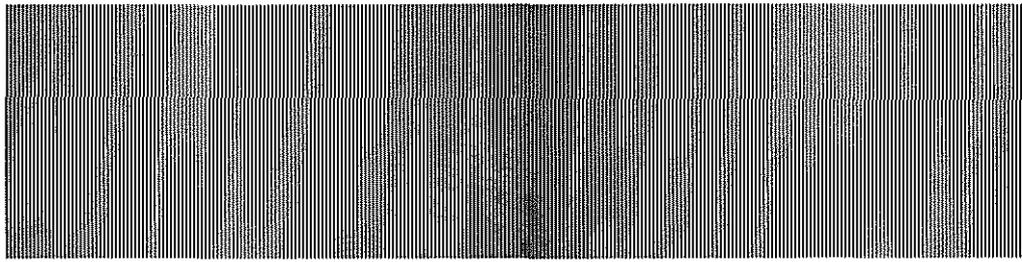


MICRO WAVE NEWS



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A Report on Non-Ionizing Radiation

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New Support for EMF-Chemical Synergy in Cancer Promotion Animal and Cellular Data Agree

Extremely low frequency (ELF) magnetic fields can act in concert with toxic chemicals to promote the development of cancer in both live animals and cell cultures, according to new experimental data.

At the *Annual Meeting of the Bioelectromagnetics Society (BEMS)*, held in Salt Lake City, UT, June 23-27, Drs. Jack McLean and Maria Stuchly of Health and Welfare Canada in Ottawa, Ontario, announced that 60 Hz magnetic fields and TPA, a known tumor promoter, act synergistically to accelerate the development of skin tumors in mice.

At the same meeting, Dr. Chris Cain of the VA Hospital in Loma Linda, CA, reported that ELF magnetic fields can enhance the action of TPA in cancer cells grown in culture. "It is fascinating that the fields have the same effect in vivo and in vitro," Cain told *Microwave News*. "This may lead us to an understanding of mechanisms of interaction."

The Canadian researchers urged that their findings be interpreted with caution. "These are preliminary results," stressed McLean in an interview. Nevertheless, their data are the first to link ELF magnetic fields to the development of cancer in live animals and thus have already attracted a great deal of interest. The absence of animal data has long undermined the EMF-

(continued on p.12)

Electromagnetic Interference Implicated in Apnea Monitor Deaths

The lifesaving function of apnea monitors—electronic alarms that sound during respiratory failure—can be thwarted by electromagnetic interference (EMI). Low levels of radiofrequency (RF) radiation common in many residential areas and power frequency electromagnetic fields (EMFs) from household appliances can disrupt the monitors.

The failure of apnea monitors has been implicated in scores of fatalities—one model has been linked to at least 70 deaths—and has been the subject of Congressional, Food and Drug Administration (FDA) and General Accounting Office (GAO) investigations.

"It is evident that these monitors need to be redesigned to withstand the ambient field strengths existing in major cities," according to researchers at the FDA's Center for Devices and Radiological Health (CDRH). The agency has issued a warning to the roughly 50,000 users of apnea monitors in the U.S. but will not finalize EMI standards for more than a year.

At least one EMI incident has already led to litigation. In 1989, Michael

(continued on p.13)

« Power Line Talk »

While EPA's Science Advisory Board (SAB) concludes its review of the draft report on EMFs and cancer (see p.7), a parallel review by the Committee on Interagency Radiation Research and Policy Coordination (CIRRPC) hasn't even begun. White House Science Advisor Dr. Allan Bromley ordered the CIRRPC review late last year after persuading EPA to make it a companion to the cancer report (see *MWN*, N/D90). Initially, CIRRPC appointed an outside panel headed by Dr. Charles Susskind of the University of California, Berkeley—who is also a member of the SAB panel—but he was soon removed. Now a committee of experts assembled by the Oak Ridge Associated Universities (ORAU) has taken over. "This way they can keep the whole business secret," an informed source told *Microwave News*. Diane Flack at ORAU's Washington, DC, office contends that there "is nothing secretive" about the review. Nevertheless, she said that the panel's first meeting in early September will be closed to outsiders. Flack said that she could not tell us who is on the committee but that she would ask the panel's chairman—whom she would only identify as being based in Oak Ridge, TN—to call us. We haven't heard from either of them since. Flack said that the panel hopes to have a draft report within six months. A 1985 CIRRPC review of NIER bioeffects by Dr. Ross Adey of the VA Hospital in Loma Linda, CA, was never made public (see *MWN*, N/D85, N/D87 and N/D90).

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There's more bad news on cancer rates: The National Cancer Institute (NCI) reports in its *Cancer Statistics Review, 1973-1988*, that the overall incidence of childhood cancer rose by 4.5% over the 16-year period. The increase was greatest for brain and nervous system cancers among white children, which rose by more than 30%. Leukemia and non-Hodgkin's lymphoma rates were also sharply higher. In an interview with the *New York Times* (June 26), NCI Director of Epidemiology and Biostatistics Dr. Joseph Fraumeni said that he thought that "people are less dismissive than they used to be" about the possible relationship between cancer and EMFs. Fraumeni is currently working on a study of childhood leukemia that will include EMFs as a possible risk factor (see *MWN*, J/F89 and S/O89). Previously we reported that the rates of brain cancer for both the elderly and people under 45 have been on the rise (see *MWN*, J/F91).

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Michigan Rep. Howard Wolpe (D) is taking his subcommittee to his home state to learn more about EMFs. A hearing, scheduled for August 6 in Battle Creek, on *EMF and High-Voltage Power Lines: A Case Study in Michigan* is the first of its kind to be held outside of Washington, DC. It will focus on the dispute over a proposed 115-mile, 345 kV transmission line from Battle Creek to Akron, IN (see *MWN*, M/J91). Invited witnesses include Dr. Leonard Sagan of EPRI, Dr. Abe Liboff of Oakland University in Rochester, MI, Cathy Smith of Michigan RAGE,

based in Battle Creek, and Dr. William Farland of EPA, as well as officials from Consumers Power and local utilities and state representatives. Wolpe, who is chairman of the House Science, Space and Technology Committee's Subcommittee on Investigations and Oversight, wrote to the Federal Energy Regulatory Commission (FERC) earlier this year in support of a request by Michigan RAGE that FERC block the line (see *MWN*, M/J91). FERC has since approved the project.

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The National Association of Regulatory Utility Commissioners (NARUC) has endorsed the National EMF Research Program (NERP) (see pp.3 and 4). In a resolution adopted July 24, NARUC's executive committee urged member utility commissioners to "encourage public education" about EMFs and to support the NERP. Two of the four members of the NERP steering committee—Chairman John Coughlin of Wisconsin and Michael Wilson of Florida—are members of NARUC's Committee on Electricity, which initiated the resolution.

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Architecture magazine's Alex Wilson has some practical advice for designing low EMF homes and offices. In the July issue, he writes that, when possible, structures should be located at least 500 feet from high voltage transmission lines. Wilson also suggests that all incoming conductors be placed close together and that major electrical equipment, such as elevator and HVAC motors, be far from occupied spaces.

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New York City Mayor David Dinkins is concerned about EMFs. In a March 6 letter to EPA Administrator William Reilly, Dinkins called on EPA to lead a strong research program, to standardize EMF testing procedures, to formulate exposure standards and to sponsor a meeting for the public. In reply, EPA has scheduled a workshop on measurements and bioeffects for August 14-15 in Albany and a public meeting for October 9 in New York City....New Yorkers are especially concerned over the threat posed by EMFs from substations. The City Council held a hearing on June 18 and has promised further action.

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"How risky are EMFs?" was the question posed to Dr. Gilbert Omenn, dean of the school of public health at the University of Washington, Seattle, and the chair of EPRI's EMF scientific advisory panel, at an electric industry seminar. "I have to rank [EMFs] with eating peanut butter" on the spectrum of public health risks, Omenn replied, according to Cyrus Noë, writing in *Clearing Up* (July 3, 1991), a Pacific Northwest utility newsletter. Omenn was referring to aflatoxin, a carcinogenic fungus sometimes found in peanuts.

EMF Research: Who's in Charge?

There is one point on which all sides of the EMF debate agree—the need for more research. But even with this unanimity of opinion, there is little hope that a comprehensive research program will begin anytime soon.

The momentum for a National EMF Research Program (NERP) has been building since James Cunningham of the New York Power Authority (NYPA) raised the idea at a congressional hearing in March 1990. All the major industry players—APPA, EEI, EPRI, ESEERCO, LPPC, NEMA, NPPA*—have now endorsed a \$20-30 million, three-to-five-year effort to produce “reliable, credible and impartial” results, jointly sponsored by government and industry.

What is missing is government leadership. EPA has just issued a new report with a wish list of 32 high priority EMF projects (see p.9). The DOE has asked for more money for its own research program. And even Dr. Allan Bromley, the President's science advisor—an outspoken skeptic of EMF risks—has conceded that “much remains to be done.” Yet none of these government offices has spoken up in favor of the NERP, leaving the states and the utilities to take the lead.

Two key questions remain: Who will run the NERP? And, who will decide who runs it?

Not long ago, it appeared that the Health Effects Institute (HEI) would lead the NERP, but that now seems less likely. HEI has left itself vulnerable to allegations that its asbestos research program (HEI-AR) is tainted by a pro-industry bias. This spring, the National Association of Attorneys General (NAAG) adopted a resolution that expressed “deep concern” that HEI-AR “is incapable of producing an objective, unbiased report...” The NAAG pointed out that HEI has consistently refused to take steps to mitigate these concerns.

Instead of trying to put these charges to rest, HEI President Dr. Andrew Sivak has allowed them to fester. Now, somewhat embarrassed, many NERP backers are distancing themselves from HEI. The NAAG resolution may be what prompted the New York State Department of Public Service to set up a steering committee to establish and oversee the NERP and to reopen the search for an organization to run it (see p.4). In contrast to HEI's desire to restrict attendance at its meetings (see p.5), the steering committee's first action was to open all its deliberations to the public. The committee has already drafted a conflict of interest policy.

Many utilities have endorsed the NERP—some have pledged allegiance directly to HEI. The Los Angeles Department of Water and Power has already given HEI \$300,000; Seattle City Light has contributed a lesser amount. (These two utilities, together with the NYPA, were among the original backers of the NERP.) At the same time, others wonder why they should pay for HEI to make up for its lack of EMF experience and why the institute has hired a consulting firm,

Gradient Corp., which has other industry EMF clients.

Most utilities will probably follow the NERP steering committee's lead. By federal default, state regulatory officials are calling the shots, and they may deny the power companies the right to charge their rate payers for HEI contributions if it is not designated as the administrator of the NERP.

One persistent refrain heard from all sides is: “Where is EPA?” Not long ago, EPA had the premier EMF research group in the world, but it was disbanded by the Reagan Administration, and now the agency appears utterly incapable of taking on EMFs. A student of bureaucracies would be amazed that an agency would refuse a new multimillion-dollar program. When Congress recently gave EPA \$750,000 for EMF research, the agency turned around and gave \$525,000 to HEI. The fact that an HEI alumnus, Dr. Ken Sexton, is the director of EPA's Office of Health Research no doubt helps HEI's prospects.

Today, a year after EPA released a draft report linking EMFs to cancer, the agency is still not supporting a single EMF experiment in its own labs—despite its new document calling for a slew of research projects. When the NERP committee invited EPA to explain how it would run the EMF research program, the agency declined to comment.

Much of the responsibility for EPA's paralysis lies with Dr. Erich Bretthauer, the assistant administrator for R&D. A political appointee, Bretthauer is the one who was summoned to the White House when the Bush Administration panicked about the political and economic implications of EPA's cancer report (see *MWN*, N/D90). Clearly, Bretthauer wishes the EMF controversy would go away, but even he realizes that this won't happen. Instead, he wants to hand over the responsibility to HEI—and keep EMFs at arm's length. (When questioned about EPA's commitment to HEI, the official line is that “no decisions have yet been reached.”)

Those who look to Congress for a resolution will be disappointed. Rep. Frank Pallone's (D-NJ) funding bill is going nowhere. A number of senior members of the House of Representatives have shown an interest in EMFs, but most are content to hold hearings rather than to press for action. For some unexplained reason, Reps. George Brown (D-CA) and James Scheuer (D-NY) have endorsed the idea of farming out EMF research to an organization outside the government—perhaps HEI.

Everyone's patience is running out: The organizational issues are simple compared to the unresolved scientific questions and the slow start does not bode well for finding any answers soon. Dr. Genevieve Matanoski, the chair of the Science Advisory Board's EMF panel, predicted that the only way to win the public's confidence is to put the research in the hands of the National Institutes of Health. She is clearly on the right track: There will be no real progress until the federal government starts to do its job.

* American Public Power Association (APPA), Edison Electric Institute (EEI), Electric Power Research Institute (EPRI), Empire State Electric Energy Research Corp. (ESEERCO), Large Public Power Council (LPPC), National Electrical Manufacturers Association (NEMA), Northeast Public Power Association (NPPA).

Telephone Linemen Study Now Finds ELF-Leukemia Link

A major epidemiological study from Johns Hopkins University (JHU) in Baltimore, MD, indicates that some telephone linemen exposed to extremely low frequency (ELF) electromagnetic fields (EMFs) had higher death rates from leukemia than other telephone company employees.

Drs. Genevieve Matanoski, Patrick Breyse, Elizabeth Elliott and colleagues at JHU's School of Hygiene and Public Health compared the records of 124 male AT&T workers who had died of acute myelogenous leukemia between 1975 and 1980 with those of 337 matched controls.

Speaking at the *Annual Meeting of the Bioelectromagnetics Society* in Salt Lake City, UT, on June 24, Matanoski reported that, "The risk is greatest for the younger workers," explaining that there is a latency period before the leukemia is observed and that early exposures are important. In a background paper, the Electric Power Research Institute (EPRI), which funded the study, noted that "some relatively high odds ratios" were seen when a 10-15-year latency period was taken into account.

"There is some suggestion of a trend of increased risk with increased exposure," Matanoski said in an interview. Exposure was estimated using a "score" defined as the product of the average daily exposure and the number of years on the job. Those workers with a higher-than-median exposure score had a 2.5 times greater risk of dying of leukemia than those with lower exposure scores.

The association was greater when peak—rather than median—EMFs were used to gauge exposures. Also, when workers were assigned to one of four categories of peak exposures, there was a trend toward higher leukemia risks with increasing exposures. Cable splicers and central office technicians who used older switching equipment had the highest peak EMF exposures.

The results counter the preliminary conclusions of no increased leukemia risk reported by Matanoski in 1988 (see *MWN*, N/D88). "There has been a change," Matanoski told *Microwave News*, explaining that on reviewing the raw data she had found a number of misclassified exposures. When these were corrected, the higher risks were identified. She noted that her data set is still incomplete.

The elevated risk among young workers is supported by a related study on leukemia incidence—in contrast to mortality—by the same JHU researchers. In that effort, first reported in

1989, they observed that young cable splicers had significantly higher rates of leukemia and lymphoma—as well as all types of cancer—than other telephone workers (see *MWN*, N/D89).

Magnetic field measurements taken in 1988-89 among telephone employees showed that average (and peak) exposures were 4.3 (99.2) mG for cable splicers, 2.5 (21) mG for central office technicians, 1.7 (31) mG for installers, 1.6 (26.9) mG for outside plant technicians and 1.5 (29.1) mG for non-linemen.

New National EMF Research Committee Established

A committee of government officials is being assembled to coordinate a \$20-30 million National Electromagnetic Field Research Program (NERP). The New York State Department of Public Service (NYDPS) is setting up the committee, with the assistance of the Large Public Power Council (LPPC), to oversee a research effort to be funded jointly with private and public funds.

The NERP is the product of the independent efforts of the NYDPS to follow up on both the New York Power Lines Project (see *MWN*, N/D88) and the LPPC's call in March 1990 for a joint private-public effort (see *MWN*, M/J90).

The steering committee's first task is to select an organization to administer the NERP. The administrative organization will, in turn, select the studies to be funded, operate the project day-to-day and oversee the scientific review of research results. At the moment, the NERP will only investigate extremely low frequency (ELF) electromagnetic field (EMF) effects.

At the NERP committee's first meeting, held June 27-28 in Washington, DC, committee member Susan Tierney stressed that the program must be free of real and perceived conflicts of interest. This is "one of the most important objectives of this panel," she said. Tierney is the Massachusetts secretary of environmental affairs.

John Coughlin, a Public Service commissioner in Wisconsin, is the chairman of the committee. The other members are Charles Imbrecht, chairman of the California Energy Commission, and Michael Wilson, a Public Service commissioner in Florida. (Imbrecht and Wilson could not attend the meeting but sent representatives in their places.) The steering committee expects to add four to six members, including federal officials and, possibly, representatives from citizens' groups, according to Larry DeWitt of the NYDPS.

At the meeting, the committee heard presentations from three of the organizations that the NYDPS had identified as possible administrators of the NERP: the Health Effects Institute (HEI), based in Cambridge, MA; the National Research Council (NRC), an arm of the National Academy of Sciences; and the Institute for Evaluating Health Risks (IEHR)—the latter two are in Washington, DC. Only HEI showed a serious interest in running the program.

Both NRC's John Burris and IEHR's Jack Moore said that their organizations would be interested in helping develop a

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research agenda but that HEI would be better qualified to administer the overall program.

The NYDPS had invited the Environmental Protection Agency (EPA) and the Department of Energy (DOE) to make presentations, but both declined.

The committee members grilled HEI over its controversial asbestos research program (HEI-AR). They were particularly concerned about the National Association of Attorneys General's condemnation of HEI-AR's refusal to answer allegations of conflicts of interest (see p.3). In interviews with *Microwave News*, a number of NYDPS staffers expressed deep concern about HEI's ability to run an open and objective EMF research program. They stressed that HEI might not be selected if the charges cannot be resolved.

At the meeting, DeWitt publicly stated that, "We have to be as concerned with the problem of appearance of a conflict" as with actual conflicts.

New York Power Authority Senior Vice President James Cunningham, who has led the LPPC effort to set up a national research program, urged the committee to act quickly. "I am sure that all utilities, businesses and individuals who have had to deal with this issue...believe it is absolutely essential that this study begin soon." Chairman Coughlin said that the panel will work "as rapidly as possible, but we don't want to get off to a false start."

The steering committee is scheduled to meet again on September 12 in Washington, DC.

HEI Moves Forward in Bid for EMF Research Program

Moving aggressively in its bid to run a national electromagnetic field (EMF) research program, the Health Effects Institute (HEI) convened a group of scientists to evaluate research needs on June 11-12 in Boston, MA. HEI, based in Cambridge, MA, is the leading contender to run a multimillion-dollar, multiyear research effort to be funded by federal and state governments and by the utility industry (see *MWN*, M/A91 and pp.3 and 4).

Dr. Richard Setlow of the Brookhaven National Labs in Upton, NY, the chairman of HEI's 13-member feasibility study committee, said that his panel is seeking to provide the institute with "an informed idea of how an HEI research program would advance our understanding" of EMF health effects. The committee will prepare brief reports identifying key scientific questions and potential research projects. A second, 12-member observers committee will review the documents and provide guidance. (For a list of members of the feasibility committee, see *MWN*, M/J91.)

Once the two EMF committees have made their recommendations, the institute's independent advisory committee will select the projects to be funded, according to HEI President Dr. Andrew Sivak. In an interview with *Microwave News*, Sivak said that he may ask some members of the feasibility and observers groups to serve on the advisory committee to make up for its lack of expertise in physics, engineering and endocrinology.

HEI and the Press

A recurring concern that has dogged HEI is the lack of openness of its research program (see p.3). When NIST's Misakian asked Sivak if HEI would prohibit researchers from talking to the press before their work is peer-reviewed, Sivak replied, "We don't go public until our review process is done." He then said, "We'll have to think about it for our management in the future." HEI would not prevent an investigator from presenting data at a meeting prior to publication, he noted.

Sivak initially denied *Microwave News* permission to cover the June meeting, stating that he thought the presence of the press would inhibit "candid, open discussion" among the committee members (see *MWN*, M/J91). He later relented, putting the issue to a vote at the opening of the session. However, he indicated that the August 26-27 meeting, at which research priorities will be decided, would be closed.

A number of the committee members made presentations on EMF research efforts in the U.S. and in the U.K.: Dr. Larry Anderson on the Battelle Pacific Northwest Lab's programs; Dr. Gary Boorman of the National Institute of Environmental Health Sciences on the National Toxicology Program's upcoming animal studies (see *MWN*, S/O90); Dr. Brian Maddock of the U.K.'s National Grid Co. on research in the U.K.; Dr. Russel Reiter of the University of Texas Health Science Center, San Antonio, on his EMF-pineal and melatonin research; Dr. Bonnie Richter on the Department of Energy's plans for in-house epidemiological studies; Dr. Walter Rogers of the Southwest Research Institute on behavioral effects; Dr. Jeffrey Saffer of the Jackson Laboratory on cell and molecular experiments; Dr. David Savitz of the University of North Carolina on epidemiology; and Dr. Stan Sussman on the Electric Power Research Institute's programs.

HEI has received \$525,000 from the Environmental Protection Agency, \$125,000 of which will be used for the feasibility study. Sivak said that in the next fiscal year, HEI hopes to get \$800,000-\$1 million for research.

When feasibility committee member Dr. Martin Misakian of the National Institute of Standards and Technology (NIST) in Gaithersburg, MD, expressed concern over HEI's administrative costs, Sivak assured him that HEI's overhead will be about 12% (see p.9). Misakian suggested that HEI use the New York Power Lines Project as a model, citing the project's minimum overhead and good quality control.

HEI will hold a second meeting August 26-27 at its headquarters to review committee reports and to design a research strategy. Setlow, Sivak and Dr. Peter Valberg of Gradient Corp. will then draft a research proposal to take to the HEI board. Gradient Corp., also in Cambridge, is coordinating the feasibility study for HEI.

Sivak said that the feasibility committee's report and the independent advisory review will be published by HEI in late October or early November.

Parents Sue Utility Over Child's Kidney Cancer

A San Diego, CA, couple is suing San Diego Gas & Electric Co. (SDG&E), charging that electromagnetic fields (EMFs) from distribution and transmission lines caused their daughter to develop kidney cancer. In a suit filed on May 29 in California Superior Court in San Diego, Michelle and Ted Zuidema also contend that the power lines lowered the value of their house, which they sold in 1990.

The Zuidemas allege that their four-year-old daughter, Mallory, developed Wilms' tumor and nephroblastomatosis as a result of EMF exposure in utero. "Mallory Zuidema's fetal development was adversely affected, her cells and chromosomes were altered and she developed cancer," the suit charges. At approximately 26 months of age, Mallory had seven golf ball-sized tumors removed from her kidneys, according to one of the family's attorneys, Frederick Schenk of Casey, Gerry, Casey, Westbrook, Reed & Hughes in San Diego.

One side of the family's former home is about 15 feet from a 12 kV distribution line. Michelle Zuidema reportedly often slept on a sofa at the corner of the house closest to the line during her pregnancy. The house also is 80 feet from a right-of-way for five transmission lines (three 69 kV lines, one 138 kV line and one 230 kV line).

After measurements inside their home revealed magnetic fields of 3.5-17 mG, the Zuidemas moved from the house in early 1990 and sold it later in the year. The selling price was \$150,000—\$50,000 more than they paid in 1985 but \$50,000 less than what they claim the house was worth. According to another of the Zuidemas' attorneys, Michael Withey of the Seattle, WA, firm of Schroeter, Goldmark & Bender, the family had notified prospective buyers of the EMF levels, in accordance with California laws. The house was sold to a group of investors led by Ted Zuidema's brother, and it now is being rented by a family with no young children.

Withey and Schenk are working on the case with Aaron Simon of Kazan, McClain, Edises & Simon in Oakland, CA. Withey and Simon are members of the Electromagnetic Radiation Case Evaluation Team (EMRCET), a national network of ten lawyers working on EMF-related cases (see *MWN*, M/A91).

The Zuidemas are seeking an unspecified award on the grounds of emotional distress, negligence, nuisance, product liability and trespass.

SDG&E responded on July 5 with a motion to dismiss the suit. The utility is arguing that the California Public Utilities Commission (PUC) has sole jurisdiction over power line EMF health effects: "The PUC's assertion of jurisdiction on the question of potential health effects associated with electric and magnetic fields is binding on the court and requires the dismissal of this action." The PUC is currently studying EMF health effects (see *MWN*, J/F91) and held a public hearing on July 26. A second hearing is scheduled for August 26 in San Francisco.

SDG&E also seeks dismissal on numerous technical grounds,

Alabama Family Seeks \$750 Million for EMF Risks

A family is seeking \$750 million from the Alabama Power Co. for physical injury, risk of cancer, mental anguish and punitive damages. Johnnie and Sharon Allen, whose property is traversed by a 230 kV transmission line which was built in 1989, contend that the utility intentionally misled them into believing that reports of health risks from EMFs were unfounded.

In their suit, filed May 3 in the Circuit Court of Jefferson County, AL, the Allens charge that Alabama Power "has engaged in a pattern and practice of concealing the dangers of EMFs from them and from the public generally." The Allens are being represented by Bill Thomason of the Bessemer, AL, law firm Paden & Thomason, and Clay Ragsdale of the Birmingham, AL, law firm Starnes & Atchison.

Alabama Power, in a written response to interrogatories from the Allens' lawyers, states that, "It is our understanding that the preponderance...of the credible scientific evidence does not support any cause-effect relation between exposure to [extremely low frequency] EMFs and health problems." The utility filed its response on June 24.

The Allens built their home in September 1987. In August 1988, Alabama Power began condemnation proceedings after the two sides were unable to reach an agreement on the sale of land that the utility wanted to use for a right-of-way. During their negotiations, according to the Allens, a utility official told Johnnie Allen that "the claims made by the super environmentalists and liberals that the transmission lines presented a danger were entirely frivolous" and that he should not be concerned about them.

The suit argues that the utility is liable for negligence, loss of property value, emotional distress, nuisance, fraudulent concealment of its knowledge of EMF risks and strict liability. In addition, the Allens are seeking an injunction to stop the operation of the line.

including the allegation that the Zuidemas' suit was not filed until after the statute of limitations expired for several of the counts. According to the utility, Judge Ben Hamerick will rule on the motion on August 23 without hearing oral arguments from either side.

An SDG&E spokesman would not discuss the specifics of the suit. But in a telephone interview, John Dawsey, a senior environmental analyst with the utility, said that EMF biological effects are a "bona fide scientific issue," adding that nothing in the scientific literature would support the type of claim made by the Zuidemas.

John Britton of SDG&E's public relations office said that more than half of the calls and letters he receives about EMFs are concerned with property values.

Australia and U.K. To Begin Major Childhood Epi Studies

Researchers in Australia and in the U.K. will soon start large-scale epidemiological studies on the possible link between power line electromagnetic fields (EMFs) and childhood cancer.

In Australia, Dr. Michael Repacholi of the Royal Adelaide Hospital will coordinate a study for the Australian Radiation Laboratory in Yallambie. The study will include 500-1,000 cases of all types of childhood cancer, with special emphasis on brain tumors and leukemia, Repacholi told *Microwave News*.

The Electricity Commission of New South Wales will sponsor the study, which is expected to cost \$1.5 million (Aus.)—about \$1.2 million U.S.—and to take three to five years to complete.

"This effort is a response to the Gibbs inquiry's recommendation for more research," Repacholi said. In February, Sir Harry Gibbs, a former High Court Chief Justice, concluded that the link between EMFs and health effects is inconclusive but recommended prudent avoidance and more research (see *MWN*, M/J91).

In the U.K., the Coordinating Committee on Cancer Research, based in London, is developing its own childhood cancer-EMF epidemiological study, according to Dr. Brian Maddock of The National Grid Co. This study "is still in the planning stages," Maddock told *Microwave News*.

The National Grid Co., which operates the transmission lines in the U.K. and is based in Leatherhead, will assist with the study's magnetic field measurements, and the National Radiological Protection Board will play a technical role, Maddock said.

In an epidemiological study published in late 1990, Dr. A.D. Clayden and coworkers at the U.K.'s University of Leeds reported finding no association between EMFs and childhood cancer, though the exposures were extremely low—below 0.1 mG (see *MWN*, J/F91).

State and Local EMF Actions: Recent Developments

Connecticut... Senate Majority Leader Cornelius O'Leary's SB 633, mandating that public utilities contribute \$150,000 to the state's EMF Task Force, passed both branches of the legislature and was signed into law by Governor Lowell Weicker on June 25. The funds will be used to hire experts to develop a policy of prudent avoidance and for an EMF literature review to set state research priorities (see *MWN*, M/J91). The task force must submit an interim report to the legislature by February 1, 1992.

Oregon... The House of Representatives and the Senate approved Senator Grattan Kerans's SB 861 by votes of 57-1 and 21-0, respectively, and Governor Barbara Roberts signed it on July 11. The bill requires the state's Energy Facility Siting Council to form a committee of representatives from the public, utilities and government to monitor EMF research and to report back to the council and to the legislature (see *MWN*, M/J91). The law will take effect on September 29.

Rhode Island... The proposed statewide three-year moratorium on construction of transmission lines above 60 kV, introduced by Rep. Steve Hernandez (H-5016) and by Senator Michael Lenihan (S-26), passed 74-1 in the House of Representatives, but was tabled by the Senate. Despite this setback, the bill "probably had the support to pass the Senate if it had come to a vote," Hernandez told *Microwave News*. He said that the bill will be re-introduced in the next legislative session, which starts in January. On July 2, Governor Bruce Sundlun announced that a newly appointed EMF task force, chaired by Scott Wolf, an aide to the governor, will consider the moratorium. Meanwhile, RI Superior Court Judge Patricia Hurst has stayed her decision to nullify a local power line moratorium in East Greenwich, and the case will be heard by the state Supreme Court. Until the high court ruling, which is not expected until next year, the Narragansett Electric Company will be forced to delay construction of the East Greenwich portion of a new 115 kV line, a company spokesman told *Microwave News*. (See also *MWN*, N/D90, J/F91 and M/J91.)

HIGHLIGHTS

SAB Panel Calls for Rewrite of EPA EMF-Cancer Report

The Environmental Protection Agency's (EPA) draft report on cancer and electromagnetic fields (EMFs) has "serious deficiencies and should be rewritten," an EPA Science Advisory Board (SAB) panel has recommended. At the same time, the panel members issued a unanimous statement that the question of EMF biological effects is "important and exceptionally challenging."

As expected, the members of the SAB's Non-Ionizing EMF Subcommittee asked EPA to tone down its conclusion that EMFs are a "possible, but not proven, cause of cancer in humans." Instead, they counseled that, "Currently available information is insufficient to conclude that [EMFs] are carcinogenic."

By the end of its third—and final—meeting, held July 23-25 in Crystal City, VA (outside of Washington, DC), the SAB panel had completed its review of EPA's draft report, *Evaluation of the Potential Carcinogenicity of Electromagnetic Fields*, for EPA

Administrator William Reilly. Previous meetings were held in January and April (see *MWN*, J/F91 and M/J91).

EPA's Dr. Robert McGaughy, the principal author of the EPA cancer report, called the panel's advice "comprehensive and very authoritative." In an interview, he said that, "We're really pretty much in agreement with their evaluation." EPA sources told *Microwave News* that rewriting the report could take up to a year.

While the panel paid the most attention to power frequency EMFs, the members issued a special warning on radiofrequency and microwave (RF/MW) radiation "hazards," recommending that EPA resume work on its stalled RF/MW exposure guidelines (see *MWN*, S/O88 and box on p.8).

Among the other conclusions reached by the panel were:

- The carcinogenicity of EMFs should not be classified using the system devised for chemicals because of "major uncertainties."

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- "There is insufficient information to designate specific values of magnetic field strength that may be hazardous to human health."
- "The epidemiological evidence is suggestive of an association between surrogate measurements of magnetic field exposure and certain cancer outcomes." But the lack of clear exposure information and of an understanding of key exposure parameters combined with a limited understanding of potential mechanisms "weakens the inference of cancer causality from these associations."
- The incidence of cancer may be affected by non-mutagenic agents which do not interfere directly with DNA—for example, hormone imbalances caused by disruptions in the pineal gland's melatonin cycle (see *MWN*, J/A90).
- "If effects on living systems at lower fields do occur, the assumptions leading to estimations of physical constraints for ef-

fects on isolated small spherical cells...may not be applicable to larger cells or cell systems such as neurons or neuronal networks."

Several panel members raised other concerns:

- Dr. Genevieve Matanoski of Johns Hopkins University in Baltimore, MD, the chair of the panel, noted that EPA should have integrated the human epidemiological data and the biological data to reach general inferences about EMF risks.
- Dr. Bary Wilson of the Battelle Pacific Northwest Lab in Richland, WA, emphasized the importance of exposure parameters such as transients and time-varying fields, arguing that the issue should be brought directly to the attention of the EPA administrator and not be buried in the report.
- Prompted by the public testimony, Dr. Nan Laird of the Harvard University School of Public Health in Boston, MA, pointed out that neither the subcommittee report nor EPA's research

SAB Conclusions and Recommendations on EPA's EMF-Cancer Report

The SAB's EMF panel is finalizing its critique of EPA's EMF-cancer report. The following excerpts include revisions made at the July 23-25 meeting.

Currently available information is insufficient to conclude that [EMFs] are carcinogenic. Human epidemiologic data report an association between surrogates for [EMF] exposure and an increased incidence of some types of cancer, but the conclusion of causality is currently inappropriate because of limited evidence of an exposure-response relationship and the lack of a clear understanding of biologic plausibility....

Some of the *in vitro* and *in vivo* data on unmodulated RF have suggested the existence of mechanisms by which human health effects, but not carcinogenicity, may be inferred. Both unmodulated and ELF-modulated RF fields of sufficient intensity can give rise to thermal effects. Non-thermal biological effects also have been reported in animals exposed to RF fields. It is well established that *in vitro* and *in vivo* experiments on ELF have shown non-thermal biologic effects at fields of moderate intensity and there are suggestive effects at lower levels. Furthermore, ELF-modulated RF fields assumed to be non-thermal can produce many of the biological effects of ELF fields alone. Hypothetical constructs relating observed biological effects to possible health effects (specifically, increased cancer risk) have been delineated. However, there are at present insufficient data on many of the critical steps in the linkage to infer causality on the basis of animal or cellular data....

[T]he EPA has not evaluated how the findings on biological effects and non-ionizing field and tissue interaction mechanisms relate to the interpretation of human studies. The strength of epidemiologic data depends on identification of supporting evidence from *in vitro* and *in vivo* data. This has not been developed in the report. The critiques of studies of biological effects are contained in the discussions of the several chapters....

The heading of chapter 5, *Supporting Evidence of Carcinogenicity*, is inappropriate. The interpretation of the biological effects in the *in vitro* systems as presented by the report does not make a case for carcinogenicity. Specific individual experiments need critical review....

Non-ionizing [EMFs] should not be classified together under the EPA's chemical carcinogenesis system because of present major uncertainties. These involve an incomplete understanding of which aspects of field-tissue interactions give rise to biological effects. Properties of the various [EMFs] such as phase angle, polarization, transients and frequency range may contribute to different

biologic effects. For these reasons, the use of the EPA's classification scheme at this time would be inappropriate and confusing....

There is insufficient information to designate specific values of magnetic field strength that may be hazardous to human health for two reasons. a) There is insufficient evidence from the human epidemiology data and from animal/cell experiments to establish unequivocal cause-and-effect relationships between low frequency EMF exposure and human health effects and cancer. b) The precise nature of the environmental low frequency EMFs potentially related to human disease remains to be elucidated. In addition to field strength, parameters such as the time-varying nature of the magnetic fields and the relevant time/exposure parameters need to be determined.

The subcommittee also wishes to express two specific policy recommendations that in its view follow inescapably from the scientific recommendations....:

Policy Recommendation No. 1: The subcommittee is unanimous in its belief that the question of [EMF] effects on biological systems is important and exceptionally challenging; and that the subcommittee's advice to the EPA should be that the report should be rewritten by EPA, and then rereviewed by the Science Advisory Board. *Policy Recommendation No. 2:* EPA should complete its efforts with regard to RF [EMFs] (including [MWs]) and issue exposure guidelines independent of present issues pertaining to lower frequencies. The current EPA report inadvertently leads even the careful reader to conclude that the potential carcinogenicity of [EMFs] of ELF (i.e., power line) frequencies is the only—or at least the principal—subject of concern with regard to non-ionizing fields. Such a conclusion would reinforce the skewed and somewhat sensationalized picture presented to the public in recent years by the news media and government agencies responding to this publicity. The report should therefore declare explicitly that the attention given to non-ionizing [EMFs] derives in the first place from long-standing concern over the hazards of RF (including [MW]) radiation. EPA has expended substantial resources on the study of such radiation over a period dating back to the EPA's inception, and EPA should complete its efforts directed toward the issuance of RF exposure guidelines. RF fields present long-known and well-understood hazards against which users and the general public must be warned and protected.

Childhood Brain Tumor Cluster in West Virginia

Five children living near a 345 kV transmission line have developed brain cancer in the last two years, according to Dr. Martha Gelderman, a family practitioner in Union, WV. In a presentation to the SAB panel, she pleaded for assistance. "We have nowhere to turn for help," she said.

Gelderman said that the five cases occurred in a rural school district serving 1,000 children. SAB panel Chair Dr. Genevieve Matanoski, an epidemiologist, called the numbers "overwhelming."

People are staying home at night reading the EPA EMF-cancer report looking for answers instead of watching television, Gelderman told the panel. "They're afraid for their children," she said. She urged the subcommittee to help "humanize" the report and called for a clearinghouse where average citizens could get accurate information.

Dr. Gayle Sharp, also from Union, told *Microwave News* that there are transformers outside of every home in the rural area and that there are three transformers within 50 feet of the home of a 12-year-old girl who recently died of brain cancer. Sharp added that the community is trying to stop a proposed 765 kV line.

A growing number of studies have linked EMF exposures at home and at work to the development of brain tumors (see *MWN*, M/A90).

agenda adequately address the public's concerns. She argued that it is "irresponsible" to say that there is something to investigate without providing guidance. Many panelists agreed that EPA should issue a citizen's guide on EMF risks. In a statement, John Rice and Sandy Travis of Annapolis, MD, who had blocked the expansion of an electrical substation, noted that EPA's draft report was essentially the only guidance they had.

• Matanoski and Dr. Charles Susskind of the University of California, Berkeley, both spoke in favor of a government-coordinated national research program. "You're not going to solve the problems of public perceptions until you put the research into the hands of the National Institutes of Health," Matanoski said. Susskind pointed out, "It would be far better for this work to be coordinated by a government agency such as the National Institute of Environmental Health Sciences."

Near the end of the meeting, some panelists expressed reservations about the prospect of the Health Effects Institute's (HEI) proposed public-private research effort (see pp.3 and 5). "HEI has absolutely inadequate experience and credentials" in EMF research, Bary Wilson said. Susskind noted that HEI's overhead costs would take a "substantial bite" out of the research budget.

In an attempt to allay these concerns, HEI's Dr. Andrew Sivak stated that HEI's strength lies in its ability to "bring together and work with key people in the field" rather than "in our knowledge and experience." He said that the institute's

overhead is about 14% (see p.5).

Speaking in support of HEI, panelist Dr. Granger Morgan of Carnegie Mellon University in Pittsburgh, PA, argued that EPA has had "extraordinary difficulty" in sustaining its research efforts, and that HEI would provide a "buffer" enabling the agency to engage in long-term research. He noted, however, that he would not want the HEI project to divert funds from existing federal EMF programs. "I will be very unhappy about that outcome," he said.

The last panel meeting, originally scheduled for September 9-10, has been canceled. Although some of the revisions were not finalized, the panel will complete its work by mail. (For a complete list of the members, see *MWN*, M/J91.)

The SAB Radiation Advisory Committee (RAC), the panel's parent group, will consider the panel's report at a September 20 meeting. If the RAC gives its approval, the SAB executive committee will review the report at its October 29-30 meeting.

SAB Panel Critical of EPA's EMF Research Strategy

The Environmental Protection Agency's (EPA) plan for research on electromagnetic field (EMF) effects drew a barrage of criticism when it was released to members of the agency's Science Advisory Board (SAB) EMF panel at a July 23-25 public meeting in Crystal City, VA.

The report, *A Research Strategy for Electric and Magnetic Fields: Research Needs and Priorities*, lists 32 specific recommendations for future studies. It was prepared at the request of EPA Administrator William Reilly by a working group under the direction of Dr. Joe Elder of EPA's Health Effects Research Laboratory in Research Triangle Park, NC. The strategy was intended as a companion to the EPA EMF-cancer report, which is being reviewed by the SAB panel (see p.7).

EPA assigned the highest priorities to research on cancer, biophysical mechanisms of interaction and exposure assessment. Studies of reproductive and developmental effects as well as of nervous system effects were labeled as "medium" priorities, with research on immune system effects and control technology as "low" priorities.

Many of the SAB panelists argued that the research recommendations are too sweeping and lack focus. "It's not a useful document," said Dr. Richard Wilson of Harvard University in Cambridge, MA. "I think the only thing missing is lower back pain," commented Dr. Kelly Clifton of the University of Wisconsin, Madison.

The panel members charged that EPA has failed to explain how the research would be done. "While the document as it stands is not a work plan, the broad implementation of EPA's research agenda should be delineated," said Dr. Karim Ahmed of Princeton, NJ. "They must address implementation," agreed Dr. Genevieve Matanoski of Johns Hopkins University in Baltimore, MD, the chair of the SAB panel.

A number of the SAB panelists asked why EPA has not been

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more explicit about its role and that of the Health Effects Institute (HEI) (see pp.3 and 5). "Who is intended to do the research?" asked Dr. Mary Ellen O'Connor of the University of Tulsa, OK, noting that, "EPA has no [EMF] research program." Dr. Charles Susskind of the University of California, Berkeley, wondered aloud why the draft says nothing about implementation when it was clear that "considerable thought [had] already [been] given to it at EPA."

Dr. Ken Sexton, the director of EPA's Office of Health Research, tried to defuse the criticism by suggesting an alternative title for the report: *A Research Domain for [EMFs]: Research for Health Effects from an EPA Perspective*. He later explained that, "We made a serious mistake by not clarifying that the nature of the document had changed during the [development] process." He said that "no decision has yet been made" as to whether EPA or some other organization, such as HEI, would do the research.

Many senior EPA officials clearly see the research report as controversial. In a June 26 presentation on the EPA strategy at the Bioelectromagnetics Society meeting in Salt Lake City, UT, portions of Elder's slides were deleted, even though the report had already been printed and was ready for distribution.

Susskind, who was a member of a previous SAB panel on radiofrequency and microwave (RF/MW) radiation health effects, observed that that panel had also assembled a research strategy in 1984 (see *MWN*, J/F84). "We haven't heard anything since then—I wish you good luck with your current strategy," he told Sexton in Crystal City.

Dr. Granger Morgan of Carnegie Mellon University in Pittsburgh, PA, called the draft "a C- effort that could be edited [at best] into a C+." He recommended that, "The document needs to place a greater emphasis on the importance of developing a basic scientific understanding [of EMF interactions]." Dr. Clark Heath of the American Cancer Society in Atlanta, GA, also argued that EPA should emphasize "the more fundamental and far-reaching need of furthering our basic understanding of biologic effects and mechanisms. Without such basic knowledge, research regarding cancer risks and exposure parameters is likely to remain shallow."

The report addresses EMFs up to 500 kHz: "Although exposure to EMFs at frequencies above [500 kHz] is also a health concern, the lower range is emphasized because of the heightened concern for possible health effects from exposure to 60 Hz EMFs from power lines and to commonly used devices in the home and workplace...." EPA states that the draft report comes in response to "widespread media attention" and "public and private concerns."

Some of the research priorities listed by EPA are:

- Evaluation of confounding factors which may distort the EMF-health effects association suggested in epidemiological studies.
- Examination of populations exposed to other than electric power frequency (50/60 Hz) EMFs.
- Animal research to determine whether EMFs can induce cancer.
- Studies of EMF effects on the behavior of laboratory animals, emphasizing learned tasks and drug interactions.

- Confirmation of EMF effects on immune response in vitro.
- Analysis of EMF interactions to determine whether biological effects are due to currents induced by time-varying magnetic fields, and whether currents induced by electric fields have categorically different effects than those produced by magnetic fields.
- Development of models of possible mechanisms of interaction, including evaluation of exposure characteristics reported to have therapeutic action in biological systems.
- Identification of sources of electric and magnetic field exposures.
- Training of individuals responsible for field measurements and the development of measurement protocols.
- Three-dimensional maps to characterize EMFs from residential appliances and industrial equipment.
- New materials to shield magnetic fields and mitigate exposures.

Canada Issues RF/MW Exposure Standard

The Canadian government has published its revised limits for occupational and public exposures to radiofrequency and microwave (RF/MW) radiation in the 10 kHz-300 GHz range. The standard includes limits for contact currents for frequencies between 10 kHz and 30 MHz.

Like the 1982 American National Standards Institute (ANSI) RF/MW guidelines, the Canadian exposure limits change as a function of frequency—forming the now common "well shape." For workers, the strictest limit is 1 mW/cm² from 30-300 MHz, rising to 5 mW/cm² at 1.5 GHz and above. At the lower frequencies 10 kHz-1 MHz, the electric and magnetic field limits are 600 V/m and 4.9 A/m, respectively. For the general public, maximum power density limits are five times lower—200 μW/cm² from 30-300 MHz and 1 mW/cm² from 1.5-300 GHz. At 10 kHz-1 MHz, the limits are 280 V/m and 2.19 A/m.

The maximum allowable contact currents are, for occupational exposures, 400f mA for 10 kHz-100 kHz and 40 mA for 100 kHz-30 MHz and, for the general public, 150f mA and 15 mA in the two frequency ranges, respectively, where f represents frequency in MHz.

Portable transmitters operating below 1 GHz with an output power of seven watts or less are exempt from the limits.

The standard has been simplified since it was first proposed in 1987 (see *MWN*, S/O87 and N/D87). For instance, there are now fewer frequency ranges—but the safety levels are essentially the same, according to Dr. Maria Stuchly, who developed the standard for Health and Welfare Canada.

The new standard is intended for use by federal agencies. But David Charron of the Ontario Ministry of Labor's Radiation Protection Service told *Microwave News* that several provincial governments may also adopt it.

Limits of Exposure to Radiofrequency Fields at Frequencies from 10 kHz-300 GHz (Safety Code 6) is available for \$4.95 (Cdn), \$5.95 (U.S.) from: Canada Communication Group—Publishing, Ottawa, Ontario K1A 0S9, Canada, (613) 956-4802. The catalog number is H46-2/90-160E.

FROM THE FIELD

Medical Microwaves in Yugoslavia

The 1st International Scientific Meeting: Microwaves in Medicine '91 was held April 8-11 in Belgrade, Yugoslavia. The conference was conceived by the Yugoslav chapter of the Institute of Electrical and Electronics Engineers' (IEEE) Microwave Theory and Techniques Society (MTT-S) and organized jointly by the MTT-S, the Scientific Committee of Serbia and the Institute of Microwave Techniques and Electronics (IMTEL), based in Belgrade. The following report was prepared for Microwave News by IMTEL's Branka Jokanovic, Dr. Stanislaw Szmigielski of the Center for Radiobiology and Radiation Safety in Warsaw, Poland, and Professor Roberto De Leo of the University of Ancona, Italy. A limited number of copies of the 304-page conference proceedings are available for \$65.00 (U.S.) each from: Branka Jokanovic, IMTEL, Bulevar Lenjina 165b, 11070 Belgrade, Yugoslavia, (38+11) 135420, Fax: (38+11) 138928. See also p.14 for details of a conference on millimeter waves in medicine to be held in Moscow in September.

About 100 participants from Belgium, Bulgaria, Czechoslovakia, Hungary, Italy, Japan, Poland, South Africa, the U.S., the U.S.S.R. and Yugoslavia attended the conference, which featured five invited presentations and 42 papers. There were sessions on medical applications of microwaves, dosimetry and instrumentation, biological effects, health hazards and safety standards and the use of polarized light. The meeting also included a roundtable discussion of electromagnetic compatibility techniques led by Professor De Leo, and a review of potential medical applications of printed antennas led by Professor Aleksandar Nesic of IMTEL. The last two sessions were made possible by the Italian Embassy in Belgrade and mark the first step toward greater cooperation between Italy and Yugoslavia in this area.

An invited paper, "Microwave Acupuncture as Stimulus for the Interaction Between Electromagnetic Fields (EMFs) and the Nervous System," by Professor Andre Vander Vorst of the Catholic University of Louvain in Louvain-la-Neuve, Belgium, as well as a series of papers from the U.S.S.R., described the use of millimeter waves (40-80 GHz) to stimulate acupuncture points, a technique based on traditional Chinese medicine. According to Mikhail Golant and Vera Nadejeva from RPA "Istok" in Moscow, this form of acupuncture is widely used in the U.S.S.R., where 40,000 patients with conditions ranging from stomach polyps, duodenal ulcers, arterial hypertension and angina pectoris to traumas and advanced neoplasms have been treated using commercially available devices. Despite the excellent results claimed by the Russian researchers, this form of nonconventional therapy cannot be evaluated in terms of modern medicine, because, according to Drs. Yuri Kholodov and Natalia Lebedeva of the Institute of Higher Nervous Activity and Neurophysiology at the U.S.S.R. Academy of Sciences in Moscow, there are presently no accepted mechanisms of interaction between millimeter waves and the central nervous system.

Yugoslav, Czech and South African engineers have developed several interesting devices using microwave energy. For instance, Dr. B. Downing of the University of Cape Town, South Africa, has designed a low-cost microwave system, operating at 2.45 GHz, for deactivating HIV—the virus associated with AIDS—in breast milk collected to feed premature newborns. And Dr. Slobodan Manola and coworkers at the Institute of Physics in Belgrade presented a way of using microwave-induced low-energy gas plasmas to sterilize medical instruments and plastic items at 75-80° C.

Professor Paul Walinsky of the Department of Medicine at Thomas Jefferson University Hospital in Philadelphia, PA, reported that microwave balloon angioplasty of the coronary and peripheral blood vessels is a promising form of therapy for atherosclerotic vascular disease. In his invited talk, he concluded that microwave angioplasty is more effective than conventional angioplasty in maintaining vascular patency in the presence of thrombus.

The treatment of an enlarged prostate using microwave hyperthermia was addressed by Dr. Hyder Arastu and associates at the Albert Einstein Medical Center in Philadelphia, PA, in their invited lecture, "The Efficacy of Transurethral Interstitial Microwave Hyperthermia in the Management of Benign Prostatic Hyperplasia [BPH],"

and by Dr. Bronislaw Stawarz and colleagues at the MMA Postgraduate Medical School in Warsaw, Poland, in a paper on the treatment of BPH with intrarectal and intraurethral microwave applicators. The two presentations indicated that intraurethral microwave hyperthermia in advanced BPH is an efficient and safe alternative to surgery.

With respect to microwave hyperthermia, Dr. Branko Kolundzija of the University of Belgrade, Yugoslavia, presented a mathematical model for plotting energy deposition and temperature distributions, and Drs. Yoshio Nikawa and Fumiaki Okada of Japan's National Defense Academy in Yokosuka described an innovative applicator. In addition, Dr. Evgeni Khizhnyak of the Institute of Cell Biophysics of the U.S.S.R. Academy of Sciences in Pushchino and a group led by Professor Fernando Bardati of the University of Rome, Italy, described non-invasive techniques to map heating during hyperthermia. The dielectric properties of biological tissues were described from a theoretical point of view by Dr. Salvatore Caorsi and coworkers at the University of Genoa, Italy, and from an experimental point of view by IMTEL's Dr. Veljko Napijalo and Branka Jokanovic.

In a series of three papers, Dr. Zdravko Stojanovic of the Institute of Aviation Medicine in Belgrade, Drs. Zoran and Milan Djordjevic of the Pacemaker Center at the University Clinical Center in Belgrade and Dr. Zdravko Kelecevic, also of the Institute of Aviation Medicine, described their work on microwave-induced health effects and protective clothing. Stojanovic, a medical doctor, presented the results of a clinical study of 253 radar operators which showed a higher incidence of irregularities in the lymphocytes and the nervous systems of workers chronically exposed to microwaves.

In a review of the possible link between EMFs and cancer, Dr. Stanislaw Szmigielski concluded that EMFs should be classified as "possible" carcinogens.

Dr. Zlatko Koren of the Department of Electrical Engineering at the University of Zagreb, Yugoslavia, recently received a grant of 3.4 million ECU [European Currency Units—approximately \$4 million, U.S.] from the Committee of Science and Technology of the European Community to coordinate bioelectromagnetic research in European countries and to establish common safety standards for all European countries. The research project is expected to take four years, beginning with a series of workshops to plan for international cooperation in epidemiological, medical and experimental studies related to the biological effects of non-ionizing radiation. Prospective epidemiological studies of cancer morbidity, as well as medical examinations of personnel occupationally exposed to radiofrequency and microwave radiation, are being planned for this effort.

The Belgrade meeting, the first conference on microwave applications in medicine, was an opportunity to introduce recent developments in this field. The organizers hope that it will stimulate further research, particularly because this field is potentially one of the most important for nonmilitary uses of microwave technology.

The 2nd International Scientific Meeting: Microwaves in Medicine '93 will be held in Italy. Those interested in attending should contact Professor Roberto De Leo, University of Ancona, Via Breccia Bianche, 60131 Ancona, Italy, Fax: (39+071) 2204 835.

cancer promotion hypothesis.

"The study is important and interesting and could be very significant," Dr. Leonard Sagan told *Microwave News* after the BEMS meeting. Sagan, the program manager for radiation studies at the Electric Power Research Institute (EPRI) in Palo Alto, CA, said that he was reluctant to offer a detailed opinion, given that the results are preliminary and that the number of animals involved was small.

"This copromotion study is potentially highly significant," observed Dr. Craig Byus of the University of California, Riverside, who is a member of the Environmental Protection Agency's (EPA) Science Advisory Board (SAB) panel that is reviewing EPA's EMF cancer assessment (see p.7). Byus added that, "It may be that you can see the EMF effect more clearly in the copromotion model than through straight promotion—both approaches should continue to be pursued." Dr. Bary Wilson of the Battelle Lab in Richland, WA, another SAB panelist, agreed: "If this study continues to be positive, it will change the playing field."

Synergy between chemicals and ELF EMFs has been the subject of increasing attention over the last few years. In a recent review paper on experiments with both ELF EMFs and ELF-modulated microwaves, Dr. Ross Adey, in whose lab Cain works, noted that, "Bioelectromagnetic research reveals clear evidence of joint actions at cell membranes of chemical cancer promoters and environmental [EMFs]. The union of these two disciplines has resulted in the first major new approach to tumor formation in 75 years" (see *MWN*, N/D90).

McLean and Stuchly, in collaboration with Dr. Ronald Mitchel of Atomic Energy of Canada in Chalk River, Ontario, painted the skin of 96 female mice with DMBA, a known cancer initiating agent, and soon afterwards treated 48 of them with 0.3 µg TPA and the other 48 with the TPA and a 20 G, 60 Hz magnetic field. The TPA was applied once a week and the field was turned on for six hours a day, five days a week. After 17 weeks, there were more than three times as many mice with tumors—a statistically significant increase—among those exposed to the TPA-magnetic field combination than in the mice only treated with TPA. There was a similar and equally significant increase in the number of tumors per mouse. The exposures are continuing—"It is still too early to say what the actual findings will be," Stuchly said in an interview at the BEMS meeting.

Indeed, as *Microwave News* goes to press, Stuchly reports that, after 23 weeks of exposure, the mice only exposed to TPA had developed more tumors and that the differences between the two groups were no longer statistically significant. Nevertheless, the number of mice with tumors and the number of tumors per mouse were still higher in the TPA-EMF-exposed group. "It appears that the field accelerates the tumor development process," Stuchly said in late July. She also noted that there was considerable variation in the number of tumors per animal. "Some mice had only one tumor, while others had up to 20," she said.

In a previous study, the Canadian team exposed mice to the 60 Hz magnetic field without TPA, after using DMBA to initiate cancer, but found no change in tumor development. Those re-

sults have been accepted for publication in a future issue of *Bioelectromagnetics*. Similar studies in Sweden by Dr. Bo Holmberg and coworkers at the National Institute of Occupational Health in Solna have also failed to show a promotional effect of a 50 Hz magnetic field—without TPA—in the development of skin cancer in mice.

"I'll breathe easier when our study is replicated both in our lab and in another lab," McLean said. Indeed, the Health and Welfare team is not waiting for the experiment to be completed before planning a new set of exposures. McLean and Stuchly said that they will begin repeating the study in September and plan future experiments with lower exposures—5 G and/or 10 G—in an effort to determine a dose-response relationship. "If the effect is real, we must know where the threshold for the magnetic field effect is," Stuchly said, adding that she would also like to test the response of the mice exposed to an intermittent field—for instance, one that turns on or off every 15 minutes.

The Canadian researchers are also investigating the mice's immune response as part of the same study. These results were not ready for release at the BEMS meeting. In their earlier study, they showed a statistically significant decrease in natural killer (NK) cell activity among mice exposed to TPA and 60 Hz fields. Those findings suggest that "the magnetic field may affect tumor growth by suppressing an immune surveillance system (NK cell activity) that would otherwise prevent or retard the growth of some tumor or leukemia cells."

Dr. Stanislaw Szmigielski of the Center for Radiobiology and Radiation Safety in Warsaw, Poland, previously reported synergistic effects between microwave radiation and benzopyrene on the development of skin tumors in mice (see *MWN*, My81 and J/A82).

Cain's cellular findings parallel the Canadian animal results: The magnetic field enhanced the action of the TPA. Cain used a co-culture of two different cell types: C3H10T1/2 fibroblasts and mutant cells—offspring of the fibroblasts that had been transformed by UV radiation. When these two cell types are grown together in the same dish, they coexist as a monolayer, but in the presence of TPA the harmony is lost and the cancer cells grow on top of one another. "Essentially, the parent cells keep the daughters in line," Cain explained to *Microwave News*. "When you add TPA, the daughter cancer cells pile up." Cain found that the number of cancer cells doubled when the co-culture was exposed to both TPA and a 1 G, 60 Hz magnetic field for one hour every six hours, every day for four weeks—as compared to TPA exposure alone.

Both Cain and Stuchly agreed that their findings are complementary. "They are two pieces of the same puzzle," Cain said. "They point in the same direction," Stuchly concurred.

In a series of experiments, Drs. Elizabeth Balcer-Kubiczek and George Harrison of the University of Maryland School of Medicine in Baltimore have shown that ELF-modulated microwaves and chemicals can initiate cancer in normal cells (see *MWN*, J/A89). "These new co-promotion results coupled with those from our lab indicate that the carcinogenicity of EMFs must be taken very seriously," Balcer-Kubiczek told *Microwave News*.

and Cory Davis of Corpus Christi, TX, sued Aequitron Medical, Inc., of Minneapolis, MN, after their infant son died—an Aequitron Model 8200 monitor had failed to warn them that the child had stopped breathing. The terms of the March 1990 out-of-court settlement were not disclosed.

“The lawsuit contended that EMI was a major factor in the failure of the monitor and that the manufacturer failed to adequately warn of any potential problem,” Cage Wavell, the Davises’ Corpus Christi-based attorney, told *Microwave News*. The family lived in an apartment building several miles from the Corpus Christi Naval Air Station. Wavell noted, however, that in the absence of detailed measurements, EMI from household appliances, particularly an electric fan near the infant’s bed, could not be discounted.

“The company knew for years that the monitors had alarm problems and that many babies had probably died,” the Davises told a congressional subcommittee chaired by Rep. Henry Waxman (D-CA) at a November 1989 hearing in Washington, DC. Depositions from the Davis case indicate that Aequitron knew of the EMI problem as early as 1983, Wavell said. In the course of the litigation, the company provided documentation of several hundred failures of Aequitron monitors, he said.

A May 1990 GAO report to the subcommittee, *Underreporting of Serious Problems with a Home Apnea Monitor* (GAO/PEMD-90-17), reproduced one Aequitron document linking the Model 8200 to 68 deaths from 1983 through 1989. A GAO examination of company records revealed at least two other allegations of fatalities. Prior to the GAO investigation, the company had reported only five deaths associated with the monitor to the FDA, however.

When contacted by *Microwave News*, Aequitron refused to comment other than to say that the Davis suit had been settled.

Apnea monitors measure cardiorespiratory activity through electrodes attached to a patient’s chest. Laboratory studies and field surveys of eight models made by four manufacturers “demonstrated that EMI can cause disruption of apnea monitors at relatively low field strengths and at common communication frequencies,” according to an FDA report, authored by Paul Ruggera and Eugene O’ Bryan, which will be presented at the Institute of Electrical and Electronics Engineers’ (IEEE) *Annual Meeting of the Engineering in Medicine and Biology Society*

in late October.

In the lab, the alarm of the most sensitive model failed when exposed to fields below 0.1 V/m at FM broadcast frequencies (88-108 MHz). Other models were found to be sensitive to very high frequency (VHF) television signals (54-88 and 174-216 MHz). Every monitor tested registered false breaths and heartbeats—which could prevent the alarm from sounding—at relatively low field strengths, according to the FDA researchers.

Field tests at 15 sites in Washington, DC, Omaha, NE, and Portland, OR, generally confirmed the lab results. At one location more than a mile from the nearest FM radio transmitter, with a maximum single signal of 1.7 V/m, erroneous breaths and heartbeats were detected by most monitors, they reported.

Based on these results and on RF measurements in several U.S. cities by the Environmental Protection Agency, the FDA concluded that a “significant percentage of the U.S. population lives in areas likely to experience EMI levels that could interfere with the most sensitive of these apnea monitors.” A preliminary report on the FDA’s findings appeared in the April issue of *Radiological Health Bulletin* and in the May issue of *Medical Devices Bulletin*, both published by the CDRH.

Though RF broadcast signals are the major focus of concern, an FDA “Safety Alert” titled *Important Tips for Apnea Monitor Users* warns that EMFs from electrical appliances or cellular telephones could affect the devices, and that even “draperies or rugs...can also cause interference with the monitor due to static electricity.”

This fall, the FDA will circulate the third draft of a technical standard for apnea monitors, which will include an extensive section on EMI. A final standard is not expected for at least another year, however. Though many manufacturers are already redesigning or retrofitting their devices to address the problem, a recall is still possible, a knowledgeable source at the FDA told *Microwave News*.

A working group of the International Electrotechnical Committee proposed a 3 V/m immunity requirement for medical devices from 26 MHz to 1 GHz in a December 1990 draft, *Medical Device Electromagnetic Compatibility Standard*.

EMI to medical devices has been the subject of increasing concern over the last few years (see *MWN*, S/O85, N/D85, M/J88, S/O88 and M/A90).

UPDATES

GOVERNMENT

Radiation Control Directors...Recent research findings on ELF EMFs and cancer “must compel the urgent attention of the radiological health community.” This was the warning issued by Dr. Leonard Solon, who recently retired as the director of the New York City Bureau for Radiation Control, to participants at the *23rd Annual Meeting of the Conference of Radiation Control Program Directors* (CRCPD) in Wichita, KS, in mid-May. In his prepared paper, Solon outlined the research data and sketched several options for CRCPD members, who traditionally have focused on ionizing radiation. According to another

participant, Ken Barat of the Arizona Radiation Regulatory Agency in Phoenix, there was agreement among participants at the meeting’s NIER workshop that, “State radiation programs need to start dealing with [NIER] health issues.” In a telephone interview, Barat explained that NIER is now being handled by various agencies in different states. “If we don’t get involved, we’re going to get passed by,” he said.

LITIGATION

Waterbed Injury...A Tennessee teenage girl and her parents claim that “chronic exposure to electrical voltage she received

UPDATES

from a waterbed heater" caused her serious harm. In a suit filed on October 1, 1990, Kristen, James and Phyllis Pope charge that Kristen "suffered from and continues to suffer serious health problems," including joint and muscle soreness, discoloration of the legs, circulation problems and headaches. For an extended period, she could not walk without assistance. The Popes' attorney, David Smith of Kinnard & Smith in Nashville, said in a telephone interview that Kristen showed "dramatic improvement" after she stopped using the waterbed. Electrical engineers hired by the Popes measured 95-120 V on the waterbed, which they concluded was caused by the inverted insertion of the power plug into a wall socket, resulting in "improper polarization." The suit charges that the waterbed heater's manufacturer, Haku-to Co. Ltd. of Japan, and its subsidiary, Shigma, Inc., of Elk Grove Village, IL, should have provided polarized plugs or should have provided a written warning explaining proper insertion of the plug. The Popes are asking \$1.25 million in damages. The trial is scheduled to begin in November.

MEETINGS

EBEA's First Congress...The European Bioelectromagnetics Association (EBEA) will hold its first congress January 23-25, 1992, in Brussels, Belgium. Abstracts are due by October 31, 1991. In addition to platform and poster presentations, roundtable discussions on specific topics are planned. Contact: Dr. M. Hinsenkamp, Hôpital Erasme, Service d'Orthopédie-Traumatologie, Route de Lennik, 808, B 1070 Brussels, Belgium, (32+2) 526-3640.

MM Waves in Moscow...An *International Scientific Meeting on Millimeter Waves of Non-Thermal Intensity in Medicine* will be held September 24-27 in Moscow, U.S.S.R. According to the announcement, Soviet researchers will present the results of 20 years of experience in theoretical and experimental research on non-thermal effects of high frequency radiation "on living systems of different level[s] of complexity." For more information, contact the meeting's organizing committee at: Marx Avenue 18, GSP-3, Moscow 103907, U.S.S.R. (7+095) 2033266.

Guy Festschrift...After 35 years at the University of Washington, Seattle, Dr. Bill Guy has retired, and a one-day symposium, sponsored by the USAF, will be held in his honor at the university on October 26. Guy is best known for his work on RF dosimetry, bioeffects and standards. Contact: Dorothy Pratt, Bioelectromagnetics Research Lab, RJ-30, University of Washington, Seattle, WA 98195, (206) 543-1071.

PEOPLE

Dr. **Om Gandhi** of the University of Utah, Salt Lake City, will be the new president of the Bioelectromagnetics Society. He will take over from FDA's Dr. **Mays Swicord** next year....Dr. **Allan Frey** has replaced Dr. **Andrew Marino** as president of the International Society of Bioelectricity. Marino also recently resigned as the editor of the society's journal (see *MWN*, M/J91). Frey reports that the society may change its name....Greg **Rauch** is leaving EPR's electrical systems division to join **Bill Feero** at Electric Research and Management. Rauch will open

a west coast office for the firm in Santa Cruz, CA....Drs. **Maria** and **Stan Stuchly** are moving to the University of Victoria's department of electrical and computer engineering in British Columbia, Canada. Stan has left the University of Ottawa and has taken up residence in Victoria as the department head. Maria will stay at Health and Welfare Canada until the end of the year before joining him....There has been a split at Environmental Research Information (ERI), the New York City consulting firm that has worked on EMFs for a number of utilities. **William Bailey** has set up Bailey Research Associates with former ERI staffers Drs. **Antonio Sastre**, **Deborah Weil** and **Linda Erdreich**; they will concentrate on EMF issues. Dr. **Jonathan Charry** said that ERI will continue to work on risk communication for corporate clients, but not on EMFs....Dr. **Russell Carpenter**, 89, who studied the effects of microwaves on the eye, died on July 28 in Williamstown, MA.

RADAR

Radar & Road Safety...A radar complex on the Yorkshire moors in the U.K. could cause traffic accidents on a nearby highway, according to a report by **Tim Williams** of ELMAC Services, a consulting firm. Williams measured electric fields of up to 30 V/m on a highway at Fylingdales in northern England, close to a Royal Air Force ballistic missile early warning system radar, which operates at a frequency of approximately 400 MHz. Williams notes that the peak fields, which are difficult to measure, may be two or three times higher than the average levels. These peak fields could interfere with electronically controlled vehicular safety systems, such as anti-lock brakes, which are designed to be immune to fields of up to 50 V/m. Measurements taken on footpaths near the complex also recorded fields of 30 V/m, which, though well below NRPB and IRPA safety standards, may expose hikers to "potentially hazardous levels" of RF radiation. The report, issued on June 17, was commissioned by Nuclear Free Local Authorities (NFLA), a Manchester-based coalition that monitors military activity. NFLA warns that areas presently not within the radar's 120° coverage may face a tenfold increase in exposure when a 360° phased array radar begins operation at the site in mid-1992. The group plans further measurements at that time. For a copy of *RAF Fylingdales EMR Survey*, contact: **David Bamber**, Nuclear Policy and Information Unit, Town Hall, Manchester M60 2LA, U.K., (44+061) 234 3244.

More on Police Radar...FDA's Center for Devices and Radiological Health (CDRH) has recommended that "users of police radar should not place the front surface of the radar unit (the antenna) within 15 cm (6 inches) of any part of the body, while the unit is transmitting." In a June 20 letter to Dr. **James Lin**, chairman of the IEEE's Committee on Man and Radiation (COMAR), Dr. **Alan Anderson**, director of CDRH's Office of Science and Technology, also advised that, "The FDA knows of no convincing evidence of a risk of cancer or other hazards from exposure to the level and type of microwave radiation produced by police radar units." Anderson was responding to Lin's March 19 request for an advisory opinion because COMAR had received several inquiries from police departments. Meanwhile, John

ETC...

Sweeney, an Agoura Hills, CA, attorney, has filed two new suits claiming that police officers Eric Bendure and Leo Hutchison of Petaluma, CA, developed cancer after using police radar units (see *MWN*, M/A91). Both suits were filed on April 18 in the U.S. District Court for California's Northern District. Sweeney had previously filed a police radar-cancer suit on March 12. More litigation may follow, because, according to Ohio Highway Patrol Trooper Gary Poynter, more than 50 police officers have reported developing cancer after using radar.

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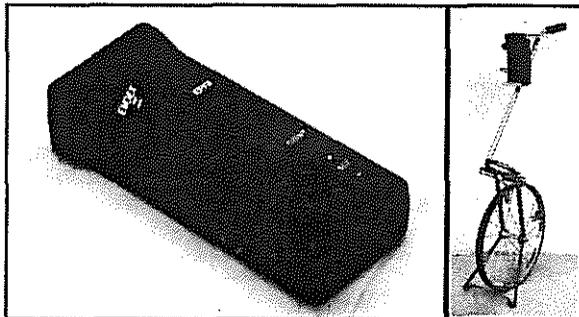
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EMF on the Airwaves... Perhaps it's coincidence, perhaps it's synchronicity, but one of the hottest pop bands in the world is called EMF. In mid-July, the British group's single, "Unbelievable," was at the top of the charts. We're not exactly sure what EMF stands for, but we hear that the "E" is for ecstasy—a psychedelic drug popular in certain locales—and that the "MF" stands for something we cannot print here.

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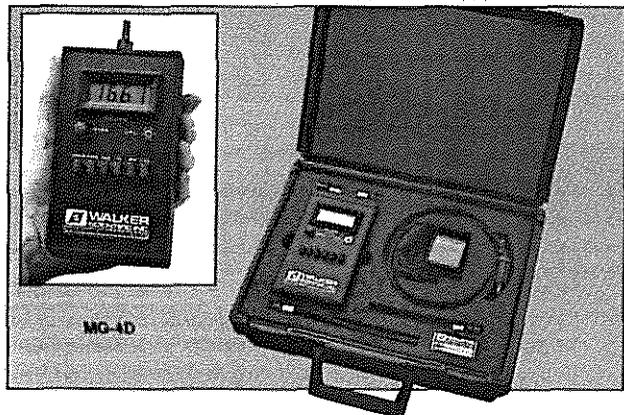
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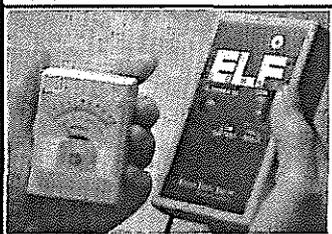
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