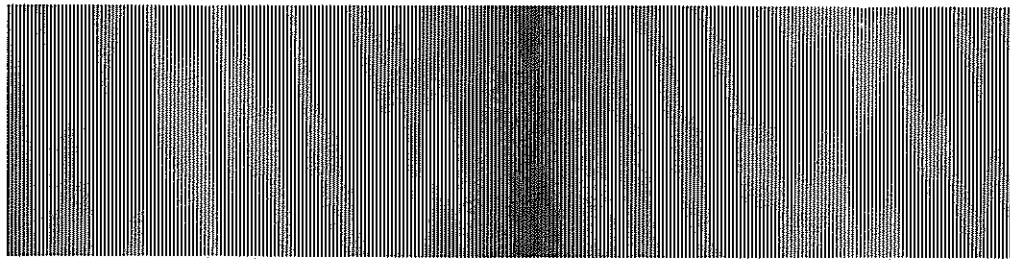


# MICRO WAVE NEWS



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A Report on Non-Ionizing Radiation

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## DOE Maps Out National EMF Research Agenda

Moving quickly to assert its new role as the lead federal agency on electromagnetic field (EMF) health research, the Department of Energy (DOE) is preparing a national agenda to coordinate federal, state and private research programs. DOE's EMF budget remains uncertain, however, despite talk of a major increase in research funding.

"It's time to mobilize and become more active," DOE's Dr. Robert San Martin announced at a DOE workshop on *Development of a Coordinated Research and Communication Program on Potential Health Effects of Electric and Magnetic Fields*, held November 20-21 in Arlington, VA. A DOE assistant secretary, Michael Davis, the highest-ranking DOE official at the workshop, agreed: "Clearly, not enough has been done to satisfy questions about adverse health effects." San Martin, who, as deputy assistant secretary for utility technologies, is responsible for the department's \$5 million EMF research budget, outlined what he called an "ambitious" schedule, which would put the new agenda into place as early as next spring.

Most workshop participants were pleased by the new sense of importance given to EMF research. Many were encouraged by the fact that Secretary of Energy Admiral James Watkins had signed the invitations to the workshop himself. Indeed, the issue has caught the interest of top-level Bush Admin-  
*(continued on p.14)*

## IEEE OKs New ANSI RF/MW Limits; Work Begins on ELF Standard

The Institute of Electrical and Electronics Engineers (IEEE) has approved revisions to the American National Standards Institute (ANSI) guidelines for human exposures to radiofrequency and microwave (RF/MW) radiation. On September 26, the IEEE Standards Board endorsed the guidelines drafted by its Standards Coordinating Committee (SCC) 28 for frequencies between 3 kHz and 300 GHz.

The new standard, designated C95.1-1991, replaces the one adopted by ANSI in 1982 (see *MWN*, S82). In the absence of federal rules, the limits have been the de facto U.S. exposure standard. The 1991 guidelines will likely assume equal importance.

The key differences between the old and the new standards are:

- The exposure limits for workers and the general public are no longer identical. Instead, separate guidelines are specified for "controlled" and "uncontrolled" environments. Uncontrolled areas are defined as those where individuals "have no knowledge or control of their exposure."
- The exposure limits have been doubled to 10 mW/cm<sup>2</sup> above 1.5 GHz and

*(continued on p.15)*

## « Power Line Talk »

After five years of writing proposals, Dr. Richard Stevens of the Battelle Pacific Northwest Labs may finally get the funds he needs to investigate the association between female breast cancer and exposures to light-at-night and/or EMFs. An announcement is not expected until February, but Stevens told *Microwave News* that, "Funding is very probable because the reviewers gave us a good enough score to put us in the money." Stevens will be working with Dr. Scott Davis of the Fred Hutchinson Cancer Research Center in Seattle, WA, who will be the principal investigator on the four-year case-control study of some 500 women with breast cancer and 500 controls. "I'm really thrilled about this," Stevens said.

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Dr. Russel Reiter at last appears to have secured a sponsor for his research. "We've agreed on a two-year contract," EPRI's Dr. Chuck Rafferty told *Microwave News* at the DOE meeting in Milwaukee in early November. "Everything is settled but the signature." Reiter will continue his work on isolating the key field parameters that determine the effects of EMFs on the pineal gland. In an interview, Reiter said that he was optimistic that the grant would go through after an October 30 site visit by an EPRI team led by Dr. Rob Kavet, a consultant based in Belmont, CA. If all goes according to plan, EPRI will help build a "Cadillac facility" at Reiter's lab at the University of Texas Health Science Center in San Antonio. Despite his international reputation, Reiter has been unable to secure funds up to now—indeed, he had been talking of quitting EMF work if he did not win support soon. To make his point, at the bottom of his Milwaukee abstract, Reiter wrote: "Unsponsored Research."

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Add Wisconsin to the list of states considering a temporary ban on new power lines because of concerns over possible EMF health effects (see *MWN*, M/J91). On November 6, Maxine Hough and eight other state representatives, along with two state senators, introduced legislation calling for a three-year moratorium on new lines above 60 kV. The bill would require

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the Wisconsin Public Service Commission (PSC) to conduct EMF research and measurement surveys during the moratorium. "It is dangerous and foolhardy to build more high voltage power lines...until we have adequate answers to the health concerns," Hough said at an October 7 press conference. Last year, Wisconsin legislators and their staffs were disturbed to learn that EMFs as high as 400 mG had been recorded in the building where they work (see *MWN*, J/F91). Madison Gas & Electric reduced the levels by reconfiguring wires and by redesigning the electrical vault, but average readings of up to 125 mG remain in some areas. Hough's announcement came the same week that the PSC held technical hearings on EMFs as part of its 20-year advance planning process. Among those testifying at the hearings were: Dr. Abe Liboff, Dr. Bruce McLeod, Dr. John Moulder, Greg Rauch, Dr. David Savitz and Michael Silva. At public hearings held later in October, members of the citizens' group Promoting Options for Wise Energy Regulation (POWER) pressed the PSC to impose its own moratorium. The PSC's board is expected to issue a strategy for addressing EMF concerns in January. State legislators in Michigan, Rhode Island and Tennessee, as well as local officials in Missouri, Rhode Island, Tennessee and Washington State, have proposed power line bans.

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Meg Gottstein has replaced Steve Weissman as the administrative law judge presiding over the California Public Utilities Commission (PUC) investigation of potential health effects of EMFs. "Staffing issues and caseloads" were the reason for the switch, Gottstein told *Microwave News*. In her first ruling, issued October 11, Gottstein denied a July 15 motion from the Cellular Carriers Association of California and the Cellular Telecommunications Industry Association requesting exemption from the investigation. In their motion, the trade groups asserted that there was no evidence linking their transmission facilities to health risks. They supported their claim with testimony from Dr. Bill Guy, who recently retired from the University of Washington, Seattle, Dr. Don Justesen of the VA Medical Center in Kansas City, MO, and Dr. Jerrold Bushberg of the University of California, Davis, and by pointing to present ANSI and NCRP standards (see p.1). Gottstein wrote that, "While [the cellular industry groups] assert that their conclusions...are unequivocal, other parties to this proceeding have raised questions concerning the adequacy and safety of existing standards, and argue that additional review of scientific evidence and expanded exposure monitoring [are] warranted." At a November 8 meeting, it was decided that the PUC would conduct a "sub-investigation" into health effects from cellular facilities. The PUC began its investigation into EMF health effects in January 1991. In February 1992, the EMF "consensus group" of utility representatives, legislators and members of the public

## No More Literature Reviews! No More Research Agendas!

Ask people what needs to be done about the EMF problem and they will answer "more research." Sound advice, but advice only a few can follow because of the lack of available funding.

The frustrations of those seeking grants turned to outrage when, in August, Congress gave the NAS-NRC \$600,000 for yet another literature review. They point out that this is more money than any federal agency except the DOE is now spending on EMF research and that this amount is enough to open a couple of labs or support a host of postdocs.

Someone forgot to tell Congress that EPA, after combing through the literature for three years, issued a landmark 460-page review; that the White House has already ordered CIRRPC to repeat the process; that NIOSH commissioned a collection of expert reviews; that at least seven states are mandating their own reviews—Connecticut's alone is costing \$150,000, while Maryland and Virginia are paying for annual updates; and that EPRI and NEMA have sponsored their own assessments, as has the U.K.'s NRPB. And, of course, the various branches of the DOD had to have their own reviews.

Then there are the reviews of the reviews. The SAB spent a year going over the EPA cancer report before issuing its own analysis. CIRRPC has canvassed all branches of the federal government for their views of the EPA report and, across the Atlantic, the NRPB has asked a committee to render one more opinion.

EPA and NIOSH have spent most of their scant resources devising lists of research needs. Actually, EPA did this twice: staffers developed their own strategy and then, for good measure, paid HEI \$525,000 for a second opinion. (The two sets of priorities are, not surprisingly, quite similar.) Not to be

left out, the leaders of BEMS are writing their own agenda. One researcher who has worked on a number of these wish lists commented at the DOE's November workshop in Washington: "They all recommend the same thing. We know what needs to be done."

Despite all the planning, EPA and NIOSH still have not started their own research programs. Ironically, a good number of those shuttling from meeting to meeting—offering opinions on what is and what is not known about EMFs—have been denied research funds. As for those lucky enough to have grants, it is a wonder that their travel schedules leave any time for research.

In controversial areas of environmental policy, decision makers put off the hard choices by asking for more research. In the EMF business, even this tactic is seen as too risky. Instead they ask for reviews and agendas. This kind of cowardice explains why some of the most interesting work in the field has been supported out of researchers' own pockets. Dr. Nancy Wertheimer, Ed Leeper, Dr. Abe Liboff and Dr. Russell Reiter, for example, have worked without grants, yet their contributions are greater than those of many researchers with institutional support.

At the DOE research review in Milwaukee, Dr. Keith Florig of RFF estimated that the EMF problem already costs the U.S. economy \$1 billion a year—an amount he believes will keep growing. Even if Dr. Robert Adair and colleagues are right that EMFs pose no health risks, they should recognize that it is too late for categorical denials. It is time they joined those who seek to settle the EMF problem with data, not dictums.

But most of all, it is time to stop stalling and get some work done.

*Abbreviations:* BEMS—Bioelectromagnetics Society; CIRRPC—Committee on Interagency Radiation Research and Policy Coordination; DOD—Department of Defense; DOE—Department of Energy; EMFs—Electromagnetic Fields; EPA—Environmental Protection Agency; EPRI—Electric Power Research Institute; HEI—Health Effects Institute; NAS-NRC—National Academy of Sciences-National Research Council; NEMA—National Electrical Manufacturers Association; NIOSH—National Institute for Occupational Safety and Health; NRPB—National Radiological Protection Board; RFF—Resources for the Future; SAB—Science Advisory Board.

will submit a report and recommendations to the PUC on power frequency fields—this will serve to "narrow the scope of the investigation," Gottstein said in a telephone interview.

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Two newspapers have now published letters in response to Dr. Robert Park's recent op-ed piece bemoaning "hysterical" reactions to EMFs (see *MWN*, S/O91). A letter by attorney Kieron

Quinn, which had not appeared before our last issue went to press, ran in the Baltimore, MD, *Evening Sun* on November 6 under the headline, "A Huckster of Junk Science." Dr. Stephen Cleary of Virginia Commonwealth University also wrote a letter after the Richmond, VA, *Times-Dispatch* ran Park's piece. Cleary's letter, published September 17, points to the same National Cancer Institute data showing a surge in cancer rates that Paul Brodeur cited in his September 6 letter to the *New York Times*. Brodeur's letter still has not appeared in print.

## Congress Weighs Large Increases in EMF Funding

Federal funding for electromagnetic field (EMF) research would increase significantly under two new Congressional proposals.

Rep. George Brown (D-CA) is sponsoring a bill to give the Department of Energy (DOE) \$70 million over ten years, of which \$30 million will come from nonfederal sources. Brown plans to hold hearings in early 1992.

Senator Frank Lautenberg (D-NJ) has proposed giving \$45 million to the Environmental Protection Agency (EPA) over four years. Both measures would take effect in fiscal year 1993 (FY93), which begins on October 1, 1992.

Although a similar proposal by Rep. Frank Pallone (D-NJ) has stagnated in the House of Representatives for two years (see *MWN*, M/J90, J/A90 and M/A91), the Brown and Lautenberg initiatives are likely to attract more support. As chairman of the House Committee on Science, Space and Technology, Brown has the seniority to move his legislation onto the floor of the House. Meanwhile, the Lautenberg proposal has already been adopted by a Senate subcommittee.

Brown's bill would transfer lead responsibility for EMF research to DOE's Office of Environment, Safety and Health from its Office of Conservation and Renewable Energy (OCRE), which is planning a national research agenda (see p.1). In a statement, Brown said that his proposal is not meant to stop DOE's planning process, but rather to help "refine it and improve it."

DOE's health office is a more appropriate place for EMF research, since OCRE also promotes electric power use, an aide to Brown explained.

In his statement, Brown protested the way that the DOE was designated as the lead federal agency (see *MWN*, S/O91). "This provision was inserted without benefit of debate and without the involvement of the authorizing committees," he said. Interestingly, no one has yet taken credit for writing this provision.

Brown's National Electromagnetic Fields Research and Public Information Dissemination Act (H.R.3953) would require the federal government to seek contributions from outside sources, such as private companies and states, to cover half of the \$60 million research budget. An additional \$10 million in federal funds would be earmarked for a public information program.

H.R.3953 also mandates the creation of an interagency committee to coordinate federal research, and would require the National Academy of Sciences (NAS) to evaluate the research each year. The bill's conflict of interest provisions call for an EMF researcher to disclose all related funding sources and to abstain from giving paid testimony and from working as a consultant.

Lautenberg's proposal calls for a new federal EMF research program at EPA, a technical advisory committee to oversee the program and a public information center. The proposal has been approved by the Senate Subcommittee on Toxic Substances, Environmental Oversight, Research and Development and is now pending before the full Environment and Public Works

## Bigger EPA EMF Budget

EPA now has an EMF research budget of \$1.94 million for fiscal year 1992 (FY92), an increase of more than \$1 million over the amount that its Office of Research and Development received in FY91. FY92 began on October 1.

EPA has not yet determined how the funds will be spent and no decision will be made until the agency completes its research strategy document (see *MWN*, J/A91), an aide to Dr. Ken Sexton, the director of the Office of Health Research, told *Microwave News*. He added that EPA is committed to funding a public-private partnership research effort, like the ones being developed by HEI (see p.6) and by the NERP steering committee (see p.5).

In FY91, EPA gave \$525,000 of its \$750,000 research budget to HEI.

The EPA research plan will no doubt be affected by DOE's new lead role and its efforts to forge a new national research agenda. EPA and DOE officials have already met to begin coordinating their efforts (see p.1).

Committee.

Introduced as an amendment to the Environmental Research, Development and Demonstration Authorization Act of 1991 (S.1655), Lautenberg's legislation would provide \$8 million for FY93, \$10 million for FY94, \$12 million for FY95 and \$15 million for FY96. At least \$1 million each year would be used for public information. The House version of S.1655 does not include a similar amendment.

Lautenberg's proposal surprised many Washington insiders. Earlier this year his spokesman said that the senator had dropped plans for EMF legislation (see *MWN*, J/A91).

## California Governor Vetoes \$7 Million EMF Bill

On October 14, Republican Governor Pete Wilson of California vetoed legislation that would have required state utilities to fund a \$7 million, four-year electromagnetic field (EMF) research, education, training and public information program. The bill, SB920, had passed both houses of the state legislature in September and had widespread support among utilities, labor and environmental groups (see *MWN*, S/O91).

"Given the fact [that] a study was just completed and because there are currently several studies ongoing nationwide, I do not feel that it is prudent for California ratepayers to expend another \$7 million," Wilson explained in his veto message. The California Department of Health Services (DHS) is conducting a \$2 million EMF study in accordance with legislation passed in 1988 (see *MWN*, S/O88 and N/D88). Both SB920 and the 1988 law were sponsored by Democratic Senator Herschel Rosenthal, the chairman of the Energy and Public Utilities Committee.

In a letter to Wilson, Rosenthal said he was "surprised" by the governor's veto, pointing out that in a 1990 progress report

to the legislature, the DHS had recommended that the state fund further research "into the basic mechanisms of EMF effects, which appear to be inadequately funded, compared to epidemiological and whole animal research." Under the proposed law, new research projects would have received up to 80% of an initial \$4 million dollar allotment.

Though the bill had almost unanimous support in both houses of the legislature, an override of the veto is unlikely. "Most members of the assembly were under the impression that the governor supported the bill," Michael Shapiro, a Rosenthal aide, told *Microwave News*. "Overrides are generally not a successful strategy in California. We're really hoping for an agreement," he said.

Most observers are confident that similar legislation will be signed into law next year. In an interview, Dr. Raymond Neutra of the DHS, who is overseeing the state's ongoing EMF research, said that he expects a new EMF bill to be placed on a fast track during the next legislative session. Jack Sahl of Southern California Edison in Rosemead agreed, noting that the governor

may not have been aware of the strong utility support for SB920.

Rosenthal is also optimistic. "We are hoping to salvage the whole bill," Shapiro said in a telephone interview. But he went on to explain that Rosenthal might agree to a compromise mandating only EMF education and training for utility personnel, public information campaigns and EMF surveys—20% of SB920 was earmarked for these programs.

## **NERP's Prospects Improve**

The National EMF Research Program (NERP) has gained support from key federal and state officials and has received start-up funding (see *MWN*, J/A91 and S/O91).

The Department of Energy (DOE) has signaled a willingness to include the NERP in its new national research agenda. A DOE deputy assistant secretary, Dr. Robert San Martin, who is responsible for the EMF research program, told *Microwave News* that he expects his department to help fund the NERP if it needs federal backing.

## **Wertheimer: Research Directions After Peters**

Failure to address seasonal variations in current loads may be "the most obvious possible explanation" for the apparent lack of an association between childhood cancer and measured magnetic fields in Dr. John Peters's epidemiological study, Dr. Nancy Wertheimer writes in a recent unpublished analysis.

Peters and coworkers at the University of Southern California (USC) in Los Angeles found a statistically significant doubling of childhood leukemia associated with high current wire codes but did not identify a similar risk with 24-hour and spot magnetic field measurements (see *MWN*, J/F91, M/A91 and S/O91). This is the second U.S. study to replicate Wertheimer and Ed Leeper's original 1979 study that first linked power lines to childhood cancer. A 1988 study by Dr. David Savitz, like Peters's, found a stronger cancer risk association with wire codes than with measured fields.

Pointing out that the seasonal variations were "much discussed" in the early planning stages of the project, Wertheimer expresses surprise that there was no mention of this aspect of the study design when the results were published in the *American Journal of Epidemiology* in November.

Wertheimer is primarily concerned with the interpretation of Peters's study. Press reports have called the results "contradictory," and even USC's November press release said the findings "paint a somewhat confusing picture." Troubled by an emerging "conventional wisdom" that there is no association of childhood cancer with household magnetic field measurements, Wertheimer offers her outlook about both the Peters study and the direction of future research.

She organizes her thoughts around four questions:

• *Are control groups really free of significant EMF exposure?* The problem here is that "average" EMF exposure may entail health risks, yet researchers have done little to obtain a truly

low-exposure control group, Wertheimer says. She suggests that current efforts are like studies of cancer risks that compare people who smoke two-and-one-half packs a day with those who smoke two packs. EMF risks are often determined simply by dividing measurements into average- and very-high-exposure groups. When the study population is divided into four groups, Wertheimer argues, a comparison of the highest-exposure group with the lowest indicates a greater cancer risk, especially if subjects exposed to bed heaters are removed from the lowest-exposure group.

• *Are researchers looking at the right etiological time period?* Wertheimer favors looking at one or two years prior to diagnosis as the critical period of exposure. Wertheimer and Leeper's original childhood study, among others, supports the hypothesis that this period is a critical time.

• *Are studies obtaining a suitable control group?* Pointing out that some observers, such as Dr. Philip Cole, have suggested that there was a bias in the selection of the control group that minimized the number of high-exposure subjects in the Peters study, Wertheimer adds that "control selection bias can cut both ways—it can reduce or increase an observed association."

• *Are researchers measuring the right aspect of EMF exposures?* Wertheimer suggests that the angle of the magnetic field vector may be more important than the field intensity. Here she revisits a topic she addressed last year in a paper at DOE's EMF research review in Denver, CO (see *MWN*, N/D90). She writes of "rather intriguing evidence" in favor of this idea: In previous studies, homes where the average field vector was "vertical" seemed to show little cancer risk, while homes with a "horizontal" average vector did "show a cancer risk that is roughly related to measurement intensity."

Indeed, two representatives of the NERP steering committee were the only outsiders invited to participate at an October 10-11 DOE meeting to develop the department's approach to EMF research. That session was a prelude to DOE's November 20-21 workshop (see p.1).

The California Department of Health Services (DHS) may contribute funds to the NERP if the state approves an EMF research program next year, according to Dr. Raymond Neutra (see p.4). Neutra stipulated, however, that the NERP must coordinate its plans with California's efforts and must enforce a strict conflict of interest policy. DHS Commissioner Dr. Molly Coye is one of three new members of the NERP steering committee; Neutra is her representative.

At its quarterly meeting, held October 16-17 in Washington, DC, NERP's steering committee announced that it will receive funds to cover its operations for one year while a research program is designed. The New York State Energy R&D Authority has promised \$75,000 for administrative expenses. The grant was made contingent on the NERP seeking an additional \$150,000, but the authority promised to make up any needed funds. The NERP plans to solicit support from state governments, utilities, labor unions and electrical equipment manufacturers, among others; it also plans to add at least one federal official to its roster.

The steering committee set up subcommittees to select a group to administer its work and to develop criteria for selecting an organization to oversee the NERP research program.

The committee's next meeting is planned for February.

### **HEI Board of Directors Delays EMF Research Plan**

The board of directors of the Health Effects Institute (HEI) has delayed the release of the institute's proposed national electromagnetic field (EMF) research agenda pending its revision. The board is seeking "some clear expressions of priority" among the research options, according to HEI President Andrew Sivak.

"The board felt that as a public document, the plan needed a broader context, with more background on EMF research,"

Sivak told *Microwave News*, adding that he expects to return to the board with a revised document by mid-December.

In an October 30 letter to Dr. Richard Setlow of Brookhaven National Laboratories in Upton, NY, Sivak explained that one board member suggested that HEI provide "a strategic plan, not just a plan of operations." Setlow is the chairman of the feasibility study committee, which helped assemble the agenda.

HEI, based in Cambridge, MA, has been developing the research plans "to provide credible scientific information" on possible health effects from power line EMFs (see *MWN*, M/A91, M/J91, J/A91 and S/091). This work is being sponsored by the Environmental Protection Agency and some electrical utilities. The draft plan, which Sivak presented to the HEI board on October 23, provides both a "short list of research directions" to be pursued if there is limited funding and an expanded list, which is "less constrained by resources."

The short list calls for:

- Identification of a reproducible effect, in a well-controlled biological system, at field intensities relevant to environmental exposure;
- Determination of the initial site of interaction;
- Elucidation of the transduction system;
- Assessment of the health consequences of such an exposure.

Among the key issues identified by HEI are: looking at biological end points other than cancer—such as reproductive and neurobehavioral effects; addressing the argument that the signal-to-noise ratio is too small to make low-level EMF effects plausible; characterizing and standardizing exposure parameters; and attracting top scientists to EMF research.

The draft plan, which was obtained by *Microwave News* after Sivak declined to make it available, signals a certain skepticism about the existence of EMF effects at environmental levels. For instance, the plan notes that, "The overall evidence [for health risks] is inconsistent at best." Nor is HEI confident that "top-line scientists" would be willing to get involved in EMF research, because it is an arena "that is plagued with results that are in apparent violation of physical laws, with no accepted mechanism of interaction, with poor replication of earlier studies, and with effects that are small."

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## **Cancer Epi Studies from Taiwan, Sweden and the U.K.**

### **Taiwan: Childhood Risks Below 1 mG**

Drs. Ruey Lin and C.Y. Li of the National Taiwan University have found a statistically significant association between childhood leukemia and *measured* magnetic fields. They also identified a trend toward increased risk with stronger magnetic fields.

In a paper presented at the Department of Energy's research review in Milwaukee, WI, in early November, Lin reported a statistically significant increased rate of leukemia among children exposed to EMFs as low as 0.8-0.9 mG. A nonsignificant

doubling occurred at 0.6-0.7 mG and at 0.7-0.8 mG.

Based on five measurements in different rooms in the case houses, the average magnetic field in these homes was 0.83 mG, compared with 0.77 mG in the homes of controls—a statistically significant difference.

Questionnaire data indicated that the households with leukemia cases used electrical appliances more frequently than did the controls. Most of the 146 cases had acute lymphoid leukemia, Lin told *Microwave News* in Milwaukee. There were 305 controls. Lin was the first researcher to report a link between EMF exposure and brain tumors (see *MWN*, Oct84 and J/A85).

## Sweden: Few New Clues from Workers

A new epidemiological study from Sweden adds to the body of research showing a link between some, but not all, types of electrical work and leukemia and brain cancer.

"Although a homogeneous pattern of increased risks of leukemia or brain tumor was not noted, the hypothesis that magnetic fields might play a part in the origin of cancer cannot be rejected," concluded Drs. Siv Törnqvist, Bengt Knave and Tomas Persson of the National Institute of Occupational Health in Solna and Dr. Anders Ahlbom of the Karolinska Institute in Stockholm.

The researchers found a number of statistically significant odds ratios (ORs): 5.7 for acute myeloid leukemia among iron and ore miners; 2.8 for chronic lymphoid leukemia (CLL) among power linemen; and 2.1 for all leukemias among telegraph and telephone workers. All linemen combined had an OR of 2.0 for CLL, which is a risk of borderline significance.

Increased rates of all types of brain tumors were identified among iron and steel welders (OR=3.2), among radio and TV repairmen (OR=2.9) and among the general class of welders

and flame cutters (OR=1.3). All of these risks were statistically significant or of borderline significance.

All electrical occupations, as a class, did not show an increased risk of leukemia or brain tumors. And none of the occupations showed an excess of both cancer types.

Electromagnetic field (EMF) exposures were estimated primarily by job category. However, the team did take some "limited" measurements at 50 Hz of intensity and duration of exposures.

Power linemen on 400 kV lines and welders probably had the highest magnetic field exposures among those with higher cancer risks. The team argued that, "If magnetic fields were the cause of leukemia and brain tumors, the same effect would be expected in both occupations," but this was not the case. Furthermore, iron and ore miners, who had an elevated leukemia risk, had an average exposure of less than 0.35 mG.

"We have very limited information on intensity and duration of exposure to magnetic fields and other potential risk factors, which most likely vary considerably within, as well as between, the occupational categories we have studied here," the team cautioned.

## New Reports from EPRI

The following reports have been published by the Electric Power Research Institute (EPRI). Copies of the reports marked with an asterisk (\*) are available from Research Reports Center, PO Box 50490, Palo Alto, CA 94303, (415) 965-4081. Copies of the report marked with a dagger (†) are available from Robert Banks Associates, Inc., PO Box 14574, Minneapolis, MN 55414, (612) 623-4600. There is no charge for most reports requested by EPRI member utilities, U.S. utility organizations, U.S. government agencies and the media.

\* J.H. Cooper, *Single Conductor Transmission Cable Magnetic Fields* (Report No. EL-7340), August 1991. Price: \$500.00. The magnetic fields from buried single conductor cables can vary by as much as a factor of ten, depending on how they are built and installed. Research at EPRI's Waltz Mill Underground Test Facility in Pennsylvania also indicated that existing procedures for calculating field strengths are generally accurate and that soil had little or no effect on aboveground magnetic fields.

\* *EMDEX II System Documentation* (EN-7497), 2 vols., September 1991. Price: \$200.00 each. The EMDEX system was developed to measure and record long-term personal exposures to EMFs. The new EMDEX II is smaller and easier to use, according to the report. Vol. 1 provides details on how to use the meter. Vol. 2 is the technical reference manual.

\* *1990 Annual Report: EMF Health Effects Research Abstracts* (EN-7460), July 1991. Price: \$5.00. This is the second annual report on EPRI's EMF research program. It includes a statement on each of 32 ongoing projects.

† *1991 EPRI EMF Science & Communication Seminar*, Forthcoming. Price: \$250.00. Papers by speakers at this year's EPRI utility seminar, including reviews of research on bioeffects (with emphasis on melatonin), wire codes, measurements, mitigation and risk assessment and communication. Also features visual materials from the workshop presentations.

\* John Peters et al., *Exposure to Residential Electric and Magnetic Fields and Risk of Childhood Leukemia* (EN-7464), November 1991. Price: \$200.00. This is an interim report on the University of Southern California childhood leukemia study, which was

widely reported in the press when preliminary results were announced last February. A shorter version of this report was published in the *American Journal of Epidemiology* in November (see *MWN*, J/F91, M/A91, S/O91 and p.5). Peters and coworkers found an elevated cancer risk among children living near power lines, but there was no association with measured EMFs.

\* G.B. Rauch, *Pilot Study of Non-Residential Power Frequency Magnetic Fields* (EL-7452s), August 1991. Price: \$495.00. EPRI researchers describe measurement protocols that were developed after gathering data at more than 34 sites in and around public schools, office buildings, power plants and substations. Techniques to characterize the spatial, temporal and harmonic content of EMF sources are reviewed. "The study showed that visual inspection alone cannot predict all possible magnetic field sources."

\* L.E. Zaffanella, *Field Effect Research at the High Voltage Transmission Research Center* (HVTRC) (EL-7104), February 1991. Price: \$200.00. Presents data from five different studies performed at EPRI's HVTRC, in Lenox, MA. Among the topics discussed are the effects of spark discharges and induced currents from overhead transmission lines and the effects of power frequency magnetic fields on video display terminals.

\* L.E. Zaffanella et al., *Network Analysis of Ground Currents in a Residential Distribution System* (EL-7369s), August 1991. Price: \$295.00. Research at EPRI's HVTRC, cosponsored by Ontario Hydro, found that ground currents in residential distribution systems, which could have a significant effect on residential EMF levels, are only moderately predictable. The uncertainty is attributed to variations in the resistance of water pipe joints, through which grounded currents often flow.

The researchers investigated leukemia and brain tumor deaths among Swedish male workers aged 20-64 between 1961 and 1979. See Siv Törnqvist et al., "Incidence of Leukaemia and Brain Tumours in Some 'Electrical Occupations'," *British Journal of Industrial Medicine*, 48, pp.597-603, 1991.

### **U.K.: Ambiguous Results Among Adults**

Adults who lived within 50 meters of an overhead power line had a slightly elevated risk of developing leukemia or lymphoma—a finding that verged on statistical significance. Dr. J. Youngson of the University of Manchester and Drs. A.D. Clayden, A. Myers and R.A. Cartwright of the University of Leeds concluded that the results show a "suggestion of a trend with distance."

"The results of this study suggest the possibility of an increased risk in the region of 1.3 at high levels of magnetic field or at close proximity to overhead power lines. However, this study lacks the statistical power to detect any small true increase in risk at these calculated levels of exposure to magnetic fields," the team concluded, adding that if there is an increased risk from

residential exposures, it is probably "extremely small."

There were ORs of 1.87 and 3.0 for those living in homes with the highest calculated magnetic field levels, 3 mG or more and 10 mG or more, respectively, but these findings were based on small numbers and were not statistically significant. There was neither a significantly increased risk nor a significant trend for the combined data set.

The team calculated magnetic field exposures from the estimated maximum load currents of the overhead lines in the five years prior to diagnosis. Only 4% of the study population had a computed magnetic field exposure greater than 0.1 mG.

The study population included men and women aged 15 or older who were diagnosed with non-Hodgkin's lymphoma or leukemia between 1983 and 1985. The team analyzed 3,144 cases and a matched set of controls, all living in northern England.

See J.H.A.M. Youngson et al., "A Case/Control Study of Adult Haematological Malignancies in Relation to Overhead Power Lines," *British Journal of Cancer*, 63, pp.977-985, 1991. A number of the members of the study team published a study of EMFs and childhood cancer last year (see *MWN*, N/D89).

## HIGHLIGHTS

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### **Connecticut Police Ban Hand-Held Radar Units**

In a precedent-setting move, the Connecticut State Police have banned the use of hand-held radar devices. On October 10, Lt. Colonel Patrick Tully, chief of the police's Office of Field Operations, ordered that antennas of two-piece radars be mounted on the outside of patrol cars. "Under no circumstances shall the antennas be operational inside the vehicles," he wrote in a departmental memo.

Connecticut's action follows growing national concern about a possible association between police radar and cancer (see *MWN*, M/J91). The number of lawsuits that have been filed by police officers and their families is expected to grow from five to as many as 20 by early next year, according to John Sweeney, the Agoura Hills, CA, attorney who is handling most of the suits (see *MWN*, J/A91 and S/O91).

A spokesman for Tully, Sgt. John Mannion, told *Microwave News* that the department's 70 hand-held units have been shelved and that the department is using only two-piece sets. Only 40 troopers are assigned to radar patrol each day, he said, and the state police have 210 two-piece units, so there will be no reduction in the enforcement of speeding violations.

Tully's action set off a ripple effect among municipal police forces in Connecticut. By mid-November, according to the Manchester, CT, *Journal Inquirer*, 24 police departments had limited or prohibited the use of police radar units. The towns include Shelton and Windsor Locks, where one and two officers, respectively, have filed workers' compensation claims, charging that use of radars caused them to develop cancer. Both towns have rejected the claims, and the three officers plan to appeal to

the state workers' compensation agency, according to the *Journal Inquirer*.

At the request of the International Brotherhood of Police Officers (IBPO), the state Department of Health Services (DHS) has agreed to evaluate these and other reported cancer cases. Sam Franzo, an IBPO representative, said that the union is collecting medical information which it will forward to the DHS. In addition, an official with the federal Centers for Disease Control will survey the technical literature, according to the health department. IBPO represents some 1,800 officers in 42 Connecticut police departments.

Franzo plans to push for more action to limit the use of police radars. "We have to have legislation," he told *Microwave News*. "Some police chiefs refuse to believe the claims linking cancer to radar." The chairman of the state General Assembly's Labor & Public Employees Committee, Rep. Joe Adamo (D-West Haven), has promised to investigate.

The state police department, according to Mannion, has conducted two exposure surveys. None of the measured levels exceeded the 5 mW/cm<sup>2</sup> safety level set by the 1982 American National Standards Institute (ANSI) for X-band and K-band radiation. Both surveys were carried out at Retlif Testing Laboratories in Ronkonkoma, NY, and were coordinated by Fred Helene, a consultant based in Wallingford, CT. A report on the test results will be submitted to the state police by the end of the year, Helene said.

Another set of measurements, taken at the Michigan State University Radar Testing Laboratory in East Lansing, reveals



that, under normal operating conditions, exposure levels are less than 1% of the ANSI limit. "We are able to conclude with a high degree of certainty that there is no evidence to support the allegation that police traffic radar operators are at risk due to prolonged exposure," the lead investigator, Dr. David Fisher, reported. *Microwave Exposure Levels Encountered by Police Traffic Radar Operators* (August 30, 1991, No. MSU-ENGR-91-007)

is available at no cost from: Fisher, Department of Electrical Engineering, Michigan State University, 260 Engineering Bldg., East Lansing, MI, 48824.

The Michigan State data are consistent with preliminary results released earlier this year by Battelle of Columbus, OH, and by the Institute for Police Technology and Management in Jacksonville, FL (see *MWN*, M/A91).

## Radiofrequency and Microwave Radiation Resources

Robert Cleveland and Michael Buccigrossi, *Trip Report: Measurement Survey, New York, NY, July 31-August 1, 1991*, unpublished and undated report by the U.S. Environmental Protection Agency (EPA) and the Federal Communications Commission (FCC), 9 pp. Available from: Buccigrossi, EPA Region II, Radiation Branch, 26 Federal Plaza, New York, NY 10278.

This report includes surveys of radiofrequency and microwave (RF/MW) radiation levels near three different types of emitters. The first site had a complex of 12 land-mobile, two-way communications antennas—operating at 43, 46 or 450 MHz and at 75, 90 or 450-500 watts—on top of a residential building. Within five feet of the antennas, readings of 133-265  $\mu\text{W}/\text{cm}^2$  were recorded. On the main roof of the building, there were "hot spots" as high as 16  $\mu\text{W}/\text{cm}^2$ . Inside a top-floor apartment, levels were less than 0.3  $\mu\text{W}/\text{cm}^2$ , the minimum level the meter can detect. At the second site, a penthouse apartment several hundred feet from a cluster of microwave antennas on top of a nearby building, levels were as high as 8  $\mu\text{W}/\text{cm}^2$  about 10-20 cm from a metal window frame. Residents of the penthouse had complained of electromagnetic interference to their electronic equipment. Readings of 3-8  $\mu\text{W}/\text{cm}^2$  and 0.3-1.3  $\mu\text{W}/\text{cm}^2$  were recorded at two other locations in the penthouse, but there were no other detectable levels in the apartment. Near the third site, another penthouse, there was a cluster of nine cellular antennas. With an effective radiated power of up to 120 watts per antenna, the cluster generated levels of 133-318  $\mu\text{W}/\text{cm}^2$  directly in front of one of the antennas—these readings dropped to 1.3-2.7  $\mu\text{W}/\text{cm}^2$  ten feet away. On the rest of the roof, the radiation levels were again less than 0.3  $\mu\text{W}/\text{cm}^2$ .

Robert Cleveland and Edwin Mantiply, *Electric and Magnetic Fields Near AM Broadcast Towers* (EPA/520/6-91/020), U.S. Environmental Protection Agency, July 1991, 81 pp. Available for \$19.00 from: National Technical Information Service (NTIS), 5285 Port Royal Rd., Springfield, VA 22161, (800) 336-4700, Order No. PB-92-101427.

Measurements of RF radiation taken 1-100 meters from eight AM broadcasting stations generally agreed with predictions made using a computer model—except within several meters of a transmitting tower base or near metal fencing or other metal objects. The model, known as the Numerical Electromagnetic Code (NEC), was developed at the Lawrence Livermore Laboratory in Livermore, CA, to identify regions near transmitting facilities where RF safety limits may be exceeded. The stations, all located in southern California, operate at 550 kHz-1.45 MHz and represent a range of electrical heights and power outputs.

Environmental Science Associates, Inc., *Gibraltar Peak Communications Site: Environmental Impact Report* (No. 91-EIR-12), County of Santa Barbara, CA, Resource Management Department, September 1991, 317 pp.

A proposed expansion of the Gibraltar Peak Communications Facilities in Santa Barbara County would result in localized RF radiation levels which would exceed the NCRP recommended exposure limits for the general public and increase the area in which occupational limits are regularly exceeded. Half of the report is an analysis of the health effects of RF radiation by Dr. Bill Guy, a retired professor of bioengineering at the University of Washington, Seattle. Members of a family that was moved from the antenna farm (see *MWN*, M/A91) have filed a \$7 million lawsuit against both the owners of the Gibraltar site and a communications firm that operates many of its antennas, according to an article in the October 14 *Santa Barbara News-Press*.

Margaret Garson et al., "A Chromosomal Study of Workers with Long-Term Exposure to Radiofrequency Radiation," *Medical Journal of Australia*, 155, pp.289-292, September 2, 1991.

There were no statistically significant differences in the rate or types of chromosomal aberrations in the stimulated lymphocytes of 38 radio linemen as compared with 38 controls. The linemen worked for Telecom Australia, erecting and maintaining broadcast, telecommunication and satellite facilities; they were exposed to 400 kHz-20 GHz radiation for an average of 15.4 years. Exposures were below the Australian occupational standard, which limits SARs to less than 1 mW/cm<sup>2</sup> (see *MWN*, M/A86). Recent tests showed that for frequencies of up to 100 MHz, induced currents from RF exposures were less than 100 mA in each leg.

*Health Physics*, 61, pp.3-67, July 1991.

Features six papers adapted from presentations at the Health Physics Society's June 1990 summer school, *Assessing Non-Ionizing Radiation Hazards*: Larry Anderson, "ELF: Exposure Levels, Bioeffects and Epidemiology"; John D'Andrea, "Microwave Radiation Absorption: Behavioral Effects"; Robert Kavet and Richard Tell, "VDTs: Field Levels, Epidemiology and Laboratory Studies"; Richard Luben, "Effects of Low Energy [EMFs] (Pulsed and DC) on Membrane Signal Transduction Processes in Biological Systems"; Sol Michaelson, "Biological Effects of [RF] Radiation: Concepts and Criteria"; Ron Petersen, "[RF/MW] Protection Guides."

Jon Klauenberg and James Merritt, "No Evidence for Microwave Interaction with Noradrenergic Neurotransmitter Systems," and Dennis Hjerlesen, "Reply," *Health Physics*, 60, pp. 282-284, February 1991.

Two members of the U.S. Air Force School of Aerospace Medicine's (USAFSAM) division of radiation sciences take issue with Hjerlesen's conclusion in a 1989 paper that microwaves can affect noradrenergic neurotransmitters. In his response, Hjerlesen, of Los Alamos National Lab, describes how the Air Force, his sponsor, operated: "[A]fter [our] results...were formally submitted to [USAFSAM], pressure was applied, suggesting that we not report significant biological effects of low-power microwave irradiation....The [USAFSAM] has consis-

## HIGHLIGHTS

tently suggested to us that there are no effects of low-level microwave exposure despite evidence to the contrary presented in the peer-reviewed literature. Empirical results from their laboratories would be helpful and might provide a more compelling argument for their position. Because the [USAFSAM] is one of the few remaining funding sources for research in the microwave bioeffects field, a more satisfying scientific response would be sustained by financial support for unrestrained research in this area by independent laboratories."

B.K. Nelson et al., "Marked Increase in the Teratogenicity of the Combined Administration of the Industrial Solvent 2-Methoxyethanol and Radiofrequency Radiation in Rats," *Teratology*, 43, pp.621-634, 1991.

RF radiation acted alone and synergistically with the industrial solvent 2-methoxyethanol (2ME) to cause malformations in the offspring of rats exposed during pregnancy. This team of NIOSH researchers used 10 MHz CW radiation at SARs of 0.8-6.6 W/Kg to maintain a 4°C increase in the rats' rectal temperature. RF exposure alone increased malformations by 30% and 2ME alone increased them by 14%. Together, the RF and the agent caused a 76% increase, "evidence of synergism." Polish researchers have also shown that RF can enhance the action of a chemical teratogen (see *MWN*, J/F87). For other RF terato-

logical studies, see *MWN*, Oct83, Ap84, Jn84, N/D86 and N/D87.

Richard Tell, *Induced Body Currents and Hot AM Tower Climbing: Assessing Human Exposure in Relation to the ANSI Radiofrequency Protection Guide*, FCC, Washington, DC, October 7, 1991, 82 pp. Available from: NTIS, see above. Order number was unavailable at press time.

Tests at two AM radio transmitters in Bakersfield and Riverside, CA, showed that the induced body currents in workers climbing the towers can routinely exceed the 1991 IEEE guidelines for "controlled" RF exposures (see p.1). Among Tell's other findings: The range of frequencies in the AM band can account for a threefold difference in the body current and a ninefold variation in the resulting wrist SAR; considerable power reductions—down to a few tens of watts—may be necessary to meet the IEEE guidelines; RF burns can easily occur in workers on hot towers even at power levels as low as 1 kW; and, "Pending the development of additional insight into the issue of body currents and exposure mitigation for hot AM tower work, broadcasters should proceed in a cautious manner with respect to authorizing routine tower work while the tower is energized." The data obtained in this study are consistent with EPA-FCC measurements taken at a Spokane, WA, AM station (see *MWN*, J/A88).

## FROM THE FIELD

### German Workshop on Mechanisms of EMF Interactions

On September 11-12, 1991, the Deutsche Forschungsgemeinschaft (DFG)—the German equivalent of the U.S. National Science Foundation—held a conference on Interaction Mechanisms of Electromagnetic Fields (EMFs) with Cellular Systems at the Max Planck Institute for Solid State Research in Stuttgart.

The statement reprinted below represents a consensus of the 25 biologists, chemists and physicists who participated at the workshop. The statement was drafted by Drs. Werner Grundler, Friedemann Kaiser, Fritz Keilmann and Jan Walleczek and was translated from the German by Walleczek. Grundler is at the Center for Radiation and Environmental Research in Neuherberg, Kaiser is at the University of Darmstadt, Keilmann is at the Max Planck Institute in Stuttgart and Walleczek is a visiting scientist at the VA Medical Center in Loma Linda, CA.

In an interview with *Microwave News* following the workshop, Walleczek said that the DFG is planning to sponsor a second meeting next spring in Frankfurt to draft an EMF research plan, with special emphasis on extremely low frequency (ELF) EMF effects. Walleczek anticipates that, if the DFG decides to approve an EMF project, a commitment will be made to a well-funded multiyear research effort.

After evaluating the current experimental evidence and after discussing possible mechanisms of interaction, it was concluded that there now exists firm evidence that *non-thermal* effects due to EMF exposures can be triggered in living cells under selected conditions.

Over the past 15 years this insight has matured because of the steady increase in the number of positive findings using a variety of different cellular systems. For example, important knowledge has accumulated from gene expression and calcium metabolism in lymphocytes and other cells, cycle times of lymphocytes and yeast cells and investigations of cell differentiation in fibroblasts. In addition, clear responses of the central nervous system and a reduction in the synthesis of the hormone melatonin have been observed.

The applied fields encompass a wide range of frequencies between microwaves and static magnetic fields. Control experiments in which temperatures, frequencies and field intensities were varied—as well as theoretical estimates of field-induced heating—rule out the possibility that the reported observations could be explained by thermal effects.

In addition to the fundamental thermodynamic constraints, theoretical concepts which could play a mechanistic role in the mediation of the observed electromagnetic influences were discussed. These included possible underlying nonlinear processes (nonlinear dynamics), the chemistry of transient radical pair and triplet states and signal transduction mechanisms.

The current state of knowledge does not yet allow a definitive explanation of the experimental findings. On the other hand, a *systematic variation of field parameters* (e.g., frequency, amplitude of the electric and/or magnetic field) in one of the above-mentioned, reproducible biological experiments could lead to significant progress in the theoretical interpretation of the reported results.

Unanimously, it was decided that these talks should continue and that they should include other scientists who could make relevant contributions. There is reasonable hope that this innovative and highly interdisciplinary field of research will receive appropriate financial support in the near future.

### EMFs from Light Boxes

To the Editor:

In an attempt to determine whether there are health risks associated with using a light box for viewing photographic transparencies, we measured magnetic field levels from both commercially available and custom-made light boxes at a photo agency in Woodstock, NY. The tests yielded some surprising results: Magnetic fields at a height of 4.5 cm above the viewing surface (the height of an average loupe) in some cases were as high as 60-80 mG. The magnetic field strength is about 6 mG at 30 cm from the surface and drops to less than 2 mG at 62 cm. This means that people editing color transparencies may be

exposed to the same field levels as electricians working with industrial power supplies, underground and overhead power line workers and welders.

Virtually all light boxes have a "ballast"—a device for converting 110 volts AC to the current necessary for a fluorescent bulb—which is the source of strong magnetic fields. A photo editor may spend hours a day within inches of the ballast, which is often located near the center of the box. The cumulative exposure can be substantial.

One option for mitigating these exposures is to remove the ballast from the light box and put it at the end of a cable. Our measurements showed that with the ballast removed the magnetic field strength was a nominal 2-3 mG at the viewing surface. Changing the circuit, however, will invalidate the UL-approved designation of the light box. Another option is to hold the loupe and the transparency away from the light box—only working at the surface when absolutely necessary.

Sincerely,

Mark Antman  
The Image Works  
PO Box 443  
Woodstock, NY 12498

Stewart Maurer, PhD  
Department of Electrical Engineering  
New York Institute of Technology  
1855 Broadway, New York, NY 10023

## EMF Exposures Among Aluminum Workers

To the Editor:

Aluminum workers have been a focus of interest concerning occupational EMF exposure in several recent studies [see *MWN*, J/A90]. It has been pointed out that workers in the "potrooms," where the large electrolytic cells are housed, are subjected to strong DC magnetic fields, often in excess of 100 G. We recently had the opportunity to take some preliminary measurements of AC fields: Such measurements revealed fields greater than 100 mG in some regions of the potrooms. These AC fields may be due to the close proximity of the rectifiers and/or the AC ripple.

Sincerely,

Michael P. Milburn, PhD  
ELMAG Research & Consulting  
203-888 Burrard St.,  
Vancouver, BC V6Z 1X9, Canada

## UPDATES

### COMPATIBILITY & INTERFERENCE

**Apache Helicopter and EMI...**The Army continues to be criticized for failing to shield its aircraft adequately from potentially dangerous EMI—such charges have been leveled by members of Congress, by the DOD Inspector General and by dozens of newspapers and magazines, including the *New York Times*, the *Washington Post* and *Time*. The latest barrage, fired in an article in the fall issue of *Compliance Engineering* magazine, is aimed at the Army's Apache attack helicopter. William von Achen, *Compliance Engineering's* editor and the author of the piece, writes that, "The EMI problems that have plagued the Apache are particularly troublesome, since Army officials knew, or should have known, of the potential for such difficulties almost from the project's inception." According to a 1988 Inspector General investigation, von Achen reports, the Apache cannot be deployed from an aircraft carrier because of EMI, and may be susceptible to "commercial microwave, television and airport radar," as well as "combat emitters, such as U.S. and allied missile radar controllers" (see *MWN*, S/O88). Von Achen also reveals that the Apache encountered serious electronic problems during its first combat duty in the 1989 U.S. invasion of Panama. He suggests that the Army—which still requires its aircraft to meet only a 20 V/m immunity requirement, while Navy and Air Force aircraft must meet a much stricter 200 V/m standard—should have known that its EMI shielding was insufficient because of its experience with the Black Hawk helicopter (see *MWN*, N/D87 and N/D88). EMI may have been responsible for a number of accidents and fatalities involving the Black Hawk—though widely reported as fact, these charges have repeatedly been denied by the Army (see *MWN*, S/O91). Furthermore, von Achen reports that Navy engineers found that EMI disrupted steering equipment, automatic flight control systems, AC and DC power systems, fire detection devices, command

instrument systems and other electronic components in the Black Hawk. Nevertheless, Army officials sidestepped *Compliance Engineering's* charges about the Apache, asserting that, "There are no known deficiencies in the EMI area that preclude operational use of the AH-64 (Apache) for all its intended missions." *Compliance Engineering* is published by Dash, Straus & Goodhue, Inc., in Boxborough, MA.

### LAW

**Attorney Advocates Utility Reform...**Utility executives must "return to their proper task—assisting the public—rather than fighting the citizens they serve," states Seattle, WA, attorney Philip McCune in an article in the winter issue of the *University of Michigan Journal of Law Reform*, published in Ann Arbor. McCune argues that growing fear of EMF health effects, coupled with "imperfect legal rules," could result in undue costs to utilities and consumers alike. "Power companies must change their approach to the construction of new power lines if they wish to expand their electrical transmission capacity," McCune writes. His article begins with a discussion of current legal theories governing EMF litigation, including eminent domain and inverse-condemnation proceedings and tort actions for those who have suffered financial, emotional or physical harm from power line EMFs. He then presents a number of "simple solutions" for utilities to allay public concerns and reduce public exposures to EMFs. These solutions include avoiding major population centers when planning transmission lines, purchasing wider rights-of-way, implementing EMF-reduction technologies when designing new lines and increasing community trust through communication. "Reforming public relations strategies and increasing safety will require some added expense, but this should not hinder their implementation," McCune asserts, adding that, "The cost of alternative power line construction

## UPDATES

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techniques represents a small fraction of the total dollars at stake in the construction of electrical transportation devices today.”

### MAGLEV

**Fire Destroys Test Vehicle...** Japanese researchers developing magnetic levitation technology saw one of their trains gutted by a fire that broke out during a test run on October 3, according to an article in the October 17 issue of *Nature*. The fire started when one of the rubber tires, designed to support the train at low speeds, went flat. Though no one was injured in the accident, maglev's status as the commercial transport system of the future may have been dealt a serious blow, according to *Nature*. David Swinbanks, reporting from Tokyo, cites a number of other potential problems with the high-speed rail technology, including difficulty in shielding the insides of the trains from high magnetic fields—there is concern that these fields could stop a pacemaker or present long-term health risks to passengers. Swinbanks goes on to state that “ambitious plans by proponents of the maglev train...must now be very much in question because of the numerous technical hurdles in the way.” Yet Japanese Transport Minister Kanezo Muraoka reportedly said that the \$23 million vehicle would be replaced and that further testing would go ahead on schedule. Attempts by *Microwave News* to obtain more information on the accident from the Japan Railway Technical Research Institute, which is conducting the tests, were unsuccessful.

### MEDICAL DEVICES

**Apnea Monitor Recalled...** On September 23, Aequitron Medical, Inc., of Minneapolis, MN, issued a recall for its Model 8200CE apnea monitor because EMI could interrupt the device's lifesaving alarm function, according to the October 2 *FDA Enforcement Report*. The Model 8200's EMI susceptibility has been linked to at least 70 deaths and has been the subject of Congressional hearings, a GAO investigation and litigation (see *MWN, J/A91*). More than 12,000 of these monitors have been distributed in the U.S., Canada and Belgium. Despite repeated requests, the company has refused to provide *Microwave News* with information on the recall.

### MEETINGS

**Australian ELF Workshop...** Papers on the biological effects of power frequency EMFs, risk perception and regulation were presented at the Australian Radiation Protection Society's *50 Hz Fields and Health* workshop on October 3-4, 1991, in Sydney. Among the contributors were Australia's Drs. Michael Repacholi and Vincent Delpizzo, the U.S.'s Drs. Jan Stolwijk, Tom Tenforde, Larry Anderson and Granger Morgan and the International Agency for Research on Cancer's Dr. Michel Coleman. The two-volume proceedings are available for \$44.00 (Aus.), including postage and handling, from: Graeme Elliott, *Radiation Protection in Australia*, PO Box 128, Rosanna, Victoria 3084, Australia.

**NIOSH Proceedings Out...** The 229-page compilation of ple-

nary papers and recommendations from NIOSH's January 1991 *Scientific Workshop on the Health Effects of Electric and Magnetic Fields on Workers* has been published (see *MWN, J/F91* and *M/A91*). Presented in the booklet, which was edited by NIOSH's Philip Bierbaum and Dr. John Peters of the University of Southern California in Los Angeles, are papers by Dr. Stephen Cleary on *in vitro* studies, Dr. Larry Anderson on *in vivo* research, Dr. Gilles Thériault on epidemiology, Dr. Dan Bracken on exposure assessment and William Feero on EMF management. The volume is available at no cost from: Publication Dissemination, DSDTT, National Institute for Occupational Safety and Health, 4676 Columbia Parkway, Cincinnati, OH 45226, (513) 533-8287.

### RESOURCES

**OTA on Circadian Rhythms...** A new report by the Congressional Office of Technology Assessment (OTA), titled *Biological Rhythms: Implications for the Worker*, asserts that altered circadian cycles can result in reduced productivity, fatigue, stress, insomnia and depression. These effects, common in many shift workers, may be due to abnormal sleep schedules and altered exposure to daylight, which regulate the pineal gland and production of the hormone melatonin. Doses of bright, fluorescent light may help the body adjust to schedule changes, according to the report. OTA concludes that much more research is needed to understand fully the biological effects of circadian rhythms. Copies of the 250-page report (GPO 052-003-01254-5) are available for \$11.00 each from: Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402, (202) 783-3238.

**Wall Chart...** The U.K.'s National Radiological Protection Board (NRPB) is offering a wall chart that illustrates the sources and effects of NIER, together with protection techniques. Single copies of *Non-Ionizing Radiations* are available free from: Publications Office, NRPB, Chilton, Didcot, Oxon OX11 0RQ, U.K., (44+0235) 831600.

### ETC...

**Microwaves and Murder...** An FCC clerk was shot to death outside the agency's Manhattan field office on November 27 by a woman who had previously complained that radiowaves were “interfering with her,” and who said that she had been subjected to “illegal surveillance” by the FCC, according to press reports. The suspect, a 53-year-old woman from Greeley, CO, apparently singled out Catherine Forster just because she worked for the FCC. In past incidents, the suspect had threatened to kill an employee at FCC headquarters in Washington, DC, and had to be physically removed from field offices in New York City and Denver, according to an account in the December 2 issue of *Broadcasting*. Richard Smith, head of the FCC's field operations bureau, told *Broadcasting* that bizarre types of behavior, even attacks, are not uncommon, adding that, “This is something we deal with day in and day out.” No other FCC employee has been killed in the line of duty.

# CONFERENCES

## 1992 Conference Calendar

January 23-25: 1st Congress of the European Bioelectromagnetics Association, Brussels, Belgium. Contact: Dr. M. Hisenkamp, Dept. of Orthopedic Surgery and Traumatology, Hôpital Erasme, Université Libre de Bruxelles, Route de Lennik 808, B-1070 Brussels, Belgium, (32+2) 555-3640.

January 26-30: IEEE Power Engineering Society Winter Meeting, Hilton Hotel, New York, NY. Contact: Frank Schink, 14 Middlebury Lane, Cranford, NJ 07016, (908) 276-8847.

February 3-7: The Health Physics of Non-Ionizing Radiation, Battelle Conference Center, Seattle, WA. Contact: Dr. John A. Leonowich, Battelle PacificNW Labs, PO Box 999, Mail Stop K3-70, Richland, WA 99352, (509) 375-6849.

March 9-10: EMF: How Dangerous? Marriott Hotel, Arlington, VA. Contact: Barry LeCerf, EMF Conference, 5072 West Chester Pike, PO Box 556, Edgemont, PA 19028, (215) 359-1249.

March 10-15: Congress on Electromagnetic Pollution and Biogeopathological Research, Foz do Iguacu, Brazil. Contact: Dr. José Barbosa Marcundes, Caixa Postal 3321, São Paulo, Cep. 01060, Brazil.

March 12-13: 1992 IEEE 18th Annual Northeast Bioengineering Conference, University of Rhode Island (URI), Kingston, RI. Contact: Dept. of Electrical Engineering, URI, Kingston, RI 02881.

March 30-April 2: Biological Effects of Ionizing and Non-Ionizing Radiation: Nuclear, UV, RF/MW, IR and Ultrasound, George Washington University (GWU), Washington, DC. Contact: GWU, School of Engineering and Applied Science, Washington, DC 20052, (800) 424-9773.

April 1-2: 28th Annual Meeting of the National Council on Radiation Protection and Measurements (NCRP), Marriott Hotel, Crystal City, VA (outside Washington, DC). Contact: Roger Ney, NCRP, 7910 Woodmont Ave., Suite 800, Bethesda, MD 20814, (301) 657-2652.

April 5-9: Meeting of the Federation of American Societies for Experimental Biology (FASEB), Convention Center, Anaheim, CA. (The International Society for Bioelectricity will participate.) Contact: FASEB Office of Scientific Meetings and Conferences, 9650 Rockville Pike, Bethesda, MD 20814, (301) 530-7010.

April 13-16: International Magnetics Conference, Adam's Mark Hotel, St. Louis, MO. Contact: John Nychuis, Purdue University, School of Electrical Engineering, West Lafayette, IN 47907, (317) 494-3524.

April 13-16: 70th Annual Convention of the National Association of Broadcasters (NAB), Convention Center, Las Vegas, NV. Contact: NAB Services, 1771 N St., NW, Washington, DC 20036, (800) 342-2460.

April 26-May 1: 6th International Congress on Hyperthermic Oncology, Convention Center, Tucson, AZ. Contact: Joseph Segilia, Conference Services, University of Arizona, 1955 E. 6th St., Tucson, AZ 85719, (602) 621-7724.

May 10-14: 2nd International Workshop on Non-Ionizing Radiation (NIR), University of British Columbia (UBC), Vancouver, Canada. Contact: Wayne Greene, NIR Workshop, 50/2075 Westbrook Mall, UBC, Vancouver, BC V5Y 1P9, Canada.

May 12-14: Instrumentation/Masurement Technology Conference (IMTC), Meadowlands Hilton, East Rutherford, NJ (outside New York City). Contact: Robert Myers, IMTC, 3685 Motor Ave., Suite 240, Los Angeles, CA 90034, (213) 287-1463.

May 17-21: 24th Annual National Conference of Radiation Control Program Directors (CRCPD), Clarion Plaza Hotel, Orlando, FL. Contact: Terry Devine, CRCPD, 205 Capital Ave., Frankfort, KY 40601, (502) 227-4543.

May 17-22: 8th World Congress of the International Radiation Protection Association (IRPA), Convention Center, Montreal, Canada. Contact: IRPA 8, 2155 Rue Guy, Suite 820, Montreal, Quebec H3H 2R9, Canada, (514) 932-9552.

May 25-27: 1992 International Symposium on Electromagnetic Compatibility, Xiang Shan Hotel, Beijing, China. Contact: Min Fang, Chinese Institute

of Electronics, Nongzhanguan Nanlu No.12, Room 2310, Beijing, 100026 China, (86+1) 5001144, ext.2310.

May 27-29: 46th Annual Symposium on Frequency Control, Lodge & Convention Center, Hershey, PA. Contact: Michael Mirarchi, Synergistic Management Inc., 3100 Route 138, Wall Township, NJ 07719, (908) 280-2024.

May 30-June 3: 27th Annual Meeting & Exposition of the Association for Advancement of Medical Instrumentation (AAMI), Marriott Hotel, Anaheim, CA. Contact: AAMI Education Dept., 3330 Washington Blvd., Suite 400, Arlington, VA 22201, (703) 525-4890, ext.214.

June 2-4: 1992 IEEE Microwave Theory and Techniques Society International Microwave Symposium, Albuquerque, NM. Contact: Mike Little, Rome Air Development Center, RADC/OCTP, Griffiss AFB, NY 13441.

June 9-12: Conference on Precision Electromagnetic Measurements, Paris, France. Contact: Ginette Bonami, Société des Electriciens et des Electroniciens, 48 Rue de la Procession, F-75724 Paris Cedex 15, France, (33+1) 45 67 07 70.

June 14-19: 1st World Congress for Electricity and Magnetism in Biology and Medicine, Walt Disney World Village, Orlando, FL. Contact: W/L Associates, 120 W. Church St., Frederick, MD 21701, (301) 663-1915.

June 23-25: 20th International Power Modulator Symposium, Hilton Hotel, Myrtle Beach, SC. Contact: Mark Goldfarb, Palisades Institute for Research, 2011 Crystal Dr., Suite 307, Arlington, VA 22202.

July 12-16: IEEE Power Engineering Society Summer Meeting, Seattle, WA. Contact: Betty Tobin, Society Special Services, IEEE, 445 Hoes Lane, PO Box 1331, Piscataway, NJ 08855, (206) 684-3370.

July 18-25: 1992 IEEE Antennas and Propagation Society International Symposium, URSI Radio Science Meeting and Nuclear EMP Meeting, Hyatt Regency Hotel, Chicago, IL. Contact: Prof. Pietergiorgio Uslenghi, Dept. of EECS (M/C 154), University of Illinois, Box 4348, Chicago, IL 60680, (312) 996-5487.

August 2-5: 27th Microwave Power Symposium, Marriott Hotel, Washington, DC. Contact: International Microwave Power Institute, 13542 Union Village Circle, Clifton, VA 22024, (703) 830-5588.

August 8-14: Annual Scientific Meeting and Exhibition of the Society of Magnetic Resonance Imaging in Medicine (SMRIM), International Congress Center, Berlin, Germany. Contact: SMRIM, 1918 University Ave., Suite 3C, Berkeley, CA 94704, (415) 841-1899.

August 10-14: Non-Ionizing Radiations: Health Physics and Radiation Protection, Massachusetts Institute of Technology (MIT), Cambridge, MA. Contact: Director, MIT Summer Session Office, Room E19-356, Cambridge, MA 02139, (617) 253-2101.

August 11-13: 1992 Asia-Pacific Microwave Conference, Convention Center, Adelaide, Australia. (Held in conjunction with the 5th Australian Millimeter and Submillimeter Wave Symposium.) Contact: Professor Harry Green, Dean, Faculty of Engineering, University of Adelaide, GPO Box 498, Adelaide SA 5001, Australia.

August 18-20: 1992 IEEE International Symposium on Electromagnetic Compatibility, Marriott Hotel, Anaheim, CA. Contact: George Kunkel, Spira Mfg., 12721 Saticoy St. South, North Hollywood, CA 91605, (818) 764-8222.

September 1-4: 3rd International Scientific Conference on Work with Display Units, International Congress Center, Berlin, Germany. Contact: Dr. Ahmet Çakir, Ergonomic Institut für Arbeits- und Sozialforschung, Soldauer Platz 3, D-1000 Berlin 19, Germany, (49+30) 302 10 50.

September 2-4: 11th International Wrocław Symposium on Electromagnetic Compatibility (EMC), Technical University, Wrocław, Poland. Contact: W. Moron, EMC Symposium, Box 2141, 51-645 Wrocław 12, Poland, (48+6) 71 48 10 41.

September 6-12: 26th Congress Ampere on Magnetic Resonance, Vraona

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Bay Hotel, outside Athens, Greece. Contact: Dr. F. Milia, Institute of Materials Science, NCSR Demokritos, GR-153 10 Ag. Paraskevi Attikis, Greece, (30+1) 65 22 872.

September 21-24: 8th International Conference on Electromagnetic Compatibility, Heriot-Watt University Conference Center, Edinburgh, U.K. Contact: Conference Services, Institution of Electrical Engineers (IEE), Savoy Pl., London WC2R OBL, U.K., (44+71) 240-1871, ext.222.

September 22-25: 1992 International Symposium on Antennas and Propagation, Hokkaido University Conference Hall, Sapporo, Japan. Contact: Yoshio Hosoya, NTT Radio Communication Systems Labs, 1-2356, Take, Yokosuka, Kanagawa, 238-03, Japan, (81+468) 59-3134.

September 23-25: 5th International Conference on Harmonics in Power Systems, Atlanta, GA. Contact: Nancy Heitman, IEEE Service Center, 445 Hoes Lane, PO Box 1331, Piscataway, NJ 08855, (206) 684-3370.

October 5-9: 1992 International Aerospace and Ground Conference on Lightning and Static Electricity, Atlantic City, NJ. Contact: Mike Cupples, FAA Technical Center, ACD 230, Atlantic City International Airport, NJ 08405, (609) 484-5228.

October 12-13: Radar 92: International Conference, Conference Center, Brighton, U.K. Contact: IEE, see September 21 above.

October 13-16: 1992 EPRI EMF Science & Communication Seminar,

Fairmont Hotel, San Francisco, CA. Contact: EMF Health Studies Program, Electric Power Research Institute (EPRI), PO Box 10412, Palo Alto, CA 94303, (415) 855-2320.

October 29-November 1: 14th International Conference of the IEEE Engineering in Medicine and Biology Society, Le Palais des Congrès, Paris, France. Contact: Robert Plonsey, Dept. of Biomedical Engineering, Duke University, Durham, NC 27706, (919) 660-5124.

November 2-5: 1992 Regional Symposium on Electromagnetic Compatibility, Hilton Hotel, Tel Aviv, Israel. Contact: Ortra Ltd., PO Box 50432, Tel Aviv 61500, Israel, (972+3) 664825.

November 12-14: JINA '92 International Symposium on Antennas, Nice, France. Contact: Dr. J.L. Guiraud, CNET-PAB, Centre de la Turbie, 06320 La Turbie, France.

### Dates and Locations To Be Announced

September/October: 11th International Conference on Gyromagnetic Electronics and Electrodynamics, Crimea, Ukraine. Contact: Dr. L.K. Mikhailovsky, Moscow Power Engineering Institute, 105835 Moscow, E-250, Krasnokazarmennaya, 14, Russia, (7+095) 362-55-32.

November: Annual Department of Energy Contractors Review, Contact: W/L Associates, 120 W. Church St., Frederick, MD 21701, (301) 663-1915.

### DOE Maps Out National EMF Research Agenda (continued from p.1)

istration officials. The White House Office of Management and Budget "is very interested in talking with us—that's a very good sign," San Martin said.

There were mixed messages as to whether there will be a surge in new funds for the national EMF program. At the workshop, San Martin and others from the DOE denied widespread rumors that the DOE EMF research budget would grow to \$15 million in fiscal year 1993 (FY93), which begins October 1, 1992. "It seems unlikely to me that there's going to be a massive injection of new federal funds," said Reid Detchon, a senior DOE official.

Representatives from the Environmental Protection Agency (EPA) and other federal agencies agreed with the DOE view that federal funding is likely to remain limited.

Many researchers were critical of the prospect of a no-growth budget. "We're angry and annoyed about the lack of a consistent DOE program. The lack of a consistent federal effort is harming the national program," said Jack Sahl of Southern California Edison in Rosemead, CA. Speaking on behalf of many participants, Dr. Asher Sheppard of the VA Hospital in Loma Linda, CA, called the level of federal commitment "pitiful."

Despite DOE's refusal to promise more research funds, however, senior officials made it clear that an increase is in fact possible if a workable, unified plan is developed. "In such a case, I don't see a problem with resources," San Martin said.

Congress might also provide more funds, according to James Cunningham of the New York Power Authority, who has been actively promoting a national research effort. An additional \$3-5 million in new federal research funds per year is "not out of the question," he said (see also p.4).

Workshop participants explored how to expand EMF research even in the absence of a larger budget. Most agreed that the new national effort should include current programs. Many suggest-

ed that, overall, 70% of the available funds should be allocated for science, 20% for engineering and 10% for communications.

The new DOE agenda is likely to include the National EMF Research Program (NERP), the proposed public-private partnership (see p.5). John Coughlin, chairman of the NERP steering committee and head of Wisconsin's Public Service Commission, argued that, "We're a necessary part of the mix." In an interview with *Microwave News* San Martin agreed, saying that the DOE might contribute funds to the NERP.

Under the new agenda, as sketched by DOE officials, the DOE would coordinate the work of other federal agencies, state governments and the NERP. The officials suggested that while the federal government might take the lead on scientific research, the electric utilities might do the best job of devising mitigation methods and the states might be best able to manage communications with the public.

Efforts are under way to smooth over differences between the DOE and other agencies with responsibility for EMFs. For instance, on November 4, representatives of the DOE and EPA met in the office of Rep. George Brown (D-CA). But a participant at the meeting said that, "It was clear that DOE and EPA hadn't yet worked out their differences."

Tensions between DOE and other federal officials were heightened by the department's decision not to invite representatives from other federal agencies to an October 10-11 DOE meeting held in preparation for the November workshop.

The DOE is now drafting a strategic EMF implementation plan. Public meetings are scheduled for January and February 1992, and a final research agenda is due by May 1992.

In addition to representatives from seven federal agencies, the 65 participants at the November workshop included experts from state agencies, private and industry research institutions, trade associations and a labor union.

15 GHz for controlled and uncontrolled exposures, respectively.

• The exposure limits still map out the well-known "well shape" for protection against energy absorption at whole-body resonances (30-300 MHz). At these most stringently regulated frequencies, the limits are 1 mW/cm<sup>2</sup> and 200 μW/cm<sup>2</sup> for uncontrolled and controlled exposures, respectively. The strictest limit specified in the 1982 standard was 1 mW/cm<sup>2</sup>. The new 200 μW/cm<sup>2</sup> level is consistent with the 1986 recommendations of the National Council on Radiation Protection and Measurements (NCRP)—though these apply to the general population regardless of the environment (see *MWN*, M/J86).

• The applicable frequency range has been extended to 3 kHz, down from 300 kHz in the 1982 standard.

• Maximum induced currents for 3 kHz-100 MHz are now included to protect against shocks and burns. The most stringent requirements are current limits of 45 mA and 100 mA through each foot for uncontrolled and controlled exposures, respectively, for 100 kHz-100 MHz. At lower frequencies, larger currents are allowed.

• Emitters with an input power of up to seven watts continue to be excluded from the standard for 100 kHz-1.5 GHz. The exclusion does not apply to devices that are attached to the human body, however.

ANSI will publish a request for public comment on the revised standard in the December 27 issue of *Standards Action*, its biweekly newsletter. The comment period will run through February 25, 1992. The C95.1 standard will then be considered by the ANSI Board of Standards Review to determine whether it will become an "American National Standard." Fred Feiner, an ANSI spokesman, explained that any negative comments which have not been resolved by the IEEE will be presented to the board.

The revision of the new standard began in 1983 (see *MWN*, J/A83) and, since then, has been the subject of almost continuous controversy. The work of the SCC-28 group has been criticized on both procedural and substantive grounds (see *MWN*, J/A85, J/A86, J/A87, M/A88, M/A89, S/O89, N/D90 and S/O91).

The IEEE Standards Board also approved a revised standard

(C95.3-1991) for the measurement of RF/MW radiation at its September meeting.

Both the C95.1 and the C95.3 standards are in the process of being printed and should be available by early 1992, according to Susan Valinoti of the IEEE Standards Department. Drafts are available now from: Customer Service, IEEE, 445 Hoes Lane, PO Box 1331, Piscataway, NJ 08855, (800) 678-IEEE (678-4333). A copy of C95.1 costs \$28.00; C95.3 costs \$36.50. Add \$4.00 for postage and handling for either standard or \$6.00 for both. There is a discount for IEEE members.

### **Chairmen of ELF Subcommittee Named**

On November 2 at a meeting held in Orlando, FL, SCC-28 Chairman Thomas Budinger of the Lawrence Berkeley Laboratory in Berkeley, CA, named Dr. John Bergeron and William Feero as the chairmen of the recently formed subcommittee 3 on extremely low frequency (ELF) safety guidelines. Bergeron is with GE Corporate Research and Development in Schenectady, NY, and Feero is with Electric Research and Management in State College, PA.

"The charge of the ELF subcommittee is to develop a scientific consensus on safe exposure guidelines and to identify practical experiments to resolve outstanding questions," Bergeron told *Microwave News*. He hopes that the subcommittee will complete its work within four years.

The subcommittee has set up two task forces: one on epidemiology chaired by Dr. Ralph Buncher of the University of Cincinnati in Ohio and one on biophysics and biology chaired by Dr. Bill Guy, who recently retired from the University of Washington, Seattle. Guy was the chairman of the subcommittee that wrote the 1982 RF/MW standard, and he played an active role in the development of the 1991 revision.

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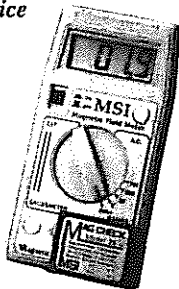
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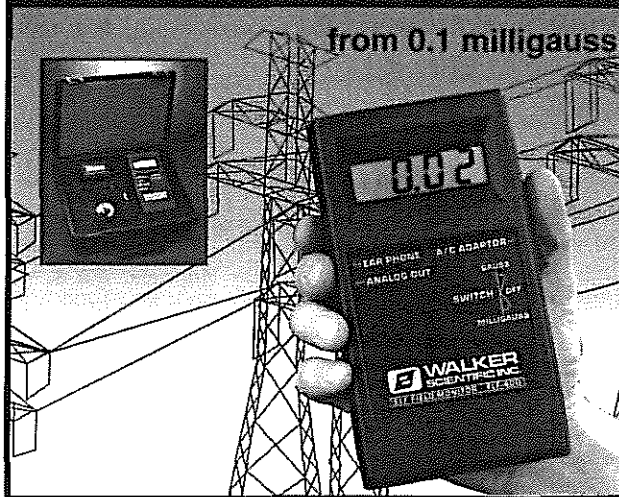


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