case-control occupational history assignment section states, "Of the occupational assignments, 21% among cases and 17% among controls were 'electrical occupations.'" Cases were utility workers dying of leukemia, brain cancer and lymphoma.<sup>1</sup> There were 773 male cases (Table 1, p.106). The number of "electrical workers" dying of leukemia, brain cancer and lymphoma is simply calculated as 0.21 times 773 or 162.3, while the expected number is 0.17 times 773 or 131.4. The difference between the observed and expected electrical workers among the cases is statistically signifi-

cant ( $\chi^2 = 7.3$ ;  $p < 0.05$ ). This leads me to conclude that electrical workers are statistically significantly overrepresented among the leukemia, brain cancer and lymphoma deaths in this utility workers cohort. 2) From the first line of Table 1, I calculated that the case cancers (leukemia, brain cancer and lymphoma) made up 17.2%<sup>†</sup> of all cancer deaths in men in the cohort. In my experience with similar occupational cohorts, these cancers ordinarily make up about 12% of total cancers. For example, in my California amateur radio operator study<sup>‡</sup> (Table 1, p.52), there were 700.6 deaths expected in California due to all cancers and 77.6 deaths expected due to leukemia, brain cancer, lymphoma, Hodgkin's disease and multiple myeloma. The expected percentage of case cancers to total cancers was 11.1%.\* Without detailed age data for this cohort (not shown in the paper), I cannot calculate a precise expected percentage.

3) In Table 7 of the Sahl study, an internal cohort analysis gave higher estimates of risk than did a case-control analysis for the same cause of death and job title. For example, in retired electricians, an internal cohort analysis gave a leukemia relative risk (RR) of 1.91, while a case-control analysis yielded an odds ratio (OR) of 1.11. Similarly, the RR of lymphoma in retired electricians was 1.65 in an internal cohort analysis vs. an OR of 0.87 in a case-control analysis. Variation in the definition of "exposure" seems to account for these differences, but I find it disconcerting that different methods of analysis of the same data give results that are this different.

4) Although the first word of the title of this paper is "cohort," no standardized mortality ratio (SMR) data are presented using local, California or U.S. death rates to calculate expected deaths. The first author of the paper assures me that these data will be presented in future reports.

For these reasons I feel justified in withholding a final decision on whether this study is negative or positive on the EMF-cancer question until I see more data.

Sincerely,

Samuel Milham Jr., MD, MPH  
2318 Gravelly Beach Loop, NW  
Olympia, WA 98512

† The lymphoma group actually includes Hodgkin's disease and multiple myeloma in addition to the lymphomas.

‡  $\{[(41 + 28 + 64) / 773] \times 100 = 17.2\%$ .

§ *American Journal of Epidemiology*, 127, pp.50-54, 1988.

\*  $(77.6 / 700.6) \times 100 = 11.1\%$ .

Milham has identified four issues that cause him to question "the negativity" of our study of cancer mortality among electric utility workers. His comments, however, are based on inappropriate analyses or misinterpretations of our data.

Using data presented in our Methods section, Milham calculates expected versus observed exposure rates. This leads him to conclude that electrical workers are overrepresented among those who died of leukemia, brain cancer and lymphoma. However, his calculations are incorrect because they are based on data we used to assign occupational information for a subset of our cohort rather than the distribution of occupations within the total cohort. We described how there was missing occupational history data. Using a variety of decision rules, we imputed or assigned occupational data for a part of the total occupational history record. For cases and controls where we made occupational history assignments, 21% of the cases had an electrical occupation and 17% of the controls had an electrical occupation. These data do not refer to the relative numbers of electrical workers who are cases and controls. The data in Table 3 provide this information.

Secondly, Milham uses data from Table 1 in an attempt to calculate unadjusted proportional mortality ratios [PMRs]. This analysis highlights one of the limitations of PMR methods. Compared to another occupational cohort, Milham has suggested that our cohort has a proportional excess of leukemias, lymphomas and brain cancers. If it is

appropriate to compare these two cohorts and if Milham's suggestion is true, then there are two possible interpretations. Either there was an excess of these cancers in our cohort, or the apparent relative excess is due to a deficit in other types of cancer. Our analysis is based on person-years<sup>†</sup> at risk for the denominator. Using person-years as a denominator for rate calculations is commonly accepted as the most appropriate method to estimate the proportion exposed in the study population that generated the cases.<sup>‡</sup>

Milham's third point raises interesting questions. Why are the results different when using different methods of analysis and why does the use of a single summary job title result in higher measures of association compared to analyses that include information from an entire occupational history? First, Milham incorrectly assumes that the different results are from the same data. They actually involve the use of different exposure data. Second, if there was a true risk, then using more complete and accurate job history information, coupled with magnetic fields measured in this work environment, should have provided higher measures of association. The lack of association observed when using stronger epidemiologic methods and more complete exposure data weakens the argument for a strong or moderate effect in this cohort. The specific bias that results from the use of a single occupational title has not been established. We have identified some candidates, some of which we discussed in the original paper.

Milham seems to criticize the use of the term "cohort" in our study title. He implies that without "standardized mortality ratio" analysis, this should not be considered a cohort study. Consulting the *Dictionary of Epidemiology*,<sup>§</sup> we found no mention of an SMR analysis being a part of the definition of cohort (or cohort analysis or cohort study). Cohort refers to the well-defined group of people who were followed up over time, as in our study (36,221 people who had worked for SCE for at least one year between 1960 and 1988).

SMR analysis is not the method of choice in the analysis of cohort data.<sup>‡</sup> Since we had collected complete demographic, occupational and mortality data on all SCE personnel, it would be inappropriate to use an external reference group in this analysis.<sup>‡</sup> The use of an external comparison group introduces bias because of the lack of comparability on other important factors between the exposed and unexposed populations. The SMR can provide useful information when sufficient data are not available to generate a comparison group from within the cohort. Our intention is to publish results from PMR and SMR analyses to help us understand the potential bias introduced when using these analytical methods. In this forthcoming paper, we compare PMR/SMR results to the more appropriate results estimated from cohort person-time and nested case-control analyses.

Finally, it is an oversimplification to characterize our results as "negative." Because of the limited number of cases in our study, our results are compatible with weak EMF effects as well as no effect. We continue to follow up the SCE cohort to obtain more cases, which will eventually yield more precise results.

Sincerely,

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† In Table 3, the footnote for PY should read "person-years" rather than "proportion-years."

‡ K. Rothman, *Modern Epidemiology*, Boston: Little Brown, 1986.

§ J. Last, Ed., *Dictionary of Epidemiology*, First Edition, New York: Oxford University Press, 1983.

## CTIA Drops FDA Role in Cellular Phone Research Program

The Cellular Telecommunications Industry Association (CTIA) is moving ahead with a three-to-five-year, \$15 to \$25 million research program, but the group has backed away from its plan to have the federal government oversee the studies. "This is going to be a scientific process that will stand on its own merits," said Dr. George Carlo, who has been put in charge of the initiative by CTIA.

At the same time, a senior official at the Food and Drug Administration (FDA)—the federal agency with the primary responsibility for regulating electronic products—has sharply criticized the industry association for presenting an overly rosy picture of cellular phone health risks. In a July 19 letter to CTIA President Thomas Wheeler, Dr. Elizabeth Jacobson, deputy director for science at FDA's Center for Devices and Radiological Health (CDRH), complains that Wheeler's confidence that cellular phones will be proved safe is "unwarranted." She also raises questions about the impartiality of the research initiative and about the way CTIA has portrayed the government's role. (The full text of the letter appears on p.9.)

CTIA has formed a three-person advisory group headed by Carlo, who is chairman of Health and Environmental Sciences Group, a consulting firm based in Washington. The advisory group is currently preparing an assessment of existing studies and a research agenda. Carlo has also set up a nine-member peer-review panel, which will comment on the research agenda and then work with the advisory group to develop requests for proposals (RFPs) for an initial six to eight studies. The RFPs should be issued in November, Carlo said, and funding should be in researchers' hands around the end of the year.

At a CTIA press conference in Washington on July 16, Carlo said that, so far, the advisory group's examination of the literature "has not yielded support for the cancer risk hypothesis." Wheeler, referring to "approximately 100" studies relevant to an evaluation of the safety of cellular phones, said that those analyzed so far "show that there is no relationship between exposure in cellular frequencies and cancer."

The research program was first announced last winter, in reaction to publicity about a lawsuit which alleges that cellular phone radiation caused a Florida woman's brain tumor (see *MWN*, M/J92 and J/F93). At a January 29 press conference, Wheeler announced that CTIA was "asking the federal government to appoint a blue-ribbon panel to review the methodology and findings of this research." No such committee has been formed, however.

Following a meeting between FDA and CTIA officials in mid-August, Dr. Mays Swicord, chief of the radiation biology branch at the CDRH in Rockville, MD, said that CTIA had "taken the offer off the table." FDA officials said that CTIA would not provide the agency with the control it requires to be directly involved in a research program. "We were ready to go ahead with it," Jacobson told *Microwave News*. "I thought it was a missed opportunity."

Carlo maintains that the process that CTIA has established "doesn't do away with the government role" that was initially

described by Wheeler. But CTIA spokesman Ron Nessen said that, "Government regulations made it difficult or impossible to do a blue-ribbon panel." Although the FDA proposed a cooperative research agreement, Nessen said, "lawyers on both sides decided this was not a proper arrangement."

Swicord and Jacobson both said that they knew of no objections by FDA lawyers to a cooperative research agreement.

Both Carlo and Nessen emphasized that officials at the FDA, at the National Cancer Institute (NCI) and at other government agencies are being consulted regularly and will review the CTIA research. Carlo is organizing a symposium in Research Triangle Park, NC, on September 30 to discuss the research agenda. As many as 35 leading RF/MW researchers from government and academia are expected to attend, Carlo said.

In her letter to Wheeler, Jacobson wrote that CTIA's statements that the FDA would "review and validate" the research "did not accurately characterize the relationship between CTIA and the FDA." She continued: "It goes without saying that we would review your data."

Jacobson's letter also found fault with CTIA for displaying "an unwarranted confidence that these products will be found to be absolutely safe." She noted that some people "might also wonder how impartial the research can be when its stated goal is 'a determination to reassure consumers.'"

Asked about Jacobson's letter, Nessen said he had not seen it, adding, "I am not familiar with any such criticisms." Wheeler did not respond to repeated calls from *Microwave News*.

Reporters at CTIA's July press conference focused on how the advisory group had come to its conclusion that the existing research provides no cause for concern. Several questions addressed Dr. Stephen Cleary's work showing that brain tumor cells proliferated at an abnormal rate following an exposure to radiofrequency and microwave (RF/MW) radiation (see *MWN*, M/A90). Cleary, of Virginia Commonwealth University in Richmond, used frequencies above and below the 800-900 MHz radiation emitted by cellular phones, but he has said that he would expect to get similar results at cellular frequencies.

"There is a long stretch between being able to measure an effect and being able to identify an adverse process that will lead to cancer," Carlo told the reporters. When pressed to say whether his advisory group rejected Cleary's work, he said: "Those studies have not passed the test of scientific rigor." He added that scientists familiar with Cleary's research had reviewed it for him and had raised "serious questions about the laboratory methods."

Several weeks after the press conference, Carlo told *Microwave News* that "it is not clear-cut that there is something consistent going on" in Cleary's research. But he added, "I've read Cleary's work and it's very important. We may need to see whether or not it is replicable."

Carlo has invited Cleary to the September 30 symposium. Also invited are the other two members of Carlo's advisory group, Dr. Bill Guy, formerly of the University of Washington, Seattle, and Dr. Ian Munro, former director general of the Health Protection Branch of Health and Welfare Canada, along with

## **FDA to CTIA: There Isn't Enough Data To Gauge Cellular Phone Risks**

*The following is the full text of a letter, dated July 19, 1993, sent by FDA's Dr. Elizabeth Jacobson to CTIA President Thomas Wheeler.*

Dear Mr. Wheeler:

I am writing to let you know that we were concerned about two important aspects of your press conference on July 16 concerning the safety of cellular phones, and to ask that you carefully consider the following comments when you make future statements to the press.

First, both the written press statements and your verbal comments during the conference seemed to display an unwarranted confidence that these products will be found to be absolutely safe. In fact, the unremittingly upbeat tone of the press packet strongly implies that there can be no hazard, leading the reader to wonder why any further research would be needed at all. (Some readers might also wonder how impartial the research can be when its stated goal is "a determination to reassure consumers," and when the research sponsors predict in advance that "we expect the new research to reach the same conclusion, that cellular phones are safe.")

More specifically, your press packet selectively quotes from our Talk Paper of February 4 in order to imply that FDA believes that cellular phones are "safe." ("There is no proof at this point that cellular phones can be harmful.") In fact, the same Talk Paper also states, "There is not enough evidence to know for sure, either way." Our position, as we have stated it before, is this: Although there is no direct evidence linking cellular phones with harmful effects in

humans, a few animal studies suggest that such effects could exist. It is simply too soon to assume that cellular phones are perfectly safe, or that they are hazardous—either assumption would be premature. This is precisely why additional research is needed.

We are even more concerned that your press statements did not accurately characterize the relationship between CTIA and the FDA. ("CTIA has asked the Food and Drug Administration to review and validate this new research to ensure its credibility.") It goes without saying that we would review your data and provide comment on it—we view that as part of our job as a regulatory agency. But since it is not yet clear whether we will help to direct the research program, it is premature to state that we will credential the research.

To sum up, Mr. Wheeler, our role as a public health agency is to protect health and safety, not to "reassure consumers." I think it is very important that the public understand where we stand in evaluating the possibility that cellular phones might pose a health risk. I am concerned that your July 16 press conference did not serve that end as well as it should have.

Sincerely yours,

Elizabeth D. Jacobson, PhD  
Deputy Director for Science  
Center for Devices and Radiological Health  
Food and Drug Administration  
Rockville, MD

several members of the peer-review panel, according to Carlo.

The members of the peer-review group are: Dr. Patricia Buffer, University of California, Berkeley; Dr. Philip Cole, University of Alabama, Birmingham; Sir Richard Doll, Oxford University, Oxford, U.K.; Dr. Om Gandhi, University of Utah, Salt Lake City; Dr. Saxon Graham, State University of New York, Buffalo; Dr. Don Justesen, VA Medical Center, Kansas City, MO; Dr. Richard Monson, Harvard University School of Public Health (SPH), Boston, MA; Dr. Dimitrios Trichopoulos, Harvard SPH; and Dr. Gary Williams, American Health Foundation, New York City.

### **Cellular Phone Class Action Suit Dismissed, New Complaint Filed**

A judge in Chicago has dismissed a class action lawsuit which alleged that cellular phone manufacturers failed to warn their customers of the possible risks associated with the use of hand-held cellular phones. The attorneys who began the suit filed an amended complaint a week later, however, on behalf of cellular phone users with brain tumors.

The original complaint, filed in early February, shortly after cellular phone safety grabbed headlines nationwide, was a class action on behalf of all users of hand-held cellular phones. Anthony Bass, an attorney with the firm of Holstein, Mack & Klein in Chi-

cago, which filed the suit, declined to say at the time whether any of the named plaintiffs were known to have injuries that might be linked to cellular phone use. "As it stands now, they will be getting tests," he told *Microwave News*. Among other claims, the suit alleged that the manufacturers had breached their implied and express warranties by failing to provide a safe product.

In an August 12 decision, Illinois Circuit Court Judge Edwin Berman rejected this reasoning. He wrote that the FCC and the FDA "have primary jurisdiction over the issues raised in this case" and that state law is preempted by federal law. He also found that the plaintiffs "had not alleged any compensable injury." Berman noted, however, that his decision "does not affect current motions by certain plaintiffs to amend by adding a subclass of persons allegedly physically injured as a result of cellular telephone usage."

The amended complaint, filed on August 20, is on behalf of all cellular telephone users who have diagnosed or undiagnosed brain tumors, according to attorney Gina Fietsam, also with Holstein, Mack & Klein. Two plaintiffs are named "on behalf of all others similarly situated." They are: William Pogue, who began using a cellular phone in November 1991 and was diagnosed with a brain tumor in June 1992; and Matthew Crist, who began using a cellular phone in January 1992 and was diagnosed with a brain tumor in November 1992. They used phones manufactured by NEC America Inc. and Motorola Inc., which are named as the defendants.

## Getting a Fix on Maglev, Electric Train and Subway EMFs

A series of new Department of Transportation (DOT) assessments of EMFs from a half-dozen existing electric train systems and an experimental magnetic levitation (maglev) system provides the most comprehensive information yet compiled on the nature and extent of the magnetic fields in passenger coaches, in locomotives and along railroad corridors.

The goal is to create "a data base of EMF characteristics of various transportation technologies," said Dr. Aviva Brecher, EMF research program manager at DOT's Volpe National Transportation Systems Center in Cambridge, MA. Prior to this effort, Brecher added, there was "no information whatsoever," even for the train technologies now in use, making it difficult to compare the EMFs from existing and proposed transportation systems.

The measurements were taken by Electric Research and Management Inc. (ERM), a consulting firm based in State College, PA, under contract to DOT. Altogether, ERM completed five separate measurement reports. These cover: Amtrak and New Jersey Transit trains; Boston's mass transit system; Washington's Metro system; France's high-speed TGV train; and the TransRapid maglev system or TR07, which runs on a test track in Emsland, Germany.

In a summary report, which draws on the findings of the other five, ERM noted that—counter to expectations—the TR07's EMFs are not unique. "The [magnitudes] of the maglev magnetic fields are not only reasonably typical of magnetic fields found on electrified transportation systems, but their frequency characteristics are not greatly different from the frequency characteristics found when looking at...electrified rail technology as a whole," ERM explained. (For a discussion of several other reports assessing the possible health risks posed by maglev and high-speed railroad EMFs, see box on p.11)

Average magnetic field levels near the floor in the passenger compartment of the TR07 were about 100 mG for the frequency range of 2.5 Hz to over 2 kHz, and they dropped off to about 20 mG "at standing head level," according to the maglev measurement report. "Spectrally, the maglev EMFs are richer than those associated with existing electric rail technology," ERM's William Feero told *Microwave News*, "but in magnitude they are not the strongest." Both Brecher and Feero noted, however, that other maglev systems, including a Japanese maglev, for which EMFs have not been measured, use superconducting technology which is very different from that of the TR07 and would have different EMF characteristics.

On an Amtrak coach, average magnetic fields in the 5 Hz to 2.56 kHz frequency range were 134 mG and peak fields reached 628 mG while the train was operating between Washington and New York—a section that is powered by a 25 Hz electrical system. Between New York and New Haven, CT, the average and peak fields were 52 mG and 305 mG, respectively; in this stretch, trains operate on a 60 Hz system. In both cases, the predominant magnetic fields were at the fundamental frequencies of the power systems—25 Hz or 60 Hz—and their harmonics.

The Boston and Washington mass transit systems—which use direct current—generally had much smaller time-varying magnetic fields than the intercity trains, but there was a notable exception. One type of subway car used on the Washington Metro system, the Series 3000, generated an average magnetic field of 317 mG and a peak field of 2,987 mG at the center of the passenger compartment. These fields are due to the control circuitry, which uses a semiconductor system rather than the electromechanical technology used in the other Metro cars. The semiconductor system is an electronic "chopper" that turns the power

### Ordering Information

The ERM reports for DOT are being distributed by the National Technical Information Service (NTIS), 5285 Port Royal Rd., Springfield, VA 22161, (800) 553-6847. The titles are: *Safety of High Speed Magnetic Levitation Transportation Systems: Magnetic Field Testing of the TR07 Maglev Vehicle and System*, April 1992, Vol. 1, PB92224666, 190 pp., Vol. 2, PB92224674, 366 pp.; *Magnetic and Electric Field Testing of the Amtrak Northeast Corridor and New Jersey Transit/North Jersey Coast Line Rail Systems*, April 1993, Vol. 1, PB93219434, 318 pp., Vol. 2, PB93219442, 632 pp.; *Magnetic and Electric Field Testing of the French Train A Grande Vitesse (TGV) Rail Systems*, May 1993, Vol. 1, PB93223071, 220 pp., Vol. 2, PB93223089, 422 pp.; *Magnetic and Electric Field Testing of the Massachusetts Bay Transportation Authority (MBTA) Urban Transit System*, June 1993, Vol. 1, PB93227619, 236 pp., Vol. 2, PB93227627, 630 pp.; *Magnetic and Electric Field Testing of the Washington Metropolitan Area Transit Authority Metrorail System*, June 1993, Vol. 1, 208 pp., Vol. 2, 546 pp.; and *Comparison of Magnetic and Electric Field Tests of Existing and Advanced Rail Systems*, June 1993, 56 pp. The last two reports are not yet listed by NTIS, but they should be available later this fall. Prices range from \$27.00 to \$77.00 for paperbacks and from \$17.50 to \$27.00 for microfiche. A limited number of copies of these reports are available at no cost from: Arne

Bang, FRA's manager of special programs, (202) 366-0457, or Dr. Aviva Brecher, (617) 494-3470.

The measurement system used by ERM for this project is described in an EPRI report, *Measurement of Power System Magnetic Fields by Waveform Capture*, February 1992, Report No. TR-100061, \$200. Contact: Research Reports Center, PO Box 50490, Palo Alto, CA 94303, (415) 965-4081. There is no charge for most reports requested by EPRI member utilities, universities, U.S. government agencies and the media.

See also, J. Hadden et al., *Safety of High-Speed Guided Ground Transportation Systems: Shared Right-of-Way Safety Issues*, September 1992, PB93126530, 202 pp., \$27.00 for paperback, \$12.50 for microfiche. Available from NTIS. Based on the premise that any new high-speed rail or maglev service will have to make use of existing transportation corridors, this report examines numerous mishap scenarios. These range from a power line falling on a high-speed train to a maglev leaving its guideway and crashing into traffic on an interstate. EMF effects are considered as a possible interference problem: the report states that maglev equipment is likely to generate stronger EMFs than conventional railroads, and it concludes that, "Electronic controls on highway vehicles that have been designed to present SAE [Society of Automotive Engineers] standards may not be able to tolerate these fields without a loss of service."

to the traction motors on and off at 273 Hz—273 times a second—the dominant frequency of the EMFs in the cars.

In addition to the assessments of the 25 Hz and 60 Hz systems, the Amtrak Northeast Corridor (NEC) report includes measurements taken on a section where diesel locomotives are still used and on an electric New Jersey Transit train. Amtrak is

considering replacing its diesel locomotives with trains similar to those used by New Jersey Transit. The Federal Railroad Administration (FRA) is currently preparing a draft environmental impact statement for the electrification of the NEC between New Haven and Boston. It will include a discussion of EMFs, based in part on ERM's measurement reports, according to

## **Bioeffects Literature Sifted for Clues on Maglev Health Risks**

### **EPA Report on Broadband EMFs**

A new literature review prepared for the Environmental Protection Agency (EPA) addresses the potential hazards of maglev EMFs by focusing on "animal and human exposure to EMFs that have components over a range of frequencies." Fields with pulsed or intermittent characteristics are "of special interest," according to the report by Drs. Arthur Pilla of Mt. Sinai School of Medicine in New York City, Russel Reiter of the University of Texas, San Antonio, and Bary Wilson of the Battelle Pacific Northwest Labs in Richland, WA.

"Although a causal link between exposure to EMFs and increased health risk has not been established for humans, cellular and animal studies offer evidence that such links are at least plausible," the authors write. They do not, however, answer the key question raised by their effort: whether exposures to broadband magnetic fields—they note that they are using "broadband" to distinguish "the complex magnetic fields that are at issue" from "purely sinusoidal" power frequency fields—are more likely to produce adverse health effects. Instead, they conclude that the data "are insufficient to make any clear determination" of which field characteristics are the most important for human health effects.

The report cites a wide range of studies, noting that EMF effects on calcium ions may be frequency-dependent, for example, and that effects on human heart rate can be enhanced when the fields are intermittent. Pineal melatonin secretion—a primary area of research for both Reiter and Wilson—is given particular emphasis. A common characteristic of the cancers that have been associated with EMF exposure, they argue, is that melatonin "appears to be protective" for all except brain tumors. Echoing ERM's conclusions (see story on p.10), the report also states that "there is no evidence that the TR07 maglev vehicle is likely to represent any risk from magnetic field exposure that is greater than that associated with one or more of the presently operating electrically powered rail systems." One scenario they consider—based on the work of Dr. Theodore Litovitz of Catholic University in Washington—actually indicates that the 25 Hz and 60 Hz Amtrak systems could be more likely to produce effects than the maglev with its broadband signals. Litovitz has demonstrated that a coherent signal, such as a pure sinusoidal 60 Hz signal of a particular duration, is necessary to produce certain effects. "Maglev magnetic fields exhibit less coherence in ELF ranges than the AC powered rail systems," the authors point out. (Drawing on Litovitz's research, Honeywell has begun marketing a computer keyboard designed to neutralize the effects of VDT EMFs; see p.18).

The report, *Broadband Magnetic Fields: Their Possible Role in EMF-Associated Bioeffects*, was begun in February 1992 at the request of Norbert Hankin of EPA's Office of Radiation and Indoor Air in Washington. The focus on maglev was added later, after ERM's measurements of the fields from the TR07 made it clear that the report could be useful in assessing the safety of maglev EMFs. Prepared for EPA under a contract from DOT, the report will be published by Dr. Aviva Brecher's office at DOT—to avoid delays due to EPA's publication review process, Brecher said. It will be identified as an EPA contractor report, Hankin said, and it will not

carry the authors' names, since it has not been through a formal review process.

### **Literature Reviews**

Two other literature reviews addressing the possible effects of maglev and electric rail EMFs are also being published by DOT. Prepared by Information Ventures Inc. in Philadelphia, the two reports contain much overlapping material. The shorter of the two focuses more specifically on adverse health effects. The longer one—which was prepared under an EPA contract but, like the broadband report, is being distributed by DOT—is meant to be a more comprehensive overview of published and unpublished research.

The reports were written by Drs. Robert Goldberg and William Creasey, both of Information Ventures; Dr. Kenneth Foster of the University of Pennsylvania in Philadelphia provided an analysis of ERM's maglev and electric railroad measurement data, which is used in the longer report to compare the magnetic field strengths and frequencies used or identified in the research with those of the maglev and electric rail systems. The authors point out, however, that "these comparisons have limited value in assessing possible human risks from the maglev exposure," since they only reflect one exposure parameter—magnetic flux density. "The magnetic field environment of the TR07 maglev is characterized by large and rapid changes," they explain.

Drafts of both reports were completed in September 1992; they have now been revised to reflect "recent major publications," including the Swedish and Danish epidemiological studies of residential and occupational EMF exposures (see *MWN*, S/O92 and N/D 92) and the CIRRPC report (see *MWN*, N/D92), according to Bruce Kleinstein, president of Information Ventures. The shorter, more narrowly focused report, commissioned directly by DOT, is titled *Potential Health Effects of Low Frequency Electromagnetic Fields Due to Maglev and Other Electric Rail Systems: A Review of the EMF Bioeffects Research Literature*. The longer report is titled *An Overview of Biological Effects and Bioeffects Mechanisms Relevant to Electromagnetic Field (EMF) Exposures Associated With Mass-Transit Electric Rail Systems*. Both will be available from NTIS later this year, according to Brecher.

### **EPRI Workshop Proceedings**

Meanwhile, EPRI has published a report based on a Chicago seminar it held for utility executives in October 1991 to consider the outlook for the development of maglev and high-speed rail systems. The participants concluded by identifying eight research tasks, including this one: "characterize electromagnetic radiation levels and define acceptable levels, controls, and mitigation measures." An unnamed person noted during a full-group discussion that EMFs could be a "showstopper" for maglev. Other than that, to judge by these proceedings, EMFs virtually were not discussed in the presentations given at this meeting.

*Proceedings: High-Speed Rail and Maglev Workshop*, Report No. TR-101700, \$200, is available from EPRI's Research Reports Center (see ordering information on p.10).

### **Maglev Safety Workshop**

Much of the work compiled in the reports discussed here will be presented in a session on EMF effects at an upcoming workshop on high-speed rail safety that is being cosponsored by the Federal Railroad Administration and the Transportation Research Board (TRB), part of the National Research Council.

The EMF session will be chaired by Janie Blanchard of Bechtel Corp. in San Francisco, who will also give a plenary talk. Other presenters are: EPA's Norbert Hankin and Lynne Gillette, ERM's William Feero, Information Ventures' Dr. Robert Goldberg, DOT's Dr. Aviva Brecher and Dr. Kenneth Groh of Argonne National Laboratory.

The meeting will be held October 18-20 in Itasca, IL, near Chicago's O'Hare Airport. Registration is \$150. For more information, contact: Reggie Gillum, TRB, 2101 Constitution Ave., NW, Washington, DC 20418, (202) 334-2382.

Glenn Goulet, also of DOT's Volpe Center, and it should be available in late September.

For each system ERM evaluated, measurements were taken in a passenger coach, in a crew compartment, in a station and along a track right-of-way. "These are extremely complex sources," explained Brecher. Indeed, to collect their data, the ERM technicians used a computerized "waveform capture" system that they developed for the Electric Power Research Institute (EPRI). The reports present much of the data in three-dimensional graphs that show how the strength and frequency of the magnetic fields change over time. Each report is divided into two volumes, the first containing analysis and the second providing appendices with more detailed data.

### **Injured Microwave Technician To Collect \$650,000 in Settlement**

In the largest settlement of a microwave radiation injury case, a technician whose eyesight was damaged by an illegal satellite uplink operated by Multicomm Telecommunications Inc. will collect \$650,000, according to his attorney, Roy Mason of Mason, Ketterman & Morgan in Baltimore.

Jon Stern of the Washington firm of Katten, Muchin, Zavis & Dombroff, who is representing National Union Fire Insurance Co. of Pittsburgh, said that the settlement between National Union and Keith Angstadt, the injured technician, seems likely, but that it is not yet final.

Angstadt was awarded \$2 million in a May 4 judgment against Multicomm. But the company was bankrupt, and there was some question as to whether Angstadt would collect (see *MWN*, M/J93). On June 22, Mason filed a complaint in Baltimore City Circuit Court — which was later transferred to U.S. District Court in Maryland — charging that National Union and Atlantic Mutual Insurance Companies were responsible for the \$2 million award because they had sold insurance policies to Multicomm and its parent company, Amway Corp. Amway has been dismissed from any liability, according to Mason.

Mason said that he now intends to collect the remainder of

the award from Madison, NJ-based Atlantic Mutual, the primary insurer, which sold Multicomm a \$1 million policy. Atlantic Mutual has already filed a "declaratory judgment action," arguing that it should not be held accountable, according to Atlantic Mutual's attorney, Allen Beasley of Breeden, MacMillan & Green in Norfolk, VA.

Angstadt is color-blind following his accidental exposure to 6 GHz microwaves from the transmitter (see *MWN*, N/D92).

### **Police Radar Health Research**

Two new studies have been issued recently on the safety of police traffic radar units:

- Czech researchers have found that weak millimeter waves that simulate emissions from a radar gun can inhibit DNA synthesis in the corneas of mice. In an effort to investigate the possible health risks associated with the use of a new radar unit, the RAMER 7F, a team from the Czech Academy of Sciences and from the Czech Military Academy, both in Brno, exposed hairless mice to 34 GHz radiation with a power density of 20  $\mu\text{W}/\text{cm}^2$  for two weeks (17 hours per day, five days per week). The experiment was run twice, each time with 12 mice, and a total of 40 controls. Most of the parameters tested showed no changes; two notable exceptions were a statistically significant smaller number of leukocytes (white blood cells) and a significant increase in the mass of the spleens in the exposed mice. Even though the decrease in corneal DNA synthesis is not significant, the researchers commented that this finding is "noteworthy." While they recommended that the use of the RAMER 7F, which is made in the Czech Republic, be allowed, they asked that its instructions "contain a warning of the danger of long-term irradiation to the eyes." See: Dolores Rotkowska, "Evaluation of the Biological Effects of Police Radar RAMER 7F," *Environmental Health Perspectives*, 101, pp.134-136, June 1993.

- Dr. Robert Davis's analysis of a cluster of testicular cancer cases among police officers in Grand Rapids, MI, and in neighboring Wyoming, MI, has been published as a "Brief Communication" in the *American Journal of Industrial Medicine (AJIM)*. At least six cases that could be related to radar use have been identified at the two departments, which have a combined work force of 340 officers (see *MWN*, M/A92). Davis, who is with the University of Washington Medical Center in Seattle, had previously estimated that this was at least triple the expected number, but he now reports that it is a nearly sevenfold excess — a statistically significant finding. Davis and coauthor Dr. F. Kash Mostofi of the Armed Forces Institute of Pathology in Washington note that the analysis was designed to minimize the possibility of finding a cancer excess. To assess the total person-years of exposure for the work force, for example, they looked at 1963 to 1991, even though the first use of radar did not occur until 1970. The officers with testicular cancer were diagnosed between 1979 and 1991. Davis and Mostofi write that the use of radar guns has not been widely studied, concluding that "further research into a possible association with testicular cancer is warranted." See: Robert Davis and F. Kash Mostofi, "Cluster of Testicular Cancer in Police Officers Exposed to Hand-Held Radar," *AJIM*, 24, pp.231-233, 1993.

In previous experiments, when he had a smaller exposure facility, Löscher observed similar effects using stronger (150 and 300 G) and weaker (3-10 mG) magnetic fields. But because he used fewer animals, these results are less statistically reliable. Nevertheless, when the rats were exposed to the 3-10 mG variable fields, the animals developed tumors more quickly. Löscher described the effect as "the hallmark of promotion."

Looking across all the studies he has completed to date, Löscher said, "My impression is that there appears to be a dose-response relationship. Clearly, there is something going on here."

Löscher's team also measured significantly lower concentrations of nighttime melatonin in the blood of the rats exposed to 3-10 mG. This could be the key to explaining the tumor results because melatonin is an oncostatic agent—that is, it can keep cancer cells in check. Löscher's team is the first to show a reduction in melatonin in the same EMF-exposed animals that have elevated breast tumor rates. Löscher plans to continue to look at melatonin levels in future studies.

"While conclusive evidence is still lacking, the pieces of the mosaic are filling in and the picture is becoming clearer and clearer," Dr. Alexander Lerchl, who ran Löscher's melatonin assays, told *Microwave News*. Lerchl, a former postdoctoral fellow in Dr. Russel Reiter's lab at the University of Texas, San Antonio, is now at the Institute of Reproductive Medicine at the University of Münster in Germany.

American scientists agreed with Lerchl. "The data are still sparse, but the tide is turning and the EMF-breast cancer hypothesis is gaining credibility," Dr. Richard Stevens of the Battelle Pacific Northwest Labs in Richland, WA, said in an interview. Similarly, Dr. David Blask, a senior research scientist at the Mary Imogene Bassett Hospital Research Institute in Cooperstown, NY, who has demonstrated melatonin's oncostatic properties, told *Microwave News* that there are "provocative data" on EMFs and breast cancer that need to be followed up.

Both Stevens and Blask expressed frustration over the cancer research establishment's lack of interest in pursuing the EMF trail. "If Löscher's work is replicated," Stevens said, "you'll see all the NCI types and other naysayers begin speaking in more respectful tones about the EMF-breast cancer hypothesis."

In fact, there are indications that researchers' attitudes are already changing. A recent paper on "etiologic hypotheses" in *Epidemiologic Reviews*, a companion publication to the *American Journal of Epidemiology*, put EMFs at the top of the list and concluded that, "Further exploration of whether residential or occupational [EMF] exposure affects breast cancer risk is warranted."

While Löscher's breast cancer experiments are the most detailed to date, they corroborate a similar study, published in 1991, by a group from the Oncology Research Center in Tbilisi, Republic of Georgia. The Georgians reported a promotional effect when they used NMU as the cancer initiator and a 50 Hz magnetic field of 200 mG (see *MWN*, M/A92).

And a Canadian team from the Bureau of Radiation and Medical Devices at Health and Welfare Canada in Ottawa has previously reported that a 20 G magnetic field can act as a copromoter (with TPA) in mice, whose skin cancers were initiated with DMBA (see *MWN*, J/A91).

On the other hand, in a paper published in *Carcinogenesis*

## EMF-Breast Cancer Sources

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

M. Gammon and E. John, "Recent Etiologic Hypotheses Concerning Breast Cancer," *Epidemiologic Reviews*, 15, pp.163-168, 1993.

R.P. Liburdy et al., "ELF Magnetic Fields, Breast Cancer and Melatonin: 60 Hz Fields Block Melatonin's Oncostatic Action on ER+ Breast Cancer Cell Proliferation," *Journal of Pineal Research*, 14, pp.89-97, 1993.

W. Löscher et al., "Tumor Promotion in a Breast Cancer Model by Exposure to a Weak Alternating Magnetic Field," *Cancer Letters*, 71, pp.75-81, 1993.

M. Mevissen et al. [including W. Löscher], "Effects of Magnetic Fields on Mammary Tumor Development Induced by 7,12-Dimethylbenz(a)anthracene [DMBA] in Rats," *Bioelectromagnetics*, 14, pp.131-143, 1993.

M. Mevissen et al. [including W. Löscher and A. Lerchl], "Effects of AC Magnetic Fields on DMBA-Induced Mammary Carcinogenesis in Sprague-Dawley Rats," in *Electricity and Magnetism in Biology and Medicine*, (Martin Blank, ed., San Francisco: San Francisco Press, 1993), pp.413-415.

A. Rannug et al., "A Study on Skin Tumor Formation in Mice with 50 Hz Magnetic Field Exposure," *Carcinogenesis*, 14, pp.573-578, 1993.

R.G. Stevens, "Electric Power Use and Breast Cancer: A Hypothesis," *American Journal of Epidemiology*, 125, pp.556-561, 1987.

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

R.G. Stevens, "Biologically-Based Epidemiological Studies of Electric Power and Cancer," *Environmental Health Perspectives*, 101, Supplement 4, 1993, in press.

M.A. Stuchly, J.R.N. McLean et al., "Modification of Tumor Promotion in the Mouse Skin by Exposure to an Alternating Magnetic Field," *Cancer Letters*, 65, pp.1-7, 1992.

earlier this year, a Swedish-American group reported that 500 mG and 5 G magnetic fields failed to promote skin tumors in mice initiated with DMBA. But Löscher pointed out that this study also used only a small number of animals.

Although Löscher's and the previous experiments point to a promotional effect, Löscher himself has not ruled out the possibility that EMFs can cause genetic effects. "There could be mutations," he said. "We will try our study without DMBA." Dr. Jack McLean, a member of the Canadian study team, also believes that magnetic fields may do more than act as a promoter. "The role of initiation needs a closer look," he said in an interview.

That EMFs can undo the protective action of melatonin was recently shown by Dr. Robert Liburdy and coworkers at the Lawrence Berkeley Lab in Berkeley, CA. They found that breast cancer cells, which did not grow in the presence of melatonin, resumed proliferating when also exposed to magnetic fields (see

## German Animal Studies Point to Breast Cancer Risk

MWN, J/A92). Blask said that he would like to repeat Liburdy's experiment as well as do animal studies.

Four studies showing that men exposed to EMFs on the job had high rates of breast cancer—a very rare disease in males—prompted increased interest in pursuing the EMF-breast cancer link among women (see MWN, N/D89, J/A90, J/F91, M/A91 and J/A92). Stevens, who first proposed the link in 1987 (see MWN, J/F87), is now collaborating with Dr. Scott Davis of the Fred Hutchinson Cancer Research Center in Seattle to pursue this idea under a grant from the National Cancer Institute (NCI) (see MWN, N/D91).

In addition, Dr. Anders Ahlbom and Maria Feychting of the Karolinska Institute in Stockholm, Sweden, are looking at breast cancer risks with the data collected for their landmark power line study. And Dr. Genevieve Matanoski of the Johns Hopkins University School of Hygiene and Public Health in Baltimore recently received a small grant to plan an epidemiological study of cancer among women who use video display terminals (VDTs), with special emphasis on breast cancer.

Löscher is the chairman of the department of pharmacology, toxicology and pharmacy at the School of Veterinary Medicine. His group includes Dr. Meike Mevissen, a postdoctoral researcher.

### **EPA Eliminates NIER Program** (continued from p.1)

Sciences (see MWN, M/J92 and M/J93, respectively), as well as those sponsored by a number of individual states. McGaughy added that a complete revision of the 367-page report could not have been ready until 1995.

"We will write a scientific statement of knowledge detailing what is known and what is uncertain," McGaughy said. The review will cover the EMF-cancer literature through mid-1993, but will not address RF/MW radiation.

The EPA report, *Evaluation of the Potential Carcinogenicity of Electromagnetic Fields*, has been at the center of the EMF controversy since a draft was released three years ago. The report concluded that EMFs from power lines and appliances are a "possible, but not proven, cause of cancer in humans" (see MWN, N/D90). An earlier draft had classified EMFs as "probable human carcinogens" but this statement was deleted before the document was circulated for comment (see MWN, M/J90). A subsequent review by EPA's Science Advisory Board (SAB) concluded that the document had "serious deficiencies and should be rewritten" (see MWN, J/A91).

Senior EPA managers were reluctant to discuss the decision not to rewrite the report. OHEA Director Dr. William Farland, McGaughy's superior, did not respond to repeated calls for comment. And David Kleffman, the deputy director of the EPA Office of Health Research and a member of the original National EMF Research Program Steering Committee set up by New York State, would only say that he "was not involved in the decision."

McGaughy announced the change in plans at a meeting of the SAB's Radiation Advisory Committee (RAC) on July 19. The move came as a surprise since as recently as the previous month McGaughy was still saying that the rewrite of the original report was going forward.

"The decision makes sense," Dr. Genevieve Matanoski, the

## Off EPA's Agenda, Onto Vice President Gore's

On July 13, Vice President Al Gore fielded questions on C-SPAN's Live Viewer Call-In Program, which was moderated by Brian Lamb. Here is one exchange:

**Moderator:** Rockland County, New York—

**Caller:** Mr. Vice President, would you please listen to me for a moment. In 1990, the Bush Administration killed an EPA report stating that the electromagnetic field is a probable carcinogen. We lost a grandchild at the age of five due to cancer. She suffered for two and half years.

**Gore:** I'm so sorry.

**Caller:** Since then, Mr Vice President, I have been begging and pleading that the electric blanket manufacturers please put a warning label on their product. My daughter went down to Sloan-Kettering Hospital and when she at random checked six out of six parents, that she checked with, all had this factor in common—that they all used an electric blanket when they were pregnant. I understand the government of Sweden just came out with long-term cause and effect on leukemia and power lines.

**Moderator:** Caller, what do you want the Vice President to do?

**Caller:** I want him to please make sure that he sees that we get a lot of research and that warning labels are put on these products because there are other governments that are doing—taking a strong stand and our government has been doing nothing.

**Moderator:** All right, thanks for your call. Mr. Vice President—  
**Gore:** This is a really interesting topic, Brian. First of all, thank you very much, caller, for sharing that personal tragedy that your family has experienced. I know how painful it must be for you. And I know that you have probably experienced a great deal of frustration in trying to talk with officials about electromagnetic fields. I know just a little about this because I tried to study it and what I found was, Brian, that the state of the science is such that they don't really have answers for a lot of the questions posed by people who are worried about electromagnetic fields. The consensus in the scientific community right now, I think, is that the concerns about the power lines probably are much less than concerns about devices such as electric blankets for women who are pregnant and that is one of the worst cases that you can talk about because there the data apparently shows that there can be a health threat from electromagnetic fields in some cases. And so I don't want to minimize this at all. In cases like that, I think that more is required. And I have made notes here as a result of what the caller has said and I think that does warrant further action.

*Gore held a hearing on NIER from VDTs and from RF heaters and sealers in 1981 when he was in the House of Representatives (see MWN, Jun81). When he was in the Senate, Gore asked the EPA to measure the magnetic fields in his office.*

chair of the RAC, said in a telephone interview from her office at the Johns Hopkins University School of Hygiene and Public Health in Baltimore, referring to the agency's budget constraints. But, she added, "EPA has to do something for the public. This is an important health issue for the public and the public needs some guidance." Matanoski was also the chair of the SAB subcommittee that reviewed the EMF-cancer document in 1991.

McGaughy said that the summary report will address can-

cer causation. "This is the central question of the new document," he said. But he stressed that the report will not deal with risk assessment. "What EPA should say to the public in the face of the scientific uncertainties will be left to [ORIA]."

Lynne Gillette, who works on EMFs at ORIA, questioned who will answer public inquiries after the cutbacks. "We get 10,000 calls a year—we counted," she said. "That's much more than for radon." She added that members of Congress are "always asking about EMFs."

Marty Halper, who until recently was the director of ORIA's radiation studies division, noted that the phones always ring after the news media highlight new research findings. "What happens when you get Swedish-type results? Who will keep up with the science? Who will answer the questions?" Halper is now a senior science adviser to EPA's environmental equity program.

Gene Durman, the acting director of Halper's former division and the deputy director of ORIA, said that the agency was considering developing a hot line to answer calls from the public.

In addition to responding to public inquiries, EPA's NIER staff does measurement surveys, sponsors literature reviews and publishes reports and booklets (see p. 11 and *MWN*, M/J93). In addition, it has the authority to develop exposure guidelines, though it has never done so.

Most of those interviewed at EPA thought the NIER program should continue because EMFs could evolve into a major public health issue. Halper, for instance, said, "I believe that there is a 50-50 chance that EMFs could turn out to be a risk that

dwarfs radon." He contrasted the lone EMF staff position to the approximately 90 people currently working on radon in EPA offices across the country. "It's a little bit ominous," said another staffer, who asked for anonymity. "They may regret the decision."

There is a general consensus within the agency that the EMF epidemiological cancer data have become stronger and more consistent since the 1990 draft was released—largely due to last year's Swedish cancer studies (see *MWN*, S/O92 and N/D92). When asked if the agency would be prepared if McGaughy's summary report pointed to a cancer problem, one senior official commented, "That will be a dilemma for us."

It is unlikely that EPA will return to RF/MW radiation issues, as was requested by the SAB (see *MWN*, J/A91). "Don't be surprised if we don't do anything on RF for the time being," Margo Oge, director of ORIA, said in an interview. "We would have to take resources from other programs. We must prioritize."

In what might be one of its last actions on RF/MW radiation, EPA is preparing detailed comments on the Federal Communications Commission's proposal to adopt the 1992 ANSI/IEEE limits (see *MWN*, M/A93).

EPA's Office of Research and Development stopped working on NIER in the mid-1980s (see *MWN*, N/D85 and S/O86). Since then it has refused to sponsor any health-related research. Earlier this year, EPA transferred all of its EMF research funds to the National Institute of Environmental Health Sciences (see *MWN*, J/F93).

## UPDATES

### COMPATIBILITY & INTERFERENCE

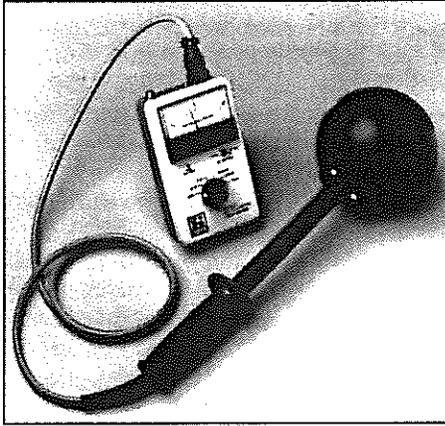
**Uncontrolled Wheelchair Movements...** Tests conducted by the FDA have shown that certain electric wheelchairs are susceptible to EMI. The agency found that some electronically controlled wheelchairs would unexpectedly stop, start or turn when exposed to RF/MW radiation at strengths of 10 V/m or less, said Howard Bassen of FDA's Center for Devices and Radiological Health in Rockville, MD. Such field levels could occur in "real-world situations," such as near a police car radio or a hand-held walkie-talkie, he said. "There are numerous reports of injuries due to unintended wheelchair movement," Bassen explained, but he cautioned that there was no definitive proof that EMI was responsible, because tests were not performed on the actual chairs in the environments where the incidents occurred. But, Bassen noted: "Laboratory tests on the same wheelchair models did show that they were susceptible to low levels of RF/MW radiation." In a May 10 letter alerting wheelchair manufacturers, the agency explained that, "The chairs tested were found to be susceptible to interference from many different RF/MW frequencies." The agency asked the wheelchair makers to share any studies or reports of incidents that they have gathered. A similar notice, seeking reports of EMI problems directly from wheelchair users, was sent out on July 7. The FDA has proposed adding EMC testing requirements to the Rehabilitation Society of North America (RESNA) wheelchair standard. Approvals for a number of new wheelchairs—which are regulated by the FDA

as medical devices—are being held up until the manufacturers provide adequate EMC testing results, Bassen said. This is the first time the FDA has addressed EMI susceptibility prior to approving a wheelchair for market.

### MEASUREMENTS

**TriField Meter Under Review...** A new, inexpensive meter designed to measure 60 Hz magnetic and electric fields and RF fields "gives misleading results," according to a review in the May issue of *QST*, the magazine of the American Radio Relay League (ARRL). The TriField meter, made by AlphaLab Inc. in Salt Lake City, was put through its paces by Dr. Wayne Overbeck, a member of ARRL's Bioeffects Committee. He used the TriField to assess a low emission NEC computer monitor and found that it recorded magnetic fields of 5 mG 12 inches from the front of the display. "When the fields...were measured with a professional meter," he writes, "the 60 Hz magnetic fields turned out to be below 0.3 mG 12 inches from the monitor." For measuring RF fields, Overbeck also found the meter wanting. In a field stronger than 0.3 mW/cm<sup>2</sup>, the meter fluctuated wildly. "Even in weaker fields, its accuracy leaves something to be desired," he adds. The manufacturer does address some accuracy issues in the meter's instruction sheet—which Overbeck compliments as "well written." The instructions warn that the meter is "frequency weighted," so that a field at other than 60 Hz will give higher readings: a 3 mG 120 Hz field will read 6 mG, Over-

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beck explains by way of illustration. Bill Lee, AlphaLab's president, suggested that the frequency-weighted meter serves a useful purpose: "I don't believe it's a good idea to only measure 60 Hz," he told *Microwave News*. A flat frequency response version is also available, he added, and might be more appropriate for VDT measurements. A more positive review of the TriField appeared in the January/February issue of *Scanning* (15, p.48, 1993), a journal devoted to scanning electron microscopy. The reviewer, David Joy of the University of Tennessee, Knoxville, notes that the meter "provides a convenient and realistically priced alternative" to the much more complex equipment commonly used to track down the source of magnetic fields that are interfering with the operation of an electron microscope. Joy also describes how the RF meter led to the discovery of a faulty seal on a microwave oven in his lab. Overbeck warns, however, that the TriField could cause undue alarm, and he suggests that the adage, "You get what you pay for," is applicable. The meter sells for \$150. (For EPA's assessment of a number of other magnetic field meters, see *MWN*, M/A93.)

## MEETINGS

**Russian Symposium...** On June 21-25, 100 experts from the former Soviet Union attended the *1st International Symposium on Electromagnetic Pollution of the Environment* at the Forest Technical Academy in St. Petersburg, Russia. In a letter to *Microwave News*, Dr. Eugene Lyskov of the Institute of the Human Brain at the Russian Academy of Science in St. Petersburg reports that papers addressed four general areas: (1) regulation and control of EMFs; (2) analysis, models and prediction of the electromagnetic environment; (3) the influence of EMFs on human beings and biosystems; (4) methods and devices for measuring EMFs. NIER from static fields up to microwaves were covered, with special attention on the influence of "EMFs on behavior, neuronal activity, immune and generative functions and cytogenesis." Surveys of residential and occupational EMF measurements were also discussed: for example, a map of EMFs from St. Petersburg's power lines developed by the Navy Research Institute was presented, as were data showing high EMF levels from subway engines. The proceedings of the conference will be published in the near future. A regional interdisciplinary council on EMF safety and compatibility is being established under the aegis of the municipality of St. Petersburg. A second conference will probably be held in St. Petersburg in 1995. For more information, contact: Dr. Eugene Lyskov, Institute of the Human Brain, Pavlov 9, St. Petersburg, 197376, Russia, fax: (7+812) 234-3247.

**EBEA's Second Congress...** The European Bioelectromagnetics Association (EBEA) will hold its second congress December 9-11, 1993, in Bled, Slovenia, about 20 miles from the international airport in Ljubljana. The site was selected to make it easy for researchers from Eastern European countries to participate. Topics to be covered include mechanisms, epidemiology, biological effects and medical applications. Invited talks will be given by Dr. Lojze Vodovnik of the University of Ljubljana on therapeutic applications of EMFs; by Dr. Clay Easterly of the

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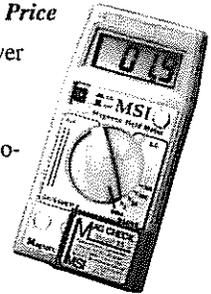
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Oak Ridge National Laboratory in Oak Ridge, TN, on EMF epidemiological studies; and by Dr. Niels Kuster of the Swiss Federal Institute of Technology in Zurich on dosimetry. Contact: Dr. Renata Karba, Faculty of Electrical and Computer Engineering, University of Ljubljana, Trzaska 25, 61000 Ljubljana, Slovenia, (38+61) 265-161.

**PEOPLE**

Dr. Brian Maddock, head of the "EMF Function" for research at the U.K.'s National Grid has retired. No replacement has been named. "It's a consolidation of management," Dr. John Male told *Microwave News*....**John Adams**, an electrical engineer with the Fields and Metrology Group at NIST's EMF Division in Boulder, CO, died after an automobile accident on July 15.

**SHIELDING**

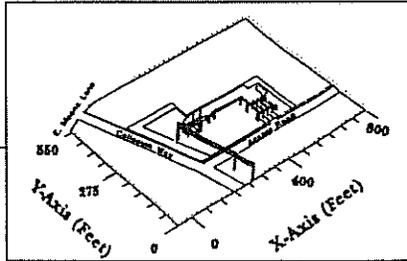
**Microwave-Absorbing Concrete...**Smart concrete may sound like an oxymoron but it is serious business at the State University of New York, Buffalo. Professor Deborah Chung of the university's department of mechanical and aerospace engineering has shown that adding carbon fibers to concrete increases its electrical conductivity, a property which can be harnessed to detect flaws and thereby give an early warning of the impending collapse of a bridge or a highway. An added benefit is that the carbon fibers also dramatically increase the concrete's ability to shield microwave radiation. A few millimeters of plain cement attenuate 1 GHz radiation by 0.4 dB, but when carbon fibers are added to the mix, the same thickness cuts the radiation by about 19.5 dB. In other words, the cement can reduce microwaves 80 times more effectively when doped with slivers of carbon. Chemicals such as sodium sulfate and potassium aluminum sulfate can be substituted for the carbon fibers, though they are not as effective, according to Chung. She published a paper on the electromagnetic shielding properties of reinforced concrete in the July 1989 issue of *Composites* (20, pp.379-381); see also, her forthcoming paper in *Smart Materials and Structures*.

**VDTs**

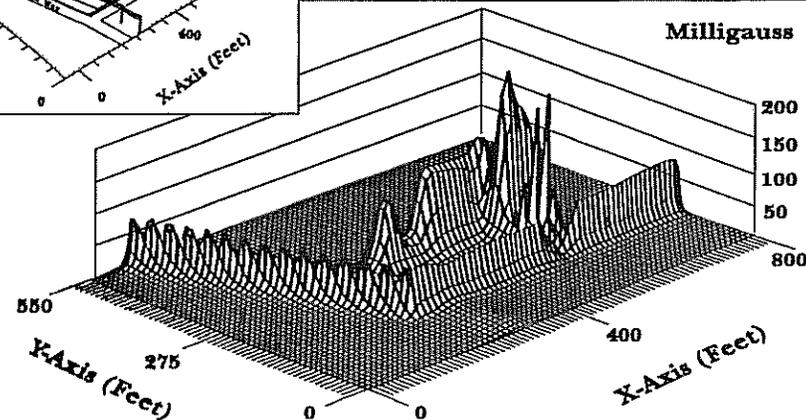
**EMX Keyboard...**Honeywell Inc.'s keyboard division is preparing to market a keyboard that can "neutralize EMF emissions from computers." The keyboard, to be called the 101 EMX, is based on techniques devised by Dr. Ted Litovitz of Catholic University in Washington. It contains a coil that emits random EMFs, known as "noise," that the manufacturer claims can block the action of a constant EMF signal from a VDT or any other source. Honeywell notes that a "growing body of evidence" links weak EMFs to cancer, reproductive problems and mood disorders. Litovitz has shown that biological effects of EMFs—in certain well-defined systems—can be blocked by superimposing electromagnetic noise. Litovitz has applied for a patent and licensed the technique to EMX Corp. of New York City. EMX is a private company, formed in 1991, to commercialize technology developed at Catholic University. For more information, contact: Lou Vasquez of Honeywell at (800) 445-6939, or Robert Blessey of EMX at (800) 508-4040.

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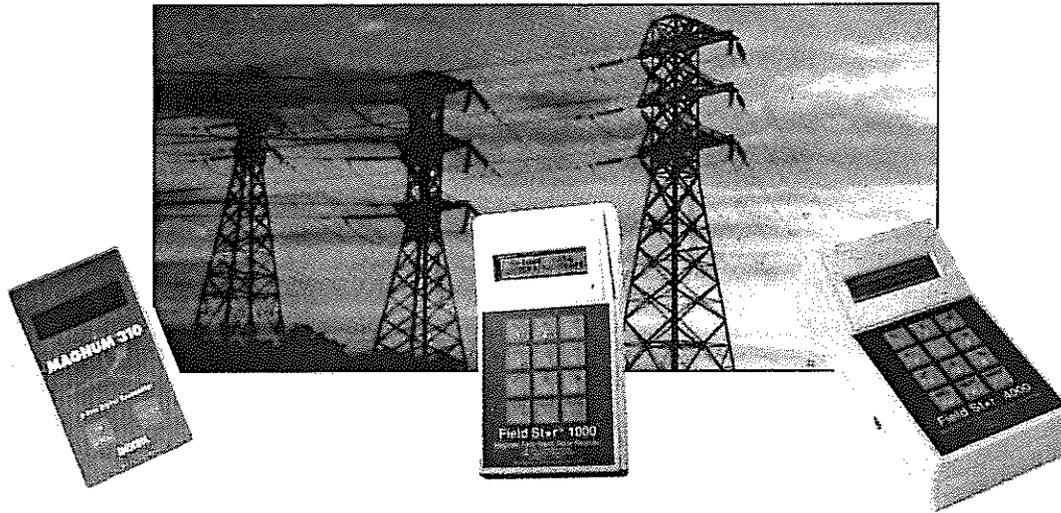
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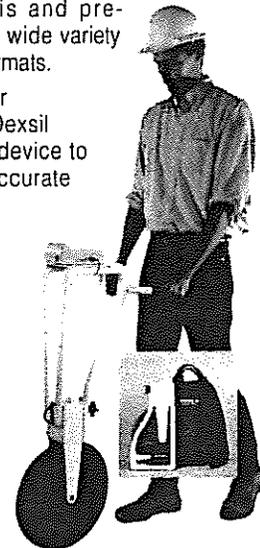
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