Carl Brighton and Solomon Pollack, eds., ***Electromagnetics in Medicine and Biology,*** San Francisco: San Francisco Press Inc., 1991, 365 pp., $37.50. A collection of 54 papers—including 13 reviews—that were presented in 1990 on the occasion of the tenth anniversary of the Biological Repair and Growth Society (BRAGS). The editors, leaders of BRAGS, write that they "believe that electromagnetism in biology and medicine has gone beyond the mere description of fascinating and perhaps amusing phenomena. The ability of electromagnetic fields to turn on intracellular messengers, to enhance ion flux into a cell, to stimulate specific growth factors and to bring about significant transcriptional changes in cells all point to an enormous potential for electromagnetism in clinical medicine." The papers are evenly divided between basic science and clinical applications, with most of the BRAGS membership represented among the authors.

Roger Coghill, ***Electrohealing: The Medicine of the Future,*** London, U.K.: Thorsons (an imprint of HarperCollins), 1992, 176 pp., $14.00 (paperback). An eclectic overview of electromedicine by the U.K.'s leading EMF activist. Coghill, who is based in Wales, covers a wide array of potential therapies, from magnetic fields to negative ions to UV radiation.

Michael Fumento, ***Science Under Siege: Balancing Technology and the Environment,*** New York: William Morrow and Co., 1993, 448 pp., $27.50. This is a "plea for rational public policy" on environmental problems, using power line and VDT EMFs, along with Alar, dioxin, Agent Orange and food irradiation, as case studies. The chapter on EMFs is mostly an attack on Paul Brodeur and his articles in *The New Yorker*. Fumento's review of the epidemiological literature is spotty at best. Fumento endorses the University of Rochester (NY) view that EMFs present little, if any, public health concern: "The $5 million it could cost to bury a small stretch of power line that will quite possibly save zero lives could be spent to vaccinate every child in the area around that stretch of power line with every vaccination he or she could possibly need." The chapter on VDTs also assails Brodeur as well as Louis Slesin, editor of *VDT News* and *Microwave News*. Here again, Fumento's understanding of the health risks is limited and much of his information is already out of date. Fumento argues that the nation's health problems stem from too much smoking and drinking and from bad diets, not from environmental insults.

Mary Kerney Levenstein, ***Everyday Cancer Risks and How To Avoid Them,*** Garden City Park, NY: Avery Publishing Group, 1992, 318 pp., $11.95. Covers everything from food additives to hazardous waste dumps to AIDS. The chapter on "Radiation in the Home" addresses EMFs, citing the writings of Becker, Brodeur, Leeper, Milham and Wertheimer, and offers a number of suggestions on limiting exposures to EMFs and RF/MW radiation.

Bengt Nordén and Claes Ramel, eds., ***Interaction Mechanisms of Low-Level Electromagnetic Fields in Living Systems,*** New York: Oxford University Press, 1992, 295 pp., $85.00. A collection of 17 papers presented at a May 1989 workshop organized by the Swedish Academy of Sciences. Today, three and one-half years later, some of the papers have been overtaken by new developments—for instance, "Magnetic Fields and Cancer: More Information Is Still Needed," by Ahlbom, Yang and Feychting is clearly out of date. Portions of the reviews by Adey, Blackman, Hamnerius, Liboff, Liburdy and Schwan have already appeared in somewhat different form elsewhere. The most useful contributions are those from Swedish labs, notably those on the permeability of the blood–brain barrier and diatom mobility. Interestingly, a consensus statement on low-level effects, issued by Nordén and Ramel after the conference, is not included—perhaps because it troubled a number of the participants (see *MWN*, N/D89 and J/F90).

J. Patrick Reilly, ***Electrical Stimulation and Electropathology,*** New York: Cambridge University Press, 1992, 504 pp., $74.95. With the assistance of a number of colleagues, Reilly has written what will no doubt become the standard text on the effects of short-term electrical exposures, both intended and accidental. Reilly's audience is the biomedical scientist and the engineer concerned with electrical safety. The chapter on "Standards and Protective Measures" is by Walter Skuggevig of Underwriters Laboratories. Reilly, a member of the staff at the Johns Hopkins University Applied Physics Lab in Laurel, MD, does not address the health effects of chronic low levels of EMFs.

Nancy J. Simon, ***Biological Effects of Static Magnetic Fields: A Review,*** Boulder, CO: International Cryogenic Materials Commission Inc., 1992, 284 pp., $50.00 in the U.S., $55.00 in Canada and $65.00 elsewhere (paperback). Simon, a physicist at the National Institute of Standards and Technology in Boulder, provides the most thorough examination anywhere available of the literature on static fields. When experimental results conflict, Simon, who also has training in molecular and cellular biology, offers possible reasons for the discrepancies. For example, in 1984 a German team announced that a magnetic field of 0.4 T could cause detectable increases in body temperature, but an attempted replication by Dr. Tom Tenforde failed (see *MWN*, J/A84 and S/O85). At the end of the volume, which includes more than 600 references, Simon lists 11 "significant static field effects that have not yet been confirmed or refuted" and concludes that, "Any of these effects, if confirmed, could seriously affect site considerations for and occupational practices in future large-scale systems with superconductors and cryogenic conductors. More research is urgently needed to address these problems."

Ellen Sugarman, ***Warning: The Electricity Around You May Be Hazardous to Your Health,*** New York: Simon & Schuster, 1992, 238 pp., $11.00 (paperback). In attempting to give an overview of the debate about potential health hazards, Sugarman has written a text littered with errors—even basic definitions cannot be trusted. In one of her more extraordinary lapses, Sugarman writes that the Kaiser VDT–miscarriage study was "designed to assess the effects on pregnancy outcomes of statewide melatonin spraying" to combat fruit flies. The pesticide was malathion. Sugarman's point of view is that the industry is covering up the health risks. Despite its shortcomings, this book is likely to sell briskly because there aren't any other primers to satisfy consumer demand for EMF information.

Louise B. Young, ***Power Over People,*** New York: Oxford University Press, 1992, 247 pp., $10.95 (paperback). A new edition of the first book to warn against the dangers of power line EMFs, originally published in 1973. Young has added an introduction and an epilogue as well as some updated references. She chronicles the battle of citizens against a large utility over the siting of a high voltage power line. Twenty years ago, Young wrote that when the public has the facts, "Then *people* will triumph *over power*."

Forthcoming

David O. Carpenter and Sinerik Ayrapetyan, eds., ***Biologic Effects of Electric and Magnetic Fields,*** San Diego: Academic Press, 1993. A two-volume work: The first is on "sources and mechanisms" and the second is on "beneficial and harmful effects." Among the contributors are: Drs. Anders Ahlbom, Dean Astumian, Andrew Bassett, A. Chiabrera, Robert Cleveland, Don Deno, Joseph Elder, Reba Goodman, Ann Henderson, Martin Kavaliers, Richard Luben, Granger Morgan, K.-P. Ossenkopp, Russel Reiter, Kurt Salzinger, Richard Stevens, Gilles Thériault, James Weaver and Bary Wilson, as well as a number of researchers from Armenia, Russia and Ukraine.

tumors. Once cellular industry stocks fell, the day after the Larry King broadcast, no one passed up the story. Over the next two weeks, the controversy was covered by the evening news programs on CBS and NBC, by ABC's *20/20* and by numerous radio and television talk shows. Every major newspaper ran at least one item—the *Wall Street Journal* featured a half-dozen stories, *USA Today* even more. *BusinessWeek, Newsweek, Time* and *U.S. News & World Report* all carried the story. An industry poll conducted shortly after Reynard appeared on *Larry King Live* found that half of all Americans knew of his lawsuit, according to a February 9 story in the *Washington Post.*

The industry unveiled its research plan in the midst of this public relations crisis. CTIA President Thomas Wheeler told a Washington press conference on January 29 that a "blue-ribbon panel" of federal agency representatives would be asked to oversee the research. He would not say definitively how much money the industry would provide—only that it would be "well into seven figures," that is, more than $1 million.

Separately, McCaw Cellular committed $130,000 for research by Dr. Om Gandhi of the University of Utah, Salt Lake City, to estimate how much radiation is absorbed by the human head from the antenna of a hand-held cellular phone. The first results will be available in about six months, according to Robert Ratliffe, a spokesman for McCaw, which is based in Kirkland, WA. The company has also agreed to exchange any customer's hand-held phone for a car phone at no charge. McCaw, which operates under the Cellular One name, is the largest cellular service provider in the U.S. and a major reseller of cellular phones.

The recent publicity has focused on hand-held units, which have antennas on the tops of the handsets, within a few inches of the user's brain and eyes. Hand-held phones account for about 60% of current cellular phone sales and about 30% of the 10 million cellular phones now in use. No one has yet suggested that car phones, for which antennas are mounted on the exterior of vehicles, present a health risk.

The NCI brain tumor study is still in the planning stages, but data collection should begin this year, said Dr. Richard Adamson, director of NCI's division of cancer etiology in Bethesda, MD.

The Cellular Phone Safety Debate: A Timeline

The controversy over the safety of cellular phone radiation reached a huge audience in late January and early February. It cropped up in newspapers and on the evening news around the U.S. (and worldwide). It was discussed in radio and television business reports and in testimony before a congressional subcommittee. It even made it into Jay Leno's opening monologue on The Tonight Show. *Here is how the story unfolded:*

• *April 8, 1992.* David Reynard files his lawsuit in Circuit Court for Pinellas County, FL, naming NEC America Inc. and a unit of GTE Corp. as defendants (see *MWN*, M/J92). Press coverage is limited to local papers.

• *January 3, 1993.* Nancy McVicar publishes a story about the lawsuit in the Fort Lauderdale, FL *Sun-Sentinel.* Her story appears in other Knight-Ridder newspapers.

• *January 12.* CNN's *Moneyline* program airs a special report on the Reynard lawsuit.

• *January 19.* Reginald Lewis, chief executive of TLC Beatrice International Holdings, dies from a brain tumor.

• *January 20.* Tenneco announces that its CEO, Michael Walsh, has been diagnosed with a brain tumor. (There is no indication that either Lewis or Walsh used a hand-held cellular phone, but news of their illnesses heightens interest in the cellular story.)

• *January 21.* Reynard appears on CNN's *Larry King Live* to discuss possible health risks from cellular phones.

• *January 22.* Prudential Securities recommends selling holdings of cellular industry shares, predicting "a spate of newspaper articles dealing with this topic over the next few weeks." Cellular industry stocks fall.

• *January 25.* Motorola calls a telephone press conference to answer questions about the safety of its products. More than 75 journalists call in, leading to dozens of print, television and radio stories.

• *January 26.* Rep. Edward Markey (D-MA) writes to FCC's Thomas Stanley, asking about the current RF/MW radiation safety standard and seeking information about any research the FCC has done on cellular phone radiation.

• *January 27.* Markey asks the General Accounting Office to investigate cellular phone safety and the history of federal regulatory efforts.

• *January 28.* McCaw Cellular Communications says it will fund additional research and allow customers to trade hand-held phones for car phones.

• *January 29.* CTIA President Thomas Wheeler announces plans for an industry research initiative, describing cellular phones as "a great made-in-America success story."

• *January 29.* Josephthal, Lyon & Ross, a securities firm, changes its evaluation of Motorola from "buy" to "hold," and downgrades Pacific Telesis, which has plans to spin off its cellular operations later this year, to "sell." Cellular stocks are battered. Motorola loses $4.875 to close at $51.00 a share with a trading volume of more than 13 million shares, making it the most active stock on the New York Stock Exchange. McCaw loses $3.375 to close at $32.50 a share and is the most active issue in the over-the-counter market. Just eight days earlier, Motorola was trading above $60 a share and McCaw was above $38 a share.

• *January 29.* The FCC answers Markey's letter, explaining that it "is not the expert agency" for evaluating the health effects of RF/MW radiation. Markey calls the FCC response an indication of "the lack of concrete data evaluating the potential health hazards...."

• *January 29.* The ABC news magazine *20/20* airs a segment on cellular phone safety.

• *February 1. BusinessWeek, Newsweek* and *Time* (all dated February 8) appear with stories about cellular phone safety.

• *February 1.* Attorneys in Chicago file a breach-of-warranty class action lawsuit against Motorola and Mitsubishi Electronic Corp., alleging that the defendants are "only now commissioning studies on how cellular phones affect users' exposure to radio waves, studies which may take years to complete."

• *February 2.* Markey's subcommittee on telecommunications and finance holds a briefing on Capitol Hill, with testimony by Dr. Stephen Cleary and officials from EPA, FCC, FDA, NCI and Motorola.

• *February 4.* The FDA releases its advisory on cellular phones.

Adamson described NCI's research plans at a February 2 congressional briefing organized by Rep. Edward Markey (D-MA), the chairman of the telecommunications and finance subcommittee of the House Energy and Commerce Committee. Markey has also requested that the General Accounting Office, an arm of Congress, prepare "a comprehensive overview of the state of scientific knowledge" about the potential health risks posed by cellular phone radiation.

The briefing brought together some key players in the safety debate. "I do believe that there is a potential relationship between exposure to fields of this type and cancer promotion," Dr. Stephen Cleary of Virginia Commonwealth University in Richmond told the overflow crowd. Cleary has shown that brain tumor cells exposed to radiofrequency and microwave (RF/MW) radiation proliferate at an abnormally high rate (see *MWN*, M/A90). In his experiments, the abnormal growth continued for five days after exposure. Such findings "suggest the possibility of cumulative effects," according to his 1990 paper. Cleary did not investigate cellular phone frequencies (800-900 MHz); he studied 27 MHz, used by RF heat sealers and other industrial equipment, and 2450 MHz, used by microwave ovens. Radiation at cellular frequencies would cause similar effects, he predicted.

Another witness at the briefing, Dr. Mays Swicord of the Food and Drug Administration's (FDA) Center for Devices and Radiological Health in Rockville, MD, said that there is no proof of a link between cellular phone radiation and cancer. But he suggested that one can limit use of hand-held cellular phones—an idea repeated in a "Talk Paper" issued by the FDA two days later. "We simply don't have enough information at this point to rule out the possibility of a risk," the FDA advisory stated.

Thomas Stanley, chief engineer of the Federal Communications Commission (FCC), emphasized that the commission "is not the expert agency for evaluating the biological effects of [RF/MW] radiation on human health and safety." He explained that the FCC has adopted the 1982 American National Standards Institute (ANSI) RF/MW guidelines and that, "Cellular telephones, including hand-held units, have been exempted from routine examination...based on calculations and measurement data indicating that they would not cause exposures that would violate the ANSI guidelines."

Markey, Stanley, Swicord, and David Kleffman of the Environmental Protection Agency's (EPA) Office of Research and Development all used the briefing to call for additional research. Kleffman noted that cellular phone safety will be raised at an upcoming EPA workshop on RF/MW radiation and health (see p.6).

Industry representatives remained unequivocal as they responded to questions about cellular phone safety. Dr. Quirino Balzano, a vice president of the land mobile products sector of Motorola Inc., which has its headquarters in Schaumburg, IL, said at the briefing that the "thorough and objective scientific process" that went into creation of the current RF/MW safety guidelines, ANSI/IEEE C95.1-1992 (see p.14), allows the industry to state with certainty that cellular phones are safe. And, during a January 25 press teleconference, Edward Staiano, president of Motorola's general systems sector, said that, "Our confidence in the safety of our products is rooted in scientific fact." Staiano referred to "more than 40 years of research" and "more than 10,000 studies" demonstrating the safety of hand-held phones.

Even after the congressional briefing, the industry campaigned to put the best face on events. CTIA's Wheeler issued a statement claiming that, "Diverse scientific viewpoints were assembled [at the briefing] in an open forum with cross-examination. The verdict was overwhelming—cellular telephones do not cause cancer."

U.K. Research on Hand-Held Phones Shrouded in Secrecy

Research on RF/MW radiation from cellular phones and related devices is also being pursued in the U.K., but specific details are hard to come by.

What is known is that the National Radiological Protection Board (NRPB) in Didcot, England, is managing a project for the Department of Trade and Industry (DTI), a government agency, to develop computer models to characterize the EMFs induced in the human head by hand-held devices. This much was learned from an NRPB spokeswoman, who also said that the research was being carried out at three English universities—Bradford, Surrey and King's College, London. She then referred us to DTI for additional details.

Further inquiries by *Microwave News* were rebuffed: Dr. Camelia Gabriel of King's College declined to comment, forwarding our request to DTI. In a September 8, 1992 letter to *Microwave News*, DTI's Graham Worsley wrote that the project is titled "Interaction of the Body with Radio Emissions from Hand-Held Transceivers," adding that, "The project is not directly concerned with research into health risks from mobile telephones." He said that DTI was preparing more information for public release and would make it available "when it is finalized." That was the last word received from Worsley or from DTI.

Motorola's Three Key Studies

After its press conference on January 25, Motorola released the following three references in response to a request for studies which show that cellular phones are safe:

W.R. Adey, S.M. Bawin and A.F. Lawrence, "Effects of Weak Amplitude-Modulated Microwave Fields on Calcium Efflux from Awake Cat Cerebral Cortex," *Bioelectromagnetics, 3*, pp.295-302, 1982.

C.V. Byus, R.L. Lundak, R. Fletcher and W.R. Adey, "Alterations in Protein Kinase Activity Following Exposure of Cultured Human Lymphocytes to Modulated Microwave Fields," *Bioelectromagnetics, 5*, pp.341-352, 1984.

C.V. Byus, K. Kartun, S. Pieper and W.R. Adey, "Increased Ornityhine Decarboxylase Activity in Cultured Cells Exposed to Low Energy Modulated Microwave Fields and Phorbol Ester Tumor Promoters," *Cancer Research, 48*, pp.4222-4226, 1988.

What They Are Saying

If there are health-related effects of fields at these levels of incident energy, they fall in the category of athermal effects. Heating is not the basis of any observed tissue interactions. Rather, for microwave fields in the GHz range, they may arise in resonant effects at the carrier frequency on vibrational and rotational behavior of molecules or portions of molecules.

Future cellular and [personal communications system] products will use RF signals which vary in instantaneous power at ELF frequencies. Where RF/MW fields are pulse- or amplitude-modulated at ELF frequencies, their range of bioeffects may be enhanced by orders of magnitude over effects of a [continuous wave] field of the same intensity and carrier frequency.

...In a regulatory perspective, the pioneering developments by Motorola of cellular phone systems operating at presumably athermal exposure levels would set aside recent ANSI/IEEE Committee 28 guidelines that have preempted consideration of athermal bio-effects by the continuing use of inherently thermal models of tissue interactions.

—Dr. Ross Adey, VA Medical Center, Loma Linda, CA, Memo to Motorola's Dr. Q. Balzano, January 24, 1993, Released by Motorola Inc., January 25, 1993

First, let me assure you that all of our products are safe. By a substantial margin, they meet all national and international safety standards on user exposure to radiofrequency energy.

...Our confidence in the safety of our products is rooted in scientific fact. For more than 40 years, we at Motorola and other scientists around the world have been researching the biological effects of RF energy. None of this scientific inquiry has demonstrated the existence of health risks from the use of cellular telephones.

—Dr. Edward Staiano, President, General Systems Sector, Motorola Inc., Press Teleconference, January 25, 1993

I tried to get this issue out to the public a couple of years ago, after realizing that this may have been a problem. And it didn't appear that the news media was willing to listen to what was being said. They asked me, was there a lawsuit involved, and at that time there was not. And my only response to that was, "I guess we'll just have to wait till enough white-collar CEO workers die off from this, and somebody'll pay attention to it."

—David Reynard, Interview on NBC's Today *show, January 26, 1993*

We do not see any obvious way for the cellular industry to refute these charges short of new tests that will take time. There are already two high-level executives stricken with brain cancer for the media to focus on and speculate about. In the meantime, we look for a barrage of bad publicity and the following events to occur:

- Further reports of consumer reaction and sales declines for both phones and cellular usage.
- The government will want to get involved. We cannot rule out the possibility of publicity-seeking congressmen holding highly publicized hearings.
- Liability lawyers will be anxious to cash in on this latest potential source of business, especially with some large well-heeled corporations like Motorola and AT&T involved.

—Lawrence Borgman, Josephthal, Lyon & Ross Inc., Market Advisory, January 29, 1993

It is apparent that the various federal agencies responsible for the health and safety of the public in this area need to coordinate efforts so that the FCC can adequately address these issues when it licenses wireless telephone services for the general public.

—Rep. Edward Markey (D-MA), Chairman, Subcommittee on Telecommunications and Finance, Press Statement, January 29, 1993

Despite the many research studies showing that cellular is safe, it has become necessary to reassure those whose doubts have been raised by this scare. It is time for truth and good science to replace emotional videotape and unsupported allegations.

Therefore, the cellular telecommunications industry is today announcing that it will fund research to re-validate the findings of the existing studies, which have found that the radiowaves from cellular phones are safe. We recognize that some may find industry-sponsored research is suspect. Therefore, we are asking the federal government to appoint a blue-ribbon panel to review the methodology and findings of this research.

—Thomas E. Wheeler, President, Cellular Telecommunications Industry Association, Washington Press Conference, January 29, 1993

The current standard [ANSI/IEEE C95.1-1992, see p.14] emerged after we carefully and deliberately winnowed down thousands of pieces of research to 321 studies....[T]his exhaustive process established a threshold, below which there was no scientific evidence of adverse health effects.

—Dr. Quirino Balzano, Vice President, Land Mobile Products Sector, Motorola Inc., Congressional Briefing, February 2, 1993

The Commission is not the expert agency for evaluating the biological effects of radiofrequency radiation on human health and safety....Cellular telephones, including hand-held units, have been exempted from routine examinations under the Commission's [National Environmental Policy Act] requirements based on calculations and measurement data indicating that they would not cause exposures that would violate the ANSI guidelines.

—Thomas Stanley, Chief Engineer, Federal Communications Commission, Congressional Briefing, February 2, 1993

How much evidence is there that hand-held cellular phones might be harmful? Briefly, there is not enough evidence to know for sure, either way....A few studies suggest that these levels can accelerate the development of cancer in laboratory animals, but there is much uncertainty among scientists about whether these results apply to the use of cellular phones....Nonetheless, we cannot dismiss these studies as irrelevant to cellular phone users....

In the absence of conclusive information about any possible risk, what should people do? It is not necessary that people stop using their hand-held cellular phones. If there is a risk from these devices—and at this point we don't know if there is—it is probably small. But if people are concerned about avoiding even potential risks, there are simple steps they can take to do so. For example, since time is a key factor in how much exposure a person receives, those who spend long periods of time on their hand-held cellular phones could consider holding lengthy conversations on conventional phones and reserving the hand-held cellular models for shorter conversations or for situations when conventional phones are not available.

—Food and Drug Administration Talk Paper, Update on Cellular Phones, *February 4, 1993*

Exemptions for Hand-Held Devices Challenged in Europe

Outside the U.S., officials are beginning to force cellular phone companies to show compliance with RF/MW radiation exposure limits. In December 1991, Germany's Radiation Protection Commission announced that hand-held communications devices would no longer be exempted from health standards and that henceforth all companies would have to provide experimental evidence that their products comply with German exposure limits. The move came after an April 1991 hearing at which manufacturers of mobile communications equipment and service providers, along with research scientists, reached a consensus that measurement data were necessary to assure safety.

The International Commission on Non-Ionizing Radiation Protection has also drafted a position statement that would reject exclusion clauses for low power devices (see *MWN*, M/J92).

In the U.S., the FCC exempts hand-held cellular phones in accordance with the 7-watt exclusion clause in the 1982 ANSI standard and is expected to maintain an exemption in light of the narrower exclusion specified in the 1991 IEEE standard, which was recently adopted by ANSI to replace the 1982 guidelines (see p.14).

The decision by the German commission was based in part on the work of Dr. Niels Kuster, a research fellow at the Swiss Federal Institute of Technology, known as ETH, in Zürich. Over the last four years, Kuster has been developing computer models to simulate the absorption of RF/MW radiation from nearby transmitters— especially from hand-held or body-mounted antennas.

Working with Dr. Quirino Balzano of Motorola Inc. in Plantation, FL, Kuster has shown that the 7-watt exclusion is incompatible with the 1982 ANSI standard's exposure limits (see *MWN*, N/D90). In an interview with *Microwave News*, Kuster said that, "The exemption in the 1991 standard is not totally satisfying because some devices, which fall within this exemption, may still exceed the basic safety limits."

Kuster is presently developing an automated test site for standardized compliance testing of hand-held transmitters for specific SAR limits under a contract from the German and Swiss Ministries of Post and Telecommunications, as well as German Telekom and Mannesmann Mobilfunk GmbH, both providers of cellular communications services. The test site and a well-defined testing procedure should be completed by the end of July, Kuster said.

Kuster's research findings are presented in his doctoral dissertation, submitted in 1992, which also provides an introduction to current and planned mobile communications systems and an overview of current safety standards. Copies of Kuster's dissertation, *Dosimetric Assessment of EM Sources near Biological Bodies by Computer Simulations* (DISS. ETH No.9697) are available for $25.00 each from: Dr. Niels Kuster, ETH, CH-8092, Zürich, Switzerland. See also, N. Kuster, "Multiple Multipole Method Applied to an Exposure Safety Study," *Applied Computational Electromagnetics Society Journal, 7*, pp.43-60, Winter 1992.

Commentary on Cellular Phone Health Risks *(continued from p.1)*

tion can contribute to the development of cancer. Laboratory, animal and human studies all point to a possible problem.

The most compelling evidence comes from Dr. Stephen Cleary's lab at Virginia Commonwealth University in Richmond: In a paper published in 1990, Cleary showed that unmodulated 27 MHz and 2450 MHz radiation can accelerate the proliferation of human brain tumor cells. Indeed, five days after a single two-hour exposure—designed to ensure that no heating occurred—the tumor cells were still growing abnormally (see *MWN*, M/A90). Obviously, Cleary's experiment must be repeated using microwaves that mimic cellular phone signals—and the sooner the better.

Only one long-term RF/MW exposure study has ever been completed and it supports a cancer risk. The five-year, $5 million study by Dr. Bill Guy at the University of Washington, Seattle, showed that small doses of radar-like microwave radiation caused a significant excess of cancer in rats (see p.13 and *MWN*, J/A84 and Mr85). Even though Guy has consistently downplayed his own results—and the U.S. Air Force, Guy's sponsor, has refused to acknowledge the possible cancer link—the Environmental Protection Agency (EPA) found that "the University of Washington study can be said to have demonstrated the carcinogenic action of this type of pulsed RF radiation" (see *MWN*, J/A90).

A smaller study, by Dr. Stanislaw Szmigielski of the Center for Radiobiology and Radiation Safety in Warsaw, Poland, found that RF/MW radiation can act as a tumor promoter in mice (see *MWN*, My81).

Other animal experiments indicate that tiny amounts of RF/MW radiation can increase the permeability of the blood–brain barrier (BBB), a membrane that controls which chemicals can migrate into brain tissue. Just last summer, Drs. Leif Salford and Bertil Persson of the University of Lund in Sweden reported leakage through the BBB of rats at specific absorption rates (SARs) as low as 0.01 W/Kg (see *MWN*, J/A92). By comparison, the 1992 ANSI/IEEE safety standard allows the head to be exposed continuously to over 100 times that level of radiation: up to 1.6 W/Kg for the general public and up to 8 W/Kg for workers, who are assumed to be aware of the risks. Even though RF/MW-induced BBB leakage was first reported by U.S. re-

searchers in 1977, and even though it provides a possible mechanism for affecting brain biochemistry, no one here has seriously pursued this line of research.

With respect to human studies, Szmigielski has twice reported that Polish military personnel exposed to RF/MW radiation have significantly more cancer than their unexposed counterparts (see *MWN*, Mr85, J/F87, J/A89 and S/O90). And Dr. Samuel Milham Jr., an epidemiologist formerly with the Washington State Department of Health, has reported that amateur radio operators, who are exposed to various sources of non-ionizing radiation, have higher-than-expected rates of cancer (see *MWN*, My85 and N/D87). Milham found an excess of acute myeloid leukemia as well as an excess of brain tumors.

Indeed, over the last decade, more than a dozen epidemiological studies have shown that people exposed to EMFs of one kind or another have higher rates of brain tumors—up to 10-13 times the expected rates (see *MWN*, M/A90).

Moving beyond the cancer connection, a series of studies carried out at the Johns Hopkins University Applied Physics Lab in Laurel, MD by Henry Kues and coworkers indicate that RF/MW radiation can have profound effects on the eye, especially in combination with commonly used glaucoma drugs (see *MWN*, J/A83, S/O86, J/A87, J/A88 and S/O91). In a recently published paper (*Bioelectromagnetics, 13*, pp.379-393, 1992), Kues's group states that glaucoma patients using timolol therapy can suffer ocular changes at an SAR as low as 0.26 W/Kg—a level that is also well below current safety standards.

All these studies, taken together, illustrate how ludicrous the cellular industry's position is. Three years ago, in its now famous report on EMFs and cancer, EPA scientists concluded that RF/MW radiation should be classified as a "possible human carcinogen" (see *MWN*, M/J90).

The Cellular Telecommunications Industry Association's (CTIA) attempts at denial and spin control are not unexpected—this must be how its executives see their role. For example, after the Food and Drug Administration (FDA) issued a "Talk Paper" that refused to rule out a possible cancer link, CTIA sent out a press release announcing that it was "pleased by FDA's conclusion that 'there is no proof at this point that cellular phones are harmful.'"

What is surprising, however, is the misleading and inconsistent picture of the scientific data presented by Motorola. A few hours after being asked which specific studies show that cellular phones are safe, the company distributed a list of three papers by Dr. Ross Adey of the VA Hospital in Loma Linda, CA and coworkers (see box, p.9). These papers show that, under certain conditions, unmodulated RF/MW radiation has no effects—but they also show that the radiation, when modulated, can induce biological changes.

Industry lobbyists have long argued that Adey's work has no bearing on health, so it is ironic to see Motorola now trying to use this research to its own advantage. But, at the same time, by implication, this evidence shows that modulated cellular signals may not be safe. Therefore, adding irony to irony, Motorola is questioning the viability of the next generation of its cellular technology, which will use modulated radiation.

Motorola, and many other companies, will soon introduce digital systems with greater capacity, efficiency and security. Motorola is betting billions of dollars on its Iridium project, a system of 66 low-Earth orbit (LEO) satellites that will allow customers to use hand-held phones anywhere on the planet. The Iridium signals will be modulated—remarkably—at 50 Hz, the European power frequency. Picking a frequency that has been implicated in dozens of cancer studies was certainly strange. As one scientist quipped, "It's hard to think of a worse choice."

To its credit, Motorola is sponsoring studies in Adey's lab to investigate the safety of its new digital technology. That work is years away from completion, but Motorola is already misusing it. At its press conference, while Motorola executives were scurrying behind the scenes to come up with the three Adey studies described above, they cited Adey's ongoing work for the company as indicating that the current analog cellular system is safe. Given that the company puts a premium on the distinction between the effects of modulated and unmodulated radiation, it should not be using results on the digital (modulated) radiation to show that the analog (unmodulated) radiation is safe. At the same time, it is worth asking: Why is Motorola willing to undermine the viability of its Iridium system?

Motorola has yet to say how powerful its Iridium phones will be, but they will probably have to be stronger than the 0.6 W cellular units now in use because the Iridium satellites will be orbiting at an altitude of 420 miles. In contrast, cellular phone signals need only travel about 10 miles. Motorola clearly understands the health risks associated with sending cellular signals long distances. In an interview with *Barron's* (February 10, 1992), a Motorola executive said the company had picked the LEO system instead of a geostationary system with satellites parked 22,000 miles overhead because, to send messages that far, the hand-held phones would cause "fried brains."

The wireless revolution envisioned by communications and computer companies will be held hostage until the public is satisfied that the technology is free of unreasonable risks. It will take years and a lot more money than CTIA, McCaw and Motorola have yet committed to settle the health questions. *Their first priority is to regain the public trust and the only way* to do so is to stop the double-talk.

MICROWAVE NEWS is published bimonthly • ISSN 0275-6595 • PO Box 1799, Grand Central Station, New York, NY 10163 • (212) 517-2800; Fax: (212) 734-0316 • Editor and Publisher: Louis Slesin, PhD; Managing Editor: Robert Dieterich; Senior Editor: Hilary A. Macht; Assistant Editor: Lara Schoeberlein; Contributing Editors: Jennifer Goren, Mark A. Pinsky; Copy Editors: Jim Feldman, Charles Rogers; Circulation Director: Barbara Gerson • Subscriptions: $285.00 per year ($315.00 Canada & Foreign, U.S. funds only); single copies: $50.00 • Copyright © 1993 by Louis Slesin • Reproduction in any form is forbidden without written permission.

FROM THE FIELD

Chinese Conference

Dr. Y. Fen of the Microwave Institute at Zhejiang Medical University sent Microwave News *this report:*

The *4th Chinese Scientific Conference on Bioelectromagnetics* was held at Xian Electronic Scientific-Technical University, Xian, China, on October 26-29, 1992. More than 40 experts attended the meeting, which was sponsored by the Chinese Society of Biomedical Engineering and the Chinese Biophysics Society. At the conference, there were five invited papers (reviews) presented in plenary session, such as "ELF Magnetic Fields and Cancer," "Mechanisms of EMF Interaction with Living Systems," "The Future of Bioelectronics," etc. and 62 papers presented in four sessions dealing with: "Biological Effects of ELF EMFs" (8 papers); "EMFs in Living Systems and How To Measure Them, and Dosimetry for Bioelectromagnetism" (7 papers); "Biological Effects of RF EMFs, Static Electricity and Magnetic Fields" (18 papers); and "Mechanisms of Biological Effects and Medical Applications of EMFs" (29 papers). Prizes were awarded to some young researchers for the papers they presented. A new Bioelectromagnetics Commission of the Chinese Society of Biomedical Engineering was established, with Dr. H. Chiang as director and Drs. J. X. Li and C. Q. Wang as deputy directors. To enhance international cooperation, academic exchanges between countries and/or areas will be one of the main tasks of the new commission. A booklet of the meeting abstracts (in Chinese) has been published. A few booklets are available from Dr. Zhong Qi Niu, Engineering Department of Electromagnetic Fields, Xian Electronic Scientific-Technical University, Xian 710071, People's Republic of China. The next conference will probably be held in Chengdu City, Sichuan Province, China.

Sincerely,
Dr. Y. Fen
Microwave Institute, Zhejiang Medical University
157 Yan An Rd., Hangzhou, Zhejiang 310006
People's Republic of China

David Savitz on Cancer Trends

Below are comments by Dr. David Savitz of the University of North Carolina, Chapel Hill, on cancer rates and electricity consumption (see MWN, *J/F91, J/A91, M/J92 and J/A92), excerpted from the January issue of* Environmental Science & Technology *as part of a discussion of the recent CIRRPC report (see p.2 and* MWN, *N/D92).*

A specific theme [in the CIRRPC report] for both cancer and adverse reproductive outcomes is that whatever the research might suggest, [EMFs] could not adversely affect health because the rise in electric power use over time has not produced epidemics of cancer, birth defects or miscarriage. In fact, the two observations are true but unrelated.

In order to produce parallel trends in exposure and disease, as is readily observed for smoking and lung cancer, for example, the secular trend data would require: (1) markedly rising exposures, (2) accurate data on the rate of the disease over time, (3) an absence of major concomitant changes in other risk factors for the disease and (4) strong association between exposure and disease.

In regard to [EMFs], all are absent. The most critical problem is that the rising use of electric power has probably not been accompanied by any increase in exposure. In moving from a pre-industrial to industrial society, exposure surely increased, but that was over a time period that is not amenable to study given the absence of accurate health records. In the past 40 years it seems unlikely that exposures have risen. One bit of empirical evidence comes from Rhode Island [Fulton et al., 1980], where homes occupied in the 1960s tended to have higher exposures than those occupied in the 1970s, presumably reflecting the movement from central cities to the suburbs, with larger yards and greater distances from homes to power lines. This demographic shift was widespread throughout the United States.

In-home wiring practices also changed over that period from a pattern that generated large magnetic fields by spatial separation of the phases to a method in which the phases are closer in space and largely cancel one another. Increasing the voltage of power lines over time leads to lower currents, compensating in part for the greater use of electricity. Ultimately, we cannot assess how the population exposure has changed from the 1950s to the 1990s, but there is good reason to believe that it does not parallel the striking increase in electricity consumption during that interval. The report invokes lack of secular trends in childhood cancer to counter results of case–control studies, as though the calendar time in which children lived were a superior exposure marker to characteristics of individual children's residences.

The health events of interest, cancer and reproductive outcomes, are not available over long enough periods to address the pre-electrical era for which a contrast in exposure can be made. Only during the past 20 years or so have reliable registries for cancer incidence and birth defects become available, with mortality data for cancer markedly influenced by improvements in survival (particularly for childhood cancers) during that period. Thus, the era in which reliable health data are available does not coincide with the period in which exposures were likely to have changed dramatically.

Finally, although temporal trends in exposure and disease can be informative, the marked changes in other relevant factors over the same period might spuriously create or mask an association with the agent of interest. Changes in dietary habits, control of infectious diseases and improvements in medical technology for diagnosing and classifying disease would likely obliterate any change related to an exposure that has a moderate or small relation to disease. Thus, distinguishing between the presence of a moderate effect of [EMFs] on health and no effect cannot possibly be done on the basis of secular trends. One might speculate on how the reviewers would (and should) react to an assertion that the rise in brain cancer in the elderly in the past 20 years is attributable to increased use of electric power.

UPDATES

GUY STUDY

A Paper Is Published... More than eight years after the results were first presented at a conference, Dr. Bill Guy and coworkers have published a paper on their five-year, $5 million, long-term, low-level microwave exposure study (see *MWN*, J/A84, Mr85 and N/D86). The report is part of a collection, published in *Bioelectromagnetics*, that was prepared for an October 1991 symposium held in Guy's honor when he retired from the University of Washington, Seattle. Until now, Guy's findings were only available in a set of nine volumes published by the U.S. Air Force. Dr. C.-K. Chou, who moved from Guy's lab to the City of Hope National Medical Center in Duarte, CA, is the lead author of the paper and the guest editor of the collection. With respect to the contentious issue of cancer, Guy's team concludes that, "The findings of an excess of primary malignancies in exposed animals is provocative. However, when this single finding is considered in light of the other parameters, it is conjectural whether the statistical difference reflects a true biological influence." See C.-K. Chou et al., "Long-Term, Low-Level Microwave Irradiation of Rats," *Bioelectromagnetics, 13*, pp.469-496, 1992.

UPDATES

POLICE RADAR

Exposure Levels... From measurements of 5,000 radar devices over the last ten years, Dr. David Fisher of Michigan State University in East Lansing concludes that, "When the device is being operated properly, the microwave exposure levels encountered by radar operators are less than 50 $\mu W/cm^2$, i.e., less than 1% of the maximum exposure level of the current safety standards." Approximately 95% of the units tested were fixed-mounted antennas and 5% were hand-held units. Fisher points out that police officers may be exposed to more than 1% of the aperture power density—which can range from 0.1 mW/cm^2 to 6.4 mW/cm^2, at X-band (8-12 GHz) and K-band (18-27 GHz) frequencies—when "the antenna is pointed at a metal object sufficiently close to the antenna [i.e., within 12 ft] and oriented so that the [EMFs] reflect directly back toward the radar operator." Fisher notes that those who place the hand-held devices in their laps will also be exposed to more than 1% of the aperture power density, though it will be reduced because of impedance mismatch. See "Microwave Exposure Levels Encountered by Police Traffic Radar Operators," *IEEE Transactions on Electromagnetic Compatibility, 35*, pp.36-45, February 1993. For more on Fisher's work, see *MWN*, N/D91 and J/A92; and for reports on other surveys, see *MWN*, M/A91 and M/A92.

STANDARDS

Approval of RF/MW Standard Upheld...ANSI's Board of Standards Review has rejected an appeal from the broadcast industry that asked for the reversal of the panel's earlier decision approving ANSI/IEEE C95.1-1992, the revised RF/MW radiation exposure guidelines. The main objection, first raised by Hammett & Edison Inc. (H&E), a San Francisco consulting firm (see *MWN*, M/J92 and N/D92), is to the standard's 100 MHz cutoff point for limiting induced body currents, which falls in the middle of the commercial FM radio band. The appeal was supported by ABC, CBS, Westinghouse Broadcasting Co. and the National Association of Broadcasters (NAB), among others. "A proper consensus was never reached due to a lack of balance on SC-4," Michael Chiarulli, manager of telecommunications engineering for ABC, told the board at a February 4 hearing in New York City. The issue of balance on SC-4, the IEEE subcommittee that drafted the standard, has been raised before, with objections focusing on the panel's large military contingent and its limited biological and medical expertise (see *MWN*, S/O89, J/A90 and N/D92). But Chiarulli argued a different point—that his industry was not properly represented. After all, he pointed out, "Broadcasters have the greatest potential for exposing the public to high levels of RF radiation." Ron Peterson of AT&T Bell Laboratories in Murray Hill, NJ, who is secretary of SC-4, countered that, "Broadcasters were well represented by Ralph Justus [who was then with the NAB] and Jules Cohen [a consultant based in Washington]." He also argued that below 100 MHz, the electric field from broadcast facilities can induce currents in excess of the limits in the new guidelines: "That's where the 100 MHz cutoff came from."

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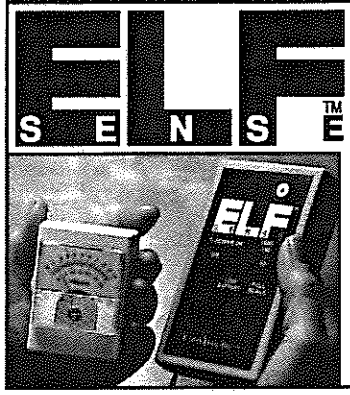
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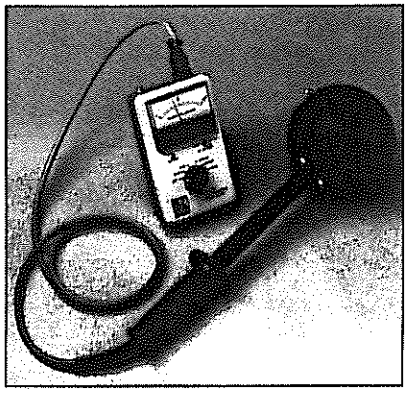
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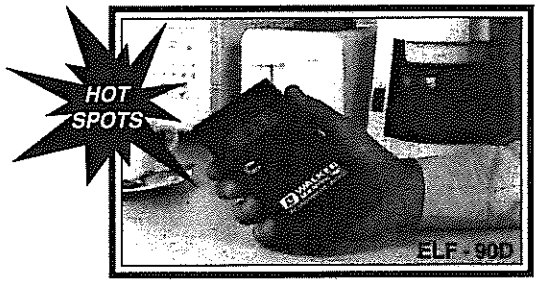
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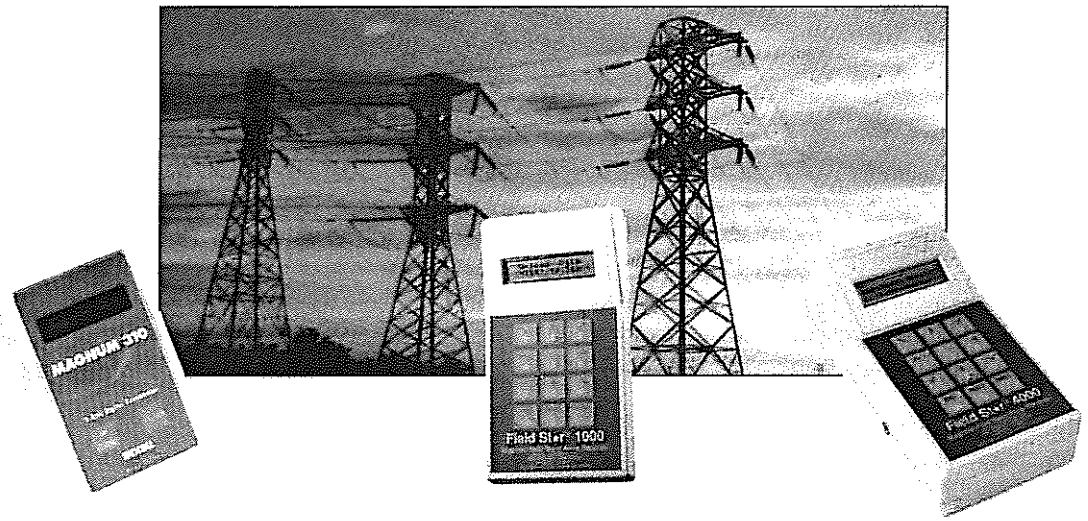
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No Consensus on Cellular Phone RF Radiation Levels in Brain

Measurements of the radiofrequency (RF) radiation absorbed in the brains of users of hand-held cellular phones are yielding vastly different results. The variation among labs is more than thirtyfold and some phones have been found to exceed the 1992 ANSI/IEEE C95.1 safety guidelines.

Well-publicized results from Dr. Om Gandhi's lab at the University of Utah, Salt Lake City, show that the maximum peak specific absorption rate (SAR) in one gram of tissue from a cellular phone with a power output of 0.6 watts is approximately 0.17 W/Kg. In contrast, Dr. Niels Kuster of the Swiss Federal Institute of Technology in Zurich has measured, under worst-case conditions, an SAR of 5.3 W/Kg. In the U.S., the ANSI/IEEE standard specifies a maximum SAR of 1.6 W/Kg averaged over one gram of tissue.

This lack of agreement has led to contradictory views about the safety of cellular phones. In a press release issued by the University of Utah in December—and widely reported in the U.S. media—Gandhi assured the public that RF exposures "are well within national safety standards." A month earlier, across the Atlantic, Kuster reached the opposite conclusion. "The present generation of mobile telephones may be questionable with respect to the current safety limits," he advised the German Federal Ministry for Post and Telecommunications in a report.

Dr. Quirino Balzano of Motorola Inc. has also been testing cellular phones at his lab in Fort Lauderdale, FL. "My data and Dr. Kuster's coincide," he told *Microwave News*.

(continued on p.13)

Florida Lawsuit Blames Couple's Rare Leukemia on EMFs

Leonard Glazer of Coral Gables, FL, claims that the chronic myelogenous leukemia (CML) that killed his wife, Elsa, and now threatens his own life was not a chance occurrence. In a suit filed on January 20 in Dade County Circuit Court, Glazer's lawyers argue that the extremely rare disease was caused by electromagnetic fields (EMFs) from Florida Power & Light Co. (FP&L) power lines outside the couple's bedroom.

Lawrence Marraffino of Boca Raton, who is representing Glazer, alleges that FP&L was negligent in failing to warn the couple about the possible health risks posed by EMFs, and, in particular, that it "withheld known scientific information" from the public. A trial date has not been set.

FP&L, which is based in West Palm Beach, maintains that an association between EMFs and cancer has not been proven. "Worldwide, numerous independent panels of experts have reviewed data on EMF research. None have concluded that EMF causes cancer," the utility argued in a written

(continued on p.12)

« Power Line Talk »

Dr. **Gilles Thériault**'s study of leukemia and brain cancer among EMF-exposed workers will be published in the March 15 issue of the *American Journal of Epidemiology*. (The journal is running behind schedule, but the issue should be out before the end of March.) Thériault, the director of the Department of Occupational Health at McGill University's medical school in Montreal, Canada, would not comment on the results prior to publication. But the three sponsoring utilities, **Electricité de France**, **Hydro-Québec** and **Ontario Hydro**, are preparing for the spotlight that shines on all major new studies. The word in the EMF community is that while the study finds some indications of elevated risk, it does not settle any of the nagging questions about the possible EMF–cancer link. Thériault had initially submitted his paper to *Science,* but the editors there did not think the subject was suited to their audience. Dr. **David Savitz**'s occupational study, sponsored by **EPRI**, will follow some months later. He reports that he intends to submit a manuscript for publication in the spring.

«« »»

The ***ABA Journal*** and ***Electrical World*** paint a dire picture of what could happen to utilities and insurance companies in the face of EMF lawsuits, adding to the growing literature on the subject (see *MWN,* M/A92 and N/D93). "This new litigation has the potential to open up a legal abyss that would dwarf the one created by asbestos," writes Roy Krieger in the January 1994 *ABA Journal,* which is published by the American Bar Association. He goes on to say that the "stage appears set" for the EMF–cancer debate to be resolved in the courtroom—not in the laboratory. "More studies exist that appear to link EMF exposure to an increased risk of cancer than existed linking asbestos exposure to an increased risk of cancer at a similar embryonic stage of asbestos litigation," he concludes. Dr. **Robert Park** of the American Physical Society, a longtime skeptic of EMF health effects, comments on the ABA article in his weekly e-mail column under the headline, "Electromagnetic Fields Attract Sharks." He notes that public concern over EMF health effects is "rising irrespective of its validity" but agrees that growing EMF litigation could eclipse asbestos suits. In the December 1993 *Electrical World* article, James Pierobon outlines what could happen if a plaintiff wins a case: "A decision against a utility would send shock waves through the electric utility industry and alter how utilities site power lines," he writes. "It could drive up the cost of insurance and compel many states to reassess the need for EMF regulations." Pierobon also says that even if a utility successfully defends an EMF suit, the legal costs can be very high, citing, as an example, the $2 million San Diego Gas & Electric Co. spent defending itself in the Zuidema case (see *MWN,* J/A91, N/D92 and M/J93)....The 376-page, fall issue of ***Shepard's Expert and Scientific Evidence Quarterly,*** a legal journal, is devoted primarily to EMF litigation, with chapters by John Burke Jr., Bruce DeBoskey, Linda Erdreich, Bruce Kelman, Marc Klein, Norman Sandler, John Ward and Michael Withey. The quarterly also features excerpts of expert testimony from the Zuidema case by Drs. Seymour Grufferman, Samuel Milham, Vikas Sukhatme and Peter Wright. For copies, contact: Shepard's/McGraw-Hill Inc., 555 Middle Creek Parkway, PO Box 35300, Colorado Springs, CO 80935, (800) 541-3334. A one year subscription costs $350; a single issue is $90.00.

«« »»

Many of the best-known members of the EMF research community will be speaking at this year's annual meeting of the **National Council on Radiation Protection and Measurements** (NCRP), to be held in Arlington, VA, April 6-7. The theme of the meeting is *ELF EMFs: Issues in Biological Effects and Public Health.* Dr. Thomas Tenforde chaired the program committee, with the help of Drs. Larry Anderson, Carl Durney, Leeka Kheifets, Granger Morgan, Charles Polk and David Sliney. There is no registration fee. For more information, contact the NCRP at (800) 229-2652 or (301) 657-2652.

«« »»

New Jersey Assemblyman **George Geist** introduced a resolution on January 24 asking the state Board of Regulatory Commissioners (BRC) to impose a two-year moratorium on the construction of new overhead transmission lines. "It is in the best interest of the public for the BRC, before permitting the construction of new high voltage transmission lines that may cause a threat to public health, to evaluate...information on electromagnetic fields...and develop a comprehensive policy," the resolution states. There is "growing scientific evidence that exposure to EMFs raises the risks of some types of cancer," it notes, adding that transmission lines have been constructed near homes and schools, "posing a potential public health threat." Residents of Washington Township, which falls within Geist's district in the southern part of the state, are actively opposing the construction of a substation and two 69 kV distribution lines by **Atlantic Electric Co.** (The company also faces an EMF personal injury lawsuit due to go to trial

Big Budget Increase for NERP

The National EMF Health Research and Communications Program (NERP) could get as much as $20 million next year, according to the President's budget, which was released in early February, as we go to press.

The fiscal year 1995 budget proposal asks for $6 million to continue DOE's "biological mechanisms research program" and $10 million for the NERP. If Congress goes along with the President's request and industry puts up its $10 million share in matching funds, the NERP would more than double next year.

"It's a very encouraging first step," Dan Vander Meer, one of the EMF program managers at NIEHS told *Microwave News.*

this spring; see *MWN,* N/D93.) Meanwhile, in **Indiana** on January 10, state Senator **Frank Mrvan** introduced a bill calling for a ban on new power lines of at least 115 kV, noting that such lines should not be allowed until it has been determined whether "rules are necessary to protect the public health from electric and magnetic fields." Bills banning the construction of new power lines have been introduced in other states but have not been enacted into law (see *MWN,* M/J91).

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Paul Brodeur appeared as a surprise witness at a power line hearing before the Energy Facility Siting Board in Providence, RI, last November, arguing that a power line proposed by **Narragansett Electric Co.** should be built underground. He spoke on behalf of the citizens of East Greenwich, one of three towns the 5-mile, 115 kV line would cross. In a telephone interview with *Microwave News,* Brodeur said that he had urged the siting board to consult with independent experts who could assess the scientific evidence on the health effects of EMFs. The utility had argued that Brodeur was not qualified to speak as an expert. " His background is in journalism, not science," said Narragansett spokesman Charles Moran. (Rhode Island press reports noted that, at the hearing, lawyers, administrators and utility representatives thumbed through the pages of Brodeur's latest work, *The Great Power Line Cover-Up,* which alleges that utilities and the government are concealing information about the health effects of EMFs.) Meanwhile, the town of East Greenwich has hired Providence lawyer **William Harsch**, who chaired the state's Public Utilities Commission in the 1970s, to argue its case. "The power company is being quite unreasonable," he said. "Why can't they bury the line?" Harsch noted that his clients are concerned about the power line's effects on property values and on health. Narragansett's Moran responded that there is no need to bury the line because the utility has agreed to build it along the far edge of an existing ROW, away from homes, and has also agreed to move an existing 115 kV line 200 feet to the site of the new line. As a result, he said, EMFs near the homes will drop from 20 mG to 1 mG. Governor Bruce Sundlun had discussed this option with the utility last summer, Moran said, when he vetoed two measures requiring that new power lines of at least 69 kV be built underground (see *MWN,* J/A93). Moran said that Sundlun had felt it would be a way to make the vetoes more palatable to power line opponents. In 1990, the East Greenwich town council banned all new power lines above 60 kV for three years (see *MWN,* N/D90). The moratorium was later overturned. The siting board will continue to hold hearings on the proposed line until the spring.

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The **Pennsylvania Power & Light Co.** (PP&L) and residents of **Scranton** have reached an agreement under which the utility will bury part of a new 2.7-mile, 138 kV line and build the rest in an industrial area, away from homes. The proposed settlement was filed on January 14 with the state Public Utility Commission (PUC), which is expected to decide whether to accept it by the middle of February, according to PUC spokesman John Frazier. PP&L's efforts to upgrade the old 69 kV line came at a bad time, it seems. Shortly after the utility first announced its plans, the media publicized an alleged cancer cluster among children living along the line. CBS's *Street Stories* and ABC's *World News Tonight* ran stories about it, on January 28 and April 6, 1993, respectively, featuring the city's mayor, Jim Connors. "Until the government tells us once and for all that EMFs don't cause cancer in children, they should not allow it in our neighborhoods," he told ABC. Under the plan, PP&L will bury a three-block section of the new line—which comes within 50 feet of houses—and remove an old overhead line that is there now, according to Joe Price of Dougherty, Leventhal & Price in Scranton, who is representing a neighborhood group. PP&L's David Osterhout said that EMFs aside, the utility would have removed the overhead line and built the new one in the industrial corridor for engineering reasons. Price told *Microwave News* that his clients felt better about PP&L burying the part of the line near homes when Dr. Samuel Milham, formerly of the Washington State Department of Health in Olympia, who testified for the PUC's Office of Trial Staff at a hearing before the commission, said that this option would be safe. EMFs directly above the buried line would not exceed 1.0 mG and they would be negligible five feet way, Price said. The Allentown-based utility also appears content with the plan: "PP&L decided to accept the settlement proposal because we believe it serves the best interests of our customers and everyone else involved," said utility spokesman Richard Beasley in a December 22 statement.

EMF Mitigation Tutorial

The IEEE's Power Engineering Society will sponsor a one-day training session on EMF mitigation techniques on April 14 at its *1994 Transmission and Distribution Conference and Exposition* in Chicago. It is being organized by Vernon Chartier of the Bonneville Power Administration (BPA) in Vancouver, WA.

The 12-part tutorial will cover all aspects of how to reduce EMFs from power lines, substations, appliances and transportation systems—whether the fields are in schools, residences or commercial buildings. Experts from Carnegie Mellon University, Electric Research and Management, Enertech Consultants, General Electric and IIT Research Institute will be among those making presentations. Background papers are being prepared and will be distributed to attendees.

Chartier advises people to reserve early, as attendance is limited to 100 and more than 15,000 are expected to come to the conference.

There will also be a training session on mitigating power line EMI on April 12, organized by Marv Loftness, a consultant based in Olympia, WA.

For more information on the April 14 workshop, contact Chartier at (206) 418-2615. For more on the April 12 EMI session, contact Loftness at (206) 357-8336.

Swedes Issue EMF Assessment; Action on Limits Due in Spring

Sweden's National Electrical Safety Board (NESB) has pushed back the timetable for action on EMF exposure limits. The board has released an interim report on possible health risks, but a full analysis of possible 2, 5 and 10 mG limits—and any proposed regulations—will not be issued until this spring, according to NESB's Henric Nilsson in Stockholm.

The report, published late last year, supports earlier government positions that embrace prudent avoidance while further research is conducted. In particular, the board reiterates the policy of the National Energy Administration that new schools, day-care centers and playgrounds should not be located where magnetic fields are above 2-3 mG. "NESB has not found any reason to reconsider this recommendation," the report states.

There is broad agreement in the scientific community that the connection between magnetic fields and cancer is not yet certain, the board concludes. But it adds that, "It seems that suspicion of such a link has strengthened." The board's assessment is based on a review of recent research—in particular, the Danish, Finnish and Swedish residential epidemiological studies and the analysis of their pooled data (see *MWN,* S/O 92, S/O93 and N/D93).

The board summarizes its views as follows: suspicion of a link between magnetic field exposures and childhood leukemia is "strong," suspicion of a link between occupational magnetic field exposures and cancer is "reasonable" and suspicion of a link between residential magnetic field exposures and cancer in adults is "weak."

Last year, the board—which has the authority to regulate EMF exposure—announced that it would examine the costs and benefits associated with limits of 2, 5 or 10 mG (see *MWN,* M/J93). This investigation was to have been completed by the end of the year, but it proved more complicated than expected, according to Nilsson. When the analysis is completed this spring, the board may present a proposed regulation or several regulatory options, Nilsson told *Microwave News*. It is also possible that the board will decide that recommendations, rather than rules, are sufficient, he added. Any proposed regulations would be circulated for comment among various government agencies.

The interim report, *Magnetfält och Cancer 1993,* is available only in Swedish. Contact: Stefan Villa, Elsäkerhetsverket (NESB), Box 1371, S-11193, Stockholm, Sweden, (46+8) 453-9700, Fax: (46+8) 453-9710. An overview in English was published by the Swedish power company, Vattenfall, in its newsletter, *E&B Extra* (No.4, December 9, 1993). Contact: Rolf Lindgren, Vattenfall Transmission AB, Folkungagatan 20, S-41102, Göteborg, Sweden, (46+31) 800302, Fax: (46+31) 156651.

Exposure Assessment Resources

J. Bowman et al., ***Electric and Magnetic Field Exposure, Chemical Exposure, and Leukemia Risk in "Electrical" Occupations*** (EPRI Report* TR-101723), December 1992.

Workers in "electrical" occupations are exposed to magnetic fields five times greater than those in "nonelectrical" jobs, according to surveys in Los Angeles, Seattle and New Zealand—where previous studies had found a higher leukemia risk (see *MWN,* J/A82, J/A89 and S/O91). This study was done by a group of researchers led by a team at the University of Southern California (USC). The electric field exposures were also "significantly greater" in Los Angeles and Seattle. The USC epidemiologists did not observe, however, a dose–response relationship between leukemia and EMF exposure. Importantly, they found that, compared to other workers, electrical workers were not exposed to higher levels of toxic chemicals (e.g., benzene) or ionizing radiation.

T. Bracken and R. Rankin, ***EMDEX Project Residential Study: Interim Report*** (EPRI Report* TR-102011), February 1993.

Bracken and Rankin found that houses in the very high current configuration category under the Wertheimer–Leeper coding scheme had, on the average, higher magnetic field levels than those in other categories. In general, there was a trend of higher field levels with wire codes, but there was considerable overlap, leading Bracken and Rankin to conclude that, "Wire code category was not a good predictor of magnetic field levels." These results are based on the first 17 months of a 25-month study at the homes of employees of 39 different utilities across the country.

P. Breysse et al., "ELF Magnetic Field Exposures in an Office Environment," ***American Journal of Industrial Medicine,*** *25,* pp.177-185, February 1994.

In response to office worker concerns over miscarriage risks from VDTs, this team from the School of Hygiene and Public Health at the Johns Hopkins University and OSHA measured EMFs in a payroll office. Time-weighted average magnetic field exposures of the office workers—from a variety of sources, including photocopiers, printers and the electrical distribution system, as well as VDTs—ranged from 1.0 to 6.5 mG with a mean of 3.2 ± 1.5 mG. The highest observed field was 27.4 mG. The team concludes that the exposures are "low when compared to electric utility linemen and other electrical environments." (See also, *MWN,* M/J91.)

C. Cartwright, P. Breysse and L. Booher, "Magnetic Field Exposures in a Petroleum Refinery," ***Applied Occupational and Environmental Hygiene,*** *8,* pp.587-592, June 1993.

Electrical workers in petroleum refineries experienced a large variation in magnetic field exposures. High voltage and low voltage electrical distribution workers were exposed to means of 11 mG and 13 mG, respectively, over a shift. Maintenance electricians, however, were exposed to less than 3 mG. In some cases, the high voltage workers were exposed to up to 2 G, averaged over a shift, with peak exposures as high as 18 G. EMF exposures in refineries are of interest because of the observed excess in brain tumors in the industry—see "Brain Tumors in the Chemical Industry," *Annals of the New York Academy of Sciences, 381,* 1982.

T. Dovan, W. Kaune and D. Savitz, "Repeatability of Measurements of Residential Magnetic Fields and Wire Codes," ***Bioelectromagnetics,*** *14,* pp.145-159, 1993.

Spot measurements and wire codes at a subset of homes Savitz used in his landmark study (see *MWN,* N/D86) were reassessed five years later, in 1990. Wire codes showed few changes over the years. Perhaps more surprisingly, spot measurements were relatively stable over a 24-hour period and were well correlated with those taken in 1985.

D. Goellner et al., ***Safety of High Speed Guided Ground Transportation Systems: EMF Exposure Environments — Summary Report*** (No. DOT/FRA/ORD-93/28), August 1993. Price not available at press time. Order from: National Technical Information Service, 5285 Port Royal Rd., Springfield, VA 22161, (800) 553-6847.

A survey of EMF exposures at home, at work and on mass transit systems—with the conclusion that the German TR07 maglev system "does not present any unusual ELF EMF exposures to passengers or crew." This report was prepared by Sanford Cohen & Associates in McLean, VA.

T. Jones et al., "Selection Bias from Differential Residential Mobility as an Explanation for Associations of Wire Codes with Childhood Cancer," ***Journal of Clinical Epidemiology,*** *46,* pp.545-548, 1993.

The association of childhood cancer and wire codes in the Savitz and Tomenius studies may be due, at least in part, to unintended bias in the selection of controls and cases, according to researchers from American Electric Power Service Corp. and Columbus Southern Power, both in Columbus, OH, working with Dr. Philip Cole of the University of Alabama, Birmingham. This bias is attributed to the observation that "high wire codes are associated with homes in which the residents are mobile and low wire codes...with homes occupied by stable residents."

W. Kaune et al., "Development of a Protocol for Assessing Time-Weighted Average Exposures of Young Children to Power Frequency Magnetic Fields," ***Bioelectromagnetics,*** *15,* No.1, in press, 1994.

Based on exposure measurements of 29 children, Kaune's team found that time-weighted averages of the magnetic fields measured throughout the children's homes were "highly correlated" with personal exposures as measured with AMEX-3D meters. They averaged 1.0 mG both inside and outside the home. The final protocol will be used in the National Cancer Institute childhood leukemia study led by Dr. Martha Linet (see *MWN,* J/F89).

W. Kaune and L. Zaffanella, ***Assessment of Children's Long-Term Exposure to Magnetic Fields (The Enertech Study)*** (EPRI Report* TR-101407), November 1992.

The most surprising finding of this study is that spot measurements were better predictors than contemporaneous personal exposure measurements of personal exposures that occurred at other times. Overall, Kaune and Zaffanella reported that wire codes and spot measurements predicted children's magnetic field exposures as successfully as more sophisticated techniques, which incorporate current load data. They proposed that residential magnetic fields have two components—one that is temporally stable, which can be captured by spot measurements, and a second, larger component, which varies over time.

M. Koontz et al., ***Assessment of Children's Long-Term Exposure to Magnetic Fields (The Geomet Study)*** (EPRI Report* TR-101406), November 1992.

Wire codes were found to be better surrogates than spot measurements for children's magnetic field exposures as measured by personal monitors (AMEX or EMDEX). Wire codes became more strongly correlated when spot measurements were averaged over two seasons. The researchers concluded that, "A single monitoring episode may not characterize long-term exposure, and single spot measurements at one point in time may not adequately predict exposure."

M. Sandström et al., "A Survey of Electric and Magnetic Fields Among VDT Operators in Offices," ***IEEE Transactions on Electromagnetic Compatibility,*** *35,* pp.394-397, August 1993.

For a study of skin rashes among office workers, these Swedish researchers from Umeå measured ELF and VLF EMFs 50 cm from the front of VDTs and elsewhere in 150 offices. VDTs were a major source of ELF magnetic fields (but not electric fields), with median levels of 2.1 mG. Background fields were 0.7 mG, but higher than 5.0 mG in some offices. They also found that EMFs from VDTs of the same model can vary greatly, which agrees with Richard Tell's survey for the NIOSH VDT study (see *MWN,* M/A91).

D. Savitz and W. Kaune, "Childhood Cancer in Relation to a Modified Residential Wire Code," ***Environmental Health Perspectives,*** *101,* pp.76-80, April 22, 1993.

Using a new three-category coding scheme—a simplification of the Wertheimer-Leeper and original Savitz wire codes—Savitz and Kaune found a stronger and more precise association between high current transmission lines and leukemia and brain tumors in children. The risk of leukemia for children living near transmission lines designated as high wire code (HWC) was nearly three times higher than for those living near low wire code (LWC) lines. For brain tumors, the risk for HWC residents was two-and-a-half times that of LWC residents. They call the intermediate exposure level medium wire code (MWC).

L. Zaffanella, ***Survey of Residential Magnetic Field Sources: Interim Report*** (EPRI Report* TR-100194), September 1992. ***Final Reports Volume 1: Goals, Results, and Conclusions*** (EPRI Report* TR-102759-V1), September 1993; ***Volume 2: Protocol, Data Analysis, and Management*** (EPRI Report* TR-102759-V2), September 1993.

This survey of approximately 1,000 homes throughout the U.S. identifies the sources, strengths and temporal variability of household 60 Hz magnetic fields. Average spot measurements exceeded 1 mG in 28% of the homes, with 6.7% exceeding 2.5 mG and 1.8% exceeding 5 mG. The largest contribution came from overhead power lines—considering this source alone, 3.3% of the homes averaged more than 2.5 mG and 0.3% had fields of more than 5 mG. The highest localized magnetic fields were produced by electric appliances, but these fields decreased quickly with distance. Zaffanella also found that magnetic field measurements made with a STAR magnetic field recorder were correlated with the Wertheimer-Leeper wire codes. He did this work while he was with EPRI's High Voltage Transmission Research Center in Lenox, MA. Zaffanella recently joined Enertech Consultants in Lee, MA.

* The Electric Power Research Institute (EPRI) is revising the pricing policy for its reports. For ordering information, contact: EPRI Distribution Center, 207 Coggins Dr., PO Box 23205, Pleasant Hill, CA 94523, (510) 934-4212.

Legal Notebook

Decision Due in Seattle Electrical Worker Case

Closing arguments have been filed in the case of Seattle City Light cable splicer and maintenance technician Robert Pilisuk, who worked at the utility for seven years until he died of acute lymphocytic leukemia in 1989 at the age of 44. The claim, brought by Pilisuk's widow, Mimi Handlin, in March 1991, was heard by the Board of Industrial Insurance Appeals in Seattle after being rejected by the Department of Labor and Industry in March 1992 (see *MWN,* M/A91 and M/J92). Handlin is seeking pension benefits for herself and her three children. Judge Linda Williams, who presided over the hearings, will issue a recommendation to the board, which will then have six months to make a decision.

In their closing statement, filed on January 21, Handlin's lawyers argued that the electrical worker's cancer was caused by on-the-job exposure to EMFs. On the basis of evidence they presented in the case, they asserted that Pilisuk's average occupational EMF exposure was 12.6 mG. "The epidemiological and laboratory research supports the conclusion that workers exposed to such high magnetic field exposures are at increased risk of leukemia," argued Michael Withey of Schroeter, Goldmark & Bender in Seattle. During the hearings, Withey introduced 43 studies that he said showed a statistically significant association between leukemia and occupational exposure to EMFs—including that of cable splicers (see *MWN,* N/D89, J/A91 and M/A93).

Attorneys for Seattle City Light rejected Withey's arguments. "There is not a single statement in all of this documentary evidence which expresses the view that 60 Hz magnetic fields cause any type of cancer, much less leukemia," wrote Mark Warnquist of LeBoeuf, Lamb, Greene & MacRae in Denver and Betty Ngan, assistant city attorney, in their closing brief. "The record cannot support a conclusion that Mr. Pilisuk's leukemia was naturally and proximately caused by occupational exposure to EMF," they concluded. In a telephone interview, Warnquist said that, "There is no basis to say that magnetic fields cause cancer."

Expert witnesses for the Pilisuk family included: Drs. Abraham Liboff of Oakland University, Rochester, MI; Samuel Milham, retired from the Washington State Department of Health, Olympia; Fred Ramsey of Oregon State University, Corvallis; and Peter Wright, now deceased, of the Poly Clinic, Seattle.

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

Expert witnesses for Seattle City Light included: Drs. Fred Applebaum, Steven Collins and Noel Weiss of the University of Washington, Seattle; Dr. John Moulder of the Medical College of Wisconsin, Milwaukee; and Laurie Oppel of Power Technologies Inc. in Schenectady, NY.

Slater School Case Moves Forward

A California judge has refused to grant Pacific Gas & Electric Co.'s (PG&E) request to dismiss a lawsuit brought by students and staff of the Slater School in Fresno and others from the area. The utility had argued in a December 9 motion that the state Public Utilities Commission has exclusive jurisdiction over EMFs. But at a January 27 hearing, Fresno County Superior Court Judge Stephen Kane did agree to drop one of the charges—negligent infliction of emotional distress—against the utility.

These are the latest developments in a case that is the largest EMF lawsuit to date. News of a cancer cluster at the Slater School was first brought to public attention by Paul Brodeur in an article in *The New Yorker* more than a year ago (see *MWN,* N/D92). There are now 35 plaintiffs claiming personal injury, property devaluation or both from PG&E's Fresno power lines. About half of the plaintiffs have cancer: five are former Slater students, three are members of the community living near the same 115 and 230 kV lines that run by the school and ten are present or former Slater teachers, according to their lawyer, Joseph Davis of Davis & Winston in Los Angeles. The current lawsuit was begun by the family of Curtis Hurd Jr., an assistant principal at the school who died of cancer (see *MWN,* J/A93), and the other plaintiffs joined the case last September. A trial date has not been set.

PG&E attorney Roger Rizzo of the San Francisco firm of Sedgwick, Detert, Moran & Arnold said that the number of claimants added to the Hurd suit has no substantive effect on the case. "It doesn't change the underlying facts, theories or defenses, even though it sounds like a relatively large number of people," he told *Microwave News*.

Meanwhile, the California Department of Health Services (DHS), which issued a report on the cancer cluster last June, has confirmed one more cancer case among Slater staff, bringing the total number to 15. In his *New Yorker* article, Brodeur had claimed that the DHS did not make enough of an effort to count cancer cases among former school employees (see *MWN,* J/F93 and M/A93). The DHS continues to maintain that the cluster was probably due to chance. "There's always an element of uncertainty, but we have not revised our conclusions," said Dr. Eva Glazer of DHS's cancer surveillance section in Berkeley. The breakdown of the 15 cases—which include cancers of the breast, uterus and colon—is "similar to what one would expect in any group of adults," Glazer wrote in an October 28 letter to Davis.

An earlier claim brought by the family of a Slater teacher who died of a brain tumor, Katie Mae Alexander, was dropped after the family's request for a continuance was denied. Alexander had worked in classrooms closest to the pow-

New York Landowners Settle Marcy-South Case

The Criscuola brothers of Downsville, NY, settled their claim with the New York Power Authority (NYPA) on February 7 for $24,000 to cover damages and court and legal fees. The New York City-based utility has also agreed to return a 2-acre plot that was taken for use as an access road to the 345 kV Marcy-South power line, which runs across the Criscuolas' property.

Last October, New York's highest court, the Court of Appeals, ruled that the Criscuolas had the right to seek compensation for losses in property value due to perceived health threats from power line EMFs, whether or not the risks are real (see *MWN,* S/O93 and N/D93).

"My clients are happy," said New York City attorney Michael Rikon, who represents the Criscuolas. Rikon's clients had originally requested $50,000 in damages from the NYPA, claiming that "cancerphobia" due to power line EMFs would affect the market value of their land. The utility had already paid the brothers more than $5,000 for two easements it took on their property.

"There was no point for the NYPA to spend any more time, energy or money on this controversy," the utility's assistant general counsel, Arthur Cambouris, told *Microwave News*. He said that the landowners had a "difficult time showing that market value was diminished in 1985 as a result of the power line" and that the NYPA "doesn't need to spend many tens of thousands of dollars to make that point when we can resolve this amicably." Cambouris also said that the easement the NYPA planned to use as an access road would have been returned to the Criscuolas anyway, because the utility decided to use another route.

Michael Gurda of Gurda, Gurda & Smith in Middletown, NY, who is representing ten other landowners who filed suits in connection with the Marcy-South line, said that hearings for these cases will begin on March 15 at the New York Court of Claims in Goshen. Gurda said that his clients are "battle-worn from a long, time-consuming procedure" and that they might be inclined to settle in the face of further appeals.

For more on the Marcy-South litigation, see *MWN,* M/A87, S/O89, J/F90 and N/D92.

er lines, where EMFs reached a long-term average of about 1 mG and generally did not exceed 2 mG, according to DHS's report. Davis disputed these measurements, claiming that the meters used to measure the magnetic fields may not have been properly calibrated and that readings were not taken from underground distribution lines near the classrooms.

CT Court Allows Discovery in Compensation Case

Lawyers for a lineman who worked for United Illuminating Co. (UI) and died of a brain tumor have received permission from a Connecticut court to obtain information from the utility—such as whether it knew about a possible link between EMFs and brain tumors or had measured employees' exposures to EMFs.

In Connecticut, claimants in workers' compensation cases are, as a matter of course, not entitled to discovery, said James Horwitz of the Bridgeport firm of Koskoff, Koskoff & Bieder, who is representing the widow of lineman George Watmough. Horwitz noted, however, that the court often makes exceptions, as it did in this instance. "Everybody recognized that in this case it was necessary," he told *Microwave News*. Horwitz's request was granted by the state's Third District Workers' Compensation Commission in New Haven last December.

Watmough's employment at the New Haven-based UI began in 1974. He was diagnosed with a glioblastoma in May 1990 and died in February 1992 at the age of 38.

Fiona Phelan, a UI spokeswoman, said that she could not comment on pending litigation. The utility's lawyer, John Letizia of Wiggin & Dana in New Haven, did not return telephone calls.

Two years ago, a Swedish electrician who developed a brain tumor received a workers' compensation award for his illness. That was the first time a government recognized occupational exposure to EMFs as a cause of cancer (see *MWN,* N/D92).

Two Charges Dropped in Meadow Street Case

A Connecticut judge has agreed to a request by Northeast Utilities to drop two of 11 charges against the power company in connection with one of the Meadow Street cases. A claim by Jack Walston alleging "injury from an ultrahazardous activity" was stricken on October 18, as was his charge that the utility had violated the state's Unfair Trade Practices Act by telling the public that the electricity in its power lines did not pose a health hazard, according to the utility's attorney, Anthony Fitzgerald of Carmody & Torrance in New Haven.

Michael Koskoff of Koskoff, Koskoff & Bieder, who is representing Walston, did not return repeated telephone calls seeking comment.

In his suit, filed on January 14, 1992, in Superior Court in New Haven (see *MWN,* J/F92), Walston alleges that EMFs from power lines and from a substation owned by the Berlin-based utility and its affiliate, Connecticut Light and Power Co., caused his benign brain tumor. Walston's was the second suit filed against the utility by a resident of Meadow Street in Guilford. The first was brought on December 14, 1991, by Walston's next-door neighbors, Melissa Bullock and her mother, who claim that Melissa's malignant brain tumor was caused by EMFs from the same electrical equipment. Trial dates have not been set for either case.

Meadow Street was catapulted into the spotlight by a 1990 article in *The New Yorker* by Paul Brodeur, who argued that the brain tumors and other health problems among residents of the one-block street were caused by EMFs (see *MWN,* S/O90, N/D90 and M/A91).

Motorola Employee's Suit Claims Cell Phone Tests Caused Tumor

A veteran Motorola Inc. research engineer, Robert Kane, filed suit against his employer in December, alleging that his brain tumor was caused by exposure to radiofrequency (RF) radiation from a prototype cellular telephone antenna. The claim was rejected by Motorola, whose spokesman said it does not "stand a prayer in the courts." Nevertheless, the case has rekindled the controversy over the safety of cellular phones.

In a series of tests in the fall of 1984, Kane used a hand-held phone with an experimental compact antenna. "Due to the structure of the antenna," Kane's complaint states, he was exposed to "an unsafe energy density level." Kane used the phone in a residential neighborhood and in an open field near Motorola's Schaumburg, IL, headquarters while other engineers monitored the transmissions. The antenna was on the top of the unit, Kane alleges, about 1 cm from his skull, just above his right ear. His inoperable tumor is in the right temporal lobe of the brain—in line with the antenna location, according to the complaint, which was filed December 13 in Cook County, IL, Circuit Court.

David Reynard, whose lawsuit against NEC was the first cellular phone–brain tumor claim, has made a similar argument about the location of the tumor that killed his wife. For an update on this case and others, see box below.

Motorola flatly denied Kane's charges at a press conference on December 17, the day after a CBS news magazine broke the story of the lawsuit. Motorola spokesman Albert Brashear said that the phone Kane tested had the antenna on the bottom, close to the jaw. He also maintained that the test unit operated at just 0.1 watts, substantially less than the 0.6 watt output power of the hand-held cellular phones now in use.

In an interview with *Microwave News,* Gina Fietsam, one of Kane's attorneys, countered: "We have the test data from 1984" to show that Kane was exposed to high RF levels. She declined to disclose the actual energy absorption levels that she believes Kane experienced. Fietsam made a particular point, however, of Kane's charge that his manager, Thomas Hull, had asked whether Kane "was feeling any heat" during the tests. She argued that, "They obviously knew that he might experience heat if they asked him that question." She declined to say if Kane did, in fact, feel warming in his head. Commercially available cellular phones and portable radios operate at power levels generally agreed to be incapable of heating tissue.

Fietsam, of the Chicago firm of Holstein, Mack & Klein, is also handling the Crist and Pogue brain tumor cases and the class action that was dismissed last summer (see below).

Dr. Quirino Balzano, vice president of Motorola's land mobile products sector, argued at the press conference that the calculations which led Kane to believe that he had been exposed to high RF levels were flawed. He said that Kane had talked to Motorola officials, before he decided to sue, about the possibility that the testing was responsible for his brain tumor. But his reasoning was "totally void of any physical foundation," Balzano said. Calling Kane's ideas "personal theories," he concluded that, "He has not been exposed to the power levels he alleges."

Kane's complaint asserts that Motorola research conducted from 1976 to 1982 demonstrated that "transmit antennas operating very close to a human head could not comply with electromagnetic energy exposure safety standards." (See also, p.1.) Kane has worked for 21 years as a Motorola research engineer, and he holds 47 patents.

Balzano, Hull and another manager, James Phillips, are all named with Motorola in the suit.

The claim of injury from an acute RF exposure—both sides agree that Kane's total cellular phone use amounted to just a few hours—is in sharp contrast with the argument in the other three brain tumor cases now pending against cellular

Brain Tumor Class Action Denied; Individual Claims Refiled

After a hearing in Chicago on December 21, Illinois Circuit Court Judge Edwin Berman rejected a class action filed on behalf of cellular phone users who have brain tumors, but he said that the claims of the two plaintiffs who were named in the suit could be refiled as standard injury claims.

The plaintiffs, Matthew Crist and William Pogue, who are suing Motorola and NEC America Inc., respectively, are represented by attorneys with Holstein, Mack & Klein and two other Chicago firms (see *MWN,* J/A93). The lawyers have asked Berman to reconsider his decision, but they also have refiled the claims as individual cases. Last summer, Berman denied a request by the same group of lawyers to establish a class action on behalf of all cellular telephone users, claiming breach of warranty, among other things, because the manufacturers had failed to provide safe products. An appeal of that decision is pending.

In St. Petersburg, FL, one of two main defendants has been dropped from the case brought by David Reynard, who alleges that cellular phone radiation caused or promoted the brain tumor that killed his wife (see *MWN,* M/J92). The claim against the service provider, GTE Mobilnet of Tampa Inc., was dismissed in early November. Compared with the case against NEC, the manufacturer of the phone, it would be "more difficult to establish a case against GTE under conventional products liability law," explained John Lloyd, Reynard's attorney. Lloyd, based in St. Petersburg, said the case was dismissed without prejudice and could be refiled. GTE Mobilnet is part of GTE Corp. in Stamford, CT.

Meanwhile, attorneys for Reynard and for NEC have revealed who they expect will testify. NEC has selected a number of experts who are well known in the bioelectromagnetics community, including: Dr. Eleanor Adair of the John Pierce Laboratory in New Haven, CT; Dr. Andrew Bassett, formerly of Columbia University, New York City; Dr. Linda Erdreich of Bailey Research Associates Inc. in New York City; Dr. Bill Guy, formerly of the University of Washington, Seattle; Dr. Don Justesen of the VA Hospital in Kansas City, MO; Dr. James Lin, University of Illinois, Chicago; and Dr. Kristian Storm III of the Comprehensive Cancer Center, University of Wisconsin, Madison. Reynard's experts include: Dr. John Holt of Perth, Australia; Dr. Jan Leestma of Chicago; and Dr. Reimer Wolter of the University of Michigan, Ann Arbor. Holt was deposed in Hawaii in mid-January.

phone manufacturers. These allege that long-term phone use causes or promotes brain tumors. Nonetheless, the case revived the controversy that has dogged the industry since last January (see *MWN,* J/F93, J/A93, S/O93 and N/D93).

Kane's allegations were first reported on December 16 by the CBS program *Eye to Eye with Connie Chung,* which portrayed the story as "an industry insider" warning of the dangers of cellular phones. "My opinion is that portable cellular transmitters, portable cellular telephones are not safe to operate," Kane told CBS reporter Roberta Baskin. Motorola's Brashear argued the next day that the suit was "a corporate stickup" and that Kane's attorneys were using "junk science and tabloid television" to exact payment from the company.

WHO Issues Health Review of 300 Hz-300 GHz EM Radiation

The World Health Organization (WHO) has issued a report, *Electromagnetic Fields (300 Hz-300 GHz),* which reviews the bioeffects and health literature through 1990. The report reaffirms the exposure guidelines for the frequencies 100 kHz to 300 GHz adopted by the International Radiation Protection Association (IRPA) in 1984 and modified in 1988 (see *MWN,* Mr84 and J/F88).

The report was written by a task group assembled for WHO by IRPA—which has now become ICNIRP, the International Commission on Non-Ionizing Radiation Protection (see *MWN,* J/A92). Dr. Michael Repacholi of the Australian Radiation Laboratory in Yallambie, the chairman of ICNIRP, led the task group.

The exposure guidelines are based on maximum whole-body specific absorption rates (SARs) of 0.4 W/Kg for workers and 0.08 W/Kg for the general public. These are designed to limit an increase in body temperature to less than 1ºC, with safety factors "to allow for unfavorable, thermal, environmental and possible long-term effects."

For partial-body exposures, a local SAR of 20 W/Kg is recommended "to avoid excessive local temperature elevations," with the added caveat that the "eye may need special consideration."

Among the task group's other conclusions are:

- "The possibility that exposure to RF fields might influence the process of [animal] carcinogenesis is of particular concern. So far, there is no definite evidence that irradiation does have an effect, but there is clearly a need for further studies to be carried out."
- "A safe limit for [1-10 ∝s] pulses cannot be identified on the basis of available evidence."
- "The effects of [AM RF fields] at the cellular, tissue and organ levels cannot be related to adverse health effects."

The members of the WHO–IRPA task group are: Prof. J. Bernhardt (Germany), Dr. C. Blackman (U.S.), Dr. L.A. Court (France), A. Duchêne (France), Prof. M. Grandolfo (Italy), Dr. M. Repacholi (Australia), Dr. R. Saunders (U.K.), Prof. M. Shandala (Russia), Dr. J. Stolwijk, (U.S.), Dr. M. Stuchly (Canada), Dr. M. Swicord (U.S.), Dr. L. Szabo (Hungary) and Dr. S. Szmigielski (Poland).

Electromagnetic Fields (300 Hz-300 GHz), Environmental Criteria No.137, 1993, which is in English with summaries in French and Spanish, is available for $30.60 from: WHO Publications Center, 49 Sheridan Ave., Albany, NY 12210, Order No.1160137. It is also available for 34 Swiss francs from: WHO Distribution and Sales, 1211 Geneva 27, Switzerland. Many countries have a local sales agent for WHO publications.

Industry Epidemiological Studies

Cellular telephone companies are funding two epidemiological studies designed to examine the possible health effects of RF radiation.

On December 13, Dr. George Carlo, who is leading the Cellular Telecommunications Industry Association's (CTIA) research program, announced that Drs. Kenneth Rothman and Nancy Dreyer of Epidemiology Resources Inc. in Newton Lower Falls, MA, would do a large-scale study of portable phone users. It will be "very expensive," Carlo told *Microwave News.*

At its December 17 press conference, Motorola said that it was in the midst of a company-wide study of brain tumors and other types of cancer. Preliminary results from Dr. Robert Morgan of Environmental Health and Strategies Inc. in Redwood City, CA, show that, since 1985, Motorola's 60,000 employees had a lower-than-expected rate of neurological cancers.

UK's NRPB Revises EMF and RF/MW Radiation Rules

The U.K.'s National Radiological Protection Board (NRPB) has released new exposure guidelines for non-ionizing electromagnetic radiation from 0-300 GHz. Overall, they are little changed from those issued in 1989 (see *MWN,* J/A89).

The "basic restrictions" for workers and the general public are given primarily in terms of current densities and SARs—quantities that the NRPB concedes "cannot be obtained directly by means of a measuring instrument." Measurable electric and magnetic field strengths, called "investigation levels," are given to help assess compliance with the basic restrictions but are not enforceable.

Induced currents for 10 Hz-1 kHz may not exceed 10 mA/m^2. Above and below that range, the limit is a function of frequency. The investigation levels for 50/60 Hz are 13-16 gauss and 10-12 kV/m for magnetic and electric fields, respectively.

For 100 kHz-10 GHz the basic restrictions continue to limit average whole-body SARs to 0.4 W/Kg—now averaged over 15 minutes, as opposed to 6 minutes. Partial-body SARs in the fetus, head, neck and trunk are now 10 W/Kg averaged over 6 minutes. For limbs, SARs can reach 20 W/Kg. For 10-300 GHz, the maximum power density is 10 mW/cm^2.

An NRPB research review completed in 1992 and a follow-up report issued last year both downplayed the possibility of EMF or RF/MW health risks (see *MWN,* M/A92 and N/D93). In the new guidelines, the NRPB again takes this

EPA Assails ANSI RF/MW Standards as Seriously Flawed

The Environmental Protection Agency (EPA) has come out strongly against the Federal Communications Commission's (FCC) proposal to adopt the ANSI/IEEE C95.1-1992 standard on RF/MW exposure, contending that the standard has "serious flaws" and questioning whether it is "sufficiently protective of public health and safety." In comments filed on November 9, 1993, in response to a request made last April by the FCC (see MWN, *M/A93), EPA criticizes, in particular, the standard's different limits for "controlled" and "uncontrolled" environments and the failure to consider nonthermal effects. It recommends that the FCC adopt the exposure limits recommended by the National Council on Radiation Protection and Measurements (NCRP) in 1986 (see* MWN, *M/J86). This is not the first time the C95.1 standard has been criticized. Last year, a research group at Kirtland Air Force Base, NM, adopted stricter limits (see* MWN, *S/O93).*

In its comments, filed on November 10, 1993, the Center for Devices and Radiological Health (CDRH) of the Food and Drug Administration (FDA) calls the new standards "appropriate," except for the "low power exclusion clause."

The deadline for submitting comments to the FCC was January 25, with reply comments due on February 24. The agency had originally set deadlines of August 13 for comments and September 13 for reply comments, but these were extended three times. The FCC granted the first delay to the National Association of Broadcasters (NAB) to complete a study intended to help broadcasters comply with the new guidelines. In early November, CBS Inc., Capital Cities/ABC Inc. and Hammett and Edison Inc. requested a further extension to January 11 so they could review the NAB study as well as data from Dr. Om Gandhi's lab at the University of Utah. CBS then asked for another two-week delay when it was unable to obtain equipment to complete induced current measurements in time. Most comments were filed at the FCC deadline—too late to be included here.

EPA's Recommendations

1. The FCC should not adopt the 1992 ANSI/IEEE standard. There are serious flaws in the standard that call into question whether the proposed use of 1992 ANSI/IEEE is sufficiently protective. The following four points address some of our concerns: a) 1992 ANSI/IEEE allows a twofold increase in the [maximum permissible exposures] at high frequencies above that permitted by the current FCC guideline; b) The two-level revised standard is not directly applicable to any population group but is applicable to exposure environments called controlled and uncontrolled environments that are not well defined and are discretionary. We disagree with this approach; c) The 1992 ANSI/IEEE conclusion that there is no scientific data indicating that certain subgroups of the population are more at risk than others is not supported by NCRP and EPA reports; d) The thesis that the 1992 ANSI/IEEE recommendations are protective of all mechanisms of interaction is unwarranted because the adverse effects level in the 1992 ANSI/IEEE standard is based on a thermal effect.

2. The FCC should consider the exposure criteria recommended by the NCRP in Report No. 86, *Biological Effects and Exposure Criteria for Radiofrequency Electromagnetic Fields,* with the addition of: a) The 1992 ANSI/IEEE limits for induced and contact RF currents, for the frequency range of 300 kHz to 100 MHz, to protect against shock and burn, and b) The FCC proposal for low power device exclusions as the standard for the public, where "public" includes all persons using these devices unless the user is operating a device as a concomitant of employment. EPA recommends consideration of 1986 NCRP for the following reasons: a) 1986 NCRP recommends RF radiation exposure limits specifically for both workers and the public; b) 1986 NCRP is more protective than 1992 ANSI/IEEE at higher frequencies; c) There are no substantive differences in the literature base supporting the 1986 NCRP and 1992 ANSI/IEEE except for the literature on RF shocks and burns. In addition, NCRP is chartered by the U.S. Congress to develop radiation protection recommendations.

3. The FCC should consider requesting that the NCRP revise its 1986 report to provide an updated, critical and comprehensive review of the biological effects on RF radiation and recommendations for exposure criteria.

FDA–CDRH's Comments

...We feel that the replacement by the FCC of the ANSI C95.1-1982 guidelines with most of the provisions of the ANSI/IEEE C95.1-1992 guidelines is appropriate and will provide a greater level of protection to the general public....

There is, however, one provision with which we must disagree....The concept of limiting the SAR induced in the body appears to be disregarded...[by] a "low-power exclusion clause" that exempts certain RF devices from the provisions of the standard only because they emit less than a specified amount of power. Recent data from technical publications and other sources indicate that certain lower-powered RF devices, such as handheld, portable, two-way radios, cellular phones, and other personal communication devices can induce relatively high SARs in portions of the body of nearby persons. Indeed, some devices that meet the requirements of the low-power exclusion clause can induce SARs that *exceed* the local-SAR limits specified elsewhere in the same standard—making the standard appear self-contradictory....

With respect to the specific levels cited in the standard for maximum permissible exposures and SARs...we do not believe this standard addresses the issue of long-term chronic exposures to RF fields....

In conclusion, CDRH recommends approval of the Proposed Rule, with the exception of the exclusion clause for low-power devices. In addition, we recommend that the scientific literature be closely monitored for possible evidence that the exposure levels cited by the new standard may need to be reduced....In our view, the adoption of the 1992 ANSI standard furthers, but does not end, our respective RF protection efforts.

stance, arguing that "there is no firm evidence" for an EMF–cancer link. "Some of the evidence is likely to have been distorted by bias against the reporting or publishing of negative results," according to the guidelines.

The complete text of the guidelines, "Restrictions on Human Exposure to Static and Time-Varying Electromagnetic Fields and Radiation," appears in *Documents of the NRPB, Vol.4,* No.5, pp.7-63, 1993. A shorter overview, "Guidelines on Limiting Exposure to Electromagnetic Fields," by Dr. Alastair McKinlay, one of the five authors of the new rules, appears in NRPB's *Radiological Protection Bulletin,* No.148, pp.19-24, 1993. For more information, contact: NRPB, Chilton, Didcot, Oxon OX11 0RQ, U.K., (44+235) 831600, Fax: (44+235) 833891.

Miscarriage Risk for Therapists Using Microwave Diathermy

Physical therapists who administered microwave (MW) diathermy during or shortly before their first trimester of pregnancy had a significant 28% higher risk of miscarriages, but those who used shortwave (SW) diathermy had no excess pregnancy loss, according to a new study from the Johns Hopkins University School of Hygiene and Public Health in Baltimore. The miscarriage risk doubled as the number of MW treatments increased—a trend which is also significant.

Writing in the November 15 issue of the *American Journal of Epidemiology* (*138,* pp.775-786, 1993), Drs. Rita Ouellet-Hellstrom and Walter Stewart suggest that the difference in risk may be due to the different frequencies of the two types of diathermy—MW operates at 2,450 MHz and SW at 27.12 MHz—and the variation in the levels of stray emissions from the units.

The Johns Hopkins researchers did not do their own exposure measurements, but based them on those published by the Food and Drug Administration (FDA). In 1980, Paul Ruggera reported that leakage from certain MW diathermy units reached as high as 15 mW/cm^2, but only 8.32 mW/cm^2 for SW devices. Physical therapists, who use diathermy to increase the blood flow to patients' deep muscle tissues, receive significant exposures only if they give many treatments and stand close to the leakage area, according to Ouellet-Hellstrom and Stewart.

The FDA proposed an exposure standard of 10 mW/cm^2 at 5 cm for MW diathermy devices, but it was never adopted (see *MWN,* F81 and J/F82).

In an interview with *Microwave News,* Stewart said that the connection between MW diathermy use and miscarriages is "not likely to be spurious" given the size of the study. There were 1,753 miscarriages matched with an equal number of normal pregnancies as controls. Given the rough estimates of exposure, Stewart said, "It would be remiss to say that the radiation is causing the MW diathermy–miscarriage association." He has begun a pilot study to see if there is variability in the emissions from different diathermy units that would warrant interviewing subjects again and reanalyzing the data.

Ouellet-Hellstrom, who is now with SRA Technologies Inc. in Falls Church, VA, said that while frequency difference might explain the association—for instance, MW radiation is absorbed by watery tissues, such as amniotic fluid, in greater quantities than SW radiation—she could not rule out other causal factors, such as chemicals, that could be correlated with MW diathermy use.

Previous studies have linked SW diathermy use to reproductive and other health problems. A Danish team led by Dr. Anders Larsen found that exposed female therapists gave birth to fewer boys, who tended to have low birth weights (*Scandinavian Journal of Work, Environment and Health, 17,* pp.324-329,1991; see also, pp.318-323). Dr. Bengt Källén and colleagues in Sweden found an increase in stillbirths and birth defects among exposed SW diathermy therapists (see *MWN,* Jun82). And a 1983 study by Dr. Stanford Hamburger at the FDA found a significant link between SW diathermy use and heart disease in male therapists (see *MWN,* J/F84).

Stronger Dose–Response in Finnish VDT–Pregnancy Study

In a further analysis of their 1992 study, Finnish researchers have found a stronger dose–response relationship between miscarriages and the extremely low frequency (ELF) EMFs from video display terminals (VDTs).

Writing in the November 15, 1993, issue of the *American Journal of Epidemiology (AJE),* Drs. Marja-Liisa Lindbohm and Maila Hietanen of the Institute of Occupational Health in Helsinki and their coworkers presented new data which show that the miscarriage risk increases with both the length of exposure and the strength of the magnetic field. They cautioned, however, that this analysis is based on a small number of cases and that its statistical reliability is, therefore, low.

The group found that women exposed to more than 3 mG (rms) for up to ten hours a week were three times more likely to miscarry and that this risk reached more than four times among those exposed over ten hours a week—this latter finding is statistically significant. These risks are relative to those of VDT users exposed to less than 1.3 mG for less than ten hours a week.

In 1992, the Finnish researchers reported that workers using terminals with ELF EMFs greater than 3 mG, measured at 50 cm, had an almost three-and-a-half times greater risk of miscarrying than women who used low emission VDTs (see *MWN,* M/A92 and M/J92). At that time, they did not detail how the risk changed with the number of hours at a high or low EMF VDT. Their paper was published in the November 1, 1992, issue of *AJE.*

"The additional data analysis that the Finns provided definitely strengthens a causal interpretation," Dr. Michele Marcus of the School of Public Health at Emory University in Atlanta told *Microwave News.* Similarly, Dr. Teresa Schnorr at the National Institute for Occupational Safety and Health in Cincinnati said that the new analysis provides "a little better evidence" of a relationship between EMFs and miscarriage.

In letters to *AJE,* Marcus and Schnorr had suggested the expanded analysis to test the strength of the EMF–miscarriage link.

The Finns are still at a loss to explain a seemingly counterintuitive finding, however: Women who did not use VDTs were two-and-a-half times more likely to miscarry than women who used low emission VDTs. They speculated that some "unmeasured risk factors," or "chance," might account for the higher-than-expected miscarriage risk among nonusers.

statement issued after the Glazer suit was filed. "As matters stand today, there is no known cause-and-effect relationship between EMF exposure and adverse health," FP&L added.

Before filing the suit, Glazer's attorneys attempted to negotiate a $15 million settlement, both sides said, declining to comment further.

The utility's lead attorney in the case, Alvin Davis of Steel, Hector & Davis in Miami, declined to discuss the lawsuit, as did cocounsel Carlos Alvarez of the Tallahassee firm of Hopping, Boyd, Green & Sams. Alvarez has long represented FP&L in EMF-related litigation.

The New York City-based Leukemia Society of America estimates that CML is diagnosed in 1.4 per 100,000 people annually in the U.S. There is no known cause for the disease, according to the society. But a number of occupational and residential studies have associated CML with exposure to EMFs.

Glazer's is the second lawsuit to link CML with power line EMFs. In a case scheduled to go to trial on April 18, John Altoonian, who has CML, claims that the Atlantic Electric Co. of Pleasantville, NJ, should be held responsible for failing to warn him that magnetic fields from the 69 kV power line that ran underneath his property—creating EMFs of 300 mG in his backyard and 29 mG in his bedroom—could threaten his health (see *MWN,* N/D93).

In 1990, the Boeing Co. of Seattle agreed to pay former employee Robert Strom more than $500,000 in an out-of-court settlement of his claim that he developed CML from on-the-job exposures to electromagnetic pulse (EMP) radiation (see *MWN,* S/O90).

The Glazers were exposed to "extremely high and unreasonably dangerous levels of EMFs which permeated [their] bedroom and infiltrated their home," according to the complaint. Howard Talenfeld of Colodny, Fass & Talenfeld in Ft. Lauderdale, who is also representing Glazer, would not reveal precise numbers. But he did tell *Microwave News* that magnetic fields in the bedroom were "two to three times the levels of 2-3 mG that have shown up in the studies linking EMFs to cancer." He said that the estimated exposures will be based on historical current loads as well as on present-day spot measurements.

Talenfeld also said that trying the case in Florida could be an advantage for his client: "The law here places a very high burden on the utility to prove the safety of its products—higher than ordinary negligence." Meanwhile, Marraffino said that he will seek to show that FP&L had information on the health effects of EMFs for many years that it did not disclose to its customers (see box at right). "FP&L's own literature will hurt them," he said, noting that he will introduce as evidence a bill insert sent out by the utility in 1993 which states that, "Beginning in the 1970s, concerns were raised that exposure to EMFs might cause adverse health effects."

The Glazers moved into the Coral Gables house in 1969. There were several power lines on the property, including two 13.8 kV distribution lines that ran within 32 feet of the couple's bed, Marraffino said. Elsa Glazer was diagnosed with leukemia in 1984 at the age of 44 and died four years later. Her husband, who moved from the house in 1989, was diagnosed in 1992 at the age of 54.

The charges made by Glazer are similar to those made by the plaintiffs in the Zuidema case, which was the first EMF personal injury lawsuit to go to trial and which was decided in favor of San Diego Gas & Electric Co. last spring (see *MWN,* J/A91, N/D92, M/J93 and S/O93). The case of a Georgia woman with lymphoma will be heard by a jury later this year (see *MWN,* S/O91, M/J92, J/A92, S/O93 and N/D93).

In their landmark 1992 study, Dr. Anders Ahlbom and Maria Feychting of the Institute of Environmental Medicine at the Karolinska Institute in Stockholm, Sweden, found an excess of CML in adults exposed to magnetic fields of more than 2 mG (see *MWN,* S/O92).

A 1988 occupational study by Drs. Susan Preston-Martin and John Peters of the University of Southern California in Los Angeles, found that welders had 19 times the expected rate of CML. The workers had "heightened exposure" to EMFs, they wrote in the *British Journal of Cancer.* A study published in *The Lancet* in 1983 by Dr. Michel Coleman, who, at the time, was at the London School of Hygiene and Tropical Medicine, found that radio and telegraph operators had 6.5 times the expected rate of CML (see *MWN,* Jun83).

Glazer: What FP&L Knew and When

Reprinted below is an excerpt from the plaintiff's January 20 complaint in Glazer v. Florida Power & Light Co.:

As admitted by defendant FP&L in recent literature sent to customers, "[b]eginning in the 1970s, concerns were raised that exposure to EMFs might cause adverse health effects...." By the mid [1970s], FP&L was aware that health effects from EMFs, including the risk of leukemia, had become a central issue in transmission line sitings in several states. By the late 1970s and early 1980s, FP&L was aware that credible scientific research clearly linked the incidence of cancer and leukemia to EMFs.

In 1984, Nancy Wertheimer, a nationally recognized researcher, testified as to her studies before FP&L counsel and management in the Putnam County jury trial of *Roberts v. FP&L* and duly warned defendant of the injurious effects of prolonged EMF exposure, including leukemia in humans.

In 1986, FP&L was once again warned of the serious dangers EMFs posed to human life by a Florida appellate court reviewing the Roberts trial case. In its published opinion, the Fifth District Court of Appeals determined that knowledge of the health effects from transmission lines was no longer within the realm of speculation and wrote of the "explosion of positive results within the last few years which indicates that extended exposure to electric transmission lines can adversely affect human life."

Additionally, FP&L has been aware that since the 1970s, study upon study upon study have documented the increased risk of leukemia in persons exposed to higher than normal [EMFs]. Defendant consciously, intentionally and willfully withheld this information from its customers so as to avoid financial expense which would result from said disclosure and to prevent the plaintiffs and others from asserting their claims.

The dosimetric studies are yielding insights into where and how RF energy is being deposited. For instance, Balzano has found that, with normal use, the peak SARs from cellular phones are near the cheek, close to the body of the phone—not in the brain. And Kuster reports that, as a general rule, "The smaller the phone, the greater the potential for a high peak SAR."

To be sure, measuring the amount of energy delivered to the brain is an inexact science. The SAR depends on the type of cellular phone and on how it is used, on the models devised to represent the human head and the instruments used to estimate electromagnetic field profiles. Even under the best of circumstances, as Howard Bassen of the Food and Drug Administration's Center for Devices and Radiological Health in Rockville, MD, explained to *Microwave News,* the uncertainty in any set of SAR measurements is never less than a factor of two.

In his study, for McCaw Cellular Communications Inc., based in Kirkland, WA, Gandhi tested ten different phones and reported peak SARs between 0.04 and 0.17 W/Kg in the brain. For five phones that he tested, Kuster found a range of 0.12-1.7 W/Kg under standard operating conditions and 2.1-5.3 W/Kg under worst-case conditions—with the phone's antenna actually touching the skull (see below and *MWN,* N/D90). Neither Gandhi nor Kuster identifies the specific phones tested, so a direct comparison of the two methods on the same units is not possible. Balzano has only tested Motorola phones in the standard operating position.

Gandhi's and Kuster's methods are quite different. In many ways, Gandhi's model is more complex and more realistic, taking into account the shielding provided by the human ear and the electrical properties of the bone in the skull.

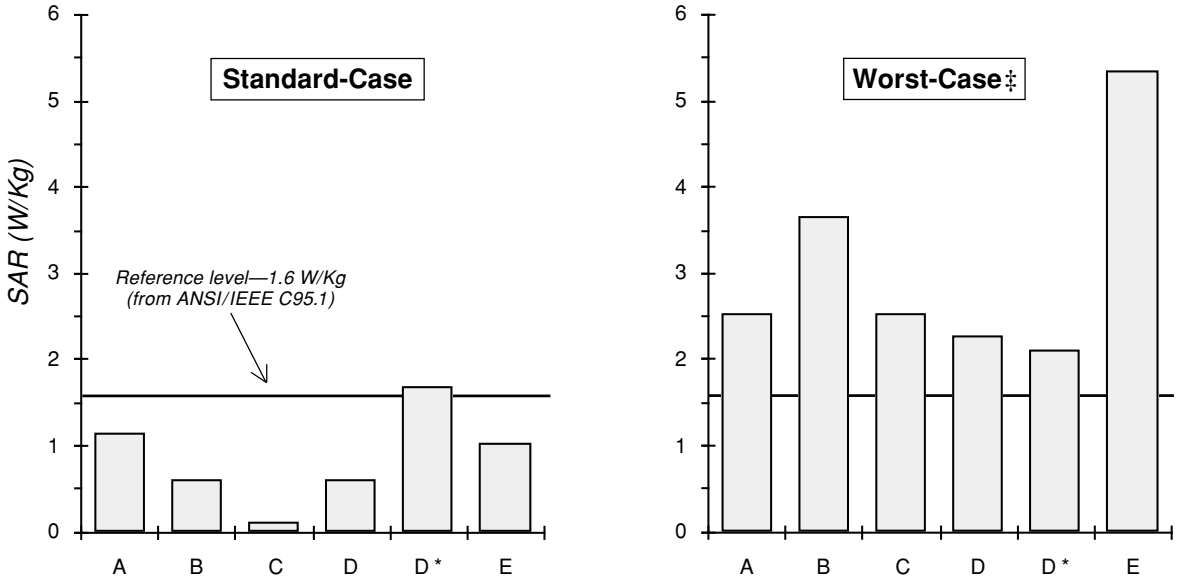
Kuster and Balzano—whose models are essentially the same—favor a cruder approach, using only a head-shaped mannequin filled with a solution that simulates brain tissue. As Balzano explains in a report that he has prepared for the Federal Communications Commission (FCC), the model is "simple and relatively easy to reproduce." He states that it has the "significant benefit of giving the *worst-case* SAR absorbed by the brain tissue and skull bones" (his emphasis).

"Kuster and I share the same philosophical approach," Balzano explained to *Microwave News.* "We want to look for the worst possible conditions of use as a means of assuring safety." For contrast, he pointed out that, according to his analysis of Gandhi's papers, Gandhi did not press the cellular phone against the ear of the simulated human head—thereby avoiding the highest SARs. Balzano also expressed some concerns about how well Gandhi had validated his model.

Gandhi declined repeated requests for an interview by *Microwave News* (see the accompanying commentary on p.14).

The German government is now requiring the testing of cellular phones under the type of worst-case conditions that Kuster and Balzano favor. "To satisfy German requirements, telephone manufacturers must demonstrate compliance un-

Spatial Peak SARs† for Hand-Held Cellular Phones—The Swiss View



Exposure data for five hand-held cellular phones (A-E) with output power of 0.6 watts. Antennas fully extended except for D*. Tests were performed with a mannequin filled with simulated brain tissue.
†Averaged over 1 gram of tissue. ‡Worst-case exposures: antenna touching head.

Adapted from: N. Kuster, T. Schmid and K. Meier, *Proceedings of VDE Meeting,* Bad Nauheim, Germany, November 9-10, 1993.

der all conditions of use and for the entire user population," Kuster said in an interview. He added that, "For some cellular phones, it is not unusual for the antenna to touch the skull." But he also noted that, "Our numbers should be interpreted with caution because we are still devising our model of the human body to assess worst-case exposures reliably."

The draft German standard is more lenient than the ANSI/IEEE guidelines—2 W/Kg averaged over 10 grams of tissue—but it does not allow any exemption like that in the ANSI/IEEE guidelines and the FCC rules (see *MWN,* J/F93).

Many other groups around the world—in Australia, Austria, Belgium, Canada, France, Italy, Japan and the U.K.—are building their own models and doing their own calculations. A number of these research teams presented papers at last summer's International Union of Radio Science meeting in Kyoto, Japan, and an even greater number are expected at the *Workshop on Safety Issues of Mobile Communication,* which Kuster is organizing as part of next summer's annual meeting of the Bioelectromagnetics Society in Copenhagen, Denmark.

Gandhi will continue his experiments with funding from the Cellular Telecommunications Industry Association's (CTIA) research program (see *MWN,* J/F93). On December 13, Dr. George Carlo, who is leading the CTIA effort in Washington, officially called the Scientific Advisory Group on Cellular Telephone Research, announced that Gandhi and Dr. C.K. Chou of the City of Hope National Medical Center in Duarte, CA, have been asked to run a series of dosimetry studies. These will cost approximately $500,000, Carlo told *Microwave News.*

"We are going to look at all the different models and choose the appropriate ones," Carlo said when asked about the variation in the dosimetric results obtained by Balzano, Gandhi and Kuster. "We will pick the most truthful, accurate and rigorous assumptions to assess exposures." By filling in the data gaps, he explained, "We can minimize the need to use worst-case models."

Commentary on Cellular Phones

Dr. Om Gandhi's Science by Press Release

In early December, the University of Utah issued a press release that began:

> Radiofrequency (RF) exposures from hand-held cellular telephones are well within national safety standards, according to the latest scientific findings conducted for the National Institutes of Health (NIH) by scientists at the University of Utah.

As expected, the news was widely reported in newspapers and on television. "Study: Cellular Phones Safe," announced *USA Today* on December 10. In most of the stories, the message was clear—the public could use their phones without fear.

Would that it were so simple. Here's what Dr. Om Gandhi and the University of Utah left out:

• The RF exposures are low *only* when the cellular phones are tested under best-case conditions, which Gandhi favors. Motorola scientists have found levels that are ten times higher than Gandhi's when the phone is pressed against the ear. (Have you ever seen anyone use a telephone any other way?) And Dr. Niels Kuster reports that the exposures can be more than 30 times Gandhi's estimates under worst-case conditions, when the antenna touches the head (see p.1). Kuster has shown that the exposures can exceed the ANSI/IEEE standard.

• Meeting the ANSI/IEEE guidelines does *not* assure safety. The FDA contests Gandhi's faith in the standard. "FDA has been concerned for some time that the standard itself may not be adequate," the agency cautioned in a December 15 statement in response to press reports on Gandhi's work. EPA and even some military labs and defense contractors have lost confidence in the ANSI/IEEE standard (see p.10 and *MWN,* S/O93). Recall also that Gandhi was the cochair of the subcommittee that wrote the ANSI/IEEE guidelines—making him a one-man judge and jury on the safety of cellular phones.

• Gandhi's work was *not* done for NIH. It was paid for by McCaw Cellular Communications Inc. In mid-December, the National Institute of Environmental Health Sciences (NIEHS) set the record straight: "NIEHS has not sponsored, specifically, a study of cellular telephones....*Dr. Gandhi's research for NIEHS does not include studies to determine the safety of any product"* (NIEHS' emphasis).

• Gandhi's work has *not* been peer-reviewed or published.

In their statements, both the FDA and the NIEHS said that they had not seen Gandhi's study. Nor is it easy to get anything except the press release. Larry Weist at the University of Utah's press office told us that Gandhi had specifically requested that his paper not be distributed to the press.

Perhaps Gandhi aims to please his corporate sponsors, but it is ethically suspect to issue public assurances of safety when other respected scientists have reached diametrically opposite conclusions.

Gandhi cannot have been unaware of Kuster's work. Kuster or members of his lab presented their results at the BEMS meeting in Los Angeles last June, at the URSI meeting in Kyoto a few months later and, once again, at the EBEA meeting in Bled, Slovenia, in December. In each case, Gandhi was also on the program.

We have no way of knowing what Gandhi really thinks because he has refused to answer our repeated phone calls and requests for interviews over the last few months. Gandhi prefers to do his science by press release.

At the *Cellular Telephone Research and Cancer Symposium,* sponsored by the industry in mid-December (see *MWN,* N/D93), FDA's Dr. Elizabeth Jacobson warned the attendees to avoid peer-review in the press. Gandhi was sitting a few feet away but he must not have been listening.

Cellular Phone Dosimetry Studies

Q. Balzano, "Exposure Assessment and Measurements in Complex Environments: Evaluation of Human Exposure from Portable Radio Communication Equipment" (abstract), *24th General Assembly of the International Union of Radio Science* (URSI), Kyoto, Japan, August 25-September 2, 1993.

Q. Balzano, O. Garay and T. Manning, *Electromagnetic Energy Exposure of the Users of Portable Cellular Telephones,* unpublished manuscript, 1994.

H.I. Bassen and T.M. Babij, "Experimental Techniques and Instrumentation," pp.141-173 in *Biological Effects and Medical Applications of Electromagnetic Energy,* O.P. Gandhi, ed., Englewood Cliffs, NJ: Prentice Hall, 1990.

O.P. Gandhi, "Millimeter-Resolution Dosimetry for EM Fields: Cellular Phones, Power Lines and MRI" (abstract), *Transactions of the 2nd Congress of the European Bioelectromagnetics Association* (EBEA), Bled, Slovenia, December 9-11, 1993.

O.P. Gandhi, J.Y. Chen and Ding Wu, "Electromagnetic Absorption in the Human Head and Neck for Cellular Phones at 835 MHz," preprint, submitted to *IEEE Microwave and Guided Wave Letters,* 1994.

N. Kuster, "Progress in High Frequency Dosimetry" (abstract), *2nd EBEA Congress.*

N. Kuster, T. Schmid and K. Meier, "Laboratory for Compliance Tests of Mobile Communication Devices with Safety Standards" (abstract), *24th General Assembly of URSI.*

N. Kuster, T. Schmid and K. Meier, "Untersuchungen der Absorption im Extremen Nafeld von Sendern" ("Studies of Absorption in the Extreme Near Field of Transmitters"), *Proceedings of VDE Meeting,* Bad Nauheim, Germany, November 9-10, 1993.

L. Martens et al., "Calculation of the Electromagnetic Fields Induced in the Head of an Operator of a Mobile Antenna" (abstract), *24th General Assembly of URSI.*

K. Meier and N. Kuster, "Standardized Dosimetric Tests of Mobile Communication Devices" (abstract), *15th Annual Meeting of the Bioelectromagnetics Society,* Los Angeles, June 13-17, 1993.

K.E. Mokhtech, G.Y. Delisle and A.G. Roberge, "Specific Absorption Rate Computation Using FDTD and a Model of the Human Head" (abstract), *24th General Assembly of URSI.*

T. Nojima, S. Nishiki and T. Kobayashi, "SAR Estimation at UHF Using Dry-Phantom Human Head Models" (abstract), *24th General Assembly of URSI.*

UPDATES

GWEN

Additional Sites Scrapped... An amendment to the 1994 Defense Appropriations Bill signed on November 11 by President Clinton eliminates funding for expansion of the Air Force's Ground Wave Emergency Network (GWEN) during fiscal year 1994, which ends September 30, 1994. The DOD now says that it will drop plans for all GWEN sites that are not yet completed. The GWEN communications system operates at 150-175 kHz from a network of towers around the country and is designed to withstand the EMP of a nuclear blast. After more than 50 towers—out of the 83 that were planned—had been finished and put into operation, further construction was put on hold in 1990 pending completion of a safety assessment by the National Academy of Sciences' National Research Council. The NAS-NRC committee concluded in May 1993 that radiation exposures from the system posed a "minimal or nonexistent" public health risk (see *MWN,* M/J93), and the Air Force resumed construction. Recent opposition to GWEN has centered more on budget considerations than on health issues. After the defense appropriation was signed into law, the amendment's sponsor, Rep. Martin Sabo (D-MN), and seven other congressmen wrote to then-Secretary of Defense Les Aspin, requesting a review of the need for additional GWEN facilities. (In 1990, Aspin, then a representative from Wisconsin, was one of two congressmen who requested the NAS-NRC assessment; see *MWN,* M/J90.) Calling the system "a relic of the Cold War," they noted that existing towers already provide a "basic back-up capability." In a January 14 letter, Emmett Paige Jr., an assistant secretary of defense, responded that, "Contracts for planned construction at all remaining sites are being terminated." Paige later confirmed that there would be no money for GWEN construction in the Pentagon's 1995 budget request, according to Charles Monfort, Sabo's legislative director. Monfort also said that, in September, the Senate rejected an amendment, introduced by Sen. Harry Reid (D-NV), to dismantle the GWEN system completely.

MAGLEV

Effects of Simulated Fields... As part of a series of experiments designed to study the biological effects of maglev magnetic field exposures, Dr. Kenneth Groh found a significant decrease in the production of seratonin-*N*-acetyltransferase (NAT), an enzyme that controls melatonin production, in the pineal gland of rats exposed to intermittent 1.75 G DC magnetic fields. Groh, of Argonne National Laboratory near Chicago, also found nonsignificant decreases in NAT and melatonin following exposures to combined continuous AC and DC magnetic fields and to strong intermittent AC fields. But a number of other types of exposures—combined intermittent AC and DC fields, for example—had no effect. Based on the extensive EMF measurements taken on the German TR07 maglev system, Groh designed an exposure system that generates fields at ten frequencies in the 0-2 kHz range, in addition to a DC field. He then ran separate experiments, varying the components: the AC and DC fields by themselves

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and together, continuously and intermittently. The rats were exposed for up to four hours. For some experiments he used field intensities approximating those of the TR07, while for others he used fields seven times as strong—since other maglev technologies, which employ superconducting magnets, are expected to produce much stronger EMFs. The exposure scenarios that were most similar to the TR07 did not produce an effect. But Groh noted that, "other types of maglev and electrified transportation systems could produce fields having intensities, durations and frequencies that do produce biological effects." Groh also used his exposure setup for a series of experiments to examine the growth of cancer cells, but he observed no changes. Groh's work was part of a series of studies funded by the Department of Transportation to examine EMF exposures and possible effects from maglev and conventional electric railroad technology. The series includes the TR07 measurements, extensive exposure assessments for existing electric railroad technologies and several literature reviews (see *MWN,* J/A93), along with a new report from EPA on EMF standards (see p.18). Groh's report, *The Biological Effects of Maglev Magnetic Field Exposures,* August 1993, PB94-118593, 56 pp., $19.50, is available from: National Technical Information Service (NTIS), 5285 Port Royal Rd., Springfield, VA 22161, (800) 553-6847. (For more on EMF effects on melatonin production, see *MWN,* M/J88, S/O88 and N/D93.)

MEASUREMENTS

New RF Probe and Recent Papers... Microwave-Narda, a division of Loral Corp., is marketing a miniature broadband probe to measure electric fields, with minimal field perturbation, in animal tissue and human models over the frequency range 400 MHz to 10 GHz. The isotropic, implantable probe, Model 8021, is ideal for measuring the SARs from hand-held cellular phones, according to Richard Strickland, Microwave-Narda's director of business development. In fact, many of those working on RF dosimetry from cellular phones are currently using it. For more information, contact: Microwave-Narda, 435 Moreland Rd., Hauppauge, NY 11788, (516) 231-1700....Dr. Motohisa Kanda of NIST in Boulder, CO, has published a tutorial paper, "Standard Probes for Electromagnetic Field Measurements," in the October 1993 *IEEE Transactions on Antennas and Propagation.* And Lauri Puranen and Dr. Kari Jokela have published "Simultaneous Measurements of RF Electric and Magnetic Near Fields—Theoretical Considerations" in the December 1993 issue of *IEEE Transactions on Instrumentation and Measurement.* The authors are with the Finnish Center for Radiation and Nuclear Safety in Helsinki.

MEDICAL APPLICATIONS

Marketing Cyclotron Resonance... The first medical device that taps the power of cyclotron resonance is headed for market. On January 19, OrthoLogic Corp. in Phoenix announced that it had received an "approval letter" from the FDA for its OrthoLogic 1000 bone growth stimulator to treat nonunion fractures. Its major advantage, according to the

company, is that it allows "shorter treatment time"—30 minutes a day instead of the 3-24 hours per day with the other stimulators that are now available. For instance, Electrobiology Inc. of Parsippany, NJ, recommends the use of its bone-healing system for 8-10 hours per day. The OrthoLogic 1000 is designed to increase the synthesis of the growth protein IGF-II (see *MWN,* M/J93) with exposures to a static field of 200 mG and a time-varying field (76.6 Hz) of 400 mG. The idea to use these combined fields, which are tuned to the cyclotron resonances of calcium and magnesium ions, was patented by Drs. Abe Liboff of Oakland University in Rochester, MI, Bruce McLeod of Montana State University, Bozeman, and Stephen Smith of the University of Kentucky, Lexington (see *MWN,* N/D90).

MEETINGS

World Congress Proceedings... Over 250 review and research papers presented in June 1992 at the *1st World Congress for Electricity and Magnetism in Biology and Medicine* (see *MWN,* J/A92) in Orlando, FL, are now available in a single volume. The wide-ranging collection—from biology to physics to policy—is intended to provide "a bird's-eye view of research in 1992 around the world on various aspects of our rapidly developing field," writes the editor, Dr. Martin Blank of Columbia University in New York City. The book runs 900-plus pages and is available for $90.00, plus $5.00 shipping and handling, from: San Francisco Press Inc., Box 426800, San Francisco, CA 94142, (510) 524-1000.

MRI

Miscarriage Risks Among Technicians... There is no "major reproductive hazard associated with MRI work," according to an epidemiological study published in the December 1993 issue of the *Journal of Occupational Medicine*—a finding that was first presented at a meeting of the Radiological Society of North America in December 1991 (see *MWN,* J/F92). Drs. Josephine Evans and David Savitz of the School of Public Health at the University of North Carolina, Chapel Hill, and Dr. Emanuel Kanal and Joseph Gillen of the Pittsburgh NMR Institute reported that the rates of infertility and low birth weight were not significantly higher among MRI technicians, but the study was less clear with respect to miscarriages. The team found a nonsignificant 30% increase in pregnancy loss among MRI workers as compared to pregnant women in other jobs. When homemakers were used as the control group, MRI workers showed a significant three-fold higher rate of miscarriage. However, this latter control group reported only a 6% rate of spontaneous abortions—suspiciously low compared to the 10-15% rate for the general population. The researchers argued that this "calls into question the validity of the relative risks based on homemakers." The "major concern" for MRI technicians, the authors wrote, is "the very powerful static magnetic field." Unlike MRI patients, who are exposed to a variety of fields including radio-frequency and gradient magnetic fields, the technicians spend most of their time in the console room, at a distance from the magnet bore. The group concluded that the findings must be tempered by the limitations of the study—the completeness

EMF Papers

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and validity of the self-reported data were unknown—and they encouraged others to continue to study the possible effects of MRI EMFs on pregnancy.

PEOPLE

William Kaune of EM Factors in Richland, WA, and Dr. **Luciano Zaffanella** of Enertech Consultants in Lee, MA, have won the 1993 IEEE/Power Engineering Society T&D Prize Paper Award for their work on "Analysis of Magnetic Fields Produced Far from Electric Power Lines," which appeared in the October 1992 issue of *IEEE Transactions on Power Delivery*....Dr. **Maria Stuchly** will be the first to hold the new industrial research chair in EMF health effects studies at the University of Victoria, British Columbia. The chair was endowed for $1.5 million by the Natural Sciences and Engineering Research Council of Canada (NSERC), BC Hydro, TransAlta Utilities of Calgary and the University of Victoria....Former EPA Administrator **Douglas Costle** has been appointed to the board of directors of the Health Effects Institute (HEI) in Cambridge, MA, and **Daniel Greenbaum**, commissioner of the Massachusetts Department of Environmental Protection, has been named HEI's president and CEO. ...Dr. **Peter Wright** of the Poly Clinic in Seattle died of cancer on December 22. Wright had testified for a number of plaintiffs in EMF personal injury suits. Most recently, he provided videotaped testimony for Nancy Jordan, whose case is expected to go to trial later this year (see *MWN,* N/D93). He also spoke on behalf of the widow of Seattle City Light lineman Robert Pilisuk, whose claim for pension benefits is now pending (see p.6). Last spring, Wright appeared as an expert witness for the Zuidemas in their case against San Diego Gas & Electric Co. (see *MWN,* M/J93).

STANDARDS

Roundup of EMF Limits... Sanford Cohen & Associates in McLean, VA, has produced a thorough review of EMF regulations and guidelines in the U.S. and worldwide, covering everything from municipal zoning rules in Irvine, CA, to power line ROW limits in New York and Florida to the Swedish VDT emissions guidelines. Individual write-ups are brief, and the body of the report is only 36 pages. "There are not a whole heck of a lot [of guidelines and regulations] in existence," Dr. Donald Goellner, one of the authors, said in a telephone interview. The report was prepared under the direction of EPA's Office of Radiation and Indoor Air as part of DOT's maglev and electric railroad safety studies (see *MWN,* J/A93). Donald Goellner and Terry Inge, *Review of Existing EMF Guidelines, Standards and Regulations,* August 1993, PB94-117819, 74 pp., $19.50, is available from NTIS (see Maglev, pp.15-16).

STATE REGULATIONS

Fees for RF/MW Sources... To raise funds for enforcement of New Jersey's RF/MW exposure rules, the state Department of Environmental Protection and Energy (DEPE) has proposed registration fees for most commercial RF/MW sources. In 1984, the state adopted the ANSI/IEEE C95.1 exposure

limits for all nonoccupational exposures, and in 1987 it extended the rules to cover workers. But the standards "have not been actively enforced because the department lacks adequate resources," according to DEPE. The fees, determined by complex calculations based on the type of source, are designed to fund fully an enforcement program with a staff of about six. This would allow inspections at more than 100 sites per year, according to the proposal. The fee for an AM broadcast antenna—the most expensive source to register—would be about $500, DEPE estimates. The sources subject to fees are: "(1) communications, navigational and radar sources possessing the potential to expose the general public or the work force to levels of RF/MW radiation in excess of [the legal exposure limits] and (2) all RF and MW heaters, sealers and industrial ovens." In a detailed discussion of what is covered by these definitions, the proposal suggests that most radio and television broadcast towers, some relay stations and many mobile radio and cellular phone base stations would be included. DEPE has decided to exempt military and federal government facilities, so most radar installations are not covered. RF heaters and sealers are singled out in the proposal because DEPE "has reason to believe that most incidents of overexposure to RF radiation occur during [their] operation." The proposal also notes that, "DEPE believes that the public may be unknowingly exposed to RF radiation in excess of the limits...at various locations accessible to the public." The full proposal was published in the *New Jersey Register* on December 6. Comments were originally due by the end of January, but this deadline was extended to February 22—to accommodate the heavy response the agency has received.

TECHNOLOGY

Randomizing Appliance EMFs... Later this year, EMX Corp., based in New York City, will begin marketing two new products designed to eliminate the health risks from exposure to EMFs: a hair dryer and a converter plug for electric blankets and heating pads. EMX will employ the same patent-pending technique that was used in its 101 EMX Keyboard for VDT EMFs, released last year, to convert the coherent fields of electrical appliances into random or incoherent fields (see *MWN,* J/A93). The 1600 Hair Dryer and the Converter Plug should be available in August, said John Blackwell, EMX's vice president for marketing and sales....At the same time, some are questioning whether it is a good idea to generate a new magnetic field to protect against an existing one. Amir Novini, president of Radiation Technology Inc. in Akron, OH, found that the random fields from the EMX keyboard were twice as strong as the fields from a Samsung 14-inch monitor. At 10 inches from the VDT, Novini measured 10 mG from the Samsung and 20 mG from the EMX keyboard. "Personally, I don't feel comfortable with the level of emissions from the keyboard. I ask myself, 'Is it safe to expose people to random fields?'" he said. Dr. Ted Litovitz of Catholic University in Washington, who devised the method used by EMX, argues that his research "shows that the biologic cell does not respond" to an incoherent field.

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MICRO WAVE NEWS

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Savitz and Loomis Find Brain Cancer Risk for Utility Workers

Link to Leukemia Inconclusive

Drs. David Savitz and Dana Loomis have found that electric utility workers who are highly exposed to electromagnetic fields (EMFs) have a greater chance of dying of brain cancer than less exposed workers. The researchers, who are at the University of North Carolina School of Public Health, Chapel Hill, did not see a link between EMFs and leukemia mortality, except among electricians who had been on the job for more than 20 years.

"This study simultaneously provides evidence against an association of magnetic fields with leukemia and for an association between magnetic fields and brain cancer," Savitz said in a prepared statement. "It does not, however, resolve the fundamental question of whether magnetic fields cause cancer."

Both researchers pointed out that the risks from EMF exposure are likely to be small for most people. Loomis said that the study shows that, "There is not some huge risk out there that we have failed to discover."

Savitz and Loomis emphasized that the observed brain cancer link is stronger than that seen in previous studies of electric utility workers. They found that workers with the highest EMF exposures had more than a two-and-a-half times greater chance of dying of brain cancer than the least exposed workers. In addition, they observed a significant exposure–response relationship for brain tumors.

In a telephone interview, Dr. Anders Ahlbom of the Karolinska Institute

(continued on p.8)

EMFs Boost Tree Growth at Exposures of 1-7 mG

A U.S. Navy submarine communications antenna slicing through the forests of northern Michigan has spurred the growth of some nearby trees exposed to its 76 Hz EMFs. Young red pines grew taller and mature aspens and red maples developed thicker trunks than similar trees growing at a control site 30 miles away.

Scientists at Michigan Technological University's (MTU) School of Forestry and Wood Products in Houghton monitored vegetation in the region from 1985 to 1994 and recorded enhanced growth as high as 74% in some red maples. These increases occurred at magnetic field levels of 1-7 mG among trees growing within 50-150 meters of the antenna. The researchers observed no changes in the growth of red oaks and paper birches.

The MTU research team was one of ten participating in a project to record changes in forest health and productivity due to the EMFs from the Navy's Project ELF in the Great Lakes region, which can send messages to

(continued on p.13)

« Power Line Talk »

One of the most provocative papers presented in Albuquerque, NM, last November was not even on the official DOE program. Germany's Dr. **Wolfgang Löscher** announced his latest **breast cancer** results at an NIEHS-DOE workshop on *Research Directions for EMF Toxicology Studies* held on Sunday, November 6, the day before the DOE's annual EMF review got under way. "DOE felt that Löscher's work had to be included in any debate on animal toxicology studies," said Paul Gailey, the manager of the EMF program at the Oak Ridge National Lab. So, DOE sent Löscher a ticket and he did not disappoint his audience, previewing some of his forthcoming papers. In 1993, Löscher, Dr. **Meike Mevissen** and their colleagues at the School of Veterinary Medicine in Hannover had reported that a 1 G 50 Hz magnetic field promotes breast cancer in rats treated with a chemical carcinogen. (Löscher's group has published new details of the 1 G work in the January 1995 issue of *Carcinogenesis (16,* pp.119-125); see also, *MWN,* J/A93 and S/O94.) In Albuquerque, Löscher showed that he also saw a response at 100 mG and at 500 mG. And when he put all the data together, he found a dramatic, linear dose–response curve. The increase in the number of tumors was statistically significant at 500 mG (p=0.029), while the effect at 100 mG was short of significance (p=0.1606). He did not see a response for 3-10 mG exposures. In addition, the Hannover group is in the midst of a host of complementary studies. For instance, they have found a 35% decrease in nocturnal serum melatonin at 100 mG and a doubling of ODC activity in rats' breast tissue at 500 mG (ODC is a key enzyme related to cell growth). NIEHS's Dr. **Gary Boorman,** who is in the midst of his own animal studies, called the Löscher results "some of the most dramatic at the meeting," adding that, "We're looking at doing a similar study right now to confirm and extend the work." Dr. **Bo Holmberg** of Sweden's National Institute of Occupational Health commented that, "It's exciting," and Dr. **Claes Ramel**, the chairman of the Royal Swedish Academy of Sciences' Environmental Committee, called the dose–response "very impressive." Battelle's Dr. **Bary Wilson** found Löscher's experiments "the best executed set of EMF cancer studies with the most consistent results" ever. Wilson and others, such as Dr. **Raymond Neutra** of the California EMF program, want Löscher's studies to be repeated in the U.S. "If you can show promotion in two different animal systems, you will have the basis—together with the epidemiological data—to classify EMFs as a possible carcinogen," Neutra said. Whether Löscher can continue his own studies is unclear. He has secured only minimal funds since his 1993 paper appeared in *Cancer Letters*. "The predominant view in Germany is that the EMF issue is all nonsense," he said. This is no surprise to Dr. **Jan Walleczek**, a German researcher now at Stanford University, who observed that, "EMFs are as political in Germany as they are in the U.S."

«« »»

Some eyebrows were raised last year after Dr. **Patricia Buffler** dismissed all possible EMF health risks and refused to endorse a policy of prudent avoidance. At a time when a number of utilities accept prudent avoidance, it seems strange that Buffler, the dean of the School of Public Health at the University of California, Berkeley, denounced the idea. "None of the 30 to 40 studies done in the last ten years has provided any convincing evidence that EMFs cause birth defects, childhood cancers, breast cancer in women or other problems," she told the *University of California at Berkeley Wellness Letter* (November 1994), a newsletter with a circulation of approximately 600,000. Thus, she concluded, advising prudent avoidance "would be in conflict with the scientific evidence, since we don't know that there is anything here to avoid" and "could result in spending millions of dollars...to avoid an unidentified 'phantom' hazard." Dr. **David Carpenter**, who, like Buffler, is a dean of a major public health school—at the State University of New York, Albany—told the ***San Francisco Bay Guardian*** (January 25, 1995) that her argument is "absolute nonsense." In an interview with the *Guardian*'s Daniel Zoll, Carpenter said that, "To say that all of the studies [citing EMF health perils] have been seriously flawed is simply not true." Zoll raises the concern that Buffler's judgment may have been colored by her many years as an EPRI consultant. In an editorial, the *Guardian* called on Buffler to disclose her financial links to EPRI: "University officials are entitled to express their opinions and make a living—but not at the expense of the credibility of their schools by giving even the appearance of a conflict of interest. As the EMF affair shows, if these authorities are taking money from an industry, the public deserves to know who is paying them, how much and how that relationship may influence their opinions even remotely."

«« »»

On February 1, Australian epidemiologist and physicist Dr. **Vincent Delpizzo** became research director of the **California EMF Program** in Emeryville. He held a similar position at the Australian Radiation Laboratory in Yallambie. "This will be a great opportunity to address some of the unresolved EMF issues," Delpizzo told us. He will report to program chief Dr. Raymond Neutra.

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The debate continues over confounders that could cast doubt on the validity of the EMF–childhood cancer link. In a 1991 paper, Dr. **Dimitrios Trichopoulos** of the Harvard School of Public Health in Boston and Dr. **Charles Poole** of the Boston University School of Public Health contended that low-income families are "difficult to identify, contact and recruit as controls" by the random-digit dialing method used in most studies (*Cancer Causes and Control, 2,* pp.267-276, 1991). If poverty is related to high EMF exposures and if fewer low-income controls than high-income controls participate in a study, they argued, then any elevated cancer risks may be unrelated to magnetic fields. Dr. **Philip Cole** of the Univer-

sity of Alabama School of Public Health, Birmingham, has made the same argument. A group of Seattle researchers has now tested this hypothesis and concludes that it is not likely to explain away the power line cancer risk—though Dr. **James Gurney**, now of the Michigan Cancer Foundation at Wayne State University in Detroit, told us that he cannot completely rule out the role of bias. Gurney and his former colleagues at the Fred Hutchinson Cancer Research Center in Seattle and at Battelle PNL found that families earning less than $15,000 a year were significantly more likely to live in homes with very-high-current-configuration (VHCC) wiring than high-income families. When they assumed that low-income controls participated at lower rates than high-income controls, risk estimates did rise, but not enough to explain the observed cancer–power line link. Gurney's results appear in the January 1995 issue of *Epidemiology (6,* pp.31-35). The EPA reached a similar conclusion based on the Swedish residential study because Maria Feychting and Dr. Anders Ahlbom did not use random-digit dialing to select controls and still found a cancer risk among children living near power lines (see *MWN,* S/O92 and S/O94). In an interview, Trichopoulos conceded that, "Gurney's paper shows that there can be a bias, but that it is not as big as we thought." As this confounder recedes in importance, **Jack Sahl** of Southern California Edison Co. in Rosemead has proposed a new one. Writing in *Cancer Causes and Control* (*5,* pp.279-283, 1994), he presents the hypothesis that "residential proximity to electric utility transmission systems is a surrogate for viral contacts." Sahl draws on U.K. studies that seek to explain excess childhood leukemia rates near nuclear power stations in remote areas of the country as actually caused by an infectious virus. He calls the failure to address the virus idea an "oversight" and predicts that rejecting the hypothesis "will help to remove uncertainties about the existing data." Here we go again.

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The **EPA**, the **DOE** and the **American Public Health Association** are cosponsoring a workshop to bring together representatives from state and local governments, utilities and grass-roots organizations in an effort to explore common goals. The workshop is expected to be held in May in the Washington area and it will be by invitation only. **Dennis O'Connor**, a policy analyst and EMF team leader at EPA's Office of Radiation and Indoor Air in Washington, said that the objective of the meeting is "to determine the policy, research and technical assistance needs of those who make decisions on EMF policies." The meeting should also help to identify tools and techniques that work well in local settings. For further information, contact: O'Connor, (202) 233-9340.

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A settlement in the personal injury lawsuit between the **St. Francis Prayer Center**, Flint, MI, and **Consumers Power Co.**, Jackson, MI, was reached on February 2, the day the trial was to begin. Charles MacInnis, a spokesperson for the utility, would not comment about specifics of the settlement because of a confidentiality clause, although he observed that, "I don't think anybody at Consumers Power believed that EMFs were in any way a factor in the illnesses that were claimed." Late last year, the utility had rejected the recommendation of a mediation panel to pay $250,000 to the prayer center and its codirector, Sister Joanne Chiaverini, to settle the lawsuit. The suit, filed on January 10, 1992, in the Seventh Judicial Circuit Court, Genesee County, MI, claimed that Chiaverini's rare blood disorder and other health problems were caused by EMFs from nearby power lines. EMF levels ranged from 2.2 mG to 9.2 mG "in and about the plaintiffs' property," according to the complaint, which charged Consumers Power with battery, trespass, nuisance and negligence. The center relocated to another site in Flint eight months before the lawsuit was filed and was seeking to recoup relocation expenses. "We felt there was really no medical or scientific evidence to support the plaintiffs' claims," said James Dempsey, the utility's attorney, explaining why the mediated settlement had been rejected. Arthur Swirtz, the plaintiffs' attorney in Flint, declined to comment.

Magnetic Fields Amplify Abnormal Cell Growth: New Evidence for Tumor Promotion

New experimental results suggest that strong magnetic fields can act as tumor promoters and transform noncancerous cells into tumor cells. The studies could lay the groundwork for explaining how magnetic fields produce cellular changes leading to cancer.

Dr. Robert West of the National Center for Toxicological Research (NCTR) in Jefferson, AR, and coworkers have found that JB-6 cells, which originate from mouse skin, formed significantly more cell colonies when grown in the presence of an 11 G 60 Hz magnetic field, compared to control cultures. Reporting on a similar set of experiments, Dr. Jeffrey Saffer of the Battelle Pacific Northwest Labs in Richland, WA, said that EMFs appear to enhance the effect of a chemical tumor promoter.

West and his coworkers plan to continue their work with JB-6 cells. They have already completed experiments at lower field levels and expect a paper to be published in the fall. West declined to discuss these results until the paper has been accepted for publication. *Microwave News* has learned, however, that West has also found a robust effect at 100 mG.

Referring to both Saffer's and West's work, Dr. Nancy Colburn, chief of the Cell Biology Section at the National Cancer Institute in Frederick, MD, said that, "I am convinced that the effect is there. There is a tumor-promoting effect at the levels of EMFs to which the cells were exposed." Colburn, who developed the JB-6 line to study tumor promotion, is collaborating with Saffer on his EMF studies.

Dr. Mays Swicord of the Center for Devices and Radio-

logical Health (CDRH) in Rockville, MD, advised that, "It is a big jump to go from these results right to cancer," but urged that the work be followed up. "If it is correct, there is the potential for adverse effects on human health," said Swicord, who is chief of the molecular biology branch at the Food and Drug Administration's (FDA) CDRH. The NCTR is also part of the FDA, and Swicord is working with West.

West cautioned that his results are preliminary. Magnetic fields caused changes similar to those induced by chemical tumor promoters, he explained. "But until we understand the mechanisms involved, I would strongly suggest that a simple model system showing growth promotion not be used for hazard assessment in humans."

A number of other animal and cellular studies have previously shown that EMFs can act as tumor promoters and co-promoters (see *MWN,* J/A91 and J/A93). In the mid-1980s, Dr. Jerry Phillips, now a member of Dr. Ross Adey's lab in Loma Linda, CA, first showed that EMFs can increase the proliferation of tumor cell colonies in soft agar (see *MWN,* J/A86).

Gene Expression: JB-6 v. HL-60

The new JB-6 findings are coming to light at a time when the bioelectromagnetics community is embroiled in a controversy over the possible effects of EMFs on gene expression.

At last summer's *Annual Meeting of the Bioelectromagnetics Society* (BEMS) in Copenhagen, Denmark, Battelle's Dr. Jeffrey Saffer and Adam Lacy-Hulbert of the U.K.'s University of Cambridge announced that neither could repeat the EMF-induced changes in gene expression in HL-60 cells, originally reported by Drs. Reba Goodman and Ann Henderson (see *MWN,* J/A94). This led to an acrimonious exchange that resumed at the DOE meeting in Albuquerque, NM, last November.

"We are looking at another example of changes in gene expression induced by magnetic fields," Goodman told *Microwave News,* referring to Dr. Robert West's JB-6 work. Goodman is at Columbia University and Henderson is at Hunter College, both in New York City.

Dr. Jerry Phillips commented that, "Many reports in the literature indicate that EMF-induced changes in gene transcription must be occurring, and it is these changes that we must identify and study in detail. JB-6 is an excellent model system for this purpose."

Saffer did not reveal his JB-6 findings at the BEMS meeting. He later conceded that he should have emphasized that his failure to see changes in gene expression in HL-60 cells did not necessarily mean that other cell lines would also fail to respond. He added that he regretted that others had jumped to this conclusion.

Saffer said that he feels that the JB-6 cell line is a "more sensitive system" than HL-60 for detecting tumor promotion. Unlike HL-60 cells, which are fully transformed, JB-6 cells need a promoter before they become tumor cells.

Cells go through several stages before they become cancerous. The JB-6 cells used by West and Saffer have taken the first step in the process and are known as initiated cells. They differ from normal cells genetically and in their susceptibility to tumor promoters. Promotion is the next step, leading to transformed or tumor cells, which may or may not go on to become malignant.

In her own lab, Colburn has used TPA, a known chemical promoter, to transform JB-6 cells into tumor cells. Colburn explained that tumor promotion involves changes in gene expression, but does not necessarily indicate that genes have been altered. Unlike normal cells, transformed or tumor cells do not need to be attached to a surface and will grow in soft agar. West and Saffer have grown JB-6 cells in soft agar following exposure to either EMFs or EMFs plus TPA.

West pointed out that, although cells grown in soft agar can usually form tumors, this is not always the case. Other tests are needed for verification. Colburn emphasized that she has shown that JB-6 cells grown in soft agar with TPA do form tumors in mice, but that, "It would be important to demonstrate this with EMFs as well."

West and his coworkers observed a 40-70% increase in the number of cell colonies when they cultured JB-6 cells in soft agar and exposed them to an 11 G 60 Hz magnetic field for 14 days. Writing in *Bioelectrochemistry and Bioenergetics, (34,* pp.39-43, 1994), they reported no association between increased growth and the strength of the induced electric field, suggesting that cells were responding to the magnetic field alone.

Saffer reported on some preliminary experiments with JB-6 cells cultured in soft agar at the Department of Energy EMF review in Albuquerque, NM, last November. He said that when he grew cells in the presence of a 10 G 60 Hz magnetic field and TPA, there seemed to be enhanced cell colony growth. In a recent interview, he said that, "There's something going on and it is worth pursuing, but a lot of work remains to be done."

Saffer pointed out that there are differences between his findings and those of West but he declined to be more specific. He did say that he is motivated by what West's lab has done but that he wants to get more supporting experimental results before commenting further.

Saffer was recently awarded a three-year grant for over $1 million from the National Institute of Environmental Health Sciences under the national EMF research program, known as RAPID, to study tumor promotion by EMFs in JB-6 cells (see *MWN,* S/O94). Saffer and his coworkers plan to look at the role of certain proteins, such as AP-1, which may be involved in the promotion process. Since AP-1 is composed in part of the proteins of two oncogenes, c-*fos* and c-*jun,* Saffer will also investigate the expression of these oncogenes in JB-6 cells.

Colburn said that, "EMFs are not unusual in that they, like other tumor promoters, work on cells that are initiated." The changes seen in EMF-exposed JB-6 cells are small, but she believes that they are highly repeatable. She said they may be undetectable in the living animal, however, when superimposed on the much greater effects of ordinary hormones and growth factors.

Swedish Magnetic Field Limits Put on Indefinite Hold

The Swedish National Electrical Safety Board (NESB) has no plans to recommend EMF exposure standards in the near future. "I cannot foresee any limits for long-term exposures to magnetic fields," Stefan Villa, a senior administrative officer at the board, told *Microwave News* in late January.

The position of the board, which has been working on EMF rules for two years, is outlined in its annual report to the Swedish government. The report was released in November 1994, two months before the National Board of Health and Welfare issued a report that downplays a possible link between EMFs and cancer, reproductive problems and other health effects (see box at right).

The NESB still favors a policy of prudent avoidance, however, and continues to advise that day-care centers, schools and playgrounds not be built where magnetic field levels exceed 2-3 mG. The board is currently surveying the number of schools, nurseries and similar facilities near power lines.

In addition, the possibility that EMFs promote cancer prompted the NESB to endorse a precautionary strategy—"if this can be done at a reasonable cost." Its three recommendations are to:

- Attempt to design/locate new power lines and power stations in such a manner that the magnetic fields are limited.
- Avoid locating new housing, schools, nurseries, etc. close to existing power stations generating considerable magnetic fields if alternative locations can be utilized.
- Attempt to limit fields of considerable strength in existing homes, schools and places of work.

The Swedish government began work on setting exposure limits in September 1992, shortly after the completion of two major epidemiological studies of EMFs and cancer (see *MWN,* S/O92). By the spring of 1993, the newly formed NESB was analyzing costs that would be associated with a 2, 5 or 10 mG standard, and it was expected to release a draft standard by the end of the year (see *MWN,* M/J93). In January 1994, the NESB pushed back its timetable, and by June the board said it probably would not recommend limits (see *MWN,* J/F94 and M/J94).

"Our knowledge of the effects of weak [EMFs] on humans is at present insufficient. We therefore have no basis on which to establish limits," the board's November report states.

Given the "present uncertain state of the art," the National Association of Swedish Electric Utilities does not consider it justifiable to modify existing lines with the sole aim of reducing fields, according to the report. Nevertheless, Vattenfall and Svenska Kraftnät, two electric utilities, and the association will continue to develop low magnetic field designs for power lines and other electrical installations.

The NESB suggests that scientific research on EMF health problems will not yield definitive answers any time soon: "It is quite possible that the knowledge required to scientifically support a link between weak magnetic fields and health risks will not be developed for many years." The board will continue to report to the government once a year.

Swedish Review: Little Evidence of EMF Link to Health Problems

A working group of the Stockholm-based Swedish National Board of Health and Welfare has found little evidence linking EMFs with cancer, adverse reproductive outcomes or skin problems. Released on January 17, the group's 257-page report—*Evaluation of the Effects on Health of Electrical and Magnetic Fields*—concluded that neither epidemiological data nor experimental studies on animals or *in vitro* support an EMF–cancer connection. "However, the possibility of there being a link between exposure and risk cannot be ruled out, especially with regard to child[hood] leukemia."

Further, the board found that there is no convincing support from epidemiology or animal studies connecting EMF exposure to miscarriages, low birth weights or malformations. Other studies, analyzing the effects of EMFs on VDT operators, did not report any pathological changes in the operators' skin, as has been hypothesized. As yet, there are no tests able to measure whether a person is electrically sensitive, the report noted.

Dr. Kerstin Hagenfeldt of the Karolinska Institute in Stockholm, who is the head of the Swedish Society of Medicine, chaired the working group that prepared the report. There are no plans to translate the report into English, a representative of the board told *Microwave News*. The National Board of Health and Welfare supervises social, public health and medical services in Sweden.

Last May, the board was one of four agencies that released an informational booklet stating that uncertainties in current scientific knowledge leave "no basis for establishing [exposure] limits" (see *MWN,* M/J94).

For a copy of the report, contact: National Board of Health and Welfare, Information Department, S-106 30 Stockholm, Sweden, Fax: (46+8) 783-3302.

AMA Discounts EMF Health Risk, Suggests Further Studies

The American Medical Association (AMA) has concluded that no scientifically documented health risks have been associated with routine exposures to EMFs. However, the Chicago-based organization suggests that more research be done, supports setting exposure levels for the public and workers and will continue to monitor future developments.

These findings are in the AMA's new, but unpublished, assessment of health effects from exposure to extremely low frequency (ELF) EMFs. The report—*Effects of Electric and Magnetic Fields*—was written by Dr. Theodore Doege, a longtime AMA staff member, for the association's Council on Scientific Affairs (CSA). It was approved by AMA's House of Delegates at its interim meeting in December 1994. No publication date has been set, although copies of the report are

available from the AMA.

The report is the AMA's official position on EMFs and its conclusions should help physicians allay patients' fears about everyday exposures, Doege told *Microwave News*. It was reviewed by: Dr. David Brill of the Geisinger Medical Center in Danville, PA, on behalf of the Pennsylvania Medical Society, and Jeffrey Greenawalt, the medical society's director of educational and scientific affairs; Dr. John Peters of the University of Southern California in Los Angeles, on behalf of the California Medical Association; and Dr. Thomas Tenforde of the Battelle Pacific Northwest Labs in Richland, WA.

The report states that some studies in the past 15 years have associated exposure to 50 or 60 Hz EMFs with "slightly elevated risks of developing cancer or leukemia in children or adults." But Doege suggests in his report that there are inconsistencies in "most" of these studies in selecting study population groups, estimating exposures and accounting for other variables.

The same inconsistencies, however, prompted Doege to urge caution in the report: "...without stronger evidence [that] there is no problem, it would be unwise to dismiss the possibility that [EMFs] have adverse health effects."

Further, there is "an urgent need for a laboratory model of the response of cells to [EMFs]," Doege states. Such a model would aid in understanding physiological responses and could point to countermeasures.

Doege recommends the formation of an "authoritative, multidisciplinary" committee under the auspices of the National Academy of Sciences (NAS) or the National Council on Radiation Protection and Measurements (NCRP) to suggest EMF and radiation exposure levels for the public and workers. In an interview, Doege said he was unaware that the NCRP began a study on the biological effects of ELF fields more than a decade ago (see *MWN,* D83 and N/D92). Further, the NAS-National Research Council's (NRC) Board on Radiation Effects Research formed a committee in 1993 to review potential health risks from EMF exposures. Congress mandated the NAS-NRC study in 1991 (see *MWN,* S/O91 and M/J93).

Another AMA recommendation encourages the National Institutes of Health, the Department of Energy and the National Science Foundation to continue research on the effects of EMF exposure, average public exposure levels, occupational exposure and the effects of field surges and harmonics.

The AMA's report is its latest on non-ionizing radiation. Others cover: VDT use (see *MWN,* M/J87); medical device susceptibility to electromagnetic pulse (EMP) (see *MWN,* S/O88 and J/A89); and pulsed electromagnetic field (PEMF) stimulation for treatment of nonunion fractures (see *MWN,* M/A89).

The AMA's EMF report also notes that a 1980 CSA study concluded that significant biological effects can occur from intense exposures to non-ionizing radiation. A 1990 CSA report stated that the association between EMFs and cancer was weak and that more research was needed. Prudent measures should be taken to reduce exposure, the report noted. Neither review was published.

Copies of *Effects of Electric and Magnetic Fields* are available from: Brenda Stewart, CSA, AMA, 515 North State St., Chicago, IL 60610, (312) 464-5046, Fax: (312) 464-5841.

No Risk of Breast Cancer Among Female Electric Blanket Users

Premenopausal women who reported using electric blankets did not have a significantly greater risk of developing breast cancer than similar women who did not use the blankets, according to Dr. John Vena and coworkers at the State University of New York, Buffalo.

Women who kept their blankets turned on all night had the greatest risk of developing breast cancer—a nonsignificant 43% increase over nonusers. In contrast, the group with the highest long-term exposure—those who had used the blankets nightly during the previous ten years—had a risk only 10% greater than expected. "Any strong association...should have been apparent" in this latter group if an EMF–breast cancer association existed, Vena and colleagues argued in the December 1 issue of the Americ*an Journal of Epidemiology (AJE, 140,* pp.974-979).

Vena and colleagues interviewed nearly 300 women over 40 who were newly diagnosed with breast cancer. They wrote that the new results offered "little evidence" of a link between breast cancer and electric blanket use. This was a follow-up to a 1991 study of breast cancer among postmenopausal women, which found a similar nonsignificant increased risk of 46% for those who used an electric blanket throughout the night (see *MWN,* S/O91).

Dr. Richard Stevens of the Battelle Pacific Northwest Labs in Richland, WA, offered a different interpretation: "When you take the two papers together, it looks as if there is weak evidence in support of the EMF–breast cancer hypothesis." He emphasized that the two studies found similar risks and that results from both approached statistical significance. "I suspect that a combined analysis would be statistically significant," he said.

In a telephone interview, Vena countered that he did not want to combine the two studies. "You would need a strong biological rationale to do that," since the disease may have different mechanisms in different age groups, he explained.

In an exchange of letters in *AJE* in 1992, following the publication of the first electric blanket study, Stevens and Vena debated its relevance to the hypothesis of an EMF–breast cancer link (see *MWN,* J/A92). Stevens pointed out that if EMFs promote cancer by disrupting the flow of melatonin, it didn't make sense to study the use of electric blankets. The source of melatonin, the pineal gland, is located in the head, which is not highly exposed to EMFs from electric blankets. Stevens said recently, however, that if the mechanism of interaction involves a direct effect upon breast cells, as some cellular work suggests, then electric blanket studies may be a relevant test of the hypothesis. Stevens first proposed the melatonin hypothesis in a 1987 paper—Vena said it was this paper that prompted his study.

Swedish Firm Resolves EMF Hypersensitivity Cases

In the late 1980s, a group of employees at Sweden's Ellemtel Telecommunication Systems Laboratories in Älvsjö reported that they were suffering from a mysterious ailment. While some believe that the symptoms—including rashes, burning skin, headaches, dizziness, nausea and fatigue—were triggered by high EMF exposures, others point to psychological causes. This phenomenon, now known as electrical hypersensitivity, was then only beginning to be recognized, although others throughout Scandinavia and in the U.S., Australia and other countries have since reported similar conditions.

Top management at Ellemtel, a research company owned jointly by Ericsson and Telia AB (formerly Swedish Telecom), decided to treat electrical hypersensitivity as a "legitimate complaint" and launched a three-year project to find practical solutions to the problem.

"The project was successful in that all personnel who suffer from this phenomenon have returned to meaningful work," Clairy Wiholm, a work environment coordinator for Ellemtel, told *Microwave News,* but added that, "We do not know why we had so many cases of hypersensitivity all at once."

Between 1988 and 1990, 27 staff members (out of approximately 1,000) developed symptoms after working at computers or near other electrical appliances—this number has since grown to over 50. "Several key figures in the company began to wonder whether these various inexplicable cases could eventually jeopardize some of the company's many vital development projects," according to a recently released 82-page English summary of a more detailed report in Swedish, written by Ellemtel's management. The fact that Ellemtel invested significant time and money in this problem "gave the individual the 'shot in the arm' which was needed to overcome his or her situation," the summary emphasizes.

In March 1990, Ellemtel began to seek ways to help its employees. The company based its policies on the premise that "hypersensitivity can be triggered by interacting factors in the physical and psychosocial environment and by the individual's personal [traits]," the report explains. Measures to lower EMF exposure for hypersensitive workers, as well as to improve the work environment, were implemented simultaneously.

Ellemtel reduced EMFs from equipment and wiring, because many of those with hypersensitivity believed that electricity was the root of their problem, according to the summary. In equipment-free offices, the 50 Hz magnetic fields were required to be less than 2 mG and electric fields less than 20 V/m.

To accommodate those who required even lower EMF levels, the company experimented with ways to create shielded offices. The fields in one room lined with aluminum sheets were 0.02-0.05 mG. Since this room was expensive to build and too small to hold everyone who needed a low EMF environment, another, conference-sized room was shielded with several layers of copper sheeting. The magnetic fields in this room were less than 0.2 mG, which the company found was comfortable for most hypersensitive employees.

Ellemtel engineers developed a variety of very low emission computer monitors, including a plasma screen, several types of liquid crystal displays and a fully shielded CRT screen.

By the end of 1992, of 49 people who had developed hypersensitivity, 35% had recovered completely, 59% had improved and 6% remained the same. In the period between the 1993 publication of Ellemtel's project report and the release of the English summary, six more workers reported becoming hypersensitive. The symptoms were less severe than in previous cases and all cited stress as the most probable cause of their symptoms, according to the company.

Ellemtel spent more than $900,000 on the project. Between 1991 and 1993, the Swedish Working Life Fund sponsored additional research on electrical hypersensitivity at Ellemtel, spending approximately $1.2 million. Much of this work—covering such topics as the impact of the physical and the psychosocial environments, the role of amalgam tooth fillings and the effects of chemicals emitted by computers—was carried out by university researchers.

Hypersensitivity in the Working Environment: Summary of a Project Report on a Swedish Company's Handling of a New Working-Environment Problem (1994) is available for 95 Kr. (approximately $12.75) from: Ellemtel, Box 1505, S-12525 Älvsjö, Sweden, (46+8) 727-3520, Fax: (46+8) 647-8276. (See also, *MWN,* J/F87, M/A87, M/J91 and N/D94.)

A Severe Case of EMF Hypersensitivity

Per Segerbäck, an electrical engineer who designs integrated circuits, was one of those at Sweden's Ellemtel Labs who developed a severe case of electrical hypersensitivity. He first experienced slight nausea and a sensation of "grit" in his eyes while working on his computer in the mid-1980s, but these symptoms disappeared when he used an antistatic spray and sat further back from the monitor. In 1989, after working long hours at a high-resolution monitor, Segerbäck developed more severe symptoms.

By early 1990, he had to go on sick leave and was unable to sleep inside his own home, which was heated electrically. He started spending nights in the family car, and later moved into a trailer parked in the garden. With the help of Ellemtel engineers, Segerbäck reduced the EMFs to a tolerable level in a room in his home by changing the wiring and plumbing, layering the entire room with ferrosilicon sheeting and placing aluminum blinds on the doors and windows.

Although he has now returned to work, Segerbäck's daily routine is severely limited; he is confined to a shielded room at home and a similarly protected office. He follows a route that avoids power lines and transformers. A few years ago, when he and his family tried to go on vacation to a cottage with no electricity on an isolated island, the trip had to be cut short when they found out that the sheep in the area were penned with electric fencing.

Segerbäck's story is included in Ellemtel's report on hypersensitivity at the company (see story at left).

in Stockholm, Sweden, said, "I am quite impressed with the brain tumor results. My feeling is that they are quite reliable."

Savitz and Loomis did not find any increase in the overall leukemia risk and they saw only nonsignificant, slightly elevated risks for acute myeloid leukemia (AML) and chronic lymphocytic leukemia (CLL) among some of the more highly exposed workers. But they cautioned that misclassification of leukemia and brain tumor subtypes on death certificates—which they relied upon for diagnoses—could be substantial.

A number of epidemiologists commented that they were not surprised that a mortality study like the Savitz–Loomis one had failed to support a leukemia risk. They said that they put more faith in a morbidity or incidence study for leukemia.

Savitz and Loomis measured exposures with an AMEX meter, which provides time-weighted average magnetic field levels. They did not measure transients—or other kinds of fields—which have been the focus of recent attention (see *MWN,* M/A94 and N/D94). William Feero said in an interview that the study was "the best done to date," but that, "We are still doing a terribly poor job on exposure assessment." Feero, of Electric Research and Management Inc., based in State College, PA, added that more needs to be learned about the different types of magnetic field exposures. "There are a hell of a lot of different field characteristics," he said.

Dr. Gilles Thériault of McGill University in Montreal, Canada, said he believes that there are a small number of people exposed to a specific, and so far unidentified, component of the field. He stressed that he is convinced that there is some connection between EMFs and cancer. "We keep seeing smoke, but we have not identified the fire. And there is a fire out there. One day we will put our finger on it."

With respect to the results of his study, Savitz explained that there is either a small risk to all workers or a large risk to a very small group of workers who are exposed to a specific type of field. Loomis said that an effect might depend on specific exposure conditions or specific characteristics of a population that have not yet been identified.

The Savitz–Loomis study, which was sponsored by the Electric Power Research Institute (EPRI) in Palo Alto, CA, included 138,905 men who had been employed full time for at least six months between January 1, 1950, and December 31, 1986, at one of five utilities—Carolina Power and Light Co., Pacific Gas and Electric Co., PECO Energy Co., the Tennessee Valley Authority and Virginia Electric Power Co. Exposures were assigned to 28 job categories on the basis of a sampling of recent measurements of nearly 3,000 workers wearing AMEX meters. Exposures for individual workers were based on these measurements and on the length of time they worked at a particular job.

This is the fourth large occupational study with detailed exposure assessments to appear in the last couple of years. In 1992, Dr. Birgitta Floderus and colleagues at the National Institute of Occupational Health in Solna, Sweden, found an increase of CLL and brain tumors among exposed workers from a variety of industries (see *MWN,* S/O92). A study of utility workers at Southern California Edison Co. (SCE), led by Jack Sahl, found no overall association between leukemia or brain cancer and EMFs (see *MWN,* M/A93 and J/A93). A three-utility Canadian–French study, headed by Thériault and published last March, found a significant association between EMFs and some leukemia subtypes as well as one type of brain tumor (see *MWN,* M/A94).

A number of earlier occupational studies, including one on electrical workers by Loomis and Savitz published in 1989, have pointed to a brain cancer risk from EMFs (see *MWN,* N/D89 and M/A90). In a much smaller study than the 1995 Savitz–Loomis study, Dr. Susan Preston-Martin and colleagues at the University of Southern California School of Medicine in Los Angeles found a more-than-fourfold increased risk of astrocytomas, a brain tumor type, among EMF-exposed workers (see *MWN,* M/A90).

Dr. Daniel Wartenberg of the Environmental and Occupational Health Sciences Institute in Piscataway, NJ, said, "There is a sense of frustration in the lack of clarity with previous studies, but they are not wildly inconsistent. The results lend more evidence in the direction of an association between magnetic fields and cancer." Like Savitz, Wartenberg is a member of the National Academy of Sciences-National Research Council's EMF committee (see *MWN,* M/J93). Dr. Jan Stolwijk of Yale University in New Haven, CT, a third epidemiologist on the panel, did not respond to a call for comment.

The brain cancer link seen by Savitz and Loomis is generally consistent with the one found by Floderus. Savitz said that their brain cancer data at the highest exposures are also "quite compatible" with those reported by Thériault's group. Writing about their study in the January 15 *American Journal of Epidemiology,* Savitz and Loomis concluded that, "Our risk estimates of 1.5-2.5 are not markedly discordant from [Thériault's] reported relative risks of approximately 1.5."

And some epidemiologists see the Savitz–Loomis leukemia results as not inconsistent with past studies because their use of death certificates may have led to an underestimation

Savitz–Sahl–Thériault: Joint Analysis Planned

Jack Sahl, Dr. David Savitz and Dr. Gilles Thériault may soon start working together to sort out apparent inconsistencies among their three studies of utility workers. But details of the joint project, including its funding, have yet to be resolved.

"We are still trying to determine an approach," Dr. Stanley Sussman, EPRI's EMF project manager, told *Microwave News*. EPRI is acting as the facilitator for the project.

Savitz said that he favors the collaboration, but that he is not optimistic that it would clarify the differences in results. And Sahl said he thinks it could be an important next step.

Dr. Claude Cardinal, Hydro-Québec's EMF program manager, said that while he likes the idea, "We will have to see if it is feasible." Thériault and the Canadian utility are at odds over the control of the data collected for his study (see *MWN,* N/D94).

of the risk as well as the misclassification of subtypes.

Floderus told *Microwave News* that she is not "surprised" by the apparent differences in leukemia results. "Very few mortality studies have found an association for leukemia, and very few morbidity studies did not obtain elevated risk estimates, so something in the morbidity/mortality study designs seems to be important." And Ahlbom commented, "The question for leukemia is whether we can identify features in the study designs that explain the apparent inconsistencies."

"Savitz is short 15-20% of the cases because not everyone will die of leukemia and that may explain the difference between his and our studies," Thériault said. In their paper, Thériault and coworkers pointed out that if they had analyzed only overall leukemia and ignored subtypes, their conclusions would have been similar to those of Sahl's group. Thériault found a threefold elevated risk of AML among highly exposed workers, but, like Sahl, saw no significant risk of leukemia overall.

Dr. Samuel Milham Jr., a consulting epidemiologist based in Olympia, WA, agreed that a mortality study does not tell the whole leukemia story. "You would miss half of the CLL," he said. He added that, "I don't think the Savitz study dismisses the leukemia–EMF connection. There is something going on." He pointed to the study's finding that longtime electricians were two-and-a-half times more likely to die of leukemia than other electricians.

Savitz said that he felt that the death certificate data were a reasonable reflection of the incidence of overall leukemia and brain cancer. But he allowed that, "We did not do an extra-high-quality study for leukemia subtypes." He explained that because the U.S. does not have a national cancer registry, they were unable to collect data on cancer incidence for the study's large and geographically diverse group of workers.

Dr. Nancy Wertheimer, based in Boulder, CO, said that, "While the Savitz–Loomis, Thériault and Floderus studies show different patterns of subtype risk, all three seem to show a significant risk for brain tumors and leukemia combined, when exposure is high in the 10-20 years before diagnosis."

With respect to estimating EMF exposures, Savitz and Loomis wrote that "relative to the 'gold standard' of accurate historical information, we undoubtedly fell short." Savitz said their historical reconstruction was limited by the lack of available utility records. He also said that while it would have been useful to have a meter with broader capabilities, they also needed one that nontechnical people could use easily. "In hindsight, we made the right choice," he said.

Standardized mortality ratios (SMRs), which compare the workers' cancer rates with those of the general population, showed that the utility workers were at a lower risk for both leukemia and brain cancer. Savitz and Loomis attributed this to the "healthy worker effect"—that is, people who have jobs are among the healthier members of the population.

Dr. Dimitrios Trichopoulos of the Harvard School of Public Health in Boston countered that he does not think that the healthy worker effect can be invoked to explain the lower SMRs for brain cancer. He explained that an employer has no way to predict whether a person who is healthy when hired may later get a brain tumor. He said that he would conclude that the utility workers in the Savitz study were "in an environment associated with a lower risk of brain tumors." Savitz agreed that the effect applies more to some diseases than to others, but he maintained that it applies to a whole range of cancers, including brain cancer.

In addition to a joint analysis with Sahl and Thériault (see p.8), Savitz and Loomis plan to analyze further the data on prostate cancer as well as a number of other diseases. Loomis pointed out that even a small elevated risk for prostate cancer could be important, since it is a common disease. Savitz also plans to look at the lung cancer data. Thériault's group recently reported a strong association between lung cancer and

Savitz–Loomis Abstract

"Reports of leukemia and brain cancer among men in electrical occupations suggest a small increase in risk, but most previous studies have failed to classify magnetic field exposure accurately or to consider potential confounders. The authors conducted an historical cohort mortality study of 138,905 men employed at five large electric power companies in the United States between 1950 and 1986 with at least 6 months of work experience. Exposure was estimated by linking individual work histories to data from 2,842 workshift magnetic field measurements. Mortality follow-up identified 20,733 deaths based on 2,656,436 person-years of experience. Death rates were analyzed in relation to magnetic field exposure history with Poisson regression. Total mortality and cancer mortality rose slightly with increasing magnetic field exposure. Leukemia mortality, however, was not associated with indices of magnetic field exposure except for work as an electrician. Brain cancer mortality was modestly elevated in relation to duration of work in exposed jobs and much more strongly associated with magnetic field exposure indices. Brain cancer risk increased by an estimated factor of 1.94 per microtesla-year of magnetic field exposure in the previous 2-10 years, with a mortality rate ratio of 2.6 in the highest exposure category. In contrast to other studies, these data do not support an association between occupational magnetic field exposure and leukemia but do suggest a link to brain cancer." David Savitz and Dana Loomis, "Magnetic Field Exposure in Relation to Leukemia and Brain Cancer Mortality Among Electric Utility Workers," *American Journal of Epidemiology, 141,* pp.123-134, January 15, 1995.

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Related papers:

H. Kromhout et al., "Assessment and Grouping of Occupational Magnetic Field Exposure in Five Electric Utility Companies," *Scandinavian Journal of Work, Environment and Health,* in press, 1995.

Dana Loomis et al., "Organization and Classification of Work History Data in Industry-Wide Studies: An Application to the Electric Power Industry," *American Journal of Industrial Medicine, 26,* pp.413-425, 1994.

Loomis et al., "Sampling Design and Field Methods of a Large, Randomized, Multisite Survey of Occupational Magnetic Field Exposure," *Applied Occupational and Environmental Hygiene, 9,* pp.49-52, 1994.

Comments on Savitz–Loomis Study

"Large studies such as this one are expensive and time-consuming. Future studies need to be designed to efficiently evaluate more refined ideas about what aspects of exposure, if any, are important and which individuals might be susceptible."

—Dr. **David Savitz**, quoted in *Carolina News Services,* University of North Carolina, Chapel Hill, news release, January 6, 1995

"It is disappointing that our results do not provide a clearer picture [of the cancer–EMF link] when combined with the previous studies of electrical workers and particularly electric utility workers."

—Drs. **David Savitz** and **Dana Loomis**, *Magnetic Fields in Relation to Leukemia and Brain Cancer Among U.S. Electric Utility Workers: Summary for a General Audience,* January 11, 1995

"I don't want to downplay the adverse aspects of our findings, but one thing our study does is show once again there is not some public health disaster lurking out there."

—Dr. **David Savitz**, quoted in "Study of Electrical Workers Has Mixed Findings on Cancer," *Washington Post,* January 12, 1995

"I really feel that this issue should have at this point a rather limited effect on the way people live their lives. I argue that where there are easy opportunities to reduce exposure, it's only reasonable to do so. But to make major changes, whether in the work of a lineman or where people live, there's a real possibility that no benefit would result."

—Dr. **David Savitz**, quoted in "Study Examines Risks of Electromagnetic Fields," *Charlotte Observer* (NC), January 11, 1995

"The IBEW continues to believe that changes in the work environment at utilities to provide further protection against the still unproven effects of EMF must not elevate the degree of risk associated with energized electric lines. We have pressed for and will continue to press for protection against the well-known, documented dangers inherent in work on or in close proximity to live lines."

—**John Barry**, president, International Brotherhood of Electrical Workers (IBEW), quoted in *IBEW News Release,* January 11, 1995

The cancer risk factor found in the Savitz–Loomis study and earlier studies is much lower than that for cigarette smoking—"miles and miles away." Still the Savitz–Loomis findings "strengthen the idea that electromagnetic fields produce some risk of cancer."

—Sir **Richard Doll**, Imperial Cancer Research Fund in Oxford, U.K., quoted in "New Study of Electromagnetism Clouds Hunt for Cancer Link," *New York Times,* January 12, 1995

"Among the many strengths of the study are its large sample size, a cohort design, a thorough identification of the study population, nearly 100% follow-up of subjects, long follow-up period, blind (on exposure status) coding of the death certificates, an extensive exposure measurement program which was based on a random sample, homogeneity of jobs, focus on an industry with the potential for high exposure, detailed occupational histories for all workers, development of specific *a priori* hypotheses, and a detailed assessment and control of potential confounding by other occupational exposures. All of these aspects are likely to minimize bias and enhance the validity of the study. Limitations related to interpretation of the study include: reliance on death certificates for diagnoses, inability to rigorously examine cancer subtypes, and the use of an instrument that was able to record only average exposures. To obtain precise and stable estimates of risk for rare cancers, such as leukemia and brain cancer, the study covered a long period of time. Reconstruction of 30 years of exposure to a complex and highly variable agent is very difficult and has likely led to misclassification. Furthermore, as with other studies of the potential health effects of magnetic fields, uncertainty as to the appropriate characteristic of the magnetic field is of concern....Of special interest are three studies of utility workers [Sahl, Savitz, Thériault]. These studies incorporate a number of methodological improvements, including *a priori* hypotheses, extensive measurements, large sample size and assessment of potential confounding. Improvements in study quality, unfortunately, have not clarified the relationship between EMF exposure and cancer. In particular, the inconsistencies in results among studies underscore our limited understanding of the risks of exposure to EMF among utility workers and suggest the need for further analyses and additional studies."

—**Electric Power Research Institute** (EPRI), *Comments,* January 1995

"I truly believe this is the best study we have to date of this question. I don't think more epidemiologic studies of larger populations with our current techniques are going to clarify this any further...until we understand more about actual mechanisms [whereby EMFs might cause cancer] and whether it is electric or magnetic fields."

—Dr. **Patricia Buffler**, University of California, Berkeley, quoted in *Washington Post,* January 12, 1995

"The question is how many more studies do we need to start protecting workers exposed to [EMFs] and people's residences?...You have to cut through all that smoke and say (the threat from the fields) is real, and we've got to start protecting people. You don't need conclusive scientific proof before you take protective health measures."

—**Michael Withey**, Seattle attorney, quoted in "Electromagnetic Fields Linked to Brain Cancer," *Seattle Post-Intelligencer,* January 13, 1995

"I think everybody recognizes we're not going to get the answers from epidemiological research."

—**Kirvil Skinnarland**, environmental affairs chief, Seattle City Light, quoted in *Seattle Post-Intelligencer,* January 13, 1995

"One of the hallmarks of what we look for...is consistency in studies, the same outcome from the same kind of exposure. We haven't been able to achieve that to date."

—**Jack Sahl**, Southern California Edison Co., quoted in *Seattle Post-Intelligencer,* January 13, 1995

"Definitive answers to the questions surrounding magnetic fields and human health are of the utmost importance to our members, their employees and customers. We must further our understanding of the similarities and differences between EMF studies. And future studies need to consider elements other than magnetic fields present during electricity production, transmission and use. We believe the National EMF Research Program could concentrate on these areas."

—**Thomas Kuhn**, president, Edison Electric Institute (EEI), quoted in *EEI News Release,* January 11, 1995

"The implications of this study are not clear. Since leukemia and brain cancer are both rare diseases, even a doubling of risk for these diseases implies only small increases in the total number of people affected. These utility workers were exposed to high magnetic fields for a long period of time, and we are not sure how that exposure relates to the general public."

—**Environmental Protection Agency**, *News Release,* January 1995

transients (see *MWN,* N/D94).

Savitz said that, "We've done about as well as we can do with the broad hypothesis that EMFs can affect health—now we need more refined ideas."

Loomis concurred: "We need to go back to the theoretical drawing board." He said that new ideas are needed about specific conditions but that without them he would not do a long-term average exposure study again.

Thériault emphasized the need for more research: "We should not quit halfway—before we have the answer. If we did, we would lose what we have learned so far. We are gaining ground." He encouraged researchers to look to the laboratory as well: "The promoter/copromoter concept is bound to lead us to a conclusion" (see p.3).

HIGHLIGHTS

« Cellular Phone Notes »

Dr. **George Carlo** reports that the Cellular Telephone Industry Association's (**CTIA**) Scientific Advisory Group (**SAG**) on Wireless Technology has a 1995 budget of over $10 million, of which $8-8.5 million is targeted for health and safety research grants. The SAG spent close to $3 million in 1994, primarily on workshops and on scientific consultants, establishing what Carlo called a "very solid foundation" for the research program. The SAG is still in negotiations on two dosimetry contracts: one with Dr. **Om Gandhi** of the University of Utah, Salt Lake City, to create a certification program for cellular phones and another with Dr. **C.K. Chou** of the City of Hope National Medical Center in Duarte, CA, for exposure assessment studies and a head-only exposure system (see *MWN,* J/F94). These projects were first announced in December 1993. "I've tried to do everything humanly possible to give C.K. the financial support he needs to get going with the project," Carlo explained, but an agreement with the medical center over a number of issues, including the use of good laboratory practices, has not yet been reached. Chou said that he remains optimistic that a contract will be signed soon, but added, "It's very frustrating." Gandhi is equally frustrated, though more pessimistic. "I really don't know what is going on," he said. (In January, the SAG changed its name — to better reflect its expanded role. Originally, the SAG was only concerned with cellular phones and brain cancer, Carlo said, while it now addresses cellular towers, electromagnetic interference and PCS systems.)

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Dr. **Ray Tice** of Integrated Laboratory Systems in Research Triangle Park, NC, who is coordinating the **international validation study** of the use of the comet assay to measure DNA breaks, expects more than 20 labs to participate (see p.12 and *MWN,* N/D94). Some 15-20 labs will work on *in vitro* experiments and approximately eight on *in vivo* exposures; there will be some overlap between the two sets of labs. Tice said they will test five readily available chemicals in one type of cell culture, probably mouse lymphoma cells—with and without metabolic activation. Microwave exposures are not planned because of the scarcity of exposure systems. Tice said that all participants will pay their own way and that anyone who is interested can join the project. They will meet on March 12 in St. Louis at the *1995 Meeting of the Environmental Mutagen Society.* He expects results in about a year. Tice can be reached at (919) 544-4589, ext.223.

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On January 17, Dr. George Carlo briefed **Carol Browner**, the administrator of the Environmental Protection Agency (EPA), on the SAG's proposed research program. Carlo said that he had assured Browner that the SAG program was "consistent and complementary" to the two-year study by the National Council on Radiation Protection and Measurements—commissioned by the EPA—on the potential effects of weak, modulated RF/MW radiation (see *MWN,* S/O94).

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At a February 1993 congressional briefing, Dr. **Richard Adamson**, then director of the **National Cancer Institute**'s division of cancer etiology, announced that a study was under way to investigate the possible links between brain tumors and cellular telephones, among other agents (see *MWN,* J/F93). Results are not anticipated until 1997-1998, according to Dr. **Peter Inskip**, who is in charge of the study, which, he said in a recent interview, is in the data collection phase. Dr. Adamson left the institute last year to head the Washington office of the National Soft Drinks Association; Dr. **Jerry Rice** is currently serving as acting director of the division.

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A workshop on ***Health Protection in Personal and Cellular Communication Systems*** was held in Eilat, Israel, on January 25 as part of the *International Symposium on Future Telecommunications and the Electromagnetic Environment,* sponsored by URSI and the ITU. The workshop was organized by Dr. **Paolo Bernardi** of the University of Rome, Italy. On January 23, Motorola's Dr. **Quirino Balzano** presented a plenary paper, coauthored with Dr. **Ross Adey** of the VA Hospital in Loma Linda, CA, on "Mechanisms of Interaction of RF/MW Fields with Living Tissues." Among the speakers at the workshop was CTIA-SAG's **Kelly Sund** on the U.S. health research program. In addition, Dr. **Paolo Vecchia** of the Istituto Superiore di Sanita in Rome reviewed epidemiological studies on long-term exposures to RF/MW radiation and Dr. **Yngve Hamnerius** of the Chalmers Institute of Technology in Göteborg, Sweden, discussed microwave-induced changes in the permeability of liposomes.

Motorola Sponsors Replication of Lai–Singh DNA Breaks Study

Motorola has contracted with Dr. Joseph Roti Roti of Washington University in St. Louis to repeat and extend recent experiments showing that microwave radiation can cause breaks in the DNA of animal brain cells.

In a paper to be published this spring, Drs. Henry Lai and Narendra Singh of the University of Washington, Seattle, report that athermal levels of microwave radiation can cause single-strand breaks in the DNA of rat brain cells (see *MWN,* N/D94). Lai and Singh used a technique called the comet assay to measure DNA breaks.

"We want to determine whether the comet assay is a repeatable and reliable test for DNA damage," said Dr. Quirino Balzano, a Motorola corporate vice president in Fort Lauderdale, FL. Balzano noted that within a week after visiting Lai and Singh's lab last August, he began negotiations with Roti Roti to replicate their study. That contract was formalized in mid-December.

In an interview with *Microwave News,* Roti Roti explained that his project is more than an "outright replication" of the Lai–Singh experiment. "We plan to use two other assays in addition to the comet assay so that if we find an effect, we might understand what is going on," he said. The two other techniques are the fluorescent halo assay and pulsed field gel electrophoresis.

Roti Roti will investigate the effects of microwave radiation on the DNA in rat brains and on three different cell lines, including rat and human brain tumor cells. He noted that he plans a "complete anatomical dissection of the rats' brains" in order to see if there are effects on different types of brain cells.

"Our strategy is to first try to repeat the Lai–Singh experiment without talking to them," Roti Roti said. "But, if we have trouble, we will work with them." The microwave exposure system is being designed and built by Dr. William Pickard of Washington University's electrical engineering department.

The first step is to repeat the Lai–Singh experiment at 2450 MHz, Balzano said, and then do the study again at cellular phone frequencies. Previously, Motorola commissioned a series of animal and cellular studies in Roti Roti's lab on the possible carcinogenicity of cellular phone signals.

Meanwhile, as we went to press at the end of January, Dr. George Carlo of the Cellular Telephone Industry Association's Scientific Advisory Group (SAG) on Wireless Technology in Washington was awaiting a response from the Harvard Center for Risk Analysis peer review board on cellular phones on whether the SAG should sponsor its own replication of the Lai–Singh study—or wait for the results of the international project to validate the comet assay (see p.11). Carlo said that Dr. John Graham, the director of the Harvard center, will present the peer review board's views at its February 16 meeting. In a separate talk, Dr. Ray Tice of Integrated Laboratory Systems in Research Triangle Park, NC, will review the use of the comet assay in genetic toxicology.

MICROWAVE NEWS is published bimonthly. • ISSN 0275-6595 • PO Box 1799, Grand Central Station, New York, NY 10163 • (212) 517-2800; Fax: (212) 734-0316 • Editor and Publisher: Louis Slesin, PhD; Senior Editors: Teresa Moogan, Gail Roberts, Susan Wensley; Associate Editor: Lara Schoeberlein; Assistant Editor: Christopher Doherty; Copy Editors: Jim Feldman, Roy Thomas Jr.; Production Coordinator: Joe Mungioli; Circulation Assistant: Diana Cooper • Subscriptions: $285.00 per year ($315.00 Canada & Foreign, U.S. funds only); single copies: $50.00 • Copyright © 1995 by Louis Slesin • Reproduction in any form is forbidden without written permission.

Industry Asks FCC To Preempt Local Rules for Cellular Towers

Two trade associations have called on the Federal Communications Commission (FCC) to preempt state and local regulations on the licensing of cellular telephone towers. The Electromagnetic Energy Association (EEA) and the Cellular Telecommunications Industry Association (CTIA) argue that federal rules are necessary for the advancement of the communications industry in general and the cellular phone industry in particular.

Concerns over the potential health hazards associated with exposure to microwave radiation from cellular phone towers have prompted many siting battles and, in some cases, have led to restrictions on where they can be located. Some communities have set microwave exposure standards that are more stringent than those used by the FCC, and some localities have prohibited towers near schools and day-care centers (see *MWN,* N/D93).

In its December 22 petition, the EEA cites examples of local and state regulations that have set tighter emissions standards than the FCC's. Such regulations, it states, have hampered the construction and operation of FCC-licensed facilities. The EEA claims that federal preemption is needed to allow the development of advanced television, digital audio broadcasting, personal communications services and cellular telephones.

CTIA's petition, filed on December 27, addresses tower siting restrictions that are not concerned with radiation hazards—for instance, aesthetic concerns. The petition cautions that the intervention of 38,000 local jurisdictions could impede the completion of the country's cellular network and raise user costs.

Because it deals specifically with radiation issues, the EEA's request will be considered as part of the FCC's still pending proposal on whether to adopt the ANSI/IEEE C95.1-1992 microwave exposure standard (see *MWN,* M/A93). "The problem will be considered by the commissioners in February or March," said Dr. Robert Cleveland of FCC's Office of Engineering and Technology in Washington. In comments on the FCC proposal, several communications companies specifically asked for federal preemption; these included: Capital Cities/ABC Inc., CBS Inc., GTE Service Corp., Hammett & Edison Inc., McCaw Cellular Communications Inc. and the National Association of Broadcasters (see *MWN,* M/J94).

CTIA's request for preemption will be considered as a separate proceeding. Notice of CTIA's petition to the FCC

was announced in a January 18 public notice. No formal announcement appeared in the *Federal Register.* Comments are due by February 17. Reply comments are due by March 6.

Citizens groups are organizing to stop the CTIA and EEA initiatives. The failure of the FCC to publish the petition in the *Federal Register,* said activist Kathy Hawk of Butler, PA, reinforces the "general impression that the FCC is nothing more than a front organization for its licensees."

Folks for Appropriate Cellular Tower Sites (FACTS), a citizens group based in Great Barrington, MA, also opposes the CTIA proposal, according to Cochair Honey Sharp Lippman. FACTS is concerned that a proposed 13-story cellular tower will destroy the Berkshires' natural beauty, affecting quality of life and tourism. "Preemptive power by the FCC would rob local communities and states of the right to local scrutiny through carefully thought-out zoning bylaws."

In 1985, responding to a number of requests, the FCC decided not to preempt state and local regulations (see *MWN,* Ap 85). Two years later, it exempted cellular towers from having to prepare environmental impact statements under the National Environmental Policy Act (see *MWN,* M/A87).

The EEA is a coalition of electronics and communications companies. CTIA, the national trade association of the wireless industry, is a member of the EEA; both are located in Washington.

Officer's Widow Refiles Police Radar Cancer Suit

The family of an Ohio highway patrolman has filed a new suit against the manufacturers of the radars that they blame for his fatal brain tumor. The suit was filed on December 14, 1994, in the U.S. District Court for the Southern District of Ohio in Cincinnati. More than 20 similar cases have been filed in the U.S., but none successfully.

In its $20 million lawsuit, the family of Wayne Vessels Jr. charge that the radar equipment he used for 15 years—from 1972 to 1987—was defective in its design, manufacture and operating instructions. They also argue that the radar guns "emitted dangerous, unhealthy and harmful microwave energy and electromagnetic radiation" at power densities sufficient to cause his cancer.

The three defendants named in the suit are Kustom Signals Inc. of Lenexa, KS, Kustom Electronics Inc. of Overland Park, KS, and MPH Industries of Owensboro, KY. Vessels filed a similar suit in March 1992; that suit was withdrawn after his death later that year (see *MWN,* M/A91, M/J92 and S/O93).

Vessels, who served with the Ohio State Patrol for 25 years, was first diagnosed with basal and squamous cell carcinoma in 1977. In January 1992, he learned that the cancer had spread to his brain; he died that December. According to the complaint, Vessels did not suspect the causal connection between the radar equipment and his illness until February 1991.

Michael Cassity of Mt. Orab, OH, an attorney representing the Vessels family, anticipates a court date late this year. He said he has identified expert witnesses who will link the radar guns to Vessels's cancer but would not comment further.

John Wykoff, an attorney for MPH Industries, is skeptical of the merits of the case. "We'll see if it goes to trial," he told *Microwave News.* "There isn't any evidence yet linking police radar with cancer." Wykoff is with the firm of Cash, Cash, Eagen & Kessel in Cincinnati.

Only one case involving police radar has gone to trial. A claim by Eric Bendure, who argued that his non-Hodgkin's lymphoma was caused by a radar gun, was rejected by a jury in January 1993 (see *MWN,* J/F93). (For a compilation of legal cases involving police radar, see *MWN,* S/O93.)

EMFs Boost Tree Growth *(continued from p.1)*

submerged submarines. The program, which concluded in 1994, was managed by the IIT Research Institute (IITRI) in Chicago.

MTU's Dr. David Reed told *Microwave News* that two other participating research teams observed similar changes in plant cycles: Dr. Thomas Burton of Michigan State University, East Lansing, observed more chlorophyll production and greater biomass in benthic algae at the bottom of the Ford River, which the antenna crosses. And Dr. Johann Bruhn at the University of Missouri, Columbia, found faster decomposition rates in plant litter near the 56-mile-long antenna.

Reed acknowledged that nothing in the literature prepared them for their finding of faster growth: "Our reaction was 'Holy Smokes! What does this mean?'" And MTU's Dr. Glenn Mroz commented that the increased tree growth surprised people "to the point that they didn't believe us."

"Most likely the trees aren't producing greater biomass at the site—just reallocating their carbon resources differently, shifting some from their roots to their leaves and branches," Reed said. He also speculated that red oaks and paper birches did not show the growth effect because they transport nutrients differently than the other types of trees. Finding the mechanisms that produce these changes was beyond the scope of the Navy project, but the MTU researchers compared the observed effects to those induced by fertilizer.

In addition to checking the trees' growth patterns, the MTU team monitored the volume and quality of fallen leaves and pine needles and the development of annuals growing below the trees. "They revealed no abnormalities," said Reed.

Although the MTU article was published over a year ago (*International Journal of Biometeorology, 37,* pp.229-234, 1993), the results were not publicized until the university issued a press release last December. Stories have since appeared in the January 14 *New Scientist* and in the January 27 *Science.*

All the data from the ten studies are now with the Board on Environmental Studies and Toxicology of the National Academy of Sciences' National Research Council (NRC) in Washington. A review committee is expected to be announced in February, according to the NRC's Raymond Wassel.

The Navy's Project ELF in northern Michigan and Wisconsin has sparked heated controversy and protests continue unabated. In response to a suit brought by the state of Wisconsin, a federal judge stopped the project in January 1984, until the Navy agreed to prepare a revised environmental impact statement (see *MWN,* J/A83, J/F84, Mr84 and J/A84). The Navy then instituted the monitoring program managed by IITRI.

Mobile Communications Dosimetry Abstracts

Hsing-Yi Chen and Hou-Hwa Wang, "Current and SAR Induced in a Human Head Model by the Electromagnetic Fields Irradiated from a Cellular Phone," *IEEE Transactions on Microwave Theory and Techniques, 42*, pp.2249-2254, December 1994.

Using a near-field finite-difference time-domain (FDTD) computer model, these Taiwanese electrical engineers at the Yuan-Ze Institute of Technology calculated the maximum SAR in the head to be 1.48 W/Kg when the 835 MHz, 0.6 W phone is at a distance of 2 cm—just below the peak partial-body SAR of 1.6 W/Kg recommended in the 1992 ANSI/IEEE standard. They found that the SAR fell to 1.31 W/Kg when they used the recent, but unpublished, estimates from the U.K. that the dielectric properties of bone may be close to those of muscle at microwave frequencies. Dr. Chen and Wang also note that the absorption of electromagnetic energy varies "drastically" with polarization.

H.-R. Chuang, "Human Operator Coupling Effects on Radiation Characteristics of a Portable Communication Dipole Antenna," *IEEE Transactions on Antennas and Propagation, 42,* pp.556-560, April 1994.

According to Chuang's calculations, the peak SARs in the head increased from 0.21 W/Kg to 1.34 W/Kg as the separation between an 840 MHz, 0.6 W dipole antenna and the head decreased from 5 cm to 1 cm. At 2 cm, the peak SAR was 0.9 W/Kg. Chuang is with Taiwan's National Cheng Kung University.

Richard Cooper and Roger Radcliff, "The Effects of a Nearby Biological Body on the Parameters of a Small Hand-Held Transmitter Operating in the HF Band (3 MHz-30 MHz)," *IEEE Transactions on Broadcasting, 40,* pp.91-97, June 1994.

Cooper and Radcliff, both of the Department of Electrical and Computer Engineering at Ohio University, Athens, show with the aid of computer models that, as expected, the efficiency of the transmitter changes with its location relative to the human body. They conclude that, "When operating in the HF band, the current distribution on the radio antenna remains essentially constant in spite of the presence of a biological body."

P.J. Dimbylow and S.M. Mann, "SAR Calculations in an Anatomically Realistic Model of the Head for Mobile Communication Transceivers at 900 MHz and 1.8 GHz," *Physics in Medicine and Biology, 39,* pp.1537-1553, 1994.

The most recent in a series of dosimetry papers from the U.K.'s National Radiological Protection Board (see *MWN,* N/D94).

O.P. Gandhi, "Some Numerical Methods for Dosimetry: ELF to Microwave Frequencies," *Radio Science, 30,* pp. 161-177, January/February 1995 (forthcoming).

Gandhi, of the University of Utah, Salt Lake City, covers a number of different types of sources of EMFs and radiation, including electric blankets, EMP and cellular phones. The cellular phone dosimetry data were commissioned by McCaw Cellular Communications Inc. (now part of AT&T) and were released in December 1993 and later corrected (see *MWN,* J/F94 and S/O94).

O.P. Gandhi, J.Y. Chen and Ding Wu, "Electromagnetic Absorption in the Human Head for Mobile Telephones at 835 and 1900 MHz," presented at the *International Symposium on Electromagnetic Compatibility,* Rome, Italy, September 13-16, 1994.

More FDTD calculations and experimental measurements for ten different mobile telephones. Gandhi shows that the head, neck and hand absorb more power from a phone with a quarter-wavelength antenna than one with a three-eighths-wavelength antenna—approximately 70% and 45%, respectively: "This is due to the fact that the peak current region for the longer antennas is higher up on the antenna. Unlike the high current region for quarter-wavelength antennas, which is very close to the ear, [the three-eighths-wavelength antenna's] high current region is further from the head, which reduces the coupling, and hence, the SARs."

Michael Jensen and Yahya Rahmat-Samii, "EM Interaction of Handset Antennas and a Human in Personal Communications," *Proceedings of the IEEE, 83,* pp.7-17, January 1995.

Jensen and Dr. Rahmat-Samii also used an FDTD model to calculate SARs for users of hand-held communication devices and found that, for a head-handset separation of 2 cm and an input power of 1 W, the peak and average SARs in the head were 0.9-3.8 W/Kg and 0.06-0.1 W/Kg, respectively, at 915 MHz. (For a 0.6 W phone, the peak levels were 0.54-2.28 W/Kg.) In addition, they report that, "The head and the hand absorb between 48% and 68% of the power delivered to the antenna." The researchers, from the Electrical Engineering Department at the University of California, Los Angeles, compared four types of antennas: a simple monopole and three kinds of flush-mounted designs. They found that integrating a planar inverted-F antenna (PIFA) in the transceiver, especially on the back of the unit, reduces the SARs. For all configurations, they note that, "The peak SAR in the head occurs either in the ear tissue or in the skin/fat layer in the antenna vicinity."

Klaus Meier, Oliver Egger, Thomas Schmid and Niels Kuster, "Dosimetric Laboratory for Mobile Communications," to be presented at the *11th International Zurich Symposium and Technical Exhibition on Electromagnetic Compatibility,* Zurich, Switzerland, March 7-9, 1995.

Describes a measurement system to test cellular phones for compliance with safety standards. Among the conclusions of this group at ETH in Zurich is that, "Measurements on various different cellular telephones confirm that partial-body exposure depends to a great extent on the construction of the device. Our experience has revealed that even internal design details of the devices can significantly affect the absorbed SAR values." (See also, *MWN,* J/F94.)

Gert Frølund Pedersen and Jørgen Bach Andersen, "Integrated Antennas for Hand-Held Telephones with Low Absorption," *Proceedings of the 44th IEEE Conference on Vehicular Technology, 3,* pp.1537-1541, June 10, 1994. (The conference was held in Stockholm, Sweden.)

These researchers, from the Center for PersonKommunikation at Aalborg University in Denmark, show that a full short-circuit PIFA—which concentrates the current near the antenna and has a relatively higher gain directed away from the user's head, "thereby reducing the losses in the human body"—causes local SARs of 0.1-0.2 W/Kg at 954 MHz and 1 W of input power. They used both FDTD calculations and measurements in phantoms. (See also, Jørn Toftgård, Sten Hornsleth and Jørgen Bach Andersen, "Effects on Portable Antennas of the Presence of a Person," *IEEE Transactions on Antennas and Propagation, 41,* pp.739-746, June 1993, and *MWN,* N/D94.)

UPDATES

EXPOSURE ASSESSMENT

More on Infant Incubators...A new magnetic field survey supports earlier reports that premature infants can be exposed to high fields when placed in incubators, and a new set of measurements indicates that those working nearby may also receive relatively high exposures. Writing in the September/October 1994 issue of *Archives of Environmental Health (49,* pp.352-354), Dr. Cynthia Bearer of the Northeastern Ohio Universities College of Medicine in Rootstown reported magnetic fields of up to 126 mG in one type of incubator and up

(continued on next page)

FROM THE FIELD

Clippings from All Over

Both McGill and Hydro-Québec agree that much work remains to be done with the data collected to pinpoint whether there is any cause-and-effect relationship between exposure to pulsed electromagnetic fields and lung cancer. The utilities have stated that they intend to make all of the study documents available to their employees, the public and public-health authorities.

—Joint statement by McGill University and Hydro-Québec, Montréal, Canada, December 16, 1994

Wind shear is one of the major banes of air travel, a killer held responsible for causing 18 crashes and 575 deaths since 1970. Aviation authorities have recently found a way to combat this menace through Terminal Doppler Weather Radar, which can provide precious minutes of advanced warning....But two of the nation's largest airports, JFK and LaGuardia on Long Island, won't be enjoying its life-saving benefits any time soon. Politicians and activists have stopped its installation there, since Long Island residents—wrongly convinced that they are already suffering an epidemic of breast cancer—have been terrified into believing that [EMFs] from the radar would afflict the area with even more cancer. This terror—indeed, most of the nation's terror of EMF in general—can be readily traced to one person. If and when a plane crashes into Long Island because of wind shear, you should know who is responsible. Meet Paul Brodeur....The evidence [for the EMF–health threat] appears to be largely based on fear, conspiracy-mongering, ignoring contrary evidence and statistical gerrymandering.

—Michael Fumento, "Shock Journalism: The Junk Reporting Behind the Power Line–Cancer Connection," *Reason,* pp.23-24, January 1995

A new study from the University of Washington has reopened a two-year-old debate on whether cellular-phone use can cause brain tumors. Though the findings are inconclusive, they show that rats experienced breaks in brain DNA tissue after being exposed to microwave radiation that some experts claim is similar to cellular-phone emissions. But Motorola, the largest maker of cell phones, argues the rats were exposed to at least 10 times the energy a cell phone transmits. "It's therefore an extremely weak comparison," says Quirino Balzano, Motorola's director of electromagnetic research.

—"Cyberscope: More Studies on Cell Phones," *Newsweek,* p.8, January 16, 1995

Results of the childhood studies have proven frustrating for epidemiologists. They expected that, as study design improved and became more sophisticated, clearer evidence of risk would emerge, say, a ten-fold risk, or evidence of no risk. Instead, the risk ratios continue to hover near 1.5 to 3. Some regard this low level of risk as evidence that there is no problem. Said Eleanor Adair, chair of IEEE's Committee on Man and Radiation: "As studies become better controlled, and study larger populations, the risk ratios are getting smaller. I would be ready to draw a conclusion right now—that there is no link there." Others see the slight growth in risk demonstrated by current data as the tip of an iceberg. One of the theories now under review is that average field strength is not the problem. Instead, it might be some variation that correlates better with wiring patterns and long-term average exposure than it does with spot field measurements. This variation could be time rate of change or suddenness of transition or peaks in field strength or certain windows of intensity or frequency. "The hypothesis itself is perhaps not the right one," Gilles Thériault, a professor and department chair at McGill University in Montréal, told *Spectrum.* "We discuss magnetic field strength, but the real culprit could be another component of the fields, for which the magnetic field is a surrogate. Perhaps we are not studying the right parameter, but only a parameter close to the right one."

—Tekla Perry, "Today's View of Magnetic Fields: Can Reducing Exposure to Low-Frequency Electromagnetic Fields Be Part of a Prescription for Health, or Is All the Commotion Just the Birth of Another Fad?" *IEEE Spectrum,* pp.15-16, December 1994

It is easy to prove that the thermally generated electric fields in human tissue are indeed much smaller than those caused by typical power line sources....The electric field in tissue is 12 orders of magnitude smaller than Adair's estimate and certainly negligible compared with the electric field induced by power lines, even if a wider bandwidth is assumed....The thermodynamically generated fields are random in phase and direction, in contrast with the external field induced by power lines. In commenting on self-organization in living cells, Benno Hess and Alexander Mikhailov [*Science, 264,* pp.223-224, April 8, 1994] point out that energy from external sources that is far from thermodynamic equilibrium, as is the field of power lines, can organize thermal fluctuations within cells. Whether this effect exists for power line fields remains to be seen. **James Fay, Massachusetts Institute of Technology, Cambridge, MA (pp.13-14).** Accepting the [April 1994 *Physics Today*] article by [Bennett] as guidance on the question of health effects of [EMFs] seems to me analogous to accepting the advice of the village blacksmith on how to fix your Swiss watch. There is no doubt that Bennett's calculations are impressive. They are probably sound and correct as well. However, the question remains, Are they relevant to the question being addressed?...There are many ways to ill-spend the public money. In my view, trying to get at the bottom of this particular health issue is not one of the major offenders. **Lynn Trainor, University of Toronto, Canada (pp.15,71).** *Bennett Replies:* James Fay assumes that biological material at body temperature only reaches thermodynamic equilibrium through radiative processes. That simply is not even approximately true, and Fay's calculations are irrelevant....Lynn Trainor raises a barrage of "questions" that appear mostly to be statements of a personal point of view....As I stated in my *Physics Today* article, I most certainly did *not* conclude that no further research should be conducted on biological interactions with ELF fields. The question is, How much public money should really be spent on this problem? **William Bennett Jr., Yale University, New Haven, CT (pp.71-72).**

—Exchange on: "Does Physics Really Rule Out Power-Line Cancers?" *Physics Today,* January 1995

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to 27 mG in a second model. These readings fall between those by Dr. Charles Polk of the University of Rhode Island, Kingston, and those by Dr. Gert Anger of the Swedish Radiation Protection Institute in Stockholm, who found maximum fields of 289 mG and 48 mG, respectively (see *MWN,* M/A94). Anger noted in a talk at the annual DOE EMF review in Albuquerque, NM, in November that the beds inside incubators can be adjusted to different levels, thus changing exposures. In the "high bed position," maximum fields are reduced by almost half—to 25 mG, he said. Similarly, Bearer observed that increasing the distance between the infant and the incubator's heating unit or fan by 20.5 cm can reduce fields in the second model from 27 mG to less than 2.5 mG. Nurses who take care of premature infants work in an elevated magnetic field environment, according to a study by Dr. Maureen Paul and colleagues at the University of Massachusetts Medical Center in Worcester (*Bioelectromagnetics, 15,* pp.519-529, 1994). Paul found that neonatal intensive care nurses are exposed to fields of up to 30 mG near incubators and spend significantly more time (10.6%) in fields over 4 mG than nurses who work with normal infants (2.5%). Anger's work has prompted Maria Feychting and Dr. Anders Ahlbom of the Karolinska Institute in Stockholm, Sweden, to study the possible risks from incubator EMFs for premature infants (see *MWN,* S/O94).

GOVERNMENT

High EMF Locations Need Not Apply... The FDA is looking for a suitable site in Orange County, CA, to build a 185,000-square-foot testing laboratory. Most of the requirements, specified in a December 4 advertisement in the *Los Angeles Times,* are not unusual; for instance, 10-13 acres, near transportation, clear title to the property and full disclosure of adverse geological conditions. One specification not usually seen in commercial real estate advertisements, however, requires that 8.5 acres of the site be at least 300 yards from high-power lines, electrical substations and microwave relay stations. Patricia Calhoun, contract specialist for FDA's Division of Construction and Facilities in Rockville, MD, explained that the FDA is concerned that EMFs and RF/MW radiation generated by electrical and microwave equipment will interfere with the testing of medical devices, such as pacemakers. The buffer area has nothing to do with the potential health effects of EMFs, she said.

MEETINGS

EBEA Proceedings... The proceedings of the *2nd Congress of the European Bioelectromagnetics Association (EBEA),* held in Bled, Slovenia, December 9-11, 1993, have now been published. The 137-page volume contains 21 of the 148 conference papers and is available in the U.S. for $244.00 from: Elsevier Science, PO Box 64484, Baltimore, MD 21264. In Europe, contact: Elsevier Science, avenue de la Gare 50, PO Box 564, CH-1001 Lausanne, Switzerland, (41+21) 320-7381, Fax: (41+21) 323-5444. The *3rd Congress of the EBEA* will be held in Nancy, France, February 29-March 2, 1996.

Australian VDT Conference... The July 1994 issue of *Radiation Protection in Australia (Vol.12,* No.3) features papers presented at *VDTs, Electromagnetic Fields and Health,* a conference held in Australia last February. The journal is published by the Australian Radiation Protection Society. Among the authors: Drs. Patrick Breysse of the Center for VDT and Health Research at the Johns Hopkins University School of Hygiene and Public Health in Baltimore; Bruce Hocking of Telecom Australia in Melbourne, Victoria; Ken Joyner of Telecom Australia Research Laboratories in Clayton, Victoria; Michele Marcus of the Emory University School of Public Health in Atlanta; and Dave Sawdon of IBM U.K. Ltd. in Winchester. Single issues of the journal are A$15.00 (approximately U.S.$11.50). For more information, contact: Dr. Colin Roy, Editor, *Radiation Protection in Australia,* PO Box 128, Rosanna, Victoria 3084, Australia, (61+3) 433-2211, Fax: (61+3) 432-1835.

RESOURCES

Overview of Bioeffects Research... Plenum Press has released *Advances in Electromagnetic Fields in Living Systems* (1994), edited by Dr. James Lin of the University of Illinois, Chicago —the first volume in a series intended to highlight current research on the biological effects and health implications of non-ionizing radiation. The contributors are: Lin on early EMF research; Dr. Kjell Hansson-Mild and Monica Sandström, both of the National Institute of Occupational Health in Umeå, Sweden, on the potential health effects of VDT EMFs; Dr. Henry Lai of the University of Washington, Seattle, on the neurological effects of RF radiation; Dr. Raphael Lee of the University of Chicago on tissue injury from ELF electric fields; and Dr. Charles Polk of the University of Rhode Island, Kingston, on therapeutic applications of EMFs. The 196-page volume costs $69.50 and is available from: Plenum Press, 233 Spring St., New York, NY 10013, (800) 221-9369, Fax: (212) 807-1047.

Policy Issues Reviewed... The fall 1994 issue of *Land Use & Environment Forum*—published by Continuing Education of the Bar • California (CEB)—features a collection of articles on EMF policy, planning and litigation. Among the authors are: attorneys Kenneth Bley of Cox, Castle & Nicholson and Susan Odell of Latham & Watkins, both in Los Angeles, on property value cases; Robert Merritt of the law firm of McCutchen, Doyle, Brown & Enersen in San Francisco on ways for public agencies to respond to EMF concerns; Cindy Sage of Sage Associates, a consulting firm in Montecito, CA, on litigation trends and the plaintiff's perspective; and Jack Sahl of Southern California Edison Co. in Rosemead on his utility's policies. Single copies are available for $56.25 each (prepaid) from: CEB, 2300 Shattuck Ave., Berkeley, CA 94704, (510) 642-8000, Fax: (510) 642-3788.

EMF Mitigation Manual... Karl Riley of Magnetic Sciences International (MSI) has published *Tracing EMFs in Building Wiring and Grounding* (1995), which offers technical instructions for electricians, among others, on ways to lower EMF levels in the office and in the home. The 126-page guide explains how certain wiring practices generate high magnetic

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fields, methods of locating the problem and techniques for reducing the fields. It costs $27.50 (plus $2.50 for postage and handling) and is available from: MSI, HCR-2, Box 850-295, Tucson, AZ 85735, (800) 749-9873, Fax: (602) 822-1640.

New Popular Books... Three books written for the general public are now available. Paul Brodeur has updated his 1993 book, *The Great Power-Line Cover-Up: How the Utilities and the Government Are Trying To Hide the Cancer Hazard Posed by Electromagnetic Fields* (see *MWN,* S/O93). The 352-page paperback includes two new chapters. It costs $12.95 and is available from: Little, Brown and Co., 1271 Avenue of the Americas, New York, NY 10020, (800) 759-0190. Laurie Tarkan's *Electromagnetic Fields: What You Need To Know To Protect Your Health* (1994) is an easy-to-read review of EMF potential hazards. The 142-page paperback, available for $4.99, assesses emissions levels from dozens of sources and suggests ways to reduce exposures. Order from: Bantam Books, 1540 Broadway, New York, NY 10036, (212) 354-6500. *The EMF Book: What You Should Know About Electromagnetic Fields, Electromagnetic Radiation, and Your Health* (1995), by Mark Pinsky, covers the risks of different types of non-ionizing radiation. Like Tarkan, Pinsky offers tips on how to reduce exposures, and an appendix provides short summaries of epidemiological studies. The 246-page paperback costs $9.99 and is available from: Warner Books, 1271 Avenue of the Americas, New York, NY 10020, (800) 343-9204.

NRPB Issues New EMF Brochure...*Electric and Magnetic Fields from the Use of Electricity* provides a basic introduction to the subject, covering definitions, typical exposures and a brief explanation of epidemiological and biological research. The four-color leaflet opens out into a poster and is available at no charge from: Press and Public Information, National Radiological Protection Board, Chilton, Didcot, Oxon OX11 0RQ, U.K., (44+235) 831600, Fax: (44+235) 833891.

STRAY VOLTAGE

Jury Awards Dairy Farm Family $1 Million... Consumers Power Co., based in Jackson, MI, must pay $1.01 million to a Michigan couple who claimed that they lost their farm because stray voltage caused milk production to decline, according to a court order signed on January 9 by Judge Edward Post of the Ottawa County Circuit Court. The order was based on a jury verdict reached on December 20, 1994. The utility has not yet decided if it will appeal the decision, a Consumers Power spokesperson told *Microwave News*. The award will allow Melvin and Della Molyneux to buy back their 240-acre farm, which they lost through foreclosure, a member of the family told the *Flint Journal* (January 3). Consumers Power's lawyers maintain that stray voltage did not affect the Molyneux's dairy cattle and that it was the family which was responsible for the productivity drop, according to the *Journal*. The utility also said it was not notified of the problem until December 1992 and corrected it three months later. Four years ago, a Minnesota jury awarded a family of dairy farmers $1 million in another stray voltage case (see *MWN,* N/D90).

CLASSIFIEDS

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EPA Shelves EMF–Cancer Report

But Link Called Stronger Than in 1990

The Environmental Protection Agency (EPA) has indefinitely delayed the release of its already long-awaited report assessing the cancer risk of electromagnetic fields (EMFs).

"The report will not come out in the foreseeable future," said Dr. Robert McGaughy of EPA's Office of Health and Environmental Assessment (OHEA) in Washington. McGaughy attributed part of the delay to "budgetary uncertainties" at the agency. McGaughy has been working on the report for some eight years.

EPA's cancer assessment is said to be in essential agreement with the conclusions of another report, prepared for the National Council on Radiation Protection and Measurements (NCRP), which calls for strong action to curtail exposure of the U.S. population (see pp.2-3 and *MWN,* J/A95), according to a source who has read both reports.

"The EPA and NCRP reports are heading in the same direction," said the source, who asked that his name not be revealed, referring to the evidence of an EMF–cancer link.

The first draft of the EPA report, released in 1990, prompted international headlines when word got out that McGaughy and his staff had concluded that EMFs were a "probable human carcinogen" (see *MWN,* M/J90). Agency officials overruled this assessment, but they still allowed that EMFs were a "possible, but not proven, cause of cancer in humans" (see *MWN,* N/D90).

An EPA Science Advisory Board (SAB) review panel, convened in 1991, sharply criticized the report as unsupported by the evidence and sent it back to the EPA to be rewritten (see *MWN,* M/J91, J/A91 and J/F92).

In an interview, McGaughy said that there are now more data supporting an EMF–cancer link than there were five to six years ago when the first draft

(continued on p.7)

EPRI Finds "Small but Significant" Occupational Brain Tumor Risk

Based on a combined analysis of 29 occupational studies, the Electric Power Research Institute (EPRI) has reported that there is a "small but significant" increase in the risk of brain cancer among workers exposed to EMFs. Biases in the studies were judged "unlikely" to be responsible for the overall increase in risk. EPRI found that some broad evidence does support an EMF–cancer connection, a significant conclusion for the industry-funded group.

But the meta-analysis did not indicate a clear dose–response relationship between EMF exposures and the incidence of brain tumors, and the EPRI team felt that adequate exposure information was often lacking. Thus, the paper cautioned, "It is not possible to conclude that EMF[s] [are] causally

(continued on p.8)

« Power Line Talk »

In a December 1995 report, **Australia's Senate Economics References Committee** advocated prudent avoidance in the design of the proposed 250-mile, 330 kV **Eastlink** high-voltage power line: "[T]he fear of detrimental health effects, whether real or imaginary, is in itself having an impact on the lives of some individuals affected by the Eastlink proposal ....[A]s a minimum policy or until evidence suggests otherwise, the concept of 'prudent avoidance' should continue to be practiced by government and power authorities." The document acknowledged the lack of consensus on what prudent avoidance means, defining it as "siting the line as far as possible from houses, outbuildings and other farm facilities." The report was based, in part, on a series of hearings at which Drs. **Mark Israel**, **Richard Luben** and **Michael Repacholi** testified (see pp.15-16). The committee also reviewed the earlier Gibbs and Peach reports, both of which advised a similarly cautious strategy (see *MWN,* M/J91). The Eastlink power line results from a December 1993 agreement between Queensland and New South Wales to connect their power grids. After the Senate committee took up the Eastlink proposal last March, it received more than 1,300 public comments—most of them in opposition. Its report is only a recommendation to the Queensland and New South Wales state governments, which will make the final decision. This could turn on a soon-to-be-released environmental impact statement, as well as on state and local elections. Eastlink is not the first EMF controversy to break out in the Australian Senate. In November 1994, for example, Senator Robert Bell of North Hobart, Tasmania, presented his colleagues with a report titled *(Non-Ionizing) Electromagnetic Fields and Human Health: Are Current Standards Safe?* by **Don Maisch** of EMFacts in Hobart. Maisch questioned the reliability of exposure standards, particularly the 1 G limit for the general public recommended by the International Commission on Non-Ionizing Radiation Protection (**ICNIRP**). Maisch's report came under fire last year, when the **Electricity Supply Association of Australia** Ltd., a utility group supporting Eastlink, released critical evaluations by two experts: Dr. **Jan Stolwijk** of the Yale University School of Medicine in New Haven, CT, and a member of ICNIRP, and Dr. **Michael Baker** of the University of Toronto, Canada. Stolwijk contended that Maisch "made many serious mistakes, misstatements and omissions in his discussion of the scientific publications.... [such that] the report as a whole has little credibility or usefulness as a scientific document" (see box on p.3). Baker maintained that "the results of the hundreds of laboratory studies involving cells, tissues and animals exposed to power frequency EMF do not provide a scientific basis to conclude that exposure to these fields cause or contribute to the development of cancer in humans." In August 1995, Maisch responded with an updated report, *Fields of Conflict,* in which he argued that "earlier studies, when combined with recent research, clearly show that there is a significant health risk from overexposure to this kind of radiation." More recently, Maisch submitted a commentary to the Senate committee investigating Eastlink, in which he conceded that Stolwijk "did have some very valid criticisms," but considered it "incredible" that Stolwijk would claim that there is no scientific evidence supporting an EMF–cancer link. For a copy of the Eastlink report, contact: Secretary, Senate Economics References Committee, Parliament House, Canberra, ACT 2600, Australia, Fax: (61+6) 277-5719.

«« »»

San Diego Gas & Electric Co. (SDG&E) and **Southern California Edison** Co. (SCE), two utilities involved in EMF lawsuits, are worried that the public might get the wrong impression from the **National Council on Radiation Protection and Measurements** (NCRP) draft report on EMF health risks (see *MWN,* J/A95). "The recent public controversy of a purported leak of a NCRP-SC-89-3 draft report undermines the trust that the public has in the scientific community," wrote **Angela Dawson**, SDG&E's EMF project manager and Dr. **Jack Sahl**, SCE's manager of health research and evaluation, in an October 6 letter to NCRP's president, Dr. Charles Meinhold. They argued that important policy decisions "may be influenced by a draft report that does not represent the views of the NCRP," and that the integrity of the council and its report had been compromised. The 2 mG limit proposed by the draft appears to be a major concern: Such a standard "has enormous implications for decision-making regarding public health and the cost of society's infrastructure." Dawson and Sahl concluded that, "It is imperative that the NCRP act now to discipline and clarify its process, before utilities and regulators react to opinion of uncertain status and credibility."

«« »»

Since the conclusions and recommendations of the **NCRP** report were leaked last summer, many have sought a copy of the complete 800-page report. But few have succeeded. While the whole report is still unobtainable, the appendix on epidemiology—a cornerstone of the EMF–cancer debate—is available, although in a condensed form. Dr. **Richard Stevens**, the author of the appendix, requested and received permission from the NCRP to reprint a version of it in the just-published

EPRI's Sussman and Kheifets Move Up

Dr. Stanley Sussman has become the director of EPRI's Environment Group, a newly created position. "I'll be sharing responsibility for planning and management with Dr. Stephen Peck, vice president for the Environment Group," Sussman told *Microwave News.*

Sussman had been manager of EPRI's EMF health effects research since 1991. Dr. Leeka Kheifets, who has taken over this position, will report directly to Peck. "I intend to stay on top of developments related to EMFs," Sussman said. "Clearly I won't be as involved as I have been, but I'll make time to keep abreast of things."

Two NAS-NRC Committee Members—Two Views of EMF Health Risks

The next major EMF health report is due to be issued in late April by the National Academy of Sciences-National Research Council (NAS-NRC) (see MWN, *S/O91, M/J93, M/A95 and S/O95). Since last year's leak of the National Council on Radiation Protection and Measurements (NCRP) draft report (see* MWN, *J/A95), the NAS-NRC has carefully guarded its findings.*

Recent documents from Australia, however, provide some indication of the positions of two members of the NAS-NRC study committee, Drs. Richard Luben and Jan Stolwijk.

Luben, of the University of California, Riverside, and the president-elect of the Bioelectromagnetics Society, testified before the Australian Senate Economics References Committee on November 8 (see pp.15-16).

In an April 21, 1995, review of an Australian report by Don Maisch (see p.2), Stolwijk, of the Yale University School of Medicine in New Haven, CT, argued against any EMF–cancer risk. Stolwijk's commentary was presented on behalf of the Electricity Supply Association of Australia Ltd. (ESAA). He is a member of the International Commission on Non-Ionizing Radiation Protection (ICNIRP). The ICNIRP limit for general public exposures is 1 G (see MWN, *M/J89).*

"My feeling, based on what I see in my laboratory, is that 1 G is a level of exposure that I would be uncomfortable with."

"We simply do not have enough information to say that EMF exposures of 10 mG-1 G, even for short times, are safe. It may be that they are safe, and we will all be relieved to find that this is so. On the other hand, the unproven but suggestive status of laboratory and animal science argues that we should not necessarily expose humans to elevated levels until we know more."

—Dr. Richard Luben

"Based on the entire body of this epidemiologic research, I find no scientific basis to conclude that EMF causes or contributes to cancer in either children or adults. I also find no scientific basis to conclude that there would be any demonstrable benefit to public health as a result of power frequency magnetic field standards at field levels below those specified in the existing ICNIRP guidelines."

—Dr. Jan Stolwijk

second edition of CRC Press' ***Handbook of Biological Effects of Electromagnetic Fields***. Stevens, an epidemiologist at the Battelle Pacific Northwest Labs in Richland, WA, concludes his chapter this way: "In spite of continued questions about the biological rationale and plausibility of EMFs harming human health, the suggestive epidemiologic data cannot and should not be dismissed. Even effects which initially seem implausible in the laboratory may prove to be causative, as illustrated by the early difficulties in confirming carcinogenic effects of benzene and inhaled arsenic, known human carcinogens. In the case of EMFs, the possibilities are of more than theoretical interest since the exposures are virtually ubiquitous in industrial societies...."

«« »»

The **California EMF Program** has awarded a contract to examine policy issues on possible EMF health effects in public schools and day-care centers (see *MWN,* M/A95). "We hope to offer decision-makers practical guidance to maintain public trust and reach closure," stated **EcoAnalysis** Inc. of Ojai, CA, in its winning proposal. EcoAnalysis will lead a team of consultants who have joined together and are calling themselves the **EMF Resources Group**. They include: Drs. Brock Bernstein and Michael Kelsh of EcoAnalysis; Dr. Edward Faeder of SRF Environmental and Health Management Inc. in Diamond Bar, CA; Laurie Geissinger of Paradigm Planning and Research in Vashon, WA; Dr. William Kaune of EM Factors in Richland, WA; Dr. Antonio Sastre of A.S. Consulting and Research Inc. in Suffern, NY; and Dr. Asher Sheppard of Asher Sheppard Consulting in Redlands, CA. The $695,000 award has angered some members of the Stakeholders Advisory Committee (SAC)—a group that counsels on program decisions—who believe that ties between the utility industry and several of the consultants present a conflict of interest. **Ellen Stern Harris**, executive director of the Fund for the Environment in Beverly Hills, CA, voiced displeasure with EcoAnalysis in particular, noting its strong association with SCE. In addition, Faeder formerly worked at SCE. "Unfortunately, to us, this award engenders a genuine sense of betrayal," Harris told Dr. **Raymond Neutra**, chief of the California EMF Program, based in Emeryville. The complaints have led Neutra to allocate $10,000 to help those SAC members who feel they lack the necessary resources and expertise to detect bias in the course of the project. Proposed changes in the general selection of future research contractors, however, were rejected at a January 18 meeting of the SAC, according to Dr. **Vincent Delpizzo**, the program's research director. He added that proposals will be evaluated with the help of peer reviewers, including SAC nominees, "only on the basis of technical merit and [will] require the winning team members to reveal information that would help others to assess potential conflict of interest or bias." The California EMF Program has awarded a second contract for a study on EMF exposures in schools to a team led by Dr. Luciano Zaffanella and Chris Hooper, both of **Enertech Consultants** in Campbell, CA. While the policy analysis and school exposure studies are not expected to be completed until 1999, the results from a project on design guidelines for building and remodeling schools, led by Brooks Cavin, an architecture professor at California Polytechnic State University, Pomona, will be released later this year. The EcoAnalysis proposal is available for $15.00 from Copy Central, 5801 Christie Ave., Emeryville, CA 94608.

California Utility Wins Dismissal of Office Cancer Lawsuit

A California judge has thrown out a lawsuit brought against Southern California Edison Co. (SCE) by a group of office workers with cancer. The suit, *Johsz v. Koll,* stems from a cluster of 11 cancer cases in a real estate office located directly over a set of SCE transformers. On January 4, the plaintiffs' attorney, Annee Della Donna of the Santa Ana firm of Wylie Aitken, moved for a new trial and a hearing was scheduled for January 30.

In granting summary judgment for SCE on December 8, Superior Court Judge Warren Siegel wrote that he was doing so "because plaintiff cannot show causation." Specifically, Siegel objected that Della Donna's expert witnesses on causation—Dr. Samuel Milham Jr., an epidemiology consultant based in Olympia, WA, and Dr. David Ozonoff of the Boston University School of Public Health—would not be able to present sufficient evidence.

"They have come to an opinion that there's a causal connection between EMFs and certain types of cancer," said Judge Siegel, according to transcripts of a December 5 hearing. "But they haven't, personally, examined any of these people....It's got to be based on personal observation. Where is the personal observation from these experts?" Unless they examined the patients themselves, he contended, they are not qualified to present an expert medical opinion. In his written ruling, the judge retreated from this a bit, but still objected that Milham's and Ozonoff's pretrial declarations:

> do not say EMFs caused plaintiffs' cancers—only that there is a causal association; that based on statistics it 'may' be a cause. Statistics may lend credence to an opinion that EMFs caused plaintiffs' cancers, but there is no expert opinion that it did in this case.

"A physical examination of the patient is not the role of an epidemiologist," Della Donna told *Microwave News* after Siegel had entered his decision. "I think the judge just didn't get it." At the hearing, Della Donna assured Siegel that Milham and Ozonoff had examined "stacks and stacks" of plaintiffs' medical records, but this did not satisfy him.

Oncologists treating the plaintiffs were also on Della Donna's expert witness list, but their pretrial declarations did not discuss causation. And at the hearing, SCE's attorney, Joel Lamp of O'Connor, Cohn, Dillon & Barr in San Francisco, objected that at least one of the oncologists' depositions stated that he had no opinion as to the cause of the cancers. Lamp dismissed Ozonoff as "some public health guy from Boston," not "a treating physician," and therefore not competent to testify as a medical expert.

Judge Siegel's ruling "surprised us all," said Gary Kwasniewski of the law firm of Sedgwick, Detert, Moran & Arnold in Los Angeles, a lawyer for Koll Co., a building management firm that was also named as a defendant in the case. "Being defense lawyers in Southern California, we don't expect judges to rule on causation, because they're too timid," Kwasniewski told *Microwave News*. "But he did." Kwasniewski supported the ruling, arguing that the testimony planned by Milham and Ozonoff was deficient: "None of these expert witnesses had the courage to say directly that EMFs caused the plaintiffs' cancer—with good reason. And the judge picked up on that."

Lamp offered a similar view, contending that Milham and Ozonoff were "hedging" in their pretrial declarations: "I thought they were beating around the bush," he said in an interview. "They never really said what they did to familiarize themselves with these peoples' conditions."

One reason lawyers were surprised by Siegel's decision is that it was not based on the arguments advanced in SCE's briefs. Ironically, the judge rejected the central point raised by the utility but ruled in their favor anyway.

SCE had indeed contended that the plaintiffs could not prove causation—but not because their experts were unfamiliar with the individual patients. An SCE brief had even stated that the important issue was not "testimony that EMFs caused plaintiffs' specific cancers." Instead, the utility said, the key point was "the threshold issue of whether EMFs cause cancer generally." SCE sought to demonstrate that there is a scientific consensus against the idea, and that Milham's and Ozonoff's views stand outside that consensus (see story at right). But Judge Siegel did not accept this argument, and when he ruled in SCE's favor it was for his own reasons.

Johsz v. Koll was filed in March of 1994 (see *MWN,* J/A 94). The plaintiffs, Michael Johsz, James Nichols and Mary Ann Stewart, had been diagnosed with brain cancer, lymphoma and breast cancer, respectively, in 1993. They are among 11 people with cancer who had worked in a real estate office on top of a set of electrical transformers, switching gear and 12 kV distribution circuits.

SCE has measured EMF levels as high as 150 mG in some spots in the office, and a study for the building owner found readings of up to 32 mG four feet above the floor in a work area that was used heavily by the plaintiffs.

In addition to Koll Co., the building owner, the defendants include SCE and the real estate firm, Grubb & Ellis. The trial had been scheduled to begin on January 8.

A related case, *Younkin v. SCE,* involving two other Grubb & Ellis employees who have cancer, was filed later and does not yet have a trial date (see *MWN,* M/J95). According to Della Donna's office, the *Younkin* case—in which a different judge is presiding—is unaffected by the *Johsz* dismissal.

MICROWAVE NEWS is published bimonthly. • ISSN 0275-6595 • PO Box 1799, Grand Central Station, New York, NY 10163 • (212) 517-2800; Fax: (212) 734-0316; E-mail: mwn@pobox.com • Editor and Publisher: Louis Slesin, PhD; Senior Editor: Peter Hogness; Associate Editor: Christopher Doherty; Contributing Editor: Lara Schoeberlein; Copy Editors: Jim Feldman, Qadri Ismail, Roy Thomas Jr.; Production Coordinator: Joe Mungioli; Circulation Assistant: Diana Cooper • Subscriptions: $285.00 per year ($315.00 Canada & Foreign, U.S. funds only); Single copies: $50.00 • Copyright © 1996 by Louis Slesin • Reproduction in any form is forbidden without written permission.

In the Courtroom, Utilities Claim "Scientific Consensus" That EMFs Do Not Cause Cancer—But Judges Are Unmoved

In two recent lawsuits, utilities have tried to prove the existence of a scientific consensus that EMFs cannot increase the risk of developing cancer. So far they have failed to win judicial support for this view.

In the *Johsz* cancer case in California, this argument was rejected by the presiding judge, though SCE later won the case on other grounds (see story at left). In the *Jordan* lymphoma lawsuit, the "scientific consensus" claim helped Georgia Power Co. and Oglethorpe Power Co. win an initial jury verdict in their favor. But a higher court ruled that claiming a "scientific consensus" was a form of hearsay, and ordered a new trial.

In *Johsz,* SCE sought to prove that "the general consensus of the relevant scientific community is that EMFs do *not* cause cancer" (their emphasis). The utility contended that support for an EMF–cancer link by Drs. Samuel Milham and David Ozonoff, expert witnesses for Johsz, represented a view that was overwhelmingly opposed by their colleagues. "Every single one of the 27 independent reviews conducted to date on the health effects of EMFs...has concluded that the scientific evidence does not show that EMFs cause or promote cancer," stated an SCE brief, citing a sworn statement by Dr. Philip Cole of the School of Public Health at the University of Alabama, Birmingham.

When *Microwave News* asked Cole whether he believed there was a scientific consensus on the health risks of EMFs, Cole said he would not comment.

"The epidemiological evidence on EMFs is stronger and considerably more abundant than it was when asbestos was accepted as a carcinogen in 1949," said Ozonoff, chair of the Department of Environmental Health at Boston University's School of Public Health, in an interview. He acknowledged that EMF health effects are controversial among scientists. "But the reasons for the lack of consensus don't have to do with scientific factors," he contended, citing instead the high social and economic stakes involved.

On the EMF–cancer connection, Ozonoff argued, "The only thing that stands in the way of general acceptance—which is not the same thing as consensus—is for someone to demonstrate a plausible biological mechanism, because everything else is there. And this is not a requirement for the standard methods of epidemiology. In fact, we still don't have a biological mechanism for asbestos."

SCE lawyer Joel Lamp expressed a different view, saying that "it may not be completely unanimous, but the vast majority of the scientific community" does not believe in an EMF–cancer connection. Lamp feels that recent findings have increased support for this view: "I think the three recent occupational cohort studies* are convincing more and more people in the scientific community that EMFs do not cause cancer."

Johsz's attorney, Annee Della Donna, countered: "If you pull out SCE's Sahl study, I think there's pretty strong evidence that EMFs cause cancer." In fact, she maintained, "if you take out the utility-influenced studies and experts, there is a consensus that EMFs do cause cancer....The reviews that SCE calls 'independent' are not independent of the utility companies."†

At a hearing on December 5, the judge rejected the idea that there is a scientific consensus about EMF effects: "On the general question of whether EMFs can cause cancer, I would deny summary judgment, because there certainly appears to be a legitimate issue of fact." He added that, "The two experts, Milham and Ozonoff, certainly have set forth their expertise and [it] certainly appears that they are recognized experts in their field."

Although SCE did not win judicial endorsement of its scientific consensus argument, it won the case—and thus fared better than Georgia Power and Oglethorpe Power in the *Jordan* lawsuit.‡ Those two utilities had a 1994 jury verdict in their favor overturned on November 30 (see *MWN,* N/D95), precisely because they had presented testimony that there was a scientific consensus.

A Georgia appeals court panel found that the lower court "committed reversible error in admitting this 'consensus' testimony," because "an expert witness may not act as a surrogate for a non-testifying expert." The unanimous decision cited a previous Georgia ruling that a trial court must reach its decisions "based on the evidence available to it rather than by simply calculating the consensus in the scientific community," and another stating that "a witness' opinion must be his own and he cannot act as a mere conduit for the opinions of others."

Oglethorpe Power and Georgia Power have petitioned the Georgia Supreme Court to hear an appeal of the reversal of judgment. The attorney for Larry and Nancy Jordan, Bruce DeBoskey of Silver & DeBoskey in Denver, told *Microwave News* he expects the court to rule soon on whether to consider the matter.

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* Dr. Jack Sahl, an SCE employee, and coworkers found no connection between EMF exposures and cancer (see *MWN,* M/A93 and J/A93). Drs. David Savitz and Dana Loomis of the University of North Carolina School of Public Health, Chapel Hill, found a link to brain cancer (see *MWN,* J/F95), and the study by Dr. Gilles Thériault of McGill University in Montreal, Canada, found significant associations between EMFs and both leukemia and lung cancer (see *MWN,* M/A94 and N/D94).

† Della Donna also contended that the existence of a consensus is not the issue in deciding whether scientific testimony will be allowed in court: "Different opinions can both be admissible, as long as they're both based on a generally accepted methodology." Lamp disagreed, arguing, "If there's a split in the scientific community, then you can't bring a suit on that issue in California."

‡ The *Jordan* suit, filed in July 1991, charged that Nancy Jordan's non-Hodgkin's lymphoma was due to EMFs from power lines on an easement next to the Jordans' property. She had lived on the property since 1983, developing breast cancer in 1985 and lymphoma in 1989 (see *MWN,* M/J94 and M/J95).

Pooled Swedish and Danish Data: Greater Childhood Cancer Risks

A combined analysis of the data from two well-publicized Scandinavian epidemiological studies gives new support for the childhood cancer–EMF link, especially for leukemia. The meta-analysis of the Swedish and Danish results, which were both first reported in 1992, indicates a statistically significant fivefold increase in childhood leukemia for exposures of 5 mG or higher. The risk of leukemia, lymphoma and brain tumors together was four times the expected rate for such exposures.

The paper, which appears in the November 1995 issue of the *European Journal of Cancer (31A,* pp.2035-2039), also presents previously unpublished data from both studies. Neither the Swedish team—Drs. Anders Ahlbom and Maria Feychting of the Karolinska Institute in Stockholm (see *MWN,* S/O92)—nor the Danish team, led by Dr. Jørgen Olsen of the Danish Cancer Society in Copenhagen (see *MWN,* N/D92), had analyzed those cases with exposures of 5 mG or higher.

When they did so, the Swedish and Danish researchers found "stronger effects for higher levels of exposure." They are cautious about drawing conclusions about "the shape of any dose–response pattern," however, because even when the two data sets are combined, the number of cases is still small. But, they argue that, "A focus on highly exposed subjects in future studies is warranted," and note that, "Choosing lower cutoff points for the exposure might lead to false negative conclusions."

For exposures of at least 2 mG, the combined analysis shows twice the risk of childhood leukemia as that from exposures below 1 mG. A similar increase was observed for lymphoma, though it was statistically less reliable. No increased risk of brain tumors was identified at 2 mG, but a nonsignificant doubling was found above 5 mG. For the three types of cancer combined, the meta-analysis yields a nonsignificant twofold increase above 2 mG.

The researchers also looked at the impact of cumulative exposures—measured in ∝T-years or mG-years—but they found that this "did not add much to the understanding of the association between magnetic fields and cancer."

Overall, the scientists are cautious about interpreting their results since "there is no known mechanism by which the magnetic field interacts with biological systems and knowledge is also limited concerning the relevant exposure measure and disease outcomes." They add that exposure to EMFs from high-voltage power lines still appears to have a small impact on public health—only one extra case of childhood leukemia per year in Sweden and Denmark is attributable to 220 kV and 400 kV power lines.

Two years ago, the researchers published similar findings linking EMFs to childhood leukemia based on data from these two studies, along with those from a Finnish study (see *MWN,* N/D93). Unlike the Swedish and Danish case–control studies, the Finnish effort was a cohort study (see *MWN,* S/O93). Because of the similarity of the designs of the Swedish and Danish studies, the researchers argue that they were able to "obtain more stable relative risk estimates" and analyze higher levels of exposure.

Next: Meta-Analysis with Data from Eight European Countries

Having completed their meta-analysis of the Swedish and Danish studies linking power lines to childhood leukemia, Drs. Anders Ahlbom and Maria Feychting will now extend it to include data sets from six additional European countries.

The European Community has awarded Ahlbom and Feychting a three-year contract to fund their new project. The study, which will use data from Denmark, Finland, France, Germany, Italy, Norway, Sweden and the U.K., is due to begin this year.

The Swedes will test three alternative hypotheses proposed to explain the observed association between power lines and leukemia: 1) it is coincidental; 2) it is real, but not due to magnetic fields; and 3) it is due to confounding by pesticides, air pollution and/or other factors.

By combining these data sets, Ahlbom and Feychting hope enough cases of exposure to high magnetic fields will be available to investigate possible causes. In addition, because exposure conditions vary from country to country, they believe they will be able to test different hypotheses.

EMF Concerns Grow in the U.K.

Lawsuits alleging childhood leukemia due to EMFs are proceeding in the U.K. In contrast to such lawsuits in the U.S., these cases are likely to be combined and decided together.

"In Britain, the courts are unlikely to consider this issue seriously more than once, so the individual cases will probably go forward together to get one central judgment," said Martyn Day of Leigh, Day & Co. in London, the plaintiffs' lead attorney. Day will be paid by the government. He added that he does not expect the matter to be decided for some time.

Day has been working on a number of childhood leukemia cases for the past several years. He first won legal aid in 1993 to represent the Studholme family, who claim that EMFs from a nearby power station and their home's electrical wiring caused their son's fatal leukemia (see *MWN,* J/A93 and S/O93). In response to objections from the National Grid Co. and from the local electricity company, Norweb, the Legal Aid Board rescinded funding. Day appealed the decision in early 1995 and the money was recently restored. Day is now preparing to bring three test cases to trial—the Studholme case and two other childhood leukemia cases involving families living close to power lines. (For more on Day's cases, see *MWN,* M/A94.)

Day considers his funding victory important because, after extensive arguments from both sides, the board deemed the case to have merit. Legal aid is awarded to those who can demonstrate both their financial need and that their claims are supportable. "Since that time we had quite a few other cases come forward, which means that we will probably end up with half a dozen good childhood leukemia cases going to trial at the same time," Day told *Microwave News.*

All of this will not happen quickly, which Day believes to be to his advantage: "It may well take two or three years be-

fore the case finally comes to trial, which means that we will be incorporating the U.S., British and Canadian studies that should be out in the next couple of years."

Day has extensive litigation experience in cases involving tobacco, nuclear power and water pollution. In a profile in the November 22 *Financial Times,* he was described as bringing "fear to British boardrooms by pioneering American-style aggressive litigation." But unlike his U.S. counterparts, according to the *Financial Times,* Day finances all of his cases with state-provided legal aid, and he cannot receive any of the compensation won by his clients.

While the EMF issue has developed considerably more slowly in the U.K. than in the U.S., the British are now becoming increasingly aware of the debate over the potential health effects of EMFs. According to recent news stories:

• Major lenders are denying mortgages for homes near power lines, reported the December 2 London *Times.* Some surveyors will not even estimate the value of houses under power lines, according to the September 25 *Daily Mail* and other papers.

• In northern England, the National Grid faces a "well-organized protest campaign" against a planned 35-mile-long power line, stated the December 31 *Sunday Telegraph.* "Eighty-six of the 121 farmers whose land would be crossed have so far refused to grant wayleaves or permanent easements, despite compensation offers of £20,000 per pylon," the paper noted. "It's not like Yorkshire farmers to refuse that sort of money without good reason," said John Greenway, a local member of Parliament. (£20,000 is approximately $30,000 U.S.)

• Citizens are fighting other utility company bids to build new power lines or are asking for hefty compensation. In Surrey, south of London, "The Grid had offered a not inconsiderable £6,000 to [a] farmer for the wayleave. He rejected it as too little," the December 10 *Sunday Times* said. "If pylons and power lines were found to be a health hazard, it could prove expensive for the Grid," the paper added.

• Parents are asking for an inquiry into eight cases of leukemia among children and adults living near the Euston-Scotland rail lines, according to the December 3 *Sunday Express.* "Campaigners blame electromagnetic fields, believed to cause cancer, from 25,000-volt overhead power lines."

EPA Shelves Revised EMF–Cancer Report *(continued from p.1)*

became public. McGaughy cautioned that he could not predict what the report, if and when completed, would finally conclude, but stated, "I personally think that the evidence is stronger today."

Dr. Doreen Hill, a senior scientist at Energetics, a consulting firm in Columbia, MD, and the author of the epidemiology chapter of the EPA report, agreed with McGaughy that the evidence for a cancer risk has increased. "All the Scandinavian studies were published after 1990," she said, referring to both childhood and occupational cancer studies. Before joining Energetics in 1992, Hill worked at the EPA. She is continuing to work on the document.

An earlier draft of the EPA report, obtained by *Microwave News* in 1994, concluded that the EMF–cancer link "is a real association that cannot be explained by improper epidemiologic methodology" (see *MWN,* S/O94).

Since then, the report has undergone a number of reviews, the most recent being three by epidemiologists: Dr. Scott Davis of the Fred Hutchinson Cancer Research Center in Seattle, Dr. Linda Erdreich of Bailey Research Associates in New York City and Dr. Leeka Kheifets of the Electric Power Research Institute in Palo Alto, CA. Both McGaughy and Hill told *Microwave News* that the three "fundamentally agreed," as McGaughy put it, with the EPA position.

The revised report had been scheduled for another review—this time by other federal agencies—during the winter of 1995-96. Then, once updated, the report would have been made publicly available. After a 90-day comment period, the cancer assessment was to be reviewed by EPA's SAB.

Dr. Genevieve Matanoski, the chair of the original SAB review panel and now the chair of the SAB's Executive Committee, said that she was disappointed that the SAB would not be asked to review the cancer document. "The EMF issue is not going to go away and the EPA should say something. The EPA must make some kind of statement, even if it can't decide, because this is the agency that the public looks to for advice," she told *Microwave News.* Matanoski is at the Johns Hopkins University public health school in Baltimore.

McGaughy concurred: "It's a little disappointing for me personally. I definitely want to get it out one way or another, as does Bill Farland." Farland, the director of EPA's OHEA, declined to be interviewed.

In an October 25 internal memorandum, EPA officials disclosed that the agency would "suspend" the planned review by the SAB at least until after September 1996. This memo attributed the delay to the planned release of two other reviews—by the NCRP and by the NAS-NRC (see p.3)—and to "uncertainties about the agency's 1996 operating budget."

"One of the original purposes for preparing the EPA document was to provide an interim analysis of available information for EPA use," according to the memo. "Release of the NAS and NCRP [reports] will supersede the need for an interim EPA report," it continued.

McGaughy also attributed the delay to a recent Senate report, which advised that, "The committee believes the EPA should not engage in EMF activities" (see *MWN,* S/O95). Some observers think this language refers to all EMF work, while others see it as meaning only that the EPA should leave the ongoing RAPID EMF research program to the National Institute of Environmental Health Sciences and the Department of Energy.

The EPA has also been under pressure to abandon the cancer report by the National Electrical Manufacturers Association (NEMA) in Washington. Douglas Bannerman, NEMA's environmental consultant, has said that, "We should not have individual agencies popping up and giving their own risk assessments" (see *MWN,* M/A95). Bannerman told *Microwave News* that he would have no objection if the cancer report were to be released through the RAPID program.

associated with the observed excess of brain cancer."

Dr. Leeka Kheifets, the new head of EPRI's EMF research program (see p.2), and her colleagues explained in the paper that there are three possible interpretations of "the body of epidemiologic evidence": (1) There is no connection between occupational EMF exposures and cancer; (2) There is a small effect across a broad population; (3) There is a strong effect on a small number of people. They concluded:

> We believe that this meta-analysis provides some evidence against the hypothesis of no association between occupational exposure to EMF[s] and the risk of cancer, provides some evidence to support the hypothesis of a small pervasive effect, and provides no clues that could help to identify a circumstance...[supporting] the third hypothesis.

Meta-analysis is a statistical technique for combining the results of several studies, taking differences in survey size and design into account. "Studies assessed to be of better quality produced lower risk estimates," reported Kheifets and coworkers. On the other hand, "when specific brain cancer subtypes were examined, i.e., gliomas, the risk increased." They also examined possible biases in the different studies, and determined that when the results were pooled the effects of these biases tended to cancel one another out.

When results were combined from the six studies that reported risks by exposure level, an exposure–response pattern did in fact emerge. But only three of the six had based their exposure categories on measured field levels, and when these three were examined alone, "no clear exposure–response pattern was present."

Their paper also noted that:

> Although there are clear differences in the levels of exposures among specific jobs, higher exposures did not correspond to higher risks. This is probably because imprecision in the exposure assessment has undoubtedly led to a large exposure misclassification, which most likely would underestimate the risk.

The findings appeared in the December issue of the *Journal of Occupational and Environmental Medicine,* in the paper by Kheifets, Dr. Abdelmonem Afifi of the School of Public Health at the University of California, Los Angeles (UCLA), Dr. Patricia Buffler of UC Berkeley and Zhong Zhang of the UCLA School of Public Health. Both Afifi and Buffler have served on EPRI's Scientific Advisory Board on EMFs.

"They found about a 20% increase in the risk for brain cancer for so-called electrical occupations," Dr. Stanley Sussman, director of EPRI's Environment Group, said in an interview. But Sussman underlined the lack of a clear dose–response relationship, explaining, "While not conclusive, that argues that EMFs may not actually be the cause of the observed increase in risk. That's perhaps just as important a conclusion." Sussman is the former head of EPRI's EMF research effort (see p.2).

Asked whether there were any policy implications from the meta-analysis, Sussman replied, "In general, we don't comment on policy applications. We are a research organization. Our job is to do high-quality research and analysis, and it's for others to...come to whatever conclusions are appropriate."

The *Washington Post* ran a story on Kheifets's paper on December 22 headlined "Electrical Workers at Greater Risk for Brain Cancer, Study Says." But Madalyn Cafruny of the American Public Power Association in Washington had a different assessment, telling *Microwave News,* "It was another confusing study with confusing results."

Richard Loughery, EMF issues manager at the Washington-based Edison Electric Institute, said in an interview, "I don't think it was that conclusive. It's just another piece we need to add to the body of evidence. Even though they found an association, it's still fairly low." As to whether the meta-analysis might prompt consideration of "prudent avoidance" of EMF exposures in the workplace, Loughery said, "The results aren't strong enough to warrant that kind of response."

The conclusions of the meta-analysis, submitted for publication on March 6, 1995, represent a major shift for Buffler, the dean of UC Berkeley's School of Public Health. For example, when Buffler was interviewed on EMFs for the November 1994 *UC Berkeley Wellness Letter,* she said:

> Early research did raise legitimate concerns about the health effects of [EMFs]. Since then, most studies have found no association, but there are occasional chance findings—blips—that keep the issue on the table.

The vast majority of the studies examined in the EPRI meta-analysis showed a positive association between EMFs and brain cancer.

Buffler appeared in the June 1995 *Frontline* television report on EMFs, in a segment discussing three recent large occupational studies (see *MWN,* J/A95 and footnote on p.5). The program introduced Buffler as one of "many epidemiologists" who think that inconsistency among the three studies and their low risk ratios "raise serious questions as to whether there is in fact a real risk, or whether all the studies are picking up is statistical noise."

In the past, Buffler has also criticized the concept of prudent avoidance—the idea that, since EMFs may pose a health hazard, it is worth taking low-cost measures to reduce exposure: "Such advice would be in conflict with the scientific evidence, since we don't know that there is anything there to avoid" (see *MWN,* J/F95).

When asked by *Microwave News* whether she stood by such previous remarks, Buffler declined to comment.

Kheifets also declined to be interviewed, but responded to questions about the study in writing and through EPRI spokesperson Barbara Klein. On the future direction of EPRI's research in this area, Kheifets told *Microwave News,* "I believe we currently do not have strong leads to initiate new major occupational EMF studies." But she wrote that there is more that can be done to understand the existing body of evidence, noting that, "Dr. Savitz continues to analyze and add information to his database to clarify his findings." Kheifets also wrote that she would lead an effort "to investigate the reasons for the differences in risk estimates between the three recent utility worker studies." A potential obstacle to this work is the fact that Hydro-Québec has blocked researchers' access to the data from Thériault's occupational study (see *MWN,* N/D94). According to Klein, Kheifets "is still working with the Canadian utilities to finalize their participation in the project."

Recent Reports from the Electric Power Research Institute (EPRI)

L. Anderson, L. Sasser and J. Morris, ***Large Granular Lymphocytic (LGL) Leukemia in Rats Exposed to 60 Hz Magnetic Fields: Preliminary Studies and Protocol*** (TR-104577), December 1994, 74 pp. Price: $200.00. Concludes that LGL leukemia in rats serves as an accurate model for evaluating the progression of the disease. The researchers, all of Battelle Pacific Northwest Labs in Richland, WA, developed a protocol to test the effects of intermittent 60 Hz EMFs on late-stage cancer in rats with LGL leukemia.

Robert S. Banks Associates, ***Proceedings: Health Implications of EMF Neural Effects Workshop*** (TR-104327), August 1994, 54 pp. Price: $200.00. The proceedings of EPRI's May 17-21, 1992, workshop in Asilomar, CA. The participants—all experts in neurobiology or EMF health effects—split up into groups to evaluate the neurological effects of EMFs on cells and molecules, tissues and organs, the whole organism and populations. Each group offered recommendations for future research. Several speakers also reviewed current knowledge on the subject.

T.D. Bracken et al., ***The EMDEX Project: Residential Study, Vol.1: Summary, Vol.2: Project Description and Results*** and ***Vol.3: Appendices*** (TR-104325-V1-3), December 1994, 64 pp., 256 pp. and 228 pp., respectively. Price (for the set): $200.00. Documents EPRI's 26-month geographic survey of wire-code configurations and EMF measurements in 396 residences, led by Dr. Dan Bracken, a consultant in Portland, OR. High EMF levels were found in houses with very-high-current wire-code configurations. However, the distribution of EMF measurements overlapped considerably among different wire-code categories, making these configurations poor indicators of EMFs. The decade in which each home was constructed was the only variable that could be linked to wire codes.

EPRI, ***Electric and Magnetic Fields Research Abstracts: 1994 Annual Report*** (TR-105863), October 1995, 88 pp. Price: $200.00. Contains 44 abstracts of ongoing EPRI-sponsored studies. Topics include: epidemiological and laboratory studies; exposure assessment; magnetic field mitigation; and risk management.

EPRI, ***The 1995 Research, Development, and Delivery Plan*** (CI-104571), March 1995, 126 pp. Price: $60.00. This guide describes the institute's new structure, summarizes the 1995 funding plan and outlines EPRI's research program for 1996. ***Highlights '95*** (BR-103740-R1) is a free six-page overview of EPRI's 1995 program and funding allocations.

J. Ferguson and K. King, ***Magnetic Field Management for Overhead Transmission Lines: Potential Options for Low Field Designs*** (TR-104413), September 1995, 137 pp. Price: $200.00. Provides utility engineers with background information on the magnetic field levels associated with specific transmission line designs. Techniques for reducing magnetic field levels from 115-500 kV lines are described and evaluated. Ferguson is with Sverdrup Corp. in Haslet, TX, and King is with GE in Lenox, MA.

C. Graham, M. Cook and H. Cohen, ***Investigation of the Effects of Magnetic Field Exposure on Human Melatonin*** (TR-104278), August 1994, 92 pp. Price: $25.00. Dr. Charles Graham and coworkers at the Midwest Research Institute in Kansas City, MO, ran the first nighttime double-blind investigation of melatonin levels in men exposed to 60 Hz fields of 10 mG and 200 mG. Overall, no significant differences were found in their melatonin levels. However, there was some evidence that EMF exposure at night might suppress melatonin in men who already have low levels of the hormone. Those exposed to the fields made more errors on a perception test than did those exposed to sham fields. (In a follow-up study, presented at last November's DOE meeting in Palm Springs, CA, Graham reported that he was unable to repeat this finding.)

G. Johnson, J. Guttman and L. Zaffanella, ***Survey Measurements and Experimental Studies of Residential Transient Magnetic Fields*** (TR-104532), December 1994, 208 pp. Price: $200.00. A pilot study evaluating the transients in 21 Northern California homes. The researchers, of Enertech Consultants in Campbell, CA, and the High Voltage Transmission Research Center in Lenox, MA, found that hundreds to thousands of transient currents occurred in each home on a given day. Homes with the Wertheimer-Leeper very-high-current configuration experienced more transients from outside sources than did homes with other wire-code configurations (see *MWN,* S/O95).

P. Keng et al., ***Electric and Magnetic Fields and Tumor Progression*** (TR-104799), December 1994, 40 pp. Price: $200.00. A University of Rochester, NY, study of the bioeffects of 60 Hz EMFs on melatonin in rats and on human colon cancer cells. The study did not confirm earlier reports that EMFs suppress nighttime levels of melatonin in rats and promote the ability of cancer cells to form colonies.

J. Peters et al., ***Exposure to Residential Electric and Magnetic Fields and Risk of Childhood Leukemia*** (TR-104528), June 1995, 108 pp. Price: $200.00. This study evaluated alternative explanations for the link between childhood leukemia and specific wire-code configurations observed in Peters's epidemiological study (see *MWN,* J/F91, M/A91 and S/O91). The researchers, of the University of Southern California in Los Angeles, found a weak, but statistically significant, link between leukemia and wire-code configurations for 232 children living in Los Angeles. They interviewed the parents, took EMF spot measurements inside and outside homes and made 24- and 72-hour measurements in the children's sleeping areas. Leukemia risk was not linked to measured fields. The team created a model with which they could more accurately predict the field levels than by using wire codes, but this model was not linked to leukemia risk, either. Finally, the researchers found no bias in the data due to dietary factors, traffic density or socioeconomic status. "We conclude that the association between leukemia risk and wire codes is not due to confounding by non-EMF-related factors or to selection bias and may reflect a causal effect of [EMFs]," they reported.

R. Rankin and T.D. Bracken, ***Association of Wire-Code Configuration with Long-Term Average 60 Hz Magnetic Fields and Exposure, Vol.1: Summary*** and ***Vol.2: Appendices*** (TR-104656-V1-2), December 1994, 68 pp. and 292 pp., respectively. Price (for both): $200.00. A progress report on a planned study of the association between cancer and wire codes in more than 200 geographically diverse U.S. households. A sampling plan, a method of selecting residents and measurement procedures are included. Over the two-year data collection period, EMFs will be measured inside and outside the houses to determine if the configuration of utility lines is tied to EMF exposure.

P. Valberg, ***Biology and Electric and Magnetic Fields: Biophysical Mechanisms of Interaction*** (TR-104800), December 1994, 50 pp. Price: $200.00. Dr. Valberg, of Gradient Corp. in Cambridge, MA, evaluated biophysical processes that have been suggested to explain EMF health effects. "None of the mechanisms reviewed was found to be free of significant problems," he concluded.

Contact: EPRI Distribution Center, 207 Coggins Dr., PO Box 23205, Pleasant Hill, CA 94523, (510) 934-4212. Call the center for international rates and quantity discounts. Publications are free to EPRI members.

Motorola Backs Replication of Study on Brain Tumor Cells

Motorola's radiofrequency and microwave (RF/MW) radiation bioeffects research program will examine whether RF/MW radiation accelerates the growth of human brain tumor cells. The cellular phone company has signed a contract with Dr. Shirley Motzkin, a professor of biology at Polytechnic University in Brooklyn, NY, under which she will try to repeat the findings of Dr. Stephen Cleary of Virginia Commonwealth University (VCU) in Richmond.

In 1990, Cleary published a now well-known study showing that human brain tumor cells continued to grow abnormally even five days after a two-hour exposure to microwaves (see *MWN,* M/A90). Cleary saw effects at specific absorption rates (SARs) as low as 5 W/Kg.

"We are going to replicate Cleary's work showing the proliferation of glioma cells at 27 MHz and 2450 MHz," Motzkin told *Microwave News*. She said that exposures will begin soon.

Motzkin has been an active member of the microwave bioeffects research community at Polytechnic for many years, previously collaborating with Leo Birenbaum and the late Saul Rosenthal. Their work focused on the effects of millimeter waves on bacteria and membranes. More recently, Motzkin researched the impact of microwaves on excitable tissue—for instance, neuromuscular systems—for the U.S. Air Force.

Cleary's work received a great deal of attention when concern over the possible link between cellular phones and brain tumors hit the newspapers in early 1993. The Cellular Telecommunications Industry Association (CTIA) has challenged the relevance of Cleary's findings because he had used a different frequency, intensity and modulation than those associated with cellular phones. A March 1994 briefing package from the CTIA included the following question and answer:

> *Q*. Have any studies shown—directly or indirectly—that cellular phones could be harmful?
> *A*. No. The work of Dr. Stephen Cleary at the Medical College of Virginia [VCU] has been cited by some as a basis for suspicion. Dr. Cleary found cancer proliferation in cells exposed to radiowaves in petri dishes. However, those experiments were conducted at a different frequency and at power levels well in excess of those used by cellular phones. No such effects have been observed in experiments performed at frequencies and power levels typical of cellular telephones....

In fact, Cleary's work has yet to be repeated at cellular phone frequencies or at lower power levels. Although Cleary has met with representatives of CTIA's Wireless Technology Research (WTR), including its chair, Dr. George Carlo, a number of times over the last few years, WTR, which is based in Washington, has declined to support work in Cleary's laboratory.

"Carlo told me that WTR could not determine where our research would fit into his program," Cleary told *Microwave News*.

In an interview, Dr. Mays Swicord, Motorola's director of biological research, said, "Cleary's work is an issue that has come to the public's attention and needs to be addressed."

In addition to sponsoring Motzkin's replication effort, Motorola is also sponsoring tumor cell proliferation studies in Dr. Ross Adey's lab at the VA Hospital in Loma Linda, CA. At the Bioelectromagnetics Society's annual meeting last June in Boston, Dr. Robert Stagg, a member of Adey's research group, reported that he could not see any RF/MW-induced proliferation in rat glioma cells. Stagg used 836 MHz radiation—in the cellular phone frequency band—at SARs of 0.21-21 mW/Kg, levels considerably lower than that used by Cleary and hundreds of times less than that associated with a typical cellular phone.

"This was not a replication of Cleary's work, but an exploration in the same area," Stagg noted in an interview. He said that his results have been submitted for publication.

Other New Motorola Studies

In addition to sponsoring brain tumor proliferation studies, Motorola has expanded its RF/MW research program to include two other projects (see also *MWN,* J/A95):

• An animal cancer study of exposures to the Iridium signal, Motorola's global satellite communications system. The principal investigator is Dr. Michael Dauphinée of the Goodwin Institute for Cancer Research in Plantation, FL.

• A study of the possible effects of the GSM digital signal on the hormone levels of humans. Dr. René de Seze of the Centre Hospitalier Universitaire in Nimes, France, is leading this effort.

Motorola expects both studies to be completed in 1996.

WTR Plans To Use Comet Assay for Study on Blood Cells

Now that WTR, CTIA's research arm, has accepted the comet assay as an effective method for measuring DNA damage in RF/MW studies (see *MWN,* N/D95), it has begun to decide how to make use of this tool.

Representatives of WTR met with researchers from three different labs in Miami on December 13 to plan a set of coordinated studies using the technique—also known as the single cell gel (SCG) assay. "They met to determine the direction of WTR's research in the SCG area," said WTR spokesperson Mike Volpe.

Present at the Miami meeting were Drs. Henry Lai and N.P. Singh of the University of Washington, Seattle; Dr. Ray Tice of Integrated Laboratory Systems in Research Triangle Park, NC; and Dr. Luc Verschaeve of VITO, the Flemish Technological Research Institute, in Brussels, Belgium. Among those attending for WTR were its attorney James Baller of Baller Hammett in Washington; WTR member Dr. Bill Guy; Dr. Graham Hook of CanTox in Mississauga, Canada; and Dr. Don McRee, WTR's director of extramural research.

"We want to see whether exposures at certain wavelengths affect DNA in human cells exposed *in vitro,"* Tice said in an interview. "We met to get some agreement on what protocol we're going to use." He explained that the three teams would expose human lymphocytes (white blood cells) to continuous-

wave 837 MHz microwaves. In addition to the comet assay, researchers will also use the micronucleus assay, an alternative method of assessing genotoxicity. All experiments will be conducted at one central exposure facility, the site for which has not yet been selected.

Some observers have criticized the use of a single exposure system as expensive and unproductive (see *MWN,* S/O95), but Tice thinks it is the logical choice: "There are some technical difficulties in carting the biology to a different lab, but that may well be less than the technical difficulties involved in setting up different exposure facilities. The biology is only as good as the dosimetry."

"It is a little inconvenient," Lai told *Microwave News,* "but there is no better way to do it since it is difficult to set up exactly the same exposure system in different labs." But he raised a potential problem with the plan: "With a central facility, people will question whether it is a truly independent replication, even though three different labs run the same experiment." Lai suggested that one alternative might be "to circulate the exposure system among the labs involved."

Singh, who together with Lai has done *in vivo* studies of the effects of RF/MW exposure on DNA in the brains of rats (see *MWN,* N/D94), described the choice of human lymphocytes as "a good starting point," but noted that "the lymphocyte system is far away from brain cells, which are the main target of investigation for cellular phone studies."

Volpe described Dr. Ian Munro, director of CanTox, as the WTR member with principal responsibility for bioeffects research. But Munro and other CanTox officials would not discuss the planned experiments. Volpe himself declined to comment on when the exposure facility would be chosen, when the experiments might begin or even which researchers had attended the Miami meeting. "WTR policy," he said, "is not to comment on things that are still being negotiated."

"The agreements haven't been signed yet," noted Tice, explaining that the final budgets depend on both the location of the central exposure facility and specifics of the experimental protocol. Both Tice and Lai said that before the actual experiments begin, researchers from all three labs will have to do some test runs to ensure that equipment and procedures are

« Cellular Phone Notes »

Scientists engaged in **Motorola**-sponsored studies of RF/MW bioeffects met with company officials January 28-30 in Plantation, FL, to discuss the status of their work. Attending were research teams from the ten projects that Motorola has announced so far (see p.10 and *MWN,* J/A95), plus Dr. **Quirino Balzano**, a corporate vice president, Dr. **Asher Sheppard**, a Motorola consultant based in Redlands, CA, Dr. **Mays Swicord**, director of Motorola's biological research, and other executives. "We discussed how to make sure that we use the best methods to achieve scientifically valid results," Balzano told *Microwave News.*

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WTR sees no reason to keep cellular antennas away from schools—in contrast to the **California Public Utility Commission's** (CPUC) November 1995 recommendation to avoid such locations (see *MWN,* N/D95). A recent WTR report states that, "There is no reason to exclude schools and similar areas as potential base station sites. Base stations have been successfully located on school properties with the support of the school and community." It also quotes one expert as saying that exposure from towers is "almost a non-issue" in terms of safety standards. The report, titled *Federal Focus National Symposium on Wireless Transmission Base Station Facilities: A Tutorial,* summarizes the findings of a meeting sponsored by WTR and organized by **Federal Focus** Inc., a nonprofit group that arranges conferences on policy issues. The participants at the October 28, 1994, meeting held at the University of Pennsylvania, Philadelphia, are not named in the report, but included government officials, RF consultants and land use and bioeffects experts. "We never give their names," Dr. **Jim Tozzi**, chairman of the Washington-based Federal Focus, said in an interview. He explained that the group does not want to imply that the conclusions are the official positions of the government representatives who were in attendance. Those at the meeting concluded that negative health consequences of athermal exposure to RF/MW radiation are believed only by "a minority of scientists" and that most of the studies that claimed to have shown such results "have nothing to do with health effects." Concerns about EMI affecting medical devices, the report states, are "expected to arise, if at all, only when a base station is mounted on the hospital roof." (The CPUC also advised against putting the antennas near hospitals.) While the conference participants acknowledged that RF/MW radiation can interfere with medical devices—noting that many hospitals have restricted cellular phone use—they dismissed the towers as a threat, since they "do not appear to pose any significant problems to powered wheel chairs or electronic medical devices."

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Call it **Motorola** style. "We have created...a new wearable product category we believe consumers will embrace enthusiastically," the giant company proudly announced in early January. Motorola's new StarTAC phone weighs as little as three ounces and is roughly the size of a pager. It's "the world's smallest and lightest cellular phone available today," the company said. But Motorola isn't just targeting business executives who want a convenient means of staying in touch. The company hopes the new phone will become an essential item for those who always want to look their best: "When folded, the StarTAC phone is so small and light it can be worn fashionably as an accessory." The phone complies with all relevant health standards, according to Motorola spokesperson Norman Sandler.

working properly. The researchers hope to compare notes on this at the Environmental Mutagen Society meeting in Victoria, Canada, in late March, according to Tice.

Volpe confirmed that WTR's *in vivo* research will begin only after WTR had completed development of an *in vivo* exposure system. "We'll be making an announcement on that in due time," he said.

Shortwave Transmitter Disturbs Sleep of Swiss Villagers

Families living near a Swiss shortwave transmitter have a higher rate of neurological complaints than those residing farther away, according to a recent report. Sleep disturbances were found to be directly associated with the strength of the transmitter, and there was a suggestion that children in a local school had more trouble learning than those in other areas.

"There is no immediate danger to the population living in the surroundings of the transmitter, and there is no reason for urgent protection measures," concluded the researchers, led by Dr. Theodor Abelin of the Department of Social and Preventative Medicine at the University of Bern in Switzerland. "On the other hand, it was clearly demonstrated that the transmitter is associated with a marked deterioration of the sleep quality of the most exposed group of persons," they added.

Since the 1970s, residents near the Schwarzenburg shortwave transmitter, 20 km (12.4 miles) south of Bern, have reported health complaints. In the early 1990s, the Swiss government commissioned a survey in which 215 people in the area kept a diary of how they felt for an average of 25 days. Those living close to the station had more subjective health complaints—problems sleeping, headaches, tiredness, irritability, lower-back ache and limb pain—than those living over 4 km away (see *MWN,* N/D93).

Follow-up studies were then conducted to identify the causes of the ailments. Based on new diaries kept by 102 villagers, a statistically significant improvement in sleep quality was observed one day after the transmitter was shut down. However, Abelin's team found no plausible mechanism to explain this. Melatonin levels in humans and in cows were not associated with radiation levels.

No excess risk of chronic illnesses, such as diabetes or cancer, was found among the population, nor was high blood pressure linked to exposure levels. But the researchers cautioned that the population in the area is too small to rule out a slight increase in risk for some chronic ailments.

The team found that fewer schoolchildren in the area were promoted from primary to secondary schools, as compared to children in a control school. However, they could not eliminate the possibility that socioeconomic differences were responsible for this discrepancy.

They concluded that a major international study would be required to investigate further any health risks associated with shortwave transmitters. The report, *Study on Health Effects of the Shortwave Transmitter Station of Schwarzenburg, Bern, Switzerland* (No.55, August 1995), was published by the Swiss Federal Office of Energy.

Three 6.1-21.8 MHz antennas with powers of 150 kW operate simultaneously at the shortwave complex. The villagers who lived within 900 meters of the station were exposed to an average of 1.4 $\propto$W/cm^2, with a minimum and maximum of 21 nW/cm^2 and 164 $\propto$W/cm^2, respectively. Those living more than 900 meters from, but within 1.5 km of, the antennas were exposed to 54 nW/cm^2 (4.9-300 nW/cm^2), and those who lived more than 4 km away were exposed to 0.54 nW/cm^2 (0.4-0.8 nW/cm^2).

The EMF levels at the measurement sites did not exceed the limits recommended by the ICNIRP. Nevertheless, the researchers suggested that, "In view of the observation of a relationship between the transmitter and sleep quality by this study, the question arises as to whether the present guidelines for acceptable magnetic field strengths should not be adapted."

Police Radar Lawsuits Face Dim Future After Dismissals

Four more lawsuits seeking to link cancer to the use of police radar have been dismissed, in Illinois, Mississippi, Ohio and Texas. Three of the dismissals were requested by plaintiffs' lawyers, who are increasingly pessimistic about winning this type of litigation.

"It appeared to us that the state of scientific knowledge was just not developed to the point where you can legally show causation," explained Larry Spencer of the firm of King & Spencer in Jackson, MS. Spencer represented Hilda Wheeler, the widow of a Mississippi highway patrol officer who died of a brain tumor in 1992. On December 4, Spencer asked the U.S. District Court in Jackson to dismiss the lawsuit.

Kustom Signals, a leading police radar manufacturer and a defendant in all four cases, noted in a statement that it has now won 22 victories, made no settlements and paid nothing in damages (see also *MWN,* J/F93 and S/O93). "We have always stood behind the safety and integrity of our products," affirmed company president John Kusek.

"The general trend in police radar cases is pessimistic for the plaintiffs," Kustom's attorney, Mark Oium of O'Connor, Cohn, Dillon & Barr in San Francisco, told *Microwave News.* "And it costs a lot to mount these cases. Once the plaintiffs see how much they have to spend and how thin their evidence is, they generally drop the suit."

Is police radar litigation coming to a close? "I don't see how anyone could conclude otherwise, given all of the dismissals," Spencer said in an interview. "I don't know any attorneys who are still willing to take on this kind of case—which is unfortunate, because I believe that one day causation will be sufficiently established. And I think that will turn out to be a very horrible set of facts for all these police officers, comparable to thalidomide."

Other plaintiffs' attorneys were reluctant to even talk about their cases. Michael Cassity of Mt. Orab, OH, attorney for the widow of Ohio State Patrol Officer Wayne Vessels Jr., in *Vessels v. Kustom,* did not respond to repeated phone calls. On January 11 in Cincinnati, U.S. District Court Judge Arthur Spiegel granted Cassity's request for a dismissal of the case. Wayne

Suit Says WTR's Epidemiological Study Is Illegal "Human Testing"

The cellular phone industry is conducting human testing on the health effects of mobile phones "without the knowledge and consent" of those being studied, according to a class action lawsuit filed in Chicago on October 26. Named as defendants are Ameritech Mobile Communications; the Cellular Telecommunications Industry Association (CTIA), including Ron Nessen, vice president for public affairs and communications, and Thomas Wheeler, president; Epidemiology Resources Inc.; Motorola; and Wireless Technology Research (WTR), including Dr. George Carlo, chair.

The case was filed in Cook County Circuit Court on behalf of Jerald Busse and other cellular phone users by Ben Barnow of the Chicago firm of Barnow & Hefty. Busse purchased a hand-held Motorola phone in December 1993, with transmission service from Ameritech. Barnow said in an interview that on January 26 a federal judge rejected a defense petition to take the matter out of the hands of the Illinois courts.

"Industry researchers have acknowledged that they cannot say for certain" that cellular phones pose no health hazards, the suit charges. In fact, it continues, the defendants "have engaged some 3,000,000 users...in a research study to determine the detrimental effects of electromagnetic radiation from cellular portable telephones." This has allegedly been done by compiling a database of "personal information," which users had provided only for billing purposes.

In the complaint, Barnow contends that:

> these defendants, along with other industry members, have put the means of the test...into the consumers' hands without informing them of the lack of proven safety of the cellular portable telephones, and have failed to advise the consumers that they would be part of a test to see if they get health maladies such as brain tumors.

"I would love to be able to respond, but since it's under litigation I'll have to go with the proverbial 'no comment,'" said Dr. Nancy Dreyer, president and CEO of Epidemiology Resources, in an interview. Epidemiology Resources has a contract with WTR, the research arm of the CTIA, to conduct large-scale studies of the health of cellular phone users (see *MWN,* J/F94 and S/O95). Ameritech and the CTIA also declined to comment.

"WTR believes that this attack on science and the scientific community is baseless, irresponsible, and counterproductive," declared a statement from WTR attorney James Baller of Baller Hammett in Washington. "The public wants and needs prompt answers to its questions about the health effects of cellular telephones. If allowed to succeed, this wasteful lawsuit would at best delay the search for truth, possibly for years....A slow or weakened scientific process would benefit only those who would prefer to appeal to the emotions of juries without being encumbered by objective scientific facts."

Motorola is "not directly involved in the epi studies," company spokesperson Norman Sandler told *Microwave News,* but "our position is that we've done the responsible thing by supporting research." Sandler added that, "We believe that this research will confirm that there is a sound scientific basis for confidence in the safety of these products."

Vessels died of basal and squamous cell carcinoma in December 1992 (see *MWN,* J/F95).

Also refusing to return calls requesting comment was John Tavormina of the Houston law firm of Helm, Pletcher, Bowen & Saunders. Tavormina was the plaintiff's lawyer in *Giraldo v. Kustom,* which was withdrawn from state District Court in Harris County, TX, on December 15. The suit was filed in June 1994 by a Houston police officer who had developed testicular cancer. Oium noted that the withdrawal came in the wake of similar action by famed attorney Joe Jamail in a major EMF–childhood cancer case in Harris County, which has historically been considered a favorable jurisdiction for plaintiffs (see *MWN,* S/O95). Oium said that, "We had some speculation" that both withdrawals were due to a recent Texas Supreme Court ruling "that pretty much adopted the federal *Daubert* rule in the state of Texas," imposing stricter standards for the introduction of scientific evidence.

The one case that was not voluntarily dismissed, *Blesy v. Kustom,* involves a different set of legal issues and will be appealed. This class action suit aims to force radar manufacturers to establish a medical monitoring fund, and the plaintiffs' attorneys feel that they will prevail in the end. "We recognized at the beginning that we had an uphill battle, and we're continuing with the case," said Norman Rifkind of Biegel, Schy, Lasky, Rifkind, Goldberg & Fertik in Chicago. The suit was dismissed from Cook County Circuit Court on November 14.

Although the six officers specifically named as plaintiffs in *Blesy* all suffer from cancer, the suit does not seek to prove that police radar was the cause. In 1994, Rifkind explained that the officers had decided to sue for medical monitoring rather than personal injury damages because "no one so far has been able to make these allegations stick" (see *MWN,* M/J94 and M/A95). But it was precisely the failure to prove an actual injury that Judge Margaret McBride cited when she threw the case out of court:

> While it is conceivable under certain circumstances [that] an Illinois court would recognize a heightened risk of contracting a disease as a present injury, this court does not believe a sufficient risk exists in the case at hand....Cases allowing medical monitoring damages usually involve long-term exposure to highly toxic substances where the risk of contracting serious illness is great....The requirement of a present injury is a traditionally sound method of disallowing what could be called speculative claims.

According to a hearing transcript, McBride expressed concern that if the complaint was allowed to go forward, the courts "would be inundated with complaints by literally hundreds of thousands of individuals who could claim that their expo-

sure to electromagnetic radiation was significant." She said this could include "motorists who periodically pass police units using radar guns, passengers on airplanes and consumers of various other household appliances—and these are just some examples."

Oium said that Kustom now faces only one active lawsuit besides *Blesy,* and that he knows of none against other police radar manufacturers. The remaining case was filed by the widow and young child of Danny Farr, a former South Carolina highway patrol officer who died of testicular cancer in May 1995.

"I think these are tough cases," said the Farr family's lawyer, John Kassel of Suggs & Kelly in Columbia, SC. "There are many issues of proof that the plaintiffs confront," he conceded. "But that doesn't mean there's not a problem." Kassel argued that many scientists are concerned about "the injuries caused by these radar guns," and that there is a need for more research on the subject.

Last June, a report from the National Institute for Occupational Safety and Health recommended that all hand-held radar units be equipped with a "dead-man switch." This feature shuts off the device when it is not gripped in the user's hand, in order to avoid unnecessary exposure (see *MWN,* J/A95 and S/O95). But in an interview with *Microwave News* in January, Kustom's Kusek stated that the company still makes radar guns without the dead-man switch, and that models lacking this safety feature sell better by a margin of more than nine to one. "They're more popular with police officers because it does get uncomfortable holding that switch down when you're monitoring a lot of traffic," Kusek explained. But he noted that Kustom makes the option of the dead-man switch available at no extra charge because of the concerns that have been raised.

FROM THE FIELD

Clippings from All Over

The weakness and inconsistent nature of the epidemiological data, combined with the continued dearth of coherent and reproducible findings from experimental laboratory research, leave one uncertain and rather doubtful that any real biologic link exists between EMF exposure and carcinogenicity. In the meantime, while considerable research funding is being devoted to the study of potential links, very real economic effects are being felt. Public concern has led to costly litigation, to delays or changes in the installation and operation of electrical transmission equipment and to a tendency for property values to decrease at locations adjoining high-voltage transmission lines. Should our research investment not lead to reproducible and cohesive results, the scientific community will need to reach some consensus about the likelihood and possible extent of risk. While it may continue to be impossible to prove either the presence or absence of risk, perhaps it can be feasible to assign likely risk boundaries upon which practical guidance for community consensus can be reached.

—Dr. Clark Heath of the American Cancer Society, "Electromagnetic Field Exposure and Cancer: A Review of Epidemiological Evidence," *CA – A Cancer Journal for Clinicians, 46,* pp.42-43, January/February 1996

The search for extraterrestrials scored a major breakthrough last year. A new system built by the SETI Institute in Mountain View, California, picked up regular signals that provided indisputable proof of intelligent life. The researchers, who were using the 64-meter radio telescope at Parkes Observatory in Australia, found a distinctive radio signal at 2.3 to 2.4 GHz every evening around dinnertime. However, the team found that signals were not coming from ET but from the microwave oven downstairs. They have since put a note on the microwave, asking people not to use it while they are carrying out observations at this frequency.

—Jeff Hecht, "Take Me to Your Microwave," *New Scientist* (U.K.), p.6, January 20, 1996

George Carlo, in support of his motion, submitted an extensive affidavit which recites his educational background, work history, residency, the history of HES and details his and HES' involvement with the cellular telephone industry. Without going through the facts of the affidavit, Dr. Carlo, who has a PhD in epidemiology and is also a lawyer, and HES could be characterized as having a non-adversarial relationship with the cellular telephone industry....It appears from both the affidavit and George Carlo's deposition transcript that to date most of the time and effort expended by HES in relation to cellular telephones has involved a review of the existing research and the formulation of a $15-25 million five-year research program. The stated purpose of this research is to determine whether cellular telephones pose a public health threat and if they do what is the appropriate response. Very little actual research has yet to take place.

—Judge Paddy McNamara, in an order dismissing Dr. George Carlo and the Health and Environmental Sciences Group Ltd. (HES) as defendants in *Debbra Wright v. Motorola Inc.,* Circuit Court of Cook County, IL, January 26, 1996 (see *MWN,* M/A95)

[A] 2 mG ambient exposure limit "would really shut down some technologies," such as electric trains. "There are limits to what one can consider for the sake of safety without going back to the Dark Ages."

—Dr. Thomas Tenforde, vice president of the NCRP and chief scientist of the Health Division of Battelle Pacific Northwest Labs, quoted in "Battling EMF Reports," *Environmental Health Perspectives, 104,* p.16, January 1996

No official tests of high-powered microwave weapons' effects on humans are on record, although that doesn't preclude the possibility that tests have been performed. (It took decades before the public heard about LSD tests by the CIA in the 1970s and radiation experiments by the Pentagon during the 1950s.) Major Tom Schultz at the public affairs office of the Assistant Secretary of Defense says he cannot answer questions about high-powered microwave weapons because research on them is classified. "We're probably quite far from a good understanding of the health effects of microwave technologies used as weapons," says [Federation of American Scientists' Steve] Aftergood. "I am not aware of any dedicated human-subject research in this area, and the continuing development of these technologies makes me nervous, because at some point they will have to be tested against human subjects. And given the background of Cold War human experimentation, I am concerned about how these tests will be conducted. At a minimum, the testing protocols need to be subjected to public review."

—Peter Cassidy, "Guess Who's the Enemy," *The Progressive,* pp.22-23, January 1996

In Australia, Mark Israel, Richard Luben and Michael Repacholi Testify on EMF Health Risks

Reprinted below are excerpts from testimony presented at an Australian Senate Economics References Committee hearing, held November 7-8, 1995, regarding the proposed Eastlink high-voltage power line (see p.2). The experts included Dr. Mark Israel of the University of California, San Francisco, Dr. Richard Luben of the University of California, Riverside, and Dr. Michael Repacholi, the chief scientist at the Royal Adelaide Hospital in Adelaide, Australia. Luben is the president-elect of the Bioelectromagnetics Society, and Repacholi is the chairman of the International Commission on Non-Ionizing Radiation Protection. (For more of Luben's comments, see p.3.)

Dr. Mark Israel

...Overall, the childhood cancer studies that have been talked about so much during the past two days show no consistent association between childhood cancer and any number of measures of EMF exposure....

A number of other studies have examined adult exposure to EMF[s] at residences and in the workplace, but none of these studies have provided a consistent, strong, plausible body of data to suggest that there are adverse health effects associated with power line frequency EMFs. I think it is really worthwhile reiterating yet again that this interpretation is shared by virtually all of the expert review panels which have examined the epidemiologic literature in this area. I am reminded of one that has been a watershed for me, and that is the one by Sir Richard Doll of Oxford University—one of the world's most experienced and respected epidemiologists....

[T]here is a huge body of literature—I mean numbered in hundreds of studies—that directly tests the issue of whether EMF[s are] likely to be important for the development of cancer. This research includes laboratory studies, biochemical research and animal studies, and it provides me, as a cancer researcher, with absolutely no cause for concern that EMFs, of the type that we are discussing, can and will cause cancer. In fact, I find the literature reassuring that this is not one of the reasons that I would worry about cancer causation or adverse health effects....

What I want to say to you is that, based on my personal education, my experience, my training as a cancer researcher, as a medical doctor, as a pediatric oncologist and based on the available molecular, cellular and animal experiments, I find no scientific basis for concluding that power frequency electromagnetic fields induce or promote cancer or any other adverse health effect. Using the accepted scientific criteria that I and the scientists with whom I associate apply to carcinogenesis, I cannot find support for the notion that power frequency [EMFs] can lead to the development of cancer.

Q: [Y]ou will not be afraid to put your house in close proximity to power lines.

It would not be a consideration. I do not like my children going in restaurants where people are smoking. There are lots of things that I do not do in order to avoid known carcinogens and problems.

Q: Power lines are not one of them?

This is not an issue for me.

Q: ...I find it interesting that as a scientist you are prepared to make absolute statements, where none of the other scientists who have appeared before us—

I am unique amongst the scientists that I think you have had. I am a physician. In the afternoon I take care of patients, in the morning I go to the lab. I do not have the luxury of keeping an open mind about everything in life. I am not against further research. My problem is that in the United States, when people come and ask me this question, they have a pool of money and they are going to put that pool of money into one kind or another of cancer research—and I have to make a value judgment; what do I think is most important. I do not put any more of that money into EMF research. My judgment is it is enough already. If there are unlimited resources I think it is fine but I do not have the luxury in my life.

Q: ...I am interested that ESAA [Electricity Supply Association of Australia Ltd.] have invited you to come to make this presentation....

I do not know these people at ESAA; I had never met them before yesterday. I do not think they knew my opinion when they invited me. They asked me to review the literature and formulate an opinion....I came here to be an advocate for children and research cancer for children. I came here to try to see that the focus on what causes childhood cancer is correctly directed, that the resources that are available for cancer research are correctly directed.

Q: Have you appeared for power companies in the United States as a witness?

Not in the last couple of years. I did several years ago, off and on. I think I have done it perhaps fewer than five or six times—maybe 10 times. I do not know, but not very often. I would say maybe 10 times in 10 years....

I do not think it matters whether [the epidemiologic data are] measured fields, closeness to power lines or anything else. If you look at the body of data in its totality, as these review panels have, you will see that it lacks the consistency, it lacks the strength, it lacks the dose–response, it lacks all of these criteria that we routinely look for in order to come to some conclusion as to whether or not cancer is associated with one variable or another.

Dr. Richard Luben

...I am...a member of Subcommittee 89.3 of the NCRP, which is the committee that produced the document that has at least partially been leaked to the press and has been discussed widely....[W]hat was leaked [from the NCRP report] is in fact the executive summary that was agreed to by the entire committee, and there is no question in my mind that the report is finished—at least at this stage. It does not constitute a working document and most certainly does not constitute a non-report....

We can say that living close to power lines is likely to be associated with an increase in childhood leukemia and possibly other cancers. We cannot at this point say that the measured EMF is the causative agent, but we have enough evidence to say that it is a possible causative agent. It seems to me that, in the absence of a better scientific understanding of the mechanisms and the linkages that are involved in these statistical epidemiological associations, prudence is a wise course to take....

[O]ur review of [the EPA's document on EMFs] found that the conclusion that EMF exposure was a possible potential carcinogen was a valid scientific conclusion....

The correlation between power lines and leukemia is statistically supportable. There are possible mechanisms based on both animal and laboratory results that suggest cancer-causing or cancer-promoting activities of electromagnetic fields. Combining the statistical association and the laboratory data, with which I am most familiar because I work with it every day, leads me to feel that there is some reason for caution.

Five years ago, when I took home a magnetic field meter to measure the magnetic fields in my household, I found that my four-year-old son's bed was in a region of the house where there was about a 4 mG exposure rate. I found that in the other corner of his bedroom the magnetic field was only 0.25 mG. I did not think that there was such a big decision to make; I simply moved his bed to the corner of the room that had [a smaller] field. If you were to ask me whether I would sell my house if there were a power line next to it, I do not know what the answer would be. But you can take wise and prudent measures to decrease the exposure of people, particularly children, to magnetic fields....

Q: Dr. Luben, it is important to us to try to establish your expertise and where you are coming from so that we can assess it.... I presume that in Australia you represent yourself.

That is correct.

Q: You were invited to come?

I was invited by Ian Macmillan as a result of his association with Victoria Powerline Action. I made it clear when this subject was raised that I was not a proponent of any particular causation mechanism. I most certainly was not going to tell anyone that I think that magnetic fields cause cancer because I do not see the scientific evidence for that. The other thing is that, unlike some witnesses, I am most certainly not being paid any fee or honorarium, nor have I ever been paid any fee or honorarium for providing my scientific opinion on these matters.

Q: Your fare [to Australia] was paid by Mr. Macmillan's group?

That is correct....We have data that indicate that magnetic fields will enhance the responsiveness of cells in culture to tumor promoters such as the phorbol ester class of compounds. We also have data that has just been published in the *Journal of Biological Chemistry* that shows that a 1 G magnetic field will activate a receptor in human B-lymphocytes which is associated with the growth of those cells and turning them into leukemias.

This is very important data because of the fact that most of the studies that have been done with leukemia cells and EMFs have been done using the wrong type of leukemia cells....

[B]ut our data are consistent with the idea that magnetic fields at levels much higher than are found in households can promote the neoplastic character of these cells....

My feeling, based on what I see in my laboratory, is that 1 G is a level of exposure that I would be uncomfortable with....

We still do not have a well-agreed-on biophysical mechanism that would allow us to biophysically describe the interaction of these magnetic fields with molecules in the cell membrane. There are several theories and some of these theories do have laboratory data that suggests that they are valid approaches. Nevertheless, there have been literally hundreds of peer-reviewed publications in the last decade demonstrating magnetic field effects, particularly at the level of 100 mG to 1 G and above, on cells in culture. So, in my opinion, it is no longer open to question whether these kinds of cellular effects can happen, but it is still an interesting and approachable question of what the biophysical mechanism is.

Dr. Michael Repacholi

...There have been millions and millions of dollars spent on occupational epidemiology, trying to identify if [electrical workers] are in fact at a higher risk. The most recent studies have also shown a confusing array of results: Some have shown increased leukemia, some have shown increased brain tumors but not leukemia and some have shown nothing at all. Here we have a group receiving exposures which are significantly higher than the general public and yet we are still getting an array of confusing results....

It has been the work of my commission to assess the literature on a continuing basis because we publish international guidelines on exposure limits that we, on the basis of the science, consider that people can be exposed to safely, based on the evidence that we have....To date, right to this day, there are no data that indicate that there should be a change to the current international guidelines on exposure limits to the 50-60 Hz fields. Perhaps I should leave it there and face the firing squad.

Q: ...Would you have any apprehension or fear for yourself or your family if you had a house in close proximity to a high-voltage power line?

From a health viewpoint—

Q: Only from a health viewpoint, yes.

I would have no problems in living—

Q: I am not talking about the aesthetics or the environment.

I hate the look of them. But, from a health viewpoint, we are actually exposed probably to higher levels of fields from various devices that we use in the home, unless you live in very close proximity to a high-voltage transmission line. And, usually, the easements in Australia are such that the levels are down to a few mG....You are exposed to much higher levels if you use an electric shaver or hair dryer....

Q: ...Do you think that research has been going on for a long enough period of time now for a scientist or you to say either that there is no health risk with high-voltage power lines or that the evidence that you have at this stage would suggest that there is none? Has the research been going long enough for that?...

My answer is that there has not been enough research....While the literature at this stage does not establish that there is an adverse health effect at the levels that we are normally exposed to, I still believe there are gaps in knowledge that we would like to have filled to substantiate our health risk assessments. We will never know everything, but we usually like to have a bulk of evidence that will say we are convinced that all this evidence is consistent; it is all pointing in the same direction and it has been well conducted. You cannot prove something does not happen.

Q: ...[I]s it fair to say that, although there are some gaps in the research, on balance you still do not think that those gaps are enough to say that there is a health risk? If you yourself wanted to live in proximity to a power line, would you think the evidence is against it rather than for it?

I believe that the evidence is against it, certainly, and—based on health—I would not worry about living under power lines. Having said that, I realize that it is still a new field, and there is more evidence needed. But you cannot wait for another 50 years to progress; you have to go on what you can establish. As a person involved in the development of guidelines, I know that you can only work on what is established and then make recommendations based on that, because then your criteria for establishing those limits are firm and able to be addressed in science and stand up to the rationale that is provided. People are concerned, and I empathize with those concerns. They are worried. They have children who are getting leukemia, but we have a normal incidence of leukemia which is occurring in the population anyway....

Let me say a few words on the NCRP report. It is a report of some committee members. It has not received any scientific peer review, which means that, in science, it does not exist....

Unfortunately the media is there to sell a story. They are not there to convey factual information. It is just part of our system....

This is a nonevent—the NCRP report—but in the media's mind it has become an event because some committee members have wanted to put this information out for whatever purpose. In science it cannot be justified in any way. I would strongly recommend that the committee ignore that report because it is a nothing report.

ELECTROMAGNETIC INTERFERENCE

Compromise Sought on Hearing Aids... The *Hearing Aid Compatibility and Access to Digital Wireless Telecommunications Summit,* held January 3-4 in Washington, addressed ways to resolve cellular phone interference with hearing aids. The conference was organized by a steering committee that included cellular industry groups, hearing aid manufacturers and organizations of the hearing-impaired. CTIA's Tim Ayers, who attended the summit, explained that it resulted from an October 2 meeting between FCC Chair Reed Hundt and wireless industry representatives: "Hundt said, 'I want this problem taken care of,' and said that everyone should work together on it." Three working groups will issue short- and long-term recommendations in March. Still unresolved is the disagreement over two different standards for digital cellular systems, TDMA (including GSM) and CDMA (see *MWN,* M/J95). "There's some interference with all technologies," explained Brenda Battat of Self Help for Hard of Hearing People (SHHH), "but there's *much, much* less with CDMA." Frederick Graefe of the Wireless Communications Council (WCC), a pro-CDMA trade group, charged that "the GSMers want to delay any resolution until after they have all their technology deployed. Once the GSM industry spends $10 billion, nobody's going to tell them they have to dismantle it." Graefe claimed that FCC's Hundt called the October 2 meeting in response to a petition filed last June by HEAR-IT NOW, a coalition that includes both SHHH and the WCC. However, Ayers, who described the CTIA as "technology-neutral," emphasized that when Hundt spoke at the summit, "He said very specifically, 'I am not going to delay a roll-out of [digital] technology.'" Battat noted that although SHHH would prefer to see the FCC make hearing aid compatibility mandatory for the wireless industry, Hundt had made clear that this would be "a very last resort." But, she said, "We're committed to making this process work."

GROUND CURRENTS

Research Plan Proposed...A Minnesota scientific advisory committee has proposed a five-year research plan on the possible role of ground currents—other than conventional stray voltage—in dairy cow health problems. The committee was established in 1994 by the state Public Utilities Commission (PUC), under orders from the state legislature, in response to concerns of farmers that such currents could be responsible for odd behavior, health ailments and a decreased milk supply in dairy cows. The research program—estimated to cost over two million dollars—would include surveys of farmers, development of measurement protocols and field and laboratory studies on how dairy cows respond to specific types of EMFs. In a January progress report, the committee noted that the available information does not show any clear relationship between the effects and ground currents. Instead, it suggested, the ailments may often be caused by nearby stray voltage sources, such as water lines or metal stalls, rather than by primary distribution lines or nonelectrical sources (e.g., bacteria or viruses). The committee, chaired by Dr. Roger Staehle of the University of Minnesota, Minneapolis, includes Drs. Larry Anderson of Battelle Pacific Northwest Labs in Richland, WA, Abe Liboff

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of Oakland University in Rochester, MI, and Charles Polk of the University of Rhode Island, Kingston. The Wisconsin PUC is currently planning to join forces with the Minnesota PUC in a related investigation of the roles of stray voltage, ground currents and EMFs in reduced milk production, according to the January 12 *Wisconsin State Journal*. Stray voltage has received substantial media attention in the Midwest, and several farmers have won million-dollar awards for damages (*MWN,* N/D90 and J/F95).

MEETINGS

Gordon Research Conference... This year's biennial Gordon conference on bioelectrochemistry is titled *Molecular and Cellular Biophysics of the Alteration of Biochemical Reactions and Transport by Electric and Magnetic Fields*. It will be held July 21-26 at Salve Regina University in Newport, RI. "We will focus on how environmental fields and fields used for medical applications—for instance, drug delivery—alter the reaction rate or transport of ions and molecules," Dr. James Weaver of MIT said in an interview. "After all, such questions are at the heart of the conceptual controversy over the effects of EMFs." Weaver is the meeting's chairman, and Paul Gailey of Oak Ridge National Lab in Oak Ridge, TN, is the vice chair. On the agenda are: biophysical mechanisms of electric and magnetic field reception; electrically driven transport across biological barriers; and molecular and biophysical events in membrane proteins. More information can be obtained automatically by return e-mail from grc_info@geldrop.mit.edu. Or Weaver, Room 20A-128, MIT, Cambridge, MA 02139, Fax: (617) 253-2514.

PATENTS

EMF Neutralizing Apparatus... Last September 19, Dr. Ted Litovitz of the Catholic University of America in Washington was granted Patent No.5,450,859 for a method that he claims reduces EMF health risks. Litovitz explains that he has found that superimposing electromagnetic "noise" upon ambient EMFs of up to 50 kV/m and/or 50 G can inhibit the biological effects of the fields. The patent states that the technology is designed "to confuse the biologic cell so that it can no longer respond to the usual fields found in the home and workplace." In this way, Litovitz contends, a fluctuating field can be used as a protective device. Dr. Abdallah Mishrick, CEO of New York City-based EMX Corp., which owns an exclusive worldwide license for the patent, calls Litovitz's invention "a safe and economical answer to EMF health hazards." EMX has already marketed a computer keyboard that neutralizes EMFs from VDTs (see *MWN,* J/A93 and J/F94), and is planning other products. These include a hair dryer, a converter plug for electric blankets and a home protection system. The company is seeking a separate patent for a device that mitigates health risks from cellular phones. "One of the best demonstrations that weak fields can cause biological effects is the fact that those effects can be eliminated," Litovitz told *Microwave News*.

PEOPLE

Dr. **Gary Boorman**, the chief of the Pathology Branch at NIEHS in Research Triangle Park, NC, has taken over as the agency's

leader on the RAPID EMF research program. **Dan Vandermeer**, who recently retired from NIEHS, had hoped to continue managing the RAPID effort (see *MWN,* N/D95), but NIEHS Director Dr. **Ken Olden** has decided that the job should go to Boorman. Boorman said that he is not yet sure whether he will be the cochair of the interagency committee....**Tom Watson** has left Crowell & Moring to open up a new firm with partners **Curt Renner** and **Paul Lumnitzer**. Watson & Renner has assumed Crowell & Moring's EMF practice. "It was an amicable separation," Watson said in an interview. "I've always dreamed of starting up my own firm." Watson did not move very far. His offices are still at 1001 Pennsylvania Ave. in Washington, but he is now on the 4th floor instead of the 11th....**John Wilson** of Con Edison in New York City has been promoted and is now the acting manager of communications and training within the Department of Environmental Affairs. Wilson was formerly EMF issue manager. **Paul Carbone** has assumed the responsibility for EMFs at the utility....Two leaders of the EMF citizens movement have died. **Edward Ronald Kinney** was a vice-president and frequent spokesman for the Seattle-based Citizens Against Overhead Power Lines (CAOPL), one of the first and most active advocacy groups in the U.S. **Claire Alston** of the Coalition to Reduce Electropollution has died of a brain tumor in British Columbia, Canada. She was the editor of the group's newsletter, *The Current*.

RF WEAPONS

Disabling People and Electronics... The military continues to explore development of RF weapons for the conflicts of the future. For instance, the *First Directed Energy Warfare (DEW) Conference,* held last year at the Mitre Corp. in McLean, VA, featured Dr. David Erwin of the Armstrong Lab at Brooks AFB, San Antonio, TX, on "DEW RF Effects" and Dr. Jose Pina of the CIA on "Ground Combat Applications of RF." Other topics included "Personnel Vulnerability" and "DEW Biological Effects." The June meeting was organized by the Association of Old Crows, whose members are specialists in electronic warfare. Conference participants had to have security clearances of "Secret" or higher, as has been the case at similar meetings in the past (see *MWN,* J/F87 and N/D93). Public discussion of RF/MW weapons has focused on disrupting technology. But a recent article in the *Airpower Journal* revealed "for the first time that the military is developing high-powered microwave weapons for use against human beings," reports Peter Cassidy in the January 1996 *Progressive* (see p.14). RF/MW and EMF-based weapons are also being studied for civilian law enforcement. Oak Ridge National Laboratory (ORNL) in Oak Ridge, TN, will soon complete a literature review for the National Institute of Justice on the feasibility of "thermal guns," which could heat the body to 105 to 107ºF and incapacitate the target; "seizure guns," which "would use EM energy to induce epileptic-like seizures"; and "magnetophosphene guns," which would cause the target to "see stars." The institute's Ray Downs in Washington cautioned that the report may not be made public. ORNL's Dr. Clay Easterly has said that some effects not associated with heating could be useful in developing nonlethal weapons (see *MWN,* N/D93).

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Plus Ça Change: Why We're Running in Place

Stronger Evidence for an Alzheimer's–EMF Connection

Epidemiological studies in the U.S. and in Sweden have produced new evidence of a link between Alzheimer's disease (AD) and occupational exposures to electromagnetic fields (EMFs). A specific biological hypothesis has been proposed that could account for the connection, and laboratory studies are planned to test it.

In the December 1996 issue of *Neurology,* Dr. Eugene Sobel and colleagues reported a fourfold increase in the risk of AD for subjects who had worked in jobs with medium-to-high EMF exposure. It was Sobel who reported the first evidence of an EMF–Alzheimer's link in July 1994, based on an analysis of three separate groups of Alzheimer's patients.

"It's an interesting observation," Dr. Zaven Khachaturian, director of the Alzheimer's Association's Reagan Research Institute, said in an interview from his office in Potomac, MD. He said that the finding should be followed up, but cautioned that the association might be caused by other risk factors in the workplace.

On November 21, Dr. Maria Feychting presented the results of her recent study in Sweden at the Department of Energy's annual research review in San Antonio. Among subjects who were 75 years or younger at the time of diagnosis, she found that those who had worked in jobs with the higher EMF exposures were five times more likely to develop AD.

Although these findings by Sobel and Feychting are both statistically significant, there are inconsistencies between them, and Feychting urged "a cautious interpretation." Still, she told *Microwave News,* she was surprised by her

(continued on p.6)

New Focus on Broadcast Radiation: Is There a Leukemia Risk?

Two new studies from the U.K. and Australia show elevated rates of leukemia near television and FM radio broadcast towers. The new results support past studies pointing to leukemia risks due to exposure to radiofrequency and microwave (RF/MW) radiation from communications and radar transmitters.

Rates of adult leukemia were nearly twice those expected within two kilometers of a TV and FM tower operated by the British Broadcasting Corp. (BBC) in Sutton Coldfield near Birmingham, England. Writing in the January 1997 *American Journal of Epidemiology (AJE),* Dr. Helen Dolk and colleagues at the London School of Hygiene and Tropical Medicine reported that the decline in leukemia risk with distance is highly statistically significant.

Dolk looked at leukemia rates in concentric circles around the Sutton Coldfield tower. Within a half kilometer, there were nine times the expected number of cases. In the area within the next half kilometer, the rate was double that

(continued on p.11)

EMF NEWS

« Power Line Talk »

Blaming power line EMFs for health effects is as logical as concluding that diet soda causes obesity after seeing a fat person drinking a Diet Coke. So reasoned **ABC**-TV's **John Stossel** on *Good Morning America*. Stossel conceded that studies have shown higher rates of cancer near power lines but called these findings deceptive. "It may be that people who live near power lines also live near busy streets and are exposed to more pollution from cars. They might eat more fried foods or exercise less or anything," he said. When *GMA*'s Charles Gibson asked whether people are just imagining that they suffer from EMFs, Stossel responded, "It's hard to say what people are imagining. Anything is possible. It's possible that all the cancer in America is caused by radiation from the planet Uranus. You can't prove what isn't true." The two reports on EMFs, which aired January 6-7, served as a teaser for Stossel's January 9 hour-long special *Junk Science: What You Know That May Not Be So,* in which he argued that science is often twisted to fit the agendas of activists, bureaucrats and lawyers (see *MWN,* J/A96 and N/D96). So who can be trusted on controversial scientific issues? Stossel touted the opinions of "the quiet scientists who are respected by their peers." In the EMF series, Stossel presented two scientific experts: **Michael Fumento**, a science writer and author of *The Myth of Heterosexual AIDS,* and Dr. **Richard Wilson** of Harvard University in Cambridge, MA. Wilson, who has ties to the Atlantic Legal Foundation in New York City, coordinated that organization's *amicus* brief for San Diego Gas & Electric Co. in the *Covalt* case, a property devaluation suit in California (see *MWN,* N/D95). Representing the other side of the scientific debate were several women who have homes near power lines, including **Joan Tukey**, a citizen activist. Meanwhile, health and safety officials at ABC headquarters in New York City are not taking any chances. In December, ABC paid a six-figure sum to **Field Management Services**, a Los Angeles-based EMF mitigation firm, to design and install shielding on the ground floor of one of its buildings. Prior to shielding, ambient levels averaged 100-200 mG. **Joe Mannetta**, an ABC network health and safety executive, did not respond to requests for comment. While ABC's concern may well have been electromagnetic interference, one professional in the EMF mitigation business told *Microwave News,* "The health issue is always there in the background."

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Seven members of the **NAS-NRC** EMF committee are trying to change the way the academy releases its reports to the public (see *MWN,* N/D96). *Microwave News* has learned that in early January they wrote to Dr. **Bruce Alberts**, the president of the academy, to raise concerns about the process by which press releases are drafted and specifically about the wording in the release announcing the **EMF report**. The academy is now polling all 16 members of the EMF panel to gauge how it should answer its critics. The dissenting seven are waiting for the response before making their concerns public. Meanwhile, in a much more strongly worded letter, Dr. **Kjell Hansson Mild** of the National Institute for Working Life in Umeå, Sweden, asked Dr. **Charles Stevens** of the Salk Institute in La Jolla, CA, the chair of the EMF panel, how "the report turned out to be so biased in [its] selection of papers." Mild, past president of the Bioelectromagnetics Society, noted that the report mainly included papers that showed no effect and omitted those that found a biological response. As of the end of January, Mild had not heard from Stevens or the NAS-NRC.

WHO EMF Project Gets No Funds from the U.S.

The World Health Organization (WHO) EMF project has failed to raise any funds from U.S. health agencies. The U.S. military may provide some support, but only for working groups.

The EMF project had actually received only 10% of its $3.3 million budget by the end of last May. Indeed, according to a confidential funding update obtained by *Microwave News*, the project had raised essentially all of its unrestricted contributions from only three countries.

The WHO itself is not contributing any money. Dr. Wilfried Kreisel, the WHO's executive director for Health and Environment, explained at a project meeting last May that the United Nations agency, which is based in Geneva, Switzerland, had other "commitments in areas of high priority."

In early 1997, Dr. Michael Repacholi, the director of the WHO project, said that he now had "just under $2 million" in hand. But he did not respond to questions about the sources of the funds and whether they were for general support or for specific tasks such as meetings or training. Repacholi was previously at the Royal Adelaide Hospital in South Australia.

As of last August, the project's unrestricted funds, received or promised, were $50,000/year for five years from Australia, $60,000/year for five years from Britain and $100,000 from Ireland—and lesser amounts from Hong Kong (US$13,000, or HK$100,000), Sweden ($20,000/year for two years) and Switzerland (US$7,300, or SF10,000).

"We have no funds to contribute," said Dr. Russell Owen of the U.S. Food and Drug Administration (FDA) in Rockville, MD. The FDA's Dr. Mary Beth Jacobs attended the EMF project's International Advisory Committee meeting, held in Geneva just prior to the formal announcement of the project last June (see *MWN,* J/A96). Planning for the EMF project had begun some years earlier.

Repacholi has also solicited funds, without success, from the National Institute of Environmental Health Sciences, the Department of Energy (DOE) and the National Institute for Occupational Safety and Health (NIOSH). "The WHO EMF effort is largely duplicative of the RAPID effort," said the DOE's Dr. Imre Gyuk. NIOSH's Dr. Gregory Lotz said that his agency does not have any funds to contribute.

Six countries have pledged resources for scientific meetings, working groups and training courses: Austria, Canada, France, Germany, Indonesia and Italy.

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Consumers Union (CU) is no longer worried about EMFs from **electric blankets**—at least in part because of the recent **NAS-NRC report**. In an update appearing in the January 1997 issue of its magazine, ***Consumer Reports,*** CU advises that the NAS finding of "no conclusive evidence" of EMF health impacts and the new generation of reduced-EMF blankets suggest "that electric bedding should not be a concern for most people." CU does caution children and pregnant women only to warm the bed and then turn off the blanket or heating pad "to avoid overheating." Back in 1989, CU recommended that pregnant women avoid electric blankets because of the heat *and* the EMFs (see *MWN,* N/D89). In its November 1995 issue, *Consumer Reports* stated that its own tests then showed that the EMFs from low-field blankets and pads were "close to the 'background' level produced by any house's wiring." A recent paper by a team at the University of Nevada, Reno, however, found that blankets with reduced magnetic fields generate electric fields that can actually be higher than those from conventional electric blankets. The Nevada researchers reported that the currents induced in the body by low-field blankets are still about two-thirds of that from conventional models (see *MWN,* N/D96).

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Eyebrows were raised from coast to coast when the program of an EMF symposium held in **Brussels, Belgium**, on January 21 reached this side of the Atlantic. Three of the four featured American speakers are among the most outspoken skeptics of EMF health effects. Dr. **Patricia Buffler** of the University of California, Berkeley, presented the epidemiological data and Dr. **John Moulder** of the Medical College of Wisconsin, Milwaukee, summarized the biomedical literature as a whole. Both Moulder and Buffler have served as paid experts for the electric utility industry. Another synthesis of the EMF science was presented by **Gary Taubes**, the journalist who has been adopted by the utilities as their answer to Paul Brodeur. Taubes's talk was entitled, "EMF, the Press and the Ease of Getting It Wrong." The fourth speaker was Dr. **Charles Graham** of the Midwest Research Institute in Kansas City, MO. "Where's the balance?" asked one surprised observer. The symposium was sponsored by **EDF** and **Electrabel**, the French and Belgian electric utilities, respectively, and was chaired by Dr. **Michael Repacholi** of the **WHO** in Geneva (see p.2).

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The theme of this year's annual meeting of the **National Council on Radiation Protection and Measurements** (NCRP) will be *The Effects of Pre- and Postconception Exposure to Radiation*. In addition to the talks on ionizing radiation and ultrasound, there will be presentations on EMFs and RF/MW radiation by Drs. **Larry Anderson** of the Battelle Pacific Northwest Labs in Richland, WA, **Mary Ellen O'Connor** of the University of Tulsa, OK, and **Elisabeth Robert** of the Institut Européen des Genomutations in Lyon, France. The NCRP's long-awaited **EMF report** apparently will not be released anytime soon. A draft of the committee's report, which recommended that strong action be taken to curb human exposures to EMFs, attracted a great deal of attention when it became public in the summer of 1995 (see *MWN,* J/A95). The report is still being reviewed, according to the NCRP's Dr. **Constantine Maletskos**. "We are expecting it to be released by the end of 1997," Maletskos said in an interview. The NCRP meeting will be held at the Crystal City Marriott in Arlington, VA, April 2-3. For more information, call (301) 657-2652 or fax (301) 907-8768.

New York EMF Property Devaluation Case Dismissed

In a victory for Consolidated Edison Co., a New York appellate court has thrown out a lawsuit seeking damages for loss of property value due to public fears of EMFs. The suit, filed by Howard and Eve Reiss, charged that a Con Ed power line next to their property had caused them to lose money on the sale of their home in the Village of Pleasantville. The Reisses have filed an appeal.

Reiss is a test case for several similar lawsuits pending in the New York courts, five others against Con Ed and three against Long Island Lighting Co. (see *MWN,* J/A94).

The December 5 ruling found that the EMF issue had in fact affected the local housing market, and that the Reisses had lost tens of thousands of dollars as a result: "The record reveals that the ultimate sale price [of $230,000] was 30% less than comparable properties in the village due to the public perception that the power line posed a health hazard."

But in wording similar to that of the recent *Covalt* decision by the California Supreme Court (see *MWN,* S/O96), Justice D. Bruce Crew wrote that EMFs "are incapable of being perceived by the senses and, thus, are not capable of resulting in a 'physical' invasion." Since the Reisses had not tried to prove that EMFs had harmed their health, and since EMFs do not cause offensive odors or noise, the court ruled that the Reisses' property had not been infringed upon, and so they were not entitled to damages.

"We're obviously pleased with the decision," said Richard Mulieri, a spokesperson for Con Ed in New York City. "We feel it can act as a precedent, not just in our service area but in the rest of the state as well."

Michael Rikon of Goldstein, Goldstein and Rikon in New York City, a lawyer for the Reisses, said that an appeal was filed on January 10, and that he expected the dismissal to be overturned. "This decision does not make any sense," he said in an interview. "It ignores the 1993 *Criscuola* decision by New York's highest court, which allows plaintiffs to sue for damages whether or not the danger is proven scientifically" (see *MWN,* N/D93 and J/F 94). "Our briefs and Con Ed's both referred to *Criscuola* repeatedly," said Rikon, "but this decision doesn't mention it once."

Rikon noted that both Crew and another member of the five-judge panel had served on the court that handed down a ruling against the Criscuola brothers, which was later overturned on appeal. But Mulieri said that Con Ed was not too concerned about the *Reiss* decision meeting a similar fate. "Good decisions usually hold up on appeal," he remarked.

Certainly the two cases are not the same. In *Criscuola,* Con Ed had already taken a portion of the brothers' property by emi-

nent domain, and the issue was how much compensation they deserved. The Reisses sought to demonstrate that the presence of a Con Ed power line adjacent to their property amounted to a *de facto* "taking," since it depressed the property's value, and one of their lawyers admitted that this was going "one step further than *Criscuola"* (see *MWN,* J/A94). But the court's decision did not address this issue.

Court Throws Out Cancer Suit Against Florida Power & Light

On January 22, a state appeals court upheld the dismissal of Leonard Glazer's lawsuit against Florida Power & Light (FPL). Glazer had filed suit in 1994, following his wife's death from chronic myelogenous leukemia (CML) in 1988, and his own diagnosis with the same rare disease in 1992. His attorneys have asked the Court of Appeal to reconsider its decision.

The *Glazer* case was the first to focus on the role of ground currents as a source of residential EMFs. Both sides agreed that most of the EMFs in the Glazer home arose from grounding connections to conductive plumbing, and not directly from FPL's distribution lines outside the house. Glazer's own experts testified that the latter alone were too weak to cause cancer (see *MWN,* M/J96).

In April 1996, the lower court granted FPL's request to limit its liability to the EMFs from its power lines, noting that FPL did not own or control the water main, and the case was subsequently dismissed.

Glazer argued on appeal that regardless of the immediate source of the EMFs, FPL had a duty to warn its customers about their potential hazards. "A manufacturer is responsible for his product wherever it might foreseeably be used," one of Glazer's attorneys, Howard Talenfeld of Colodny, Fass & Talenfeld in Ft. Lauderdale, told *Microwave News.*

Indeed, the Court of Appeal rejected FPL's argument that because it did not own the water line, it was entirely free of responsibility. The court ruled that had the utility clearly known that EMFs from ground currents posed a health risk, "FPL could not sit silently and not warn its customers of this potential hazard."

But the appellate panel still accepted the distinction between EMFs from ground currents versus those from power lines. No study during the time Glazer lived in his home, it held, "specifically examined...whether magnetic fields emanating from plumbing lines may be linked to cancer." Therefore, it ruled, FPL had no duty to warn its customers about EMFs from ground currents.

A separate opinion from Judge Gerald Cope criticized the majority's logic on this point, writing, "There is no particularly good reason why...the fields created by water lines should necessarily be considered apart from magnetic fields created by the distribution wires." Cope agreed with the majority that FPL had no duty to warn—but only because "the level of scientific knowledge...does not...sufficiently establish the existence of a health risk."

"The company is very pleased with this result," said FPL's lead attorney, Alvin Davis of Steel, Hector & Davis in Miami. "It was a difficult and emotional case, and the company and I are both sympathetic to Mr. Glazer because of his illness. But it was not the company's fault."

If the Court of Appeal refuses to reconsider its decision, Glazer's only option would be to appeal to the state's Supreme Court. Asked if his client would do so, Talenfeld said, "We're studying the decision very carefully—but Mr. Glazer is committed to proceeding."

In September a judge found that Glazer was liable for paying a large portion of FPL's legal costs, and the utility has demanded $268,000 (see *MWN,* S/O96). FPL's attorney, Davis, would not comment when asked if the company would drop this demand if Glazer agreed not to appeal.

Focus Again on Electric Fields: Now a Link to Brain Tumors

A new paper from France has made it clear that the revived interest in electric fields and cancer is not just a fad.

Drs. Marcel Goldberg, Pascal Guénel and coworkers, who collaborated on the joint Canadian-French epidemiological study published in 1994, have found a statistically significant threefold increase in the risk of brain tumors for those utility workers with the highest cumulative exposure to 50 Hz electric fields. They saw no link between electric fields and leukemia. Goldberg and Guénel are with INSERM in Saint-Maurice, a suburb of Paris.

Those workers exposed to average fields of 13 V/m or more for 25 years or longer had seven times the expected rate of brain tumors. There was an indication of a dose–response relationship, but it was not a smooth association. Goldberg also saw an "unexpected" association with colon cancer.

Writing in the December 15, 1996, issue of the *American Journal of Epidemiology (144,* pp.1107-1121), the French researchers called the brain tumor association "remarkable," since "brain tumors were with leukemia the sites most strongly suspected *a priori* to be linked with extremely low frequency fields." They added that, "If the observed association with brain tumor is real, it implies that electric fields may have their own role in the development of the disease, in conjunction or not with magnetic fields."

The original analysis of the Canadian-French data showed an association between magnetic fields and leukemia and a lesser link with brain tumors (see *MWN,* M/A94). Last year, Canada's Dr. Anthony Miller of the University of Toronto found even higher risks of leukemia among Ontario Hydro workers when he took into account both magnetic *and* electric fields (see *MWN,* J/A96).

Also last year, a group at the U.K.'s University of Bristol proposed that electric fields play a critical role by concentrating radon decay products (see *MWN,* M/A96 and S/O96). Another U.K. study has linked electric fields to childhood leukemia (see *MWN,* N/D96).

A meta-analysis of 29 occupational epidemiological studies by the Electric Power Research Institute in Palo Alto, CA, found "a small but significant" increase in brain cancer among workers exposed to EMFs (see *MWN,* J/F96; also M/A90).

EMF RAPID Innovative Biomedical Research Grants

In early January, the National Institute of Environmental Health Sciences (NIEHS) awarded 21 grants as part of the EMF Research and Public Information Dissemination (RAPID) innovative biomedical research program. Funding began on January 10, 1997, and will last for one or two years. For past awards, see *MWN,* S/O94 and M/A95. Those researchers who received earlier RAPID grants are marked with a †.

Investigator/Institution	Award	Project
Dr. Dean Astumian† University of Chicago	$100,000 (2 years)	To develop theories of biophysical, nonlinear mechanisms of EMF effects that address biologically relevant EMF exposure conditions on cells.
Dr. Elizabeth Balcer-Kubiczek† University of Maryland, Baltimore	$100,000 (2 years)	To investigate changes in immediate, early gene transcription induced by 60 Hz EMFs with a high harmonic content.
Dr. Martin Blank Columbia University, New York City	$100,000 (2 years)	To characterize the mechanism of EMF signal transduction by cells and to determine the environmentally relevant exposure parameters using the enzyme cytochrome oxidase.
Dr. Lucio Costa University of Washington, Seattle	$99,944 (2 years)	To study the ability of 60 Hz EMFs to increase the basal- and mitogen-stimulated proliferation of human astrocytoma (brain tumor) cells and the possible role of protein kinase C.
Dr. Gale Louise Craviso University of Nevada, Reno	$100,000 (2 years)	To use fluorescence imaging of intracellular calcium in isolated adrenal medullary chromaffin cells to define the EMF-induced calcium response as a function of several EMF parameters.
Dr. Reba Goodman Columbia University, New York City	$100,000 (2 years)	To evaluate the effects on gene expression by intermittent EMF exposures during the suppression and induction of neoplastic transformation.
Dr. Guy David Griffin Oak Ridge National Lab, Oak Ridge, TN	$98,665 (2 years)	To begin to explain the mechanisms by which EMFs can affect gap junctional intercellular communications and thereby their role in tumorigenesis.
Dr. Charles Buell Grissom University of Utah, Salt Lake City	$100,000 (2 years)	To study the influence of weak DC magnetic fields (<10 G) on biochemically important enzymatic reactions—with emphasis on changes in radical pair recombination.
Dr. Theodore Hahn VA Medical Center, West Los Angeles	$99,970 (2 years)	To see whether continuous EMF exposures can induce or promote brain tumors in animals, with or without ionizing radiation, using tissue from a previous lifetime mouse lymphoma study.
Dr. Tom Hei Columbia University, New York City	$100,000 (2 years)	To examine, using double-blind studies, the possible mutagenic effects of extremely low frequency (ELF) magnetic fields in combination with gamma rays or benzo(a)pyrene.
Dr. Daniel Kripke University of California, San Diego	$98,729 (2 years)	To critically test whether EMF exposures in the bedroom influence the daily excretion of melatonin among aging volunteers.
Dr. Henry Lai† University of Washington, Seattle	$98,792 (2 years)	To further confirm the blocking effect of melatonin on magnetic-field-induced single- and double-strand DNA breaks in brain cells of rats and the involvement of free radicals.
Dr. Howard Lieberman Columbia University, New York City	$100,000 (2 years)	To identify the changes in protein synthesis profiles in yeast induced by ELF EMFs and the controlling molecular mechanisms for these alterations in gene expression.
Dr. Lise Loberg IIT Research Institute (IITRI), Chicago	$100,000 (2 years)	To test the hypothesis that EMFs alter the molecular regulatory pathways that are normally activated in cells exposed to DNA damaging agents using A-T cells.
Dr. David McCormick† IITRI, Chicago	$50,000 (1 year)	To address the biological activity of complex EMF metrics—including harmonics, transients and time-varying magnetic fields—on pineal function in rats.
Dr. Lee James McDonald IITRI, Chicago	$100,000 (2 years)	To systematically explore the effects of 60 Hz EMFs on the stress response of cultured human cells.
Dr. Russel Reiter† University of Texas, San Antonio	$85,660 (2 years)	To determine whether 60 Hz magnetic fields increase the DNA damage caused by a carcinogen (due to an increase in the concentration of free radicals).
Dr. Bernadette Ryan IITRI, Chicago	$50,000 (1 year)	To define the potential risk to the developing fetus of harmonics, transients and varying field intensities in conjunction with 60 Hz magnetic fields.
Dr. Asher Sheppard Loma Linda University, Loma Linda, CA	$99,970 (2 years)	To estimate the attributable fraction of childhood leukemia from exposures to power frequency magnetic fields using novel methods of exposure assessment.
Dr. Jesse Sisken University of Kentucky, Lexington	$100,000 (2 years)	To resolve whether power frequency EMFs can affect signal transduction mechanisms—specifically the capacitative calcium entry system—that regulate cellular proliferation.
Dr. Michael Yost University of Washington, Seattle	$98,249 (2 years)	To analyze an existing data set on EMF exposures and noctural melatonin levels to investigate the possible roles of exposure metrics, exposure timing and job tasks.

A Special Emphasis Panel reviewed proposals October 28-29, 1996. The members of the panel were: Drs. Jerry Williams (chairman), Johns Hopkins University, Baltimore; Teresa Audesirk, University of Colorado, Denver; Kenneth Cantor, National Cancer Institute, Rockville, MD; Christopher Davis, University of Maryland, College Park; Om Gandhi, University of Utah, Salt Lake City; Ann Ganesan, Stanford University, Stanford, CA; Sek Wen Hui, Roswell Park Cancer Institute, Buffalo, NY; Susan Ledoux, University of South Alabama, Mobile; Howard Liber, Harvard School of Public Health, Boston; Dana Loomis, University of North Carolina, Chapel Hill; Gregory Lotz, National Institute for Occupational Safety and Health, Cincinnati; Michael McCabe, Wayne State University, Detroit; Kenneth McLeod, State University of New York, Stony Brook; Martin Misakian, National Institute of Standards and Technology, Gaithersburg, MD; Howard Petty, Wayne State University; Charles Polk, University of Rhode Island, Kingston; Jeffrey Schwartz, University of Washington, Seattle; Douglas Spitz, Washington University Medical School, St. Louis; Robert Ullrich, University of Texas, Galveston; Peter Valberg, Gradient Corp., Cambridge, MA; Lynn Wiley, University of California, Davis; Steven Yellon, Loma Linda University, Loma Linda, CA.

own results: "I had expected no association at all."

The link between AD and EMFs in the workplace was also raised in a broad study of occupational mortality in 27 states over a ten-year period conducted by researchers at the National Institute for Occupational Safety and Health in Cincinnati and at Johns Hopkins University in Baltimore. In the September 1996 *American Journal of Public Health,* they reported higher death rates from AD and motor neuron diseases "among occupations that could have exposure to EMFs," such as radio and TV station employees, power plant workers, electricians and telephone installers. They stressed that further study was needed before the association could be regarded as confirmed.

A biological mechanism through which EMF exposure might lead to AD was proposed by Sobel and Dr. Zoreh Davanipour, both of the University of Southern California School of Medicine in Los Angeles, in a second paper in the same issue of *Neurology.* They cited experiments by Drs. Ross Adey, Carl Blackman, Robert Liburdy and Ewa Lindström, among others, in which EMF exposures led to a rise in intracellular calcium ion concentrations. Sobel and Davanipour then described how this change could increase production of a protein that plays a key role in the development of Alzheimer's disease.

"People who study magnetic field biology and those studying AD don't talk to each other that much," commented Sobel. "But they're publishing things that fit together like a jigsaw puzzle."

U.S. and Swedish Studies

Sobel's team studied 326 Alzheimer's patients and used 152 patients with other forms of dementia as controls. Their primary occupations throughout their lives were classified by the researchers as likely to result in low, medium or high EMF exposures. They found that those whose main occupations were thought to have had high or medium EMF levels were almost four times more likely to have developed AD. For men alone there was a fivefold increase, while for women alone the risk was more than three times greater.

Sobel's previous study had examined two groups of AD patients in Finland and one in Southern California, and he consistently found that working in medium-to-high EMF jobs tripled the risk of the disease (see *MWN,* J/A94). Sobel has now examined four separate groups of AD patients, using a different type of control population each time. Since two sets of controls had other dementias, Sobel told *Microwave News,* "We suspect that what we've found may be specific to Alzheimer's disease and not involve other kinds of dementia."

One limitation of all the studies, Sobel noted, was exposure assessment. In his latest effort, jobs were categorized on the basis of the existing literature on occupational exposure levels, with medium-to-high exposure defined as an average of more than 2 mG, or intermittent exposure over 10 mG. "There's a fair amount of error in these assessments," said Sobel. "We don't know what kind of equipment people used or how close they were, and there can be a lot of variation within an occupation." Also, since data were not collected on length of employment in different occupations, it was not possible to tell whether there was a dose–response relationship. Writing in *Neurology,* Sobel urged that future investigators "examine dose–response relationships using direct EMF exposure measurements on comparable equipment and estimated duration and frequency of exposure."

Drawing on data from a broad study of aging using the Swedish twin registry, Feychting and coworkers examined 55 people with AD and 12 with vascular dementia, and two separate control groups of cognitively normal people. They found that subjects whose last job had average EMF exposures of more than 2 mG were about two and a half times more likely to have AD. This result was not statistically significant; however, for subjects 75 years old or younger at the time of diagnosis, a significant fivefold increase in the risk of AD was observed.

Feychting's study, which has been submitted for publication, also found a significantly increased risk for both kinds of dementia taken together. The odds were between three and four times greater for all ages, and almost six times higher for those 75 years or younger when diagnosed.

But Feychting and her colleagues found this association with respect to the subjects' *most recent* occupation. When they examined EMF exposures in each subject's *primary* job throughout life, as Sobel had, there was no noticeable increase in the risk of AD at all. This was probably the most important inconsistency between the U.S. and Swedish studies.

When Sobel was asked what might account for the difference, he said that only in his most recent study had the questionnaire

Lou Gehrig's Disease and EMFs

Davanipour and Sobel have also uncovered a link between occupational EMF exposures and amyotrophic lateral sclerosis (ALS), more commonly known as "Lou Gehrig's disease." Their findings, which were first presented at the Department of Energy (DOE) EMF research review in November 1995, appear in the first issue of *Bioelectromagnetics* for 1997 (see *MWN,* N/D95).

The researchers examined 28 ALS patients and 32 controls, and estimated lifetime EMF exposures on the job. They wrote that the study "indicates a trend in increased risk with increased exposure." For subjects with at least 20 years of work experience, the 25% who were most exposed faced a risk more than seven times as great as those who were least exposed.

"This was a small study," commented Sobel, "and obviously needs to be replicated with more participants and better controls." Several previous studies have indicated that occupational EMF exposure could be a risk factor for ALS, but all have used much less precise exposure assessments.

The importance of knowledge of relevant exposures was underlined by an earlier case study published by Davanipour. She described an office worker with ALS who was exposed to fields of over 75 mG because his desk was located directly above a transformer (see *MWN,* M/A92).

Davanipour and Sobel's paper in *Bioelectromagnetics* proposed a mechanism to explain EMFs' role in ALS. They suggested that EMFs may infrequently trigger an immune response creating an antibody that binds to certain calcium channels in motor neurons, thus interfering with the cells' ability to regulate calcium ion concentrations. "The idea, put forward by Dr. Stanley Appel, is that too much calcium then gets into the motor neurons and kills them," Sobel explained.

clearly asked for primary occupation throughout the subject's life. "We didn't do the data collection," he explained. "In the first three it was worded something like, 'What was this person's occupation?', and so the answers could have been a mix." For example, he said, one subject's occupation was entered as "army general"—clearly not his primary lifetime occupation.

Another inconsistency lies in the fact that the Swedish study found that the risk for vascular dementia went up at least as much as the risk for AD. This is at odds with Sobel's results from one group in Finland, in which vascular dementia patients were used as controls and the relative risk of AD was found to be three times greater. "We still think the effect is specific to AD," said Sobel, "but it's clear there's a need for further work on this."

Feychting, of the Karolinska Institute in Stockholm, told *Microwave News,* "Our findings, together with Sobel's, indicate that it may be worthwhile to pursue research in this area." However, Feychting indicated that she currently has no such plans.

A Biological Mechanism?

Sobel and Davanipour's proposed biological mechanism starts with the observation that "EMF exposure appears capable of upsetting intracellular [calcium ion] homeostasis." An increase in intracellular calcium ion concentration has been shown to increase production of soluble amyloid beta, a protein thought to initiate a cascade of reactions that cause senile plaques in the brain and eventually lead to Alzheimer's disease.

Especially significant to this hypothesis is the evidence that amyloid beta is produced outside of the brain, with deposits of the protein found not only in the brain but also in the skin, subcutaneous tissue and intestine. Thus, even if EMF exposures of the brain are low, high exposures at the hands, feet or torso might still contribute to the development of AD. Sobel and Davanipour describe how a protein produced by a gene that is a known risk factor for Alzheimer's disease might help soluble amyloid beta to cross the blood-brain barrier.

"It seems reasonable that changing levels of calcium in the cells could lead to the disease," said the Reagan Institute's Khachaturian. "But whether EMFs do change calcium concentrations remains a question. Going from *in vitro* tests to human beings is a big step."

"Alzheimer's is not a single disease," observed Khachaturian, "and some forms are dictated by strong genetic factors. But genetic factors seem to interact with environmental ones." Sobel's team made some attempt to exclude subjects with early-onset familial AD, which they noted is primarily genetic in origin.

Khachaturian said that Sobel's model deserves further examination. "In this field we don't have the luxury of throwing out any ideas. Some of these concepts sound far-fetched at first—but too many times ideas that were dismissed by the gurus of science turned out to be important. As long as an idea can be tested, it shouldn't be rejected out of hand."

Testing this hypothesis is exactly what Sobel plans to do next. Sobel and Davanipour have drafted proposals for a set of laboratory experiments that would examine their proposed mechanism, to be conducted by the Health and Environment Research Institute (HERI), a nonprofit research foundation which they recently established in Upland, CA. One experiment would involve measuring the levels of soluble amyloid beta in the blood of sewing machine operators before and after EMF exposures from their machines. They have also developed plans for HERI to conduct a broad population-based study of AD and occupational EMF exposure in Finland, using subjects from five ongoing studies of aging—one of which has been in progress for 37 years.

"I would emphasize that we were looking at occupational exposures," said Sobel, "which are much higher than those usually found in the home." In their hypothesis paper in *Neurology,* Sobel and Davanipour stressed that "low-cost public health measures can be taken to reduce occupational EMF exposure."

A case in point is sewing machines. Sobel and Davanipour have just completed an EMF exposure study of home sewing machines for the Department of Energy's RAPID program. Their report, completed in December, noted that, "Home sewing machines are used in many occupations and not just for making or repairing clothing at home." Past work by Sobel and others has shown that garment workers have some of the highest EMF exposures of any occupation, sometimes as high as 600 mG (see *MWN,* M/A95 and S/O95).

Sobel and Davanipour found that exposures from newer, computer-assisted home sewing machines, which use DC motors, could be reduced fairly easily. The main source of EMFs in these machines is the transformer, which can be separated from the machine. This is common with other devices, such as notebook computers, and would drastically reduce exposure.

This is not relevant to industrial-style machines, since almost all of them use AC. But on industrial models the motor itself is separate from the machine—it is mounted under the operator's table, and provides the machine with power by a belt. "Moving the motor further from the operator would help a lot," Sobel said, "and should not be too difficult to design."

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« Wireless Notes »

The cellular phone and personal communications industry continues to be frustrated by delays in cellular tower siting, even after Congress preempted state and local RF/MW standards in the 1996 **Telecommunications Act** and President **Bill Clinton** issued an executive order expediting the use of federal land and buildings (see *MWN,* S/O95). It blames communities that have set moratoriums to block, at least temporarily, the installation of transmitters (see *MWN,* M/J96, S/O96 and N/D96) and those federal agencies that have denied phone companies access to government property. Now, the industry is putting its foot down: It has asked the FCC and the President for relief. On December 16, the CTIA filed a formal petition with the FCC seeking to preempt moratoriums. At that time CTIA President **Thomas Wheeler** argued that moratoriums "are too often being used as a subterfuge to avoid complying with federal law." He also asked the FCC to "fulfill its obligation to develop and maintain a uniform and consistent national policy that will eliminate such barriers." In support of its petition, the CTIA sent the FCC a list of 150 communities with moratoriums in place—20 of which, it claims, will last indefinitely. On another front, in a January 3, 1997, letter to the FCC, Wheeler attacked state and local governments for charging phone companies "excessive" fees and for attempting to set their own RF/MW exposure standards. Michele Farquhar, chief of the FCC's Wireless Telecommunications Bureau (WTB), agreed in her January 13 response that some of these tactics are illegal under the telecom act, but added that the courts—not the FCC—have jurisdiction over them. Meanwhile, on January 28, the **Personal Communications Industry Association** (PCIA) petitioned the FCC to preempt moratoriums longer than three months, to end the prohibition of antennas on existing structures and to stop discrimination against new service providers. The CTIA's Wheeler has also asked Clinton whether federal agencies have violated his executive order. "The wireless telecommunications industry continues to experience significant antenna-siting resistance from far too many federal agencies in defiance of your order and the law," Wheeler wrote in a December 2, 1996, letter. The President has not yet replied, but several agencies have since begun to discuss the problem with the CTIA, according to **Tim Ayers**, a spokesperson for the Washington-based industry group. "We've had a number of subsequent meetings with these agencies," Ayers told *Microwave News*. The situation has been touchy even in cases where federal agencies have cooperated. Last year, two communities accused the U.S. Postal Service of not seeking their permission before allowing antennas on its property (see *MWN,* N/D96).

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The **FCC**'s WTB has scheduled a three-hour **public forum** on siting issues in Washington for February 10, 1997. Those who cannot attend can now obtain a free video of the proceedings by sending a blank T-120 tape and a request indicating the date and title of the forum to: FCC, Office of Public Affairs, Television Staff, Room 202, 1919 M St., NW, Washington, DC 20554, (202) 418-0460, Fax: (202) 418-2809.

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Two new booklets—one from the **PCIA** and the other from the **Communications Workers of America** (CWA) and the **EMR Alliance** (see *MWN,* S/O96)—offer local officials vastly different perspectives on tower siting. While the industry views cellular and PCS towers as a boon, activists see them as a blight. According to the PCIA's 13-page ***Understanding the Future Today: A Wireless Industry Guide to Towers and Communities***, PCS will benefit communities, creating an estimated 300,000 new jobs over the next 15 years. Because antennas are placed high up and point away from the ground, the PCIA maintains that RF/MW radiation is "typically far below the levels determined by widely cited expert groups to pose health-related concerns to the public." But the 48-page CWA-EMR Alliance booklet, ***Your Community Guide to Cellular Phone Towers***, has a different take: "The jury is still out on health effects. We should proceed with caution until conclusive health evidence is in." The PCIA contends that towers may improve property values by bringing access to phone services. The CWA-EMR Alliance booklet, on the other hand, lists property devaluation as one of the main reasons to oppose wireless facilities. It compares cellular towers to power lines, which, the union and the activists claim, cause nearby homes to depreciate in value by 30-40%. The EMR Alliance has also issued an eight-page pamphlet, ***Cell Tower Static***, which similarly outlines the history of wireless technology and notes some successful efforts to oppose towers. For a copy of the PCIA booklet, which costs $3.00 for members and $4.00 for nonmembers, contact: PCIA, 500 Montgomery St., Suite 700, Alexandria, VA 22314, (703) 739-0300, Fax: (703) 836-1608, E-mail: <lee.h@pcia.geis.com>. To order the CWA-EMR Alliance booklet ($10.00, or $15.00 outside the U.S.), contact: EMR Alliance, 410 West 53rd St., Suite 402, New York, NY 10019, (212) 554-4073, Fax: (212) 977-5541, E-mail: <emrall@aol.com>.

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The influx of **PCS** antennas on 3,000 lampposts throughout **New York City** (see *MWN,* S/O96) has not gone unnoticed by some electromagnetically sensitive residents. An ad in the December 25-31 *New York Press,* a free weekly, voiced their concerns:

> If you have been ill since 11/15/96 with any of the following: eye pain, insomnia, dry lips, swollen throat, pressure or pain in chest, headache, dizziness, nausea, shakiness, other aches & pains, or flu that won't go away, you may be a victim of a new MICROWAVE SYSTEM BLANKETING THE CITY. We need to hear from you.

The text was followed by the address and telephone number for the Cellular Phone Taskforce, whose president, **Arthur Firstenberg**, fled the city in mid-November, shortly after the PCS systems were up and running. Firstenberg, who himself is sensitive, told *Microwave News* that his condition had worsened and that he is now seeking out other New Yorkers with similar symptoms to bring a lawsuit. In early January, he said that he had received more than 20 responses, adding that each caller knew of at least one other person claiming to be electrically sensitive. "It sounds like hundreds or thousands of people are having these same symptoms," Firstenberg said. "I think there's grounds for a personal injury lawsuit."

Wireless Transmissions Blamed for Mysterious Problems

ATMs Get Dirty Data

Last November in Albuquerque, NM, the automated teller machines (ATMs) in a local grocery chain started behaving erratically. "They were on and off for a couple of days," said Paul Boushelle of First Security Bank of New Mexico, which operates the machines. Boushelle told *Microwave News* that the problem was eventually traced to a new cellular phone service provider. "That company was on a frequency that was next to ours, and it started to bleed into our signal," he explained. "But ours was carrying data that has to be totally clean."

Boushelle would not specify whether the interference was caused by a cellular tower or by passing phones, nor would he name the phone company involved: "We identified it, and it's been resolved. I'd prefer not to say more than that." But he noted that First Security has used RF transmitters in its ATMs for about eight years, and that this was the machines' first experience with electromagnetic interference (EMI). "They've been economical," he said, "and helped avoid problems like phone lines cut by construction projects."

This kind of EMI will become more common since ATMs with RF transmitters are becoming widespread, said Boushelle. "Everybody in the world seems to have decided that wireless is the way to do things," he commented. "Pretty soon they're going to use satellites. With the increase in electronic payment transactions, more and more financial institutions will have enough volume that satellites will make sense."

Bad Vibrations in Apache Junction

"It was a very annoying and obnoxious sensation," said utility representative Mike Zimmerman. "I wouldn't want to be subjected to that all the time." Zimmerman, community relations supervisor for the Salt River Project in Phoenix, was talking about the persistent hum in Judy Hill's home in Apache Junction, AZ. "It's not an audible noise to me," Zimmerman told *Microwave News.* "It was a sensation or feeling—a low, pulsating vibration."

William Wright, non-ionizing radiation program manager at the Arizona Radiation Regulatory Agency (ARRA) in Phoenix, said, "I could hear it, and almost feel it. You had two different frequencies—one high-pitched and one much lower, which felt like it was around 60 cycles."

Hill blames the tower operated by Cellular One, which overlooks her home from a distance of about 1,000 feet. She points to articles in the scientific literature about RF hearing, sometimes called the Frey effect, a well-established phenomenon in which pulsed microwaves can directly cause auditory sensations.

"The noise started in 1992, after they changed from the whip antennas to the reflector-wall antennas," Hill said in an interview. The possible connection did not occur to her until 1994, at which time she began to read whatever she could about microwave effects. She added that her daughter had suffered from serious headaches, but that these had abated after the child's bed was moved to a different location in the house.

"When Mrs. Hill called us a few weeks back, we went right out there," David McCarley, vice president of network operations for Cellular One in Phoenix, said in an interview. "We have cooperated fully with everyone involved, including state officials, and there's no indication that we are the source. All our antennas are licensed by the FCC and in compliance with all federal regulations." According to McCarley, the tower has both omnidirectional and panel antennas for conventional cellular transmissions in the 800 MHz band, and a low-power point-to-point dish operating at 2 GHz.

The RF hearing effect has only been demonstrated with pulsed microwave transmissions, and McCarley said that none of the antennas use pulsed signals. While the antennas might use digital signals in the future, he added, they now use analog signals and have always done so.

Wright said that he had done measurements from 300 MHz up to 2 GHz and found nothing unusual, and that tests with an OSHA hearing meter failed to find auditory signals that might account for the vibration. But he explained that the latter does not completely rule out an acoustic source: "A frequency might've been missed, or the meter may have averaged it in. What you need is a sound spectrum analyzer, but that's an awfully expensive piece of equipment which we don't have."

Wright intends to return to Hill's home and measure RF/MW power densities at the site. "We'll try and see if it's something modulated from the antenna's transmissions," he said. "Right now we're kind of scratching our heads." Zimmerman took readings in the home with a 60 Hz gaussmeter but found magnetic fields of only 1-2 mG. He said that he had only felt the vibration in two rooms, but that the sensation was distinctive and unusual.

In being described as somewhere between a noise and a vibration, the phenomenon at Hill's home is similar to the "Taos hum," which was investigated in 1993 by scientists from the University of New Mexico, Sandia National Laboratories, Los Alamos National Labs and Phillips Lab at Kirtland Air Force Base, all in New Mexico (see *MWN,* M/J93 and N/D93). Researchers failed to find any acoustic, electromagnetic or seismic source for the hum. In 1993, Rep. Bill Richardson (D-NM)—recently nominated by President Clinton to be the U.S. ambassador to the United Nations—charged that some Department of Defense project was the most likely cause of the Taos hum.

Hudson Valley Woman Alarmed

In upstate New York, Diana Novosel has filed a complaint with the state Public Service Commission alleging that a nearby cellular phone tower is interfering with her home security system. The alarm has often gone off for no apparent reason, and an alarm company technician told Novosel that the problem was caused by the tower.

But, in October, a technician from Hudson Valley Cellular, which operates the tower on behalf of NYNEX, was unable to trigger the alarm with any of a series of test calls transmitted through the tower. "We saw no connection," Hudson Valley Cellular's general manager, Peter Mercer, told *Microwave News,* pointing out that the tower transmits in the 800-900 MHz range, while the alarm system operates at 40.6 MHz.

Mercer said that although Novosel's house is in a "completely rural" area in Columbia County, it is in a very complex RF environment: "On the same property as our tower, there's a guy who operates a paging company and who is also an avid ham radio operator. Also, Novosel's home is a few hundred yards from the New York State Thruway, where you've got the trucks with their two-way radios." Finally, he noted, the alarm system operates at close to the 46-48 MHz band used by many cordless phones. Asked whether Hudson Valley Cellular transmissions could generate a subharmonic or a modulated signal that might trigger the alarm system, Mercer said, "It seems highly unlikely—unless that alarm is really bad and has no filters on it at all."

Mercer said that his company was more than willing to do further testing jointly with the alarm company, adding, "The whole RF issue and tower siting is very sensitive, so when someone has a problem we try to respond as thoroughly as we can." However, he said that so far the alarm firm has not made anyone available.

Novosel confirmed this and expressed her frustration with the situation: "I'm willing to open up my home to anyone who can help. I just want my security system to work, and to know that there's not a problem with exposure to microwaves." She said that her migraine headaches had become worse in this period and that her 12-year-old son had started having migraines for the first time. "I don't *know* that they're linked," she said, "but I am concerned."

FCC Delays RF/MW Safety Rules for Towers, Not Phones

Antennas for radio and TV broadcast, cellular towers and other fixed transmitters will not have to comply with the new RF/MW guidelines of the Federal Communications Commission (FCC) until September 1, 1997. A delay had been requested by the Cellular Telecommunications Industry Association (CTIA), National Association of Broadcasters (NAB), Personal Communications Industry Association (PCIA) and seven wireless service providers, and was granted in a unanimous FCC order on December 23.

"We do not concur with petitioners who suggest that granting any extension of the transition period will have significant adverse effects on public health," the commission stated in its ruling. The request for a delay had been opposed by several citizens' groups, including the Brooklyn Green Party and the New York-based Cellular Phone Taskforce (see *MWN,* S/O96; also p.8).

Hand-held telephones are not affected by the postponement. All cellular phones have in theory been subject to the new limits since they were adopted on August 1, 1996, and personal communications services (PCS) phones even before that. But the commission has been vague about how to show that phones are in compliance (see *MWN,* J/A96). At an FCC-sponsored meeting on February 4, researchers will discuss the best way to measure the energy that users absorb from a cellular phone.

This 'invitation-only' session is limited to those doing technical work in cellular phone dosimetry, said Dr. Robert Cleveland of the FCC's Office of Engineering & Technology (OET) in Washington. "We want to begin to get some consensus on what kind of protocols to use" in measuring specific absorption rates (SARs), Cleveland told *Microwave News.*

The draft of a technical bulletin on the new RF/MW rules, which the OET is circulating for comment, states only that compliance "can be demonstrated by either laboratory measurement techniques or by computational modeling." But Cleveland said that the February 4 meeting would try to get more specific, and would probably influence the bulletin's final form.

The technical bulletin, known as OET-65, was originally scheduled for release last November but should now be ready in March, according to Cleveland. "It won't be issued until the commission responds to all the issues raised in last fall's petitions for reconsideration of the new rules," he explained. "The December 23 order only dealt with the extension. A second order, dealing with the other issues, is expected out after mid-February." He added that OET-65 would probably come out a couple of weeks later.

Industry groups often cited the delay in OET-65 in their requests for an extension of the fixed transmitter rules, and almost all had asked that the extension run until one year after the bulletin's release. "We would like to have seen the effective date pushed back farther," PCIA spokesperson Sheldon Moss said in an interview, "but we're pleased that it's been extended." Moss said that the FCC has shown itself to be "flexible and open-minded."

The delay in implementing the antenna regulations does not affect the ban on state and local RF/MW radiation rules. Cleveland noted that the telecom act's preemption of state and local safety rules became effective when the act was signed into law in February 1996. Until the new rules take effect on September 1, Cleveland explained, most transmitters will continue to fall under the RF/MW standard adopted by the FCC in 1985—the 1982 ANSI standard. An exception is PCS antennas, which were made subject to the 1992 ANSI/IEEE standard in a 1994 commission decision.

EC Plan for Wireless Research

The European Commission (EC) Expert Group on health effects of wireless phones has called for a five-year research program with a budget of 23.8 million Ecus—over 20 million U.S. dollars (see *MWN,* S/O95 and N/D95). Of this, about two-thirds would be spent on biological studies, and the rest on epidemiology.

The group's chair, Dr. Alastair McKinlay of the U.K.'s National Radiological Protection Board, has stressed the importance of independence from industry influence (see p.15). Leo Koolen, at the EC's headquarters in Brussels, Belgium, told *Microwave News* that the EC would respond to the expert group's report by the spring.

For reasons that remain unclear, the EC has been slow to release the report to the public.

Court Says "No Evidence" for Cell Phone Brain Tumor Lawsuit

A lawsuit charging that a Motorola cellular phone was responsible for a Georgia man's brain cancer has been dismissed by the state Court of Appeals. The November 25 decision held that Richard Ward did not have enough supporting evidence to warrant taking the case to a jury.

In response to Motorola's motion for dismissal, Ward's lawyer had submitted affidavits from two expert witnesses, Drs. Andrew Marino of Louisiana State University Medical Center in Shreveport and David Perlmutter, a neurologist at the Naples Rehabilitation Center in Naples, FL. But the three-judge panel objected that neither affidavit "explained a mechanism by which an electromagnetic field can cause cancer, set out any statistical correlation between EMF exposure and cancer, or otherwise explained how [each expert] reached his conclusion."

But even if such explanations had been provided, it would not have satisfied the court. The decision noted that Georgia courts had "recently considered another case in which it was alleged that EMFs caused cancer"—the *Jordan* power line–cancer case. The latest ruling in *Jordan* held that "the scientific evidence regarding whether EMFs cause harm of any kind is inconclusive," and the Court of Appeals ruled that this alone was reason enough to dismiss Ward's cellular phone lawsuit. Neither the appeal briefs nor the decision drew any clear distinction between power line EMFs and RF/MW radiation. (For other reasons, the appellate decision in *Jordan* set aside a jury verdict in favor of the utilities and ordered a retrial; see *MWN,* J/F96.)

"The decision was very ill reasoned," said Ward's lawyer, William Gray of Dennis, Corry, Porter & Gray in Atlanta. "There's no contention that Marino and Perlmutter weren't qualified. These

guys could easily have explained their views on the scientific mechanism. But this decision makes the court act as the gatekeeper of scientific debate, and there's no precedent for that in Georgia."

The concept of the judge as "gatekeeper" of scientific evidence was central to the U.S. Supreme Court's *Daubert* decision, which was cited in the dismissal of David Reynard's original cellular phone lawsuit in federal court in Florida (see *MWN,* M/J95, S/O95 and M/J96). But *Daubert* is not part of Georgia law, and Motorola's brief made a point of stating that *Daubert* was not part of its argument.

"We think the *Ward* dismissal is a significant and important decision," said Motorola spokesperson Norman Sandler, "and we welcome the court's ruling." Sandler told *Microwave News* that the *Ward* ruling confirms the message of *Reynard:* "We now have two cases that have been dismissed because they failed to submit enough credible scientific evidence to even move forward to trial. This exposes the hollowness of the claims advanced by these cases and others like them."

"It'll be unfortunate if one of these cases doesn't reach the point where it can educate a lot more people," commented Gray. "This is a very politically charged piece of litigation—probably even more so than tobacco, because of the level of public ignorance."

In late December, Gray asked the Georgia Supreme Court to consider an appeal. At press time, the state's high court had not yet responded. "If it's denied," said Gray, "it'll be difficult to go any further."

New Focus on Broadcast Radiation *(continued from p.1)*

expected. At greater distances from the tower, the leukemia rate declined steadily, until it reached background levels some eight kilometers away.

The London team did not make any RF/MW measurements, relying instead on a survey by the BBC, which showed that radiation levels generally declined with distance from the transmitter. The maximum radiation level found was 1.3 $\propto W/cm^2$ for TV, and 5.7 $\propto W/cm^2$ for FM, signals at a distance of 2.5 meters above the ground. Due to reflections from buildings and the ground, they found that, "There was considerable variability between different measurement points at any one distance from the transmitter," according to Dolk.

Dolk's study was prompted by reports of a cluster of leukemia and lymphoma cases near the tower (see *MWN,* S/O92). Dr. Mark Payne, a medical doctor in Birmingham who uncovered the cases years ago, told *Microwave News:* "I think my findings have been vindicated."

In an effort to put the Sutton Coldfield findings into perspective, Dolk also investigated the leukemia rates near 20 other antenna sites in the U.K. This study yielded results that were much less clear. They "at most give no more than very weak support to the Sutton Coldfield findings," Dolk wrote in a second paper published in the same issue of the *AJE*.

Meanwhile, an Australian study indicating a greater risk of leukemia among children living near four TV stations located on three broadcasting towers in Sydney has been published in the *Medical Journal of Australia* (see *MWN,* N/D95).

Dr. Bruce Hocking, an occupational medicine consultant based in Melbourne and the former chief medical officer at Australia Telecom (now called Telstra) reported that children living within four kilometers of the towers had a 50% greater incidence of leukemia and more than twice the expected mortality rate due to leukemia. For children and adults combined, there was a 25% increased incidence of leukemia. All three of these results are statistically significant.

Hocking's calculations showed that the maximum RF/MW power level from the TV stations near the three towers was 8 $\propto W/cm^2$ and declined to 0.2 $\propto W/cm^2$ at a distance of four kilometers. He did not make any actual measurements.

The U.K. and Australian studies add to a patchwork of previous work that points to a leukemia risk from broadcast radiation:

- In 1982, Dr. William Morton of the Oregon Health Sciences University in Portland found higher rates of leukemia and breast cancer near broadcast towers in Portland (see *MWN,* J/F82).
- Five years later, Dr. Bruce Anderson and Alden Henderson of the Hawaii Department of Health reported "significantly higher" leukemia rates in areas with broadcast towers in Honolulu as compared to areas without towers (see *MWN,* M/J87).
- Clusters of leukemia have also been reported next to two different U.S. Navy communications installations, one in Lualualei, Hawaii, and one in Thurso, Scotland (see *MWN,* M/J87 and S/O92).

In addition, two epidemiological studies of those who are exposed to RF/MW radiation show higher rates of leukemia:

- Dr. Stanislaw Szmigielski of the Center for Radiobiology and Radiation Safety in Warsaw, Poland, found that military personnel exposed to RF/MW radiation had higher rates of leukemia and lymphoma. For younger soldiers, the risks reached over eight times that expected and are highly significant (see *MWN,* M/J95).
- Dr. Samuel Milham Jr. reported a significant excess mortality rate due to acute myeloid leukemia, multiple myeloma and cer-

RF/MW Radiation and Cancer References

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Ray Cartwright, "Cancer and TV Towers: Association but Not Causation," *Medical Journal of Australia, 165,* pp.599-600, December 1996.

Helen Dolk et al., "Cancer Incidence Near Radio and Television Transmitters in Great Britain, Part I. Sutton Coldfield Transmitter," pp.1-9, and "Part II. All High-Power Transmitters," pp.10-17, *American Journal of Epidemiology, 145,* January 1, 1997.

Bruce Hocking et al., "Cancer Incidence and Mortality and Proximity to TV Towers," *Medical Journal of Australia, 165,* pp.601-605, December 1996.

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Samuel Milham Jr., "Increased Mortality in Amateur Radio Operators Due to Lymphatic and Hematopoietic Malignancies," *American Journal of Epidemiology, 127,* pp.50-54, January 1988.

William Morton and David Phillips, "Radioemission Density and Cancer Epidemiology in the Portland Metropolitan Area," Research Triangle Park, NC: U.S. Environmental Protection Agency, June 1983.

Stanislaw Szmigielski, "Cancer Morbidity in Subjects Occupationally Exposed to High-Frequency (Radiofrequency and Microwave) Electromagnetic Radiation," *Science of the Total Environment, 180,* pp.9-17, 1996.

tain types of lymphoma among amateur radio operators (see *MWN*, N/D87 and J/F89).

"There are so many smoking guns linking RF to cancer that it's high time that somebody took a systematic look at the subject," Milham said in an interview from his office in Olympia, WA.

Dr. Ray Cartwright of the University of Leeds, U.K., took a more cautious position. In a commentary accompanying Hocking's paper, he noted that while there is now some support for a link between RF/MW and leukemia, a "more complete knowledge of the causes of childhood leukemia is essential in order to go down the road from association to causation. In that regard we have taken only the first few steps of a very long journey."

U.K. Advisory Panels Discount Cancer Risk

Radiation officials in the U.K. argued that the 20-tower study negated the Birmingham results and that there was no RF/MW cancer risk. In fact, they concluded that the issue was closed.

"Overall these data do not indicate that residence close to a radio/TV transmitting mast is associated with an increased risk of leukemia," read a statement from the Committee on the Medical Aspects of Radiation in the Environment (COMARE), a longstanding government advisory panel. The committee found that there was no need for further epidemiological studies.

Similarly, the U.K.'s National Radiological Protection Board (NRPB) in Chilton stated that, "The results of these studies provide no justification for further epidemiological studies around such sites, nor do they have implications for the siting of existing or new transmitters."

To buttress their arguments, COMARE and the NRPB noted that in the 20-tower study the incidence of non-Hodgkin's lymphoma (NHL) *increased* with distance from the towers. "Such opposing trends clearly do not demonstrate a pattern that would be consistent with a particular effect produced by the Sutton Coldfield transmitter," COMARE said.

"The apparently opposing trends with distance for leukemia and NHL imply that the decreasing trend in leukemia risk with increasing distance may be due to chance," Dr. Alastair McKinlay, the head of the NRPB's non-ionizing radiation department, told *Microwave News*.

Most of the leukemia cases included in the 20-tower study were near a single tower at Crystal Palace in South London, which has nearly the same power output as Sutton Coldfield (4 MW), but which does not include a high-power FM transmitter. Dolk counted 62 adults with leukemia within two kilometers of the Crystal Palace tower, but only 17 cases at the same distance from the 19 other towers. Most of the towers are in sparsely populated areas.

Dolk did not observe the same decline in leukemia risk with distance from the Crystal Palace tower. But, when she categorized those towers which had either FM transmitters of greater than 250 kW or similarly powerful FM antennas and TV antennas, she found, in each case, a significant decrease in risk of leukemia with distance from the towers.

Because of the small number of cases, these relationships are not sturdy. "No clear interpretation seems possible as to whether the overall decline in risk with distance is associated specifically with TV or FM transmission or a combination of the two," Dolk wrote in the *AJE*. "The results in the second paper do not point strongly to an effect of transmission...and certainly not to differences between frequencies," she told *Microwave News*.

The two U.K. studies, which were released on Christmas Eve, attracted little attention from the British press. Indeed, Graham Brown, a BBC spokesperson, said in an interview that he had not even been contacted about the study.

The Australian study garnered much more attention—at least partly due to the intense controversy over the siting of cellular phone towers across the country and because the Australian government is considering relaxing its own RF/MW standards.

Hocking told the *Sydney Morning Herald* (December 10) that, "The research does not prove that radiofrequency caused the leukemia, but it does not reassure that mobile phone base stations are harmless."

"MICROWAVE NEWS" FLASHBACK

Years 15 Ago

• A U.S. District Court judge in Los Angeles dismisses a charge brought against the government by Marine Sergeant George Watson, who claimed that his exposure to RF/MW radiation at the U.S. Embassy in Moscow caused his son's birth defect.

• Dr. William Morton of the University of Oregon reports a significant association between extremely low levels of RF/MW radiation—possibly from TV towers—and lymphatic leukemia, adenocarcinoma of the uterus and breast cancer among Portland, OR, residents.

Years 10 Ago

• Dr. Stanislaw Szmigielski of the Center for Radiobiology and Radioprotection in Warsaw, Poland, releases preliminary results of a five-year study indicating a link between RF/MW radiation and cancer—especially leukemia and lymphatic cancers.

• Maryland officials protest the U.S. Navy's decision to site the EMPRESS II on the Chesapeake Bay, contending that the electromagnetic pulse simulator could cause EMI to ships' electronics, forcing Baltimore's port to close for 20 days a year, and could also interfere with a nearby nuclear power plant.

• Writing in the *American Journal of Epidemiology,* Dr. Richard Stevens suggests that EMFs and/or light-at-night may be responsible for increased breast cancer rates in industrial countries.

Years 5 Ago

• Eight people living near Patrick Air Force Base, FL—seven within 400 yards of an air traffic control radar—between 1967 and 1983 are diagnosed with Hodgkin's disease, according to a study by the state's Department of Health and Rehabilitative Services.

• Two brain cancer victims from the same street in Guilford, CT—whose stories were reported by the *New Yorker*'s Paul Brodeur—sue Connecticut Light and Power. They charge that EMFs from power lines and from a substation caused their tumors.

• Wisconsin's Public Service Commission orders state electric utilities to use technology that minimizes EMF emissions.

Motorola, Microwaves and DNA Breaks: "War-Gaming" the Lai-Singh Experiments

The following documents, recently obtained by Microwave News, *provide a rare behind-the-scenes glimpse of how a large corporation responds to the results of scientific research. On December 13, 1994, Norman Sandler of Motorola's corporate communications department sent two memos to Michael Kehs of the Burson-Marsteller public relations firm in Washington. Sandler discussed how to respond to findings by Drs. Henry Lai and Narendra Singh of the University of Washington, Seattle, and enclosed an eight-page draft of an internal strategy paper on the Lai-Singh work.*

Lai and Singh had found an increase in single-strand DNA breaks in the brain cells of rats after a single two-hour exposure to 2.45 GHz microwaves, at power levels considered safe according to current exposure standards. These results had not yet been published, but—as Motorola's strategy paper noted—they were about to be reported by Microwave News *(see* MWN, *N/D94; also J/F95, M/A95, J/A95, N/D95, J/F96 and M/J96).*

Below are the full text of one of the memos and excerpts from the internal strategy paper, which Sandler and Kehs were editing. "Rusty," referred to in the memo, is Albert R. Brashear, a Motorola corporate vice president and director of corporate communications. Bob Weisshappel is an executive vice president, and manager of Motorola's Cellular Subscriber Group.

MEMORANDUM

To: Michael Kehs *Date:* December 13, 1994
From: Norm Sandler *Re:* Revision of Lai-Singh Materials

Rusty just had an animated telephone conversation with Bob Weisshappel, who was as insistent as ever about the prominent inclusion of the frequency differentiation argument in our materials. He also was adamant that we have a forceful one- or two-sentence portion of our standby statement that puts a damper on speculation arising from this research, as best we can.

I tried to do that in the latest proposed revision of the standby statement, but offer this new, somewhat strengthened version of the second paragraph for consideration:

"While this work raises some interesting questions about possible biological effects, it is our understanding that there are too many uncertainties—related to the methodology employed, the findings that have been reported and the science that underlies them—to draw any conclusions about its significance at this time. Without additional work in this field, there is absolutely no basis to determine whether the researchers found what they report finding—or that the results have anything at all to do with DNA damage or health risks, especially at the frequencies and power levels of wireless communication devices."

In discussing the frequency differentiation issue, we should be able to say that Lai-Singh and Sarkar[1]: • Were not conducted at cellular frequencies, so are of questionable relevance; • Run counter even to other studies performed at 2450 MHz, raising possible questions about the findings.

I can accept that as a logical way to raise and defend the frequency differentiation argument. Where I think we differ is in the prominence it should be given in our public statement(s). Maybe the construction proposed above, which hits the frequency/power level issue right off the bat without making a federal case out of it, will suffice.

I'm off to Dallas, but obviously am reachable if necessary. I'm hoping we can get this document revision out of the way and return to more pressing matters (at least in terms of long-term priorities). I think we have sufficiently war-gamed the Lai-Singh issue, assuming SAG[2] and CTIA[3] have done their homework. We may want to run this by George Carlo[4] and fill him in on the contacts we've made.

• • •

Excerpts from
Confidential Working Draft #3—12/13/94
Developments in Radiofrequency/DNA Research: Position Paper

Question and Response

How can Motorola downplay the significance of the Lai study when one of your own expert consultants is on record telling Microwave News *that the results—if replicated—could throw previous notions of RF safety into question?*

It is not a question of downplaying the significance of the Lai study. In his comments to *Microwave News,* Dr. Sheppard[5] raised the key question: Can this experiment be replicated and interpreted? We will have to wait and see. Until the results of follow-up studies are in, any conclusions about the significance of this study are pure speculation.

There is another reason to caution against jumping to drastic conclusions—the hypothesis doesn't square with human experience. If cellular radio signals could cause DNA damage, we would expect to see increased cancer rates among people exposed to RF energy. But there is no evidence to suggest this is the case.

What studies can you cite to prove RF energy doesn't *affect DNA?*

We have identified at least 18 published studies of animal and cell cultures exposed to electromagnetic fields (microwave frequencies, RF and ELF) that show no effect on DNA.

Action Planned

In addition to the response materials already prepared by the SAG (see attached copies), we will work with the SAG to identify appropriate experts to comment in general on the science of DNA research, in addition to any experts SAG may be able to recommend to publicly comment on one or both of these particular studies.

Media Strategy

It is not in the interest of Motorola to be out in front on this issue because the implications of this research—if any—are industrywide. Therefore, we suggest that the SAG be the primary media contact followed by the CTIA. It is critically important that third-party genetic experts, including respected authorities with no specific background in RF, be identified to speak on the following issues:

- Problems with the Lai-Singh and Sarkar studies.
- The health implications of DNA single-strand breaks.

We do not believe that Motorola should put anyone on camera. We must limit our corporate visibility and defer complex scientific issues to credible, qualified scientific experts. We have developed a list of independent experts in this field and are in the process of recruiting individuals willing and able to reassure the public on these matters. SAG will be prepared to release Munro[6]-Carlo memos, which touch on key points made in this material.

1. Dr. Soma Sarkar of the Institute of Nuclear Medicine and Allied Sciences in New Delhi, India, who had published related findings earlier in the year.
2. The Scientific Advisory Group, now known as Wireless Technology Research (WTR), based in Washington, DC.
3. Cellular Telecommunications Industry Association, based in Washington, DC.
4. Dr. George Carlo, chair of the SAG/WTR.
5. Dr. Asher Sheppard, a consultant based in Redlands, CA.
6. Dr. Ian Munro of CanTox in Mississauga, Canada, one of the three members of the SAG/WTR.

U.S. Air Force Looks to the Battlefields of the Future: Electromagnetic Fields That Might "Boggle the Mind"

In November 1994, the Secretary of the Air Force, Dr. Sheila Widnall, asked the Air Force's Scientific Advisory Board (SAB) to identify those technologies that will guarantee the air and space superiority of the U.S. in the 21st century. A number of meetings were held in the first half of 1995, resulting in the publication the following year of 15 volumes under the general title New World Vistas: Air and Space Power for the 21st Century.

The volume on directed energy weapons notes that, "U.S. R&D laboratories have made progress in the development of several key HPM [high-power microwave] weapon components, pointing toward an operational capability of such weapons in ten to twenty years." Several sections of the Directed Energy Volume, *including "RF Gunship" and "Computers and HPM," consist of only the section title and the following sentence: "This section is included in the classified appendix." A 16th volume, containing these and other classified materials, is not generally available.*

Dr. Gene McCall, the director of the SAB, also asked all those who participated in the project "to write an anonymous, 1,000-word (or less) essay which looks 50 years out into the future." He encouraged them to "stretch" their minds. "Don't be afraid to go 'way out' in your forecast," he told them. The purpose of these essays, as the introduction to the resulting collection (the Ancillary *volume) points out, is to generate "a moment of brilliance" which will one day "trigger a breakthrough." Reprinted below is an excerpt from one essay, "Biological Process Control."*

Each of the volumes begins with the following disclaimer: "This report is a forecast of a potential future for the Air Force. This forecast does not necessarily imply future officially sanctioned programs, planning or policy."

To order copies of New World Vistas, *contact: Jerry Jekielek, AF/SB, 1180 Air Force Pentagon, Washington, DC 20330, (703) 697-4811, Fax: (703) 693-6262, E-mail: <jekielekg@af.pentagon.mil>.*

For more on EMFs and HPM for mind-control and other weapons applications, see MWN, *J/F87, N/D93, J/F96 and S/O96.*

Looking 50 years into the future is extremely easy and, at the same time, exceedingly difficult. Easy, since I will not be around to catch the flak for being very wrong. Difficult, since it is really presumptuous to pretend that you have the vision to see the future. Nonetheless, you asked for it and here goes.

As we look forward to the future, it seems likely that this nation will be involved in multiple conflicts where our military forces increasingly will be placed in situations where the application of the full force capabilities of our military might cannot be applied. We will be involved intimately with hostile populations in situations where the application of nonlethal force will be the tactical or political preference. It appears likely that there are a number of physical agents that might actively, but largely benignly, interact or interfere with biological processes in an adversary in a manner that will provide our armed forces the tools to control these adversaries without extensive loss of life or property. These physical agents could include acoustic fields, optical fields, electromagnetic fields and combinations thereof. This paper will address only the prospect of physical regulation of biological processes using electromagnetic fields.

The literature regarding the interaction of biological processes with electromagnetic fields is growing at a rapid rate. Sources are becoming more available, biomedical instrumentation is improving so that the interactions between biological processes and physical fields can be examined with fewer artifacts and the principles underlying these interactions are becoming clearer and more amenable to theoretical prediction.

Prior to the mid-21st century, there will be a virtual explosion of knowledge in the field of neuroscience. We will have achieved a clear understanding of how the human brain works, how it really controls the various functions of the body and how it can be manipulated (both positively and negatively). One can envision the development of electromagnetic energy sources, the output of which can be pulsed, shaped and focused, that can couple with the human body in a fashion that will allow one to prevent voluntary muscular movements, control emotions (and thus actions), produce sleep, transmit suggestions, interfere with both short-term and long-term memory, produce an experience set and delete an experience set. This will open the door for the development of some novel capabilities that can be used in armed conflict, in terrorist/hostage situations and in training. New weapons that offer the opportunity of control of an adversary without resorting to a lethal solution or to collateral casualties can be developed around this concept. This would offer significant improvements in the capabilities of our special operation forces. Initial experimentation should be focused on the interaction of electromagnetic energy and the neuromuscular junctions involved in voluntary muscle control. Theories need to be developed, modeled and tested in experimental preparations. Early testing using *in vitro* cell cultures of neural networks could provide a focus for more definitive intact animal testing. If successful, one could envision a weapon that would render an opponent incapable of taking any meaningful action involving any higher motor skills, (e.g. using weapons, operating tracking systems). The prospect of a weapon to accomplish this when targeted against an individual target is reasonable; the prospect of a weapon effective against a massed force would seem to be more remote. Use of such a device in an enclosed area against multiple targets (hostage situation) may be more difficult than an individual target system, but probably feasible.

It would also appear possible to create high fidelity speech in the human body, raising the possibility of covert suggestion and psychological direction. When a high power microwave pulse in the GHz range strikes the human body, a very small temperature perturbation occurs. This is associated with a sudden expansion of the slightly heated tissue. This expansion is fast enough to produce an acoustic wave. If a pulse stream is used, it should be possible to create an internal acoustic field in the 5-15 kHz range, which is audible. Thus it may be possible to "talk" to selected adversaries in a fashion that would be most disturbing to them.

In comparison to the discussion in the paragraphs above, the concept of imprinting an experience set is highly speculative, but nonetheless, highly exciting. Modern electromagnetic scattering theory raises the prospect that ultrashort pulse scattering through the human brain can result in reflected signals that can be used to construct a reliable estimate of the degree of central nervous system arousal. The concept behind this "remote EEG" is to scatter off of action potentials or ensembles of action potentials in major central nervous system tracts. Assuming we will understand how our skills are imprinted and recalled, it might be possible to take this concept one step further and duplicate the experience set in another individual. The prospect of providing a "been there-done that" knowledge base could provide a revolutionary change in our approach to specialized training. How this can be done or even if it can be done are significant unknowns. The impact of success would boggle the mind!

Clippings from All Over

The most subtle but poisonous effect of Bad Information is the decline of intelligent conversation. It used to be that you couldn't talk about religion and politics, but now you can't talk about religion, politics, UFOs, phonics, nutrition, the Kennedy assassination, O.J. Simpson, Shakespeare's true identity, proper child-rearing techniques, the significance of birth order and whether power lines give you cancer.

— Joel Achenbach, "Reality Check: You Can't Believe Everything You Read. But You'd Better Believe This," *Washington Post,* p.C18, December 4, 1996

"If you believe in God, Iridium is God manifesting himself through us."

— Raymond Leopold, chief technical officer of Iridium, Motorola's satellite-based wireless phone system, quoted by Quentin Hardy in "How a Wife's Question Led Motorola To Chase Global Cell Phone Plan," *Wall Street Journal,* p.A1, December 16, 1996

[W]hen the meeting was over and everyone had gone home, I was left feeling slightly disappointed and just a little frustrated. A few extra pieces of the jigsaw had been obtained, and although some parts were beginning to coalesce, the overall pattern remained as elusive as ever, tantalizingly out of reach.

—Dr. Zenon Sienkiewicz, a senior scientific officer at the U.K.'s National Radiological Protection Board (NRPB), "Plus Ça Change" (a report on the June 1996 Bioelectromagnetics Society meeting), *Radiological Protection Bulletin* (U.K.), p. 43, December 1996

"Washington is like a dead mackerel on the beach—it shines and it stinks."

—Joseph Dear, outgoing administrator of the Occupational Safety and Health Administration, quoted by Cindy Loose in "What So Proudly They Served," *Washington Post,* p.A1, January 16, 1997

Clearly it would be both arrogant and rash of physicists to argue that because we have not yet been able to think of a possible physical mechanism, it is impossible for there to be an effect.

—Drs. John Swanson, David Renew and Nigel Wilkinson, members of the EMF Team at the National Grid Co.'s Technology and Science Division Laboratories in Leatherhead, U.K., "Power Lines and Health," *Physics World* (U.K.), p.33, November 1996

The bottom line is that we need more objective information about EMFs and the public's health. As utility workers, we deserve to know the truth about EMF exposure.

—Hal Nixon, safety director at the Utility Workers Union of America (UWUA) Local 223, AFL-CIO in Dearborn, MI, "Safety Update: What Is the Truth About EMF Exposure?" *UWUA Local 223 Annunciator,* p.8, December 1996

THE NRC REPORT CONFIRMS DEGENERATIVE SPINE DISEASE ATTACKS EMF SCIENTISTS

—Headline from cover story in *Network News,* newsletter of the EMR Alliance (based in New York City), Fall/Winter 1996-97

We are here faced with a situation familiar to the clinician looking at two X-ray views, one showing a suspicious lesion and another not. Is the difference due to artifact, masking of the lesion or quality of the film? The discrepancies in the magnetic field work are not likely to be resolved by yet more epidemiological observation in search of a biological mechanism. If we had a replicable laboratory mechanism for carcinogenesis operating at the field intensities of 50/60 Hz transmission and distribution lines...many doubters might be converted.

—Dr. David Ozonoff, Boston University School of Public Health, "Commentary: Fields of Controversy," *The Lancet* (U.K.), *349,* p.74, January 11, 1997

A fundamental requirement of the funding mechanism is that industry and other funding bodies should be provided with the opportunity to contribute funding and materials in kind to the research program but should neither have, nor be seen to have, any influence over the choice of research studies funded, the conduct or the outcome of such studies or the publication of the results.

—Dr. Alastair McKinlay of the U.K.'s NRPB, "Possible Health Effects Related to the Use of Radiotelephones: Recommendations of a European Commission Expert Group," presented at the *International Seminar on Biological Effects of Nonthermal Pulsed and Amplitude-Modulated RF Electromagnetic Fields and Related Health Hazards,* Munich, Germany, November 20-22, 1996 (see p.10)

It is intriguing to speculate to what extent...stochastic resonance [is] widely exploited in biological systems to detect weak signals. This remains an open question....

—Drs. P. Jung and K. Wiesenfeld, Georgia Institute of Technology, Atlanta, "Too Quiet To Hear a Whisper: Add Some Noise, and Many Dynamic Systems Respond to Weak Signals More Strongly..." *Nature, 385,* p.291, January 23, 1997

Bob-o-links Sing Off-Key

The scientist Robert Adair
has knowledge of physics to spare.
He can wow one and all
about a bat and a ball,
but his biology leaves us in despair.

From baseball, the national sport,
to a role as a friend of the court.
I suggest that blind Justice
would do well to trust us.
Biology's not simple like tort.

There's another old Bob on the scene,
whose biology is even more lean.
This Bob is called Park,
and he's more in the dark,
and temperamentally far less serene.

These Bobs, like Ernie and Bert,
make comments that often divert.
Though with words Bobs are agile,
their biology is fragile,
and the truth they often pervert.

I wish Bobs would give it a rest,
and do what they surely do best.
No need for apology,
for not knowing biology,
in physics there is no contest.

We received the above poem from Dr. Martin Blank of Columbia University in New York City. Blank is the president-elect of the Bioelectromagnetics Society. He will take over as president in June.

CONFERENCES

1997 Conference Calendar (Part II)

Web site addresses are in italics.

February 22-26: **6th International Symposium on Environmental Concerns in Rights-of-Way Management,** Hilton Hotel, New Orleans, LA. Contact: Randy Williams, Environmental Management Energy Services Inc., L-ENT-5D, PO Box 61000, New Orleans, LA 70161, (504) 576-6274, Fax: (504) 576-4536.

March 3-5: **Wireless '97,** Moscone Convention Center, San Francisco, CA. Contact: Cellular Telecommunications Industry Association, 1250 Connecticut Ave., NW, Washington, DC 20036, (202) 785-2842 or (800) 463-4088, Fax: (202) 785-0721, <*www.wireless97.com*>.

April 10-11: **Medical Applications of Microwave and Radiofrequency Fields Meeting,** Hammersmith Hospital, London, U.K. Contact: Dr. Alan Preece, Medical Physics University Research Centre, University of Bristol, Horfield Rd., Bristol BS2 8ED, U.K., (44+117) 928-2469, Fax: (44+117) 928-2470, E-mail: <a.w.preece@bristol.ac.uk>.

April 17-18: **5th Nordic Workshop on the Biological Effects of Low Frequency Electromagnetic Fields,** Norwegian University of Science and Technology, Trondheim. Contact: Gunnhild Oftedal, Telenor HMS-Tjeneste Midt-Norge, N-7005 Trondheim, Norway, (47+73) 54.35.72, Fax: (47+73) 54.33.40, E-mail: <gunnhild.oftedal@trondheim.midtnorge.telenor.no>.

May 17-23: **1997 American Industrial Hygiene Conference & Exposition (AIHCE),** Dallas, TX. Contact: AIHCE, 2700 Prosperity Ave., Suite 250, Fairfax, VA 22031, (703) 849-8888, Fax: (703) 207-3561, <*www.aiha.org*>.

May 19-21: **IEEE Instrumentation and Measurement Technology Conference (IMTC/97),** Château Laurier Hotel, Ottawa, ONT, Canada. Contact: Prof. Wojtek Bok, IMTC/97 Conference Chair, University of Québec at Hull, P.O. Box 1250, Suite B, Hull, PQ J8X 3X7, Canada, (819) 773-1623, Fax: (819) 773-1683, E-mail: <bok@uqah.uquebec.ca>.

June 4-5: **ICNIRP Symposium on the Biological Effects of Static and ELF Electric and Magnetic Fields and Related Health Risks,** Bologna, Italy. Contact: R. Matthes, Institut für Strahlenhygiene, Bundesamt für Strahlenschutz, Ingolstaedter Landstrasse 1, D-85764 Oberschleissheim, Germany, (49+89) 31603-288, Fax: (49+89) 31603-289, E-mail: <matthes@bfs.de>, <*www.sz.shuttle.de/dm1001/icnirp.htm*>.

June 7-11: **32nd Annual Meeting and Exposition of the Association for the Advancement of Medical Instrumentation (AAMI),** Sheraton Hotel, Washington, DC. Contact: AAMI Education and Conferences Dept., 3330 Washington Blvd. Suite 400, Arlington, VA 22201, (703) 525-4890, Fax: (703) 276-0793.

June 8-13: **2nd World Congress for Electricity and Magnetism in Biology and Medicine,** Meeting of the BEMS, BES, SPRBM and EBEA, Bologna, Italy. Contact: Dr. William Wisecup, W/L Associates Ltd., 7519 Ridge Rd., Frederick, MD 21702, (301) 663-4252, Fax: (301) 371-8955, E-mail: <75230.1222@compuserve.com>.

June 11-13: **International Conference on Consumer Electronics,** Westin Hotel O'Hare, Rosemont, IL. Contact: Diane Williams, 67 Raspberry Patch Dr., Rochester, NY 14612, (716) 392-3862, Fax: (716) 392-4397, E-mail: <d.williams@ieee.org>, <*www.ieee.org/ce/icce97/*>.

June 12-14: **30th Annual Conference of the Society for Epidemiologic Research (SER),** Convention Center, Edmonton, ALB, Canada. Contact: Sandy Adams, SER, 111 Market Pl., Suite 840, Baltimore, MD 21202, (410) 223-1626, Fax: (410) 223-1620, E-mail: <sadams@phnet.sph.jhu.edu>, <*www.sph.jhu.edu/pubs/jepi*>.

June 23-24: **Cellular Phones: Is There a Health Risk?,** Watergate Hotel, Washington, DC. Contact: Lara Timmerman, International Business Communications, 225 Turnpike Rd., Southboro, MA 01772, (508) 481-6400, ext.456, Fax: (508) 481-4473, E-mail: <ltimmerman@ibcusa.com>.

June 29-July 3: **42nd Annual Meeting of the Health Physics Society (HPS),** San Antonio, TX. Contact: HPS, 1313 Dolley Madison Blvd., Suite 402, McLean, VA 22101, (703) 790-1745, Fax: (703) 790-2672, E-mail: <hpsburkmgt@aol.com>.

July 13-17: **1st World Conference on Breast Cancer,** Kingston, ONT, Canada. Contact: Conference Office, 841 Princess St., Kingston, ONT K7L 1G7, Canada, (613) 549-1118, Fax: (613) 549-1146.

July 14-16: **32nd Microwave Power Symposium,** Château Laurier Hotel, Ottawa, ONT, Canada. Contact: International Microwave Power Institute, 10210 Leatherleaf Ct., Manassas, VA 20111, (703) 257-1415, Fax: (703) 257-0213, E-mail: <AssnCtr@idsonline.com>.

July 20-24: **1997 IEEE PES Summer Meeting,** Berlin, Germany. Contact: IEEE PES Executive Office, 445 Hoes Lane, PO Box 1331, Piscataway, NJ 08855, (908) 562-3882, Fax: (908) 981-1769, E-mail: <soc.pe@ieee.org>, <*www.ieee.org/power*>.

August 4-7: **6th International Symposium on Recent Advances in Microwave Technology,** Beijing, China. Contact: Prof. Banmali Rawat, Dept. of Electrical Engineering, University of Nevada, Reno, NV 89557, (702) 784-1457, Fax: (702) 784-6627, E-mail: <rawat@ee.unr.edu>, <*www.cs.unr.edu/~sushil/isramt.html*>.

August 18-22: **1997 IEEE EMC Symposium,** Convention Center, Austin, TX. Contact: Edwin Bronaugh, PO Box 80647, Austin, TX 78708, (512) 258-6687, Fax: (512) 258-6982, E-mail: <97.emc.symp@emctest.com>, <*www.emctest.com/ieee97/*>.

August 25-29: **International Symposium on High-Voltage Engineering,** Palais de Congrès, Montréal, PQ, Canada. Contact: Dr. F.A.M. Rizk, JPdL Multi Management Inc., 1410 Stanley, Suite 609, Montréal, PQ H3A 1P8, Canada, (514) 287-1070, Fax: (514) 287-1248, <*www.ireq.ca/ish97*>.

September 1-3: **10th International Conference on Electromagnetic Compatibility,** University of Warwick, Coventry, U.K. Contact: IEE, Savoy Pl., London WC2R 0BL, U.K., (44+171) 344-5473, Fax: (44+171) 240-8830, E-mail: <lhudson@iee.org.uk>.

September 8-11: **PERM-IT'97: Annual Conference of the Australian Radiation Protection Society,** Hilton Hotel, Adelaide, Australia. Contact: Plevin and Associates, PO Box 54, Burnside, South Australia 5066, (61+8) 8379-8222, Fax: (61+8) 8379-8177, E-mail: <plevin@camtech.net.au>, <*www.camtech.net.au/~plevin/permit.html*>.

September 9-13: **Microwave and High Frequency Heating Conference,** Fermo, Italy. Contact: Professor Alberto Breccia, United Institute of Chemical, Radiochemical and Metallurgic Sciences, University of Bologna, Via S. Donato 15, I-40127 Bologna, Italy, (39+51) 242-052, Fax: (39+51) 249-770.

October 14-16: **IEE RADAR '97,** International Conference Center, Edinburgh, U.K. Contact: IEE, Savoy Pl., London WC2R 0BL, U.K., (44+171) 344-5469, Fax: (44+171) 240-8830, E-mail: <conference@iee.org.uk>, cite RADAR '97 in your message.

October 22-23: **ICNIRP Symposium on Risk Perception, Risk Communication and Its Application to EMF Exposure,** Vienna, Austria. Contact: R. Matthes, see June 4 above.

October 26-29: **4th International Symposium on Biologically Closed Electric Circuits in Biomedicine,** Radisson Hotel South, Bloomington, MN. Contact: Dr. George O'Clock Jr., College of Science, Engineering and Technology, Mankato State University, PO Box 8400, MSU Box 215, Mankato, MN 56002, (507) 389-1410, Fax: (507) 389-1095, E-mail: <george_oclock@ms1.mankato.msus.edu>.

October 30-November 2: **19th Annual International Conference of the IEEE/EMB Society,** Chicago Marriott Downtown, Chicago, IL. Contact: Meeting Management, 2603 Main St., Suite 690, Irvine, CA 92714, (714) 752-8205, Fax: (714) 752-7444, E-mail: <MeetingMgt@aol.com>, <*www.eecs.uic.edu/~embs97*>.

November 2-6: **DOE-EPRI Annual Review of Research on Biological Effects of Electric and Magnetic Fields from the Generation, Delivery and Use of Electricity,** Holiday Inn by the Bay, San Diego, CA. Contact: Dr. William Wisecup, see June 8 above.

November 11-13: **Transmission & Distribution World Expo '97,** World Congress Center, Atlanta, GA. Contact: Michael Eby, *Transmission & Distribution World,* 9800 Metcalf Ave., Overland Park, KS 66212, (913) 967-1782, Fax: (913) 967-1905.

Part I of the conference calendar appeared in our last issue, N/D96.

CANCER WATCH

Wearing RF Antennas... Going undercover may be even riskier than previously thought. Three members of an English surveillance unit in Northern Ireland have died of colon cancer in the last year, prompting concerns over the radio antennas that were strapped to the skin of their lower backs, according to the U.K. *Sunday Times (*January 19). Everything about the unit is top secret, but the *Times* estimated that it involves about 150 people. The detectives, who were part of the Royal Ulster Constabulary, were in their 30s, which is young to develop colon cancer. One policeman told the *Times* that, "It is a matter of personal preference where you wear the transmitter, but many people do put it at the small of their backs next to the colon because it is unlikely that anyone who brushes up against it will notice."

CELLULAR TELEPHONE INTERFERENCE

Pacemaker Studies Around the World... Dr. Vincenzo Barbaro of the Istituto Superiore di Sanità in Rome, Italy, examined EMI from analog phones to pacemakers and discovered—contrary to other reports—that many phones (10 out of 25) caused interference. His report appears in the October 1996 issue of *Pacing and Clinical Electrophysiology (PACE),* in a special section on EMI from cellular phones to cardiac pacemakers and implantable defibrillators. Dr. Werner Irnich of the Justus-Liebig University in Giessen, Germany, found similar results with analog phones. Analog phones use continuous waves while those of digital models are pulsed. Irnich explained that, "If there were no pulsing during call organization (handshake with the base station before ringing), all mobile phone systems [using CW] would not harm a patient. In reality, there are broad pulses of varying duration [for] up to 3.5 seconds, which may influence an implant." Irnich endorsed a 20 cm separation distance for pacemakers and cellular phones, comparable to the six inches recommended by the FDA and WTR in the U.S. (see *MWN,* N/D96). However, Dr. Andreas Wilke of Marburg University in Germany concluded that although such EMI "appear[s] to be rare...pacemaker-dependent patients in particular should avoid the use of cellular phones." This advice is stricter than that given in the U.S. This issue of *PACE* also includes an overview of current research by Dr. David Hayes of the Mayo Clinic in Rochester, MN, Dr. Roger Carrillo of Mt. Sinai Medical Center in Miami and Gretchen Findlay and Martha Embrey of WTR in Washington, as well as papers by other researchers in Germany and Australia. Copies can be ordered for $30.00 plus shipping from: Futura Publishing, PO Box 418, Armonk, NY 10504, (914) 273-1014, Fax: (914) 273-1015.

PEOPLE

Dr. **Ken Joyner**, formerly the manager of EMR and Environmental Safety at Telstra's Research Labs in Australia, has joined Motorola as the Asia Pacific regional program manager for electromagnetic energy. He will continue to be based in Australia....Dr. **John Zimbrick** has stepped down as the director of the National Academy of Sciences' (NAS) Board on Radiation Effects Research in Washington to become a professor of radiation biophysics in the School of Health Sciences at Purdue University in West Lafayette, IN. Zimbrick and Dr. **Larry Toburen**, who left

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the board to be a professor of physics at East Carolina University (see *MWN,* S/O95), were responsible for the recent NAS-NRC report on EMFs (see *MWN,* N/D96)....More changes in LeBoeuf, Lamb's EMF legal practice. A few months back, **Mark Warnquist** stepped out of the line of fire (see *MWN,* S/O96); now **Russell Yates** has left the firm's Denver office. **Robert Alessi**, the head litigator in LeBoeuf's Albany, NY, office, is the new head of the EMF practice. Alessi also serves as the environmental counsel to the New York Power Pool....Dr. **Peter Semm** of German Telekom, best known for his work on magnetic sensing and the pineal gland, has taken a leave of absence as associate editor of *Bioelectromagnetics* due to a series of health problems. Dr. **Raphael Lee** has joined the journal as associate editor, replacing Dr. **Roy Aaron**. Lee is the director of the Burn Center and the Electric Injury Research Program at the University of Chicago....At the end of 1996, Dr. **Jack Lee** retired from the Bonneville Power Administration in Portland, OR. His EMF responsibilities are now being shared by Deborah Malin in Fish and Wildlife and Rick Stearns in Transmission Engineering. Lee said he may do some consulting....**James Cunningham** has become the president of the Pennsylvania Electric Association in Harrisburg. Cunningham, previously with LILCO and with the NY Power Authority, was an early backer of what is now known as EMF RAPID, the federal research program (see *MWN,* M/A90)....**Jon Palfreman**, producer of "Currents of Fear," the controversial *Frontline* TV show on EMFs (see *MWN,* J/A95), has won an American Association for the Advancement of Science (AAAS) journalism award for "Breast Implants on Trial," also for PBS' *Frontline*. The AAAS publishes *Science* magazine.

RESOURCES

RF at-a-Glance... The U.K. National Radiological Protection Board (NRPB) has issued a pamphlet on *Radiowaves,* the latest in its "At-a-Glance" series. The NRPB maintains that the "only established biological effects" of RF radiation are due to heating. The current evidence of a link between RF exposure and cancer is "weak," the pamphlet states, adding that "no persuasive biological mechanism has been established for such an effect." The color pamphlet includes pictures of common types of RF transmitting antennas. Single copies of the pamphlet are available free from: Press and Public Relations, NRPB, Chilton, Didcot, Oxon. OX11 0RQ, U.K., (44+1235) 822744, Fax: (44+1235) 822746, E-mail: <pressoffice@nrpb.org.uk>. Previously, the NRPB has issued pamphlets on non-ionizing radiation (*MWN,* N/D91) and on electricity and EMFs (see *MWN,* J/F95).

Annotated Bibliography... Marija Hughes has released her third annotated compendium on EMF and RF/MW radiation health risks. The first two volumes addressed computer health hazards. This edition covers the whole range of non-ionizing radiation issues from 1973 through 1996 and features three different indexes: by author, by subject and by legal citation. It also includes a glossary. A copy of *Computers, Antennas, Cellular Telephones and Power Lines: Health Hazards* is available for $35.00 with a personal check or $50.00 with an institutional check from: Hughes Press, 2400 Virginia Ave., NW, Suite C501, Washington, DC 20037, (202) 293-2686.

Plus Ça Change... Why We're Running in Place

The recent NAS-NRC report on EMFs and childhood leukemia only considered, as a matter of policy, the results of studies that had been replicated. In many ways this is a reasonable procedure—but if the follow-up studies are never done, it creates a false impression.

When discussing the health effects of non-ionizing radiation, one hears—again and again—that "the results are murky," or "the studies are contradictory." It's been said so often that it's become a cliché. Studies with provocative results in this field are rarely followed up and often ignored. On the cover of this issue we report on two cases, from different ends of the spectrum, that fall into this unfortunate pattern.

Tower Shell Game

It's a simple story. A doctor in Birmingham, U.K., found what he considered to be a cluster of leukemia cases near a tower with the most powerful radio and TV transmitters in England. The press picked up the story and a formal epidemiological study got under way.

Now, five years later, the study shows that the doctor was right. The incidence of leukemia was twice the expected rate. The cancer risk declined with distance from the tower, and a statistical analysis indicated that the odds of this happening by chance were one in a thousand.

What happened next? Was the doctor, who had been roasted for leveling false charges, toasted for his insight? Did radiation officials promise to get to the bottom of the matter?

Not exactly.

One reason it took five years to vindicate the doctor is that the Birmingham results were not released until a second study had been completed—one that looked at cancer rates near 20 other high-power transmitters in Britain. These latter findings did not mesh with the first set. As the team, from the London School of Hygiene and Tropical Medicine, dryly commented, the results "at most give no more than very weak support" for the observed leukemia cluster.

Why was it necessary to sit on the first study until the second was completed? One clue: all the results were released on Christmas Eve. If you want to bury a news story, there is no better time to give it to the press.* All the more so for a complicated science story like this one.

Two U.K. advisory radiation panels did their part to kill interest in the story. No further work was needed, they concluded.

But it seems premature to declare the case closed. There are enough differences among the 21 sites to rule out any hasty conclusions. After all, an Australian study published around the same time found excess childhood leukemia in the community near a TV antenna farm in Sydney. And an earlier study in Honolulu, Hawaii, also found excess cancer near radio and TV towers.

Some observers wonder why residents get worried when a communications company decides to put an antenna in their backyard. No further study of that question is needed.

The establishment's lack of medical and scientific curiosity—if not moral responsibility—is astounding. It's a fact that there are more leukemia cases the closer you get to the Birmingham tower, but no one seems too concerned about finding the cause.

Forgotten Dementia

Alzheimer's disease affects about 4 million people in the U.S. today. Now, studies of Alzheimer's patients in three countries—Finland, Sweden and the U.S.—have shown that people exposed to EMFs on the job are more likely to get the disease. Yet research on occupational EMFs and Alzheimer's has received little funding or official support. "We've done this on a shoestring," said Dr. Eugene Sobel, who was the first to make the link.

Every study so far has shown a connection, with statistically significant results pointing to a risk three to five times greater for those who've worked in jobs with medium or high EMF exposures. These are much higher risk ratios than those found in the association between childhood leukemia and wire codes. But the Alzheimer's studies have not received a dime from U.S. groups that focus on EMF health effects research.

Why are the California, DOE, EPRI and RAPID EMF research programs so completely absent? Sobel's findings were first announced two and a half years ago, yet Alzheimer's disease doesn't seem to be on their agendas.

After the *Los Angeles Times* ran an article about Sobel's most recent work, he received a donation for Alzheimer's research from a small upscale clothing manufacturer in L.A. "The owners are genuinely concerned about their employees," Sobel told us, "which was nice to see."

And it was nice that they knew how to act quickly—they heard news that concerned them and responded without delay. Unfortunately, the same cannot be said for the major funders of EMF health research. It's time they started to pay attention to the Alzheimer's connection.

* Richard Smith, editor of the *British Medical Journal,* made a similar point in a commentary on the news coverage of a different epidemiological study that was also released just before Christmas. "It bodes ill for British democracy," he wrote in the journal's January 4, 1997, issue, "...that the press can be led so easily by the nose."

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The Price of Ignorance:
Hidden Risks and Absent Benefits

Two Labs at Odds Over Microwaves and DNA Breaks

Controversy Over Comet Assay

Three years after Drs. Henry Lai and N.P. Singh first announced that microwave radiation could increase the frequency of single-strand DNA breaks in the brains of live rats, their work is still clouded by controversy.

At scientific meetings over the last 18 months, Drs. Joseph Roti Roti and Robert Malyapa of Washington University in St. Louis have openly challenged the Lai-Singh findings, which are often cited as an indication of potential health risks from mobile phones.

Writing in the December 1997 issue of *Radiation Research,* Roti Roti and Malyapa report that 835 MHz, 847 MHz and 2450 MHz radiation did not increase the number of single-strand DNA breaks in two different types of cultured cells. They exposed the cells at specific absorption rates (SARs) of either 0.7 W/Kg or 1.9 W/Kg. Many analog cellular phones operate at 835 MHz, while a number of digital models operate at 847 MHz.

In another paper, accepted for publication by *Radiation Research* but not yet published, Roti Roti and Malyapa say that they have also failed to find any changes in the DNA in the brains of live rats exposed to microwave radiation.

Lai and Singh, both at the University of Washington, Seattle, contend that the Roti Roti-Malyapa work is flawed. "There is something seriously wrong with those experiments," Singh told *Microwave News*.

Not long after the Lai-Singh report of increased DNA damage became

(continued on p.12)

Long-Suppressed Draft EPA Report: EMFs Present a Cancer Risk

Power-frequency electromagnetic fields (EMFs) should be considered a risk factor for childhood cancer, staff at the Environmental Protection Agency (EPA) concluded in 1994. This conclusion appears in a report which was suppressed by EPA's senior managers and never released to the public.

The report, recently obtained by *Microwave News,* reveals that analysts at EPA's Office of Research and Development (ORD) recommended that: "[T]he apparently real association of disease with surrogates of prolonged magnetic field exposure has been established, so that it must be considered as one risk factor for [cancer]." (For the full text of the draft report's discussion and conclusions, see pp.7-8.)

Work on the report stopped in 1995 and it has been on hold ever since. "It is still an internal document and will probably not be released," said EPA's Dr. Robert McGaughy in early 1998. McGaughy, a senior scientist at ORD's National Center for Environmental Assessment in Washington, was in charge of

(continued on p.6)

« Power Line Talk »

As the **RAPID** program draws to a close and the **NIEHS** focuses on finishing its final report to Congress, there comes word of another step in the review process. **Donna Shalala**, the secretary of Health and Human Services, will send the report on the EMF research program to Congress—not Dr. **Kenneth Olden**, the director of the NIEHS. Up to now, it has been generally assumed that Olden would decide how to answer Congress' mandate to determine whether EMFs affect human health. NIEHS staffers said that no one should be surprised by this extra layer of bureaucracy. "This is standard protocol," said Dr. **Gary Boorman**, who heads the RAPID effort at the NIEHS. According to NIEHS' present schedule, Olden's draft of the final report should be completed and sent to Shalala by October 30. Still unclear is how long Shalala will need to review—and possibly revise—the document before she forwards it to the appropriate congressional committees.

«« »»

Shirley Linde, the chair of the National EMF Advisory Committee, wants to make sure that the public is not misled by the way the **RAPID** final report is released. "The history of press releases from organizations of national stature asked to look into the status of EMF research leaves me with a chilling concern for what may come out of an NIEHS press release," she said at the opening of NIEHS' epidemiology review symposium on January 12 in San Antonio. Linde expressed her displeasure at the actions of the National Academy of Sciences, the National Cancer Institute and the *New England Journal of Medicine* and wants to make sure the same mistakes are not made again. Linde is asking that an advisory committee be set up to review the press materials accompanying the NIEHS report. Some in the audience were visibly irritated by Linde's blunt comments; others shared her concerns. For example, Dr. **Charles Poole**, an epidemiologist who recently joined the faculty at the University of North Carolina, Chapel Hill, expressed support for Linde's position. He believes that any effort to put a spin on a new paper or report is counterproductive because no one can predict how it will eventually play out. "At the time a paper is published, it is just embarking on its real peer review," he told *Microwave News*.

«« »»

At the beginning of the discussion of **childhood cancers** at the NIEHS epidemiology review, Dr. **David Savitz** of the University of North Carolina, Chapel Hill, asked those present if they believed that some aspect of EMFs is causally related to some form of childhood cancer. The 25-odd participants assigned a probability from 0 to 1, with 1 indicating certainty of a causal link. There was a wide variation in opinions—from 0 to 0.8, with a mean score of 0.55. Savitz repeated the exercise at the end of the session, after some hours of debate, and found that people had not changed their minds much. The mean rose just a tiny fraction, to 0.59. "Most people did not move at all," Savitz told *Microwave News*. "Either people were unresponsive to the arguments or they were already too familiar with them." Asked where he himself stood, Savitz replied, "After all these years, I am still on the fence."

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The **California Public Utilities Commission** (CPUC), not the civil courts, has sole jurisdiction over EMF personal injury claims, according to the December 8 ruling of an appeals court in San Francisco. This decision moved California one step closer to ending all EMF litigation in the state. The ruling in ***Ford v. Pacific Gas & Electric*** (PG&E) cited the state Supreme Court's ***Covalt*** decision, which had already granted the CPUC jurisdiction over EMF property cases (see *MWN,* M/J95, S/O96 and N/D96). On January 5, the appellate panel certified its opinion for publication, an important step because it establishes the opinion as precedent for California's lower courts. Asked about the effect on any new EMF personal injury cases, **PG&E** attorney **Frederick Baker**, of Sedgwick, Detert, Moran & Arnold in San Francisco, answered, "I think it effectively wipes them out. This decision is now binding on every Superior Court in the state." On January 16, **Cynthia Ford**'s attorney, **Ron Herron** of Herron & Herron in San Francisco, asked the state Supreme Court to review the decision. Herron's petition contends that since the CPUC has no power to award damages, the *Ford* decision leaves anyone harmed by EMFs without a legal remedy. He told *Microwave News* that he expects a response within three months. Ford is the widow of a telephone line worker who died of a brain tumor in 1994 (see *MWN,* M/A95 and M/A97).

«« »»

Meanwhile, in New York, attorneys for **Howard** and **Eve Reiss** have petitioned the **U.S. Supreme Court** to hear an appeal in their EMF property lawsuit. They object to a New York court ruling dismissing their suit, which stated, "The EMFs at issue here are incapable of being perceived by the senses and, thus, are not capable of resulting in a 'physical' invasion." The Reisses' attorneys argue that to consider EMFs to be "nonphysical" only because they cannot be perceived by the five senses is a distinction that "makes no sense." They contend that the ruling violates the Fifth Amendment's guarantee against government "taking" of property without compensation. The Reisses filed suit in 1994 against **Consolidated Edison**, claiming that a Con Ed power line adjacent to their property caused them to lose 30% on the sale of their home in Pleasantville (see *MWN,* J/A94 and J/F97). In December 1996, an appeals court ruled against them, and in September 1997, New York's highest court refused to consider an appeal. **Eric Bregman** of Sive, Paget & Riesel in New York City, one of the Reisses' attorneys, said he expects the U.S. Supreme Court to say early this year whether it will take the case. **Joe Petta**, a spokesperson for Con Ed in New York City, told *Microwave News,* "We don't believe there is a constitutional is-

Correction

In the "Talk of San Diego," which appeared in our last issue (N/D97), we reported that Dr. David McCormick of the IIT Research Institute in Chicago did not attend this year's DOE–EPRI EMF review. In fact, McCormick was there and presented a poster paper. We regret the error.

sue here, and therefore the U.S. Supreme Court should not hear this case."

«« »»

Dr. **Leonard Sagan** died of a brain tumor on December 8. Until his retirement in 1996, Sagan was a senior medical scientist at **EPRI** in Palo Alto, CA, where he worked on both ionizing radiation and EMFs. Sagan took over the institute's EMF program in 1986 in response to the electric utility industry's growing concerns over possible links between EMFs and cancer (see *MWN,* S/O86). By the time Sagan stepped down five years later, the EMF health studies program had a budget of $10 million a year. In 1996, Sagan published a paperback book reviewing the EMF debate, titled *Electric and Magnetic Fields: Invisible Risks?*

«« »»

The **California EMF program** must still submit its final report by March 1, 2000. In December, the **CPUC** rejected a request for a ten-month extension from the state's Department of Health Services (DHS), which manages the EMF effort. At the same time, the commission gave the DHS permission to prepare a more ambitious report than the technical summary that was originally called for. The DHS will now produce an independent risk assessment that will be "an official [DHS] pronouncement on the hazard or safety of EMF exposure," based not only on state-sponsored research but on all available evidence. **San Diego Gas & Electric** (SDG&E) had argued that the EMF program was not authorized to continue past December 1997, and asked the CPUC to shut it down by December 31, 1998 (see *MWN,* J/A97). But the CPUC recognized that the hiring of the program staff was not finished until 1995 and that research projects will not be completed until February 1999. The commission rejected SDG&E's deadline, but also refused to give the DHS more time to complete the newly expanded final report. That report must still be finished according to the original timetable, one year after the end of research.

«« »»

The utility industry may think that the question of power lines and cancer is closed, but the news has not yet reached the world of television. The issue was front and center in several recent episodes of **ABC**'s courtroom drama series ***The Practice***. A group of cancer patients are shown suing "Boston Power," whose transmission line runs near their homes, and the state of Massachusetts. They claim that the power line caused their cancers and that the state failed to warn them of the EMF hazard. Their only expert witness is a former Boston University epidemiologist, whose career took a nosedive when he attempted to go public with his research linking power lines and cancer. He then became an alcoholic. On the EMF–cancer link, he argues that, "Just because we have not figured out why does not mean we don't have a problem." The plot touches all the bases: The plaintiffs' attorney seeks to introduce "two recent Swedish studies" showing that children living near power lines are more likely to develop leukemia, as well as the EPA draft cancer report (see p.1). To buttress its defense, the utility puts 11 experts on the stand, including a Yale professor who at first says he knows of no evidence to support the plaintiffs' claims but later softens that position under cross-examination. Other details seem to have been borrowed from the lawsuit filed by famed Texas litigator Joe Jamail on behalf of 11 families whose children have cancer and from a childhood leukemia lawsuit settled out of court by Massachusetts Electric (see *MWN,* M/A95, J/A95 and S/O95). After the television plaintiffs reject first a $1 million and then a $6 million settlement offer, the jury awards them $3 million in damages from the utility and $36 million from the state. But there is no happy ending for the plaintiffs. The presiding judge overturns the jury's verdict—on a motion from Boston Power—because the cancer connection, he contends, was based on invalid science. The plaintiffs vow to appeal.

Watson & Renner Firm Splits

There has been a split in the law firm of Watson & Renner, which has represented many utilities in EMF cases. The firm's Denver and Washington offices have separated, and informed sources say that litigation may follow.

Watson & Renner's Denver office opened in mid-1997, with attorneys who had worked on EMF suits in the Denver office of LeBoeuf, Lamb (see *MWN,* M/J97). Now the Denver office has closed, and attorneys there have opened a new firm.

"Watson & Renner, PLLC, agreed that the firm would no longer do business effective January 1," Denver attorney Mark Warnquist said in an interview. "Thereafter, the Washington and Denver offices set up new firms. We have a new firm here, Yates & Leal, with five lawyers, four of whom are partners." Warnquist would not comment on the reasons for the split.

"It's not a big deal," said Tom Watson, downplaying the seriousness of the dispute. "In my mind it's an accounting matter. Of course, you have the usual lawyer-posturing, but ultimately I think it'll get settled."

A source close to the conflict said that it was touched off when the Rittman family dropped its cellular phone lawsuit (see *MWN,* N/D97), in which Watson & Renner was representing defendant Cellular One. According to this source, a disagreement over who would handle the firm's remaining EMF work led to its breakup, the closing of the Denver office and the layoff of all support staff in Washington.

Watson denied these assertions: "Our clients, of course, were pleased to put an end to the Rittman suit without the expense of a trial. And as far as we're concerned, that just brings in more business for the future." The Rittman case had no relation to changes in the firm, he insisted, and it sparked no changes in staffing in Washington. "We've always been a very lean-staffed outfit. If you can use a computer and do your own voice mail, you don't need a secretary." Nor did the DC office have to lay off any legal assistants, he said, because "the Rittman case hadn't kicked into high gear yet."

Watson admitted that the legal entity of "Watson & Renner, PLLC," no longer exists. But, he said, "we're still here, doing the same things for the same people." The three lawyers in the Washington office are now doing business simply as "Watson & Renner," he explained, "the name under which we began a few years ago."

New Animal Studies Find No Link Between 50/60 Hz Magnetic Fields and Cancer

Three new animal experiments have found no evidence that EMF exposure increases the risk of cancer. The studies include large-scale, two-year efforts in Canada and in Japan, and a smaller, eight-week experiment in the U.S.

"These studies represent additional information," said Dr. Gary Boorman of the National Institute of Environmental Health Sciences (NIEHS) in Research Triangle Park, NC, an expert in animal toxicology and head of the EMF RAPID research program. "But it's the cumulative evidence that matters."

In an interview, Boorman declined to comment on the weight of that evidence so far, explaining that whatever he said would soon be obsolete. This April, he said, the NIEHS will hold a science review symposium on EMF animal research which "should have eight or nine studies to discuss, five or six of which will have completely new data."

All three new studies exposed F344 rats to continuous power-frequency magnetic fields for about 20 hours a day. Researchers took great pains to ensure, as the Japanese team put it, that "the fields were not contaminated by transient spikes" or harmonics. The Canadian group, led by Dr. Rosemonde Mandeville of the University of Quebec in Laval, explained that its goal "was to evaluate the carcinogenicity of 60 Hz magnetic fields *per se*."

Mandeville exposed four groups of 50 female rats each to fields of 20 mG, 200 mG, 2 G or 20 G. In her paper, she explains that the induced currents in rodents are 10-15 times smaller than in humans: "Accordingly, the lowest field intensity [20 mG] gives rodents an exposure that may be slightly higher than residential exposures for humans."

In this experiment, the overall incidence of tumors was actually lower in the exposed groups than among controls, though this difference was not statistically significant. Mandeville paid particular attention to leukemia and to brain and breast tumors. No significant dose-response trends were found for specific tumors, except for pituitary gland adenoma, which showed an inverse relationship with EMF exposure. Mandeville believes this association is probably due to chance.

Mandeville calculates that the number of animals used gives this experiment the power to detect a doubling of the risk of cancer. Smaller increases, however, could go unnoticed.

The study was funded by the Canadian health ministry, the government of Quebec, Hydro Quebec and Ontario Hydro.

The Japanese team, led by Mitsuru Yasui of the Tokyo Electric Power Co.'s Engineering Development Center and Dr. Yoshihisa Otaka of the Mitsubishi Kasei Institute of Toxicological and Environmental Sciences in Ibaraki, used three groups of 48 male and female rats. Two groups were exposed to 50 Hz fields, at strengths of 5 G or 50 G, while the third served as the control.

There was a statistically significant increase in one benign type of skin cancer among male rats, with nine cases in the 50 G exposure group as compared to two among controls. There were also five cases in the 5 G exposure group. The researchers write that the incidence in the 50 G group "is insignificant compared with historical control values in our laboratory," and "therefore can be considered as a chance occurrence."

The U.S. study was part of NIEHS' National Toxicology Program (NTP), and was carried out in an exposure facility at the IIT Research Institute (IITRI) in Chicago directed by Dr. David McCormick, with Boorman's collaboration (see *MWN,* S/O90 and S/O92). In addition to F344 rats, B6C3F1 mice were also used, with 10 male and 10 female animals in each exposure group. Exposure levels for both rats and mice were 20 mG, 2 G or 10 G. Overall, the researchers found "no evidence of toxicity related to eight-week exposure to 60 Hz magnetic fields."

In addition to the three continuous exposures, one group of rats and another of mice were exposed to intermittent fields of 10 G, switched on or off every hour. No EMF effects were observed in these animals, either.

The results of a two-year NTP study, conducted at IITRI with 2,000 animals and the same exposure levels, will be released in time for the NIEHS symposium in April, Boorman said.

Many of the animal studies linking cancer and EMF exposure have been initiation/promotion studies, including those by Drs. Craig Byus and Maria Stuchly (see *MWN,* M/A96 and M/A97), Dr. Jukka Juutilainen (see *MWN,* M/A96) and Dr. Wolfgang Löscher (see below). In this type of experiment, animals are exposed to a known carcinogen and then to EMFs, to see if EMFs promote the growth of the resulting cancers.

None of the three just-published studies used this design, but Boorman believes they are relevant to an evaluation of whether EMFs promote the development of cancer. "Promoters still in-

No EMF–Breast Cancer Link Seen in Löscher Replication

In their attempt to repeat key German animal experiments, U.S. researchers did not find that EMFs promote breast cancer. Drs. Larry Anderson and James Morris of the Battelle Labs in Richland, WA, sought to replicate the breast cancer effect under a contract from the NIEHS, as part of the RAPID research program (see *MWN,* M/A96 and M/A97).

"Preliminary reports suggest that Anderson's team has been unable to repeat the German findings," according to NIEHS' Dr. Gary Boorman.

Anderson and Morris tested whether EMFs would promote the development of breast cancer initiated in female rats with the chemical carcinogen DMBA, as first reported by Drs. Wolfgang Löscher and Meike Mevissen of the School of Veterinary Medicine in Hannover, Germany (see *MWN,* J/A93, J/F95, M/A95 and J/A95).

Boorman told *Microwave News* that a technical report on the Battelle work will go through a public peer review on March 11 at the NIEHS in Research Triangle Park, NC. The peer-review panel will include Dr. Martin Misakian of the National Institute of Standards and Technology in Gaithersburg, MD, and Dr. Maria Stuchly of the University of Victoria in British Columbia, Canada.

crease cancer in most long-term studies," he explained. "The idea is that the animals contain already-initiated cells. So, although I've heard some concern that a promotional effect may not be seen without an added initiator, this is not necessarily the case."

The NIEHS science review, to be held April 6-9 in Phoenix, will consider new data from initiation/promotion studies on breast cancer carried out at the Battelle Pacific Northwest Labs (see box on p.4), and at Sweden's National Institute of Occupational Health by Dr. Tomas Ekström, as well as from a 2,600-mouse study of leukemia at the University of California, Los Angeles sponsored by the Electric Power Research Institute (EPRI).

Brain cancer is rare in humans, and was rare in the animals in the recent Mandeville, Yasui-Otaka and Boorman-McCormick studies. Boorman noted that this means larger numbers are needed to detect an effect, if any. A UCLA brain tumor study with over 3,000 mice should also be finished by April, he added.

Mandeville is currently finishing an initiation/promotion study of brain cancer, with the same EMF exposures as her study described above. She said, "We are working very hard to get that done in time to present results" at the NIEHS symposium.

Hopefully, said Boorman, a clearer picture will emerge from that meeting. But he cautioned that, "Sometimes the public and others expect a simple yes-or-no answer, when the problem is more complicated than that." Mandeville commented, "It's going to be very exciting to be at that meeting and see what happens. We'll have results from something like 15,000 animals. D-Day is really the April symposium."

"I believe there are biological effects of magnetic fields," Mandeville said in a November interview. Her lab found effects on ODC, an enzyme involved in tumor promotion, after as little as five weeks of exposure. She said that ODC effects have been "demonstrated and repeated" at EMF levels as low as 20-40 mG (see *MWN,* N/D97).

However, Mandeville suggested that the development of cancer may be too complex for the effects of EMFs to emerge clearly in laboratory studies. "I think we are looking at the wrong thing," she explained, adding that she would like to study neurological effects of EMFs, such as their possible impact on Alzheimer's disease (see *MWN,* J/F97).

Among current animal studies, Boorman said that only Ekström has examined the effects of transients, and he knows of no recent or ongoing studies of cancer and EMF harmonics.

He also knows of no animal studies with circularly polarized fields, as opposed to the linear fields in the three just-published studies. "We debated whether to use those as well," he explained, "but at the outset there was no reason to think that would make a difference, and the engineering requirements are more complex. Right now I'd say it would be nice to have had that as well."

G. Boorman et al., "Eight-Week Toxicity Study of 60 Hz Magnetic Fields in F344 Rats and B6C3F1 Mice," *Fundamental and Applied Toxicology, 35,* pp.55-63, 1997.

R. Mandeville et al., "Effects of the Potential Carcinogenicity of 60 Hz Linear Sinusoidal Continuous-Wave Magnetic Fields in Fischer F344 Rats," *The FASEB Journal, 11,* pp.1,127-1,136, November 1997.

M. Yasui et al., "Carcinogenicity Test of 50 Hz Sinusoidal Magnetic Fields in Rats," *Bioelectromagnetics, 18,* pp.531-540, 1997.

Yale Study Links Miscarriage And Electric Blanket Use

Use of electric blankets at the time of conception almost doubles the risk of spontaneous abortion, according to Dr. Kathleen Belanger and colleagues at Yale University in New Haven, CT.

Their prospective study, published in the January 1998 issue of *Epidemiology (9,* pp.36-42), followed 2,967 women who planned to give birth at Yale-New Haven Hospital between 1988 and 1991. No increased risk was found for use of electrically heated waterbeds, or for living near high-current power lines.

The women were originally interviewed before their 17th week of pregnancy; 135 of them had a miscarriage in the succeeding months. Those using electric blankets during the month they became pregnant were 1.84 times more likely to have a spontaneous abortion than those who did not, a statistically significant increase. When this figure is adjusted for such factors as age and caffeine consumption, the relative risk falls to 1.74 and is not quite significant.

Among daily users of electric blankets, the risk to pregnancy was higher with longer use, as well as with higher temperature settings. But these results were far from significant, and the Yale team notes that they are based on small numbers.

A limitation of this study, according to Belanger and coworkers, was its inability to detect early pregnancy loss: "Only 14.1% of the cohort was interviewed before 10 weeks' gestation, but the greatest proportion of pregnancy losses occur before the tenth week of pregnancy, often before pregnancy is even recognized."

The paper notes that a Finnish study of residential EMF exposures overcame this problem by following women who were attempting to have a child and testing for changes that occur in the body at the beginning of pregnancy. Dr. Jukka Juutilainen of the University of Kuopio found that those with higher exposures had more than five times the risk of pregnancy loss compared to women who were less exposed (see *MWN,* M/A92).

"The Juutilainen study suggests that the loss happens very early," commented Dr. Nancy Wertheimer from Boulder, CO. "I would expect to see the effect only in the very early spontaneous abortions, and the Yale study missed most of those." On the finding of a link to miscarriages later in pregnancy, Wertheimer said, "We'll have to see how that fits in with other data."

To evaluate the effects of residential EMFs from power lines, Belanger used the wire code categories first developed by Wertheimer and Ed Leeper for their study in Denver. "It's not clear that our wire codes work very well in the New Haven area," Wertheimer told *Microwave News.* "In any case, my intuitive impression is that power line fields will rarely be high enough to have an impact" on spontaneous abortion rates, in contrast with the much-higher exposures caused by using electric blankets.

Belanger did not respond to repeated requests for comment. Her study was supported by EPRI and the National Institute of Drug Abuse. It drew on a data set previously used by Dr. Michael Bracken, Belanger and others at Yale in a study of EMF exposure and electric blanket and waterbed use, which found no link to birth defects or low birth weight (see *MWN,* M/J95).

writing the report.

Over the last three years, the EPA has repeatedly refused to release the report. For instance, when Curt Suplee, the science editor at the *Washington Post,* filed a Freedom of Information Act request for the report a couple of years ago, the agency declined to give it to him, arguing that the document was still under review and therefore not subject to the act.

The first draft of the EPA report, completed in early 1990, recommended that EMFs be classified as "probable human carcinogens," a designation previously given to DDT, PCBs and formaldehyde. When that draft was released to the public later that year, this designation was deleted, but the EPA nevertheless concluded that EMF studies of leukemia, lymphoma and brain tumors among children and workers "show a consistent pattern of response that suggests, but does not prove, a causal link" (see *MWN,* M/J90 and N/D90).

The 1994 report found that the evidence of an EMF–cancer link had become stronger over the next four years. "On the whole," it concluded, "the epidemiologic evidence with respect to childhood cancer and EMF exposure more clearly points to an increased risk of cancer, especially leukemia, in relation to residence in homes with exposures determined by high wire code configurations, close proximity or historically calculated fields." During the time between the completion of the two drafts, Drs. Maria Feychting and Anders Ahlbom of the Karolinska Institute in Stockholm, Sweden, announced that they had found a reliable association between childhood leukemia and historically calculated EMF exposures (see *MWN,* S/O92).

The EPA conceded, however, that there was much still to be learned. Uncertainties remain, the 1994 draft continued, "on the nature of the relevant exposure parameters," and these "still render the data insufficient to conclusively determine a causal relationship with field parameters that are measurable." The report also cautioned that there was "little evidence" of an association between residential EMF exposure among adults and cancer.

In interviews with *Microwave News* this January, both McGaughy and Dr. Doreen Hill, who drafted the epidemiology chapter of the EPA report, noted that the conclusions of their report were consistent with those in the chapter on EMF epidemiology in the report issued by the National Academy of Sciences-National Research Council (NAS–NRC) (see *MWN,* S/O96).

"They are not that different," McGaughy said. "The conclusions are similar," added Hill, who commented that, "Politics always overshadow everything." Hill, who used to work at the EPA in Washington, is now with Energetics Inc., a consulting firm based in Columbia, MD.

Dr. Christopher Portier of the National Institute of Environmental Health Sciences (NIEHS) in Research Triangle Park, NC, who is leading the EMF risk assessment for the RAPID program, agreed with McGaughy and Hill that the NAS–NRC and EPA reports are in many ways quite similar. McGaughy has provided the NIEHS with a copy of the EPA report, though the EPA stipulated that the NIEHS could not cite it or quote from it.

McGaughy, Hill and Portier's comments will surprise many, since there is a widespread impression that the EPA and the NAS–NRC reports are at odds with each other. In an interview with *Microwave News,* Portier resolved the apparent contradiction. "They had very different objectives," he explained. The NAS–NRC sought a yes-or-no answer to the question of whether a causal link between EMFs and cancer has been proven, Portier continued, while the EPA was addressing the issue from a public health perspective.

"The NAS–NRC wanted conclusive proof, but sometimes the issues are not black and white," McGaughy said. "In such cases, we must be sure that our actions are based on a reasonable probability of harm. This appeared to be the case for EMFs."

The conclusions of the draft 1994 EPA report are also in general agreement with those of the EMF report drafted by a committee of the National Council on Radiation Protection and Measurements (NCRP) (see *MWN,* J/A95). That report called for strong action to curtail EMF exposures of the U.S. population. Although it was forwarded to the NCRP in 1995, that report is still under review by the council and has not been officially released.

The 1990 EPA report caused an international sensation and prompted strong criticism from the electric utility industry (see *MWN,* J/F91). The following year, a review by EPA's Science Advisory Board downplayed the cancer risk and asked that the report be revised (see *MWN,* M/J91 and J/A91).

After McGaughy completed the new draft of the EMF report in August 1994, he sent it out for peer review by four scientists from outside the agency. At that time, McGaughy asked that those receiving a copy of the report not reveal or distribute any section of it, at least in part because "the conclusions are not yet fully developed."

McGaughy completed a revised draft of the cancer report in September 1995. The next step was slated to be a review by other federal agencies, but instead the report was shelved (see *MWN,* J/F96).

The 1995 draft is "not materially different" from the 1994 draft, McGaughy said, but "the argument is more solid and some mistakes were corrected." McGaughy declined to provide a copy of the 1995 draft to *Microwave News.*

When asked whether last year's epidemiological study of childhood leukemia and EMFs by the National Cancer Institute (see *MWN,* J/A97) would have changed his conclusions, McGaughy replied "This one study is not enough to overcome past studies."

The EPA has said that the decision to stop work was largely due to budget constraints, but a number of agency staffers now place the responsibility for abandoning the EMF effort on senior managers at EPA's ORD as well as on Ramona Trovato, then the director of the Office of Radiation and Indoor Air. None of the senior managers wanted to revisit the controversial subject of EMFs, agency sources said.

In addition, industry pressured the agency not to release the cancer report. Leading this movement was Douglas Bannerman of the National Electrical Manufacturers Association in Washington. In 1995, Bannerman argued that, "We should not have individual agencies popping up and giving their own risk assessments" (see *MWN,* M/A95). Later that same year, the U.S. Senate Committee on Appropriations cut $350,000 out of the EPA budget because "the committee believes EPA should not engage in EMF activities" (see *MWN,* S/O95). Soon afterwards, the EPA stopped all work on the cancer report.

Draft EPA Cancer Report: Discussion and Conclusions

Note: This chapter presents the main conclusions, but is not yet polished, precise, or comprehensive enough to be considered even the authors' final position, and of course EPA review is needed before it can be considered the EPA position. The authors invite comments on this draft.

DISCUSSION AND CONCLUSIONS

Residential Studies

The childhood cancer epidemiology studies consistently show repeated findings of a small excess relative risk of leukemia and brain cancer in children who live in homes near the electrical power distribution network. In this statement, "small" means an odds ratio of 1.5 to 3.5 with lower 95% confidence bounds close to 1.0 in individual studies and above 1.0 when studies are combined using meta-analysis techniques by expert groups of epidemiologists. In this statement, "near" means either (a) in the U.S., homes with a wire code classification of VHCC, which is the highest magnetic field exposure category of weighted distances from distribution lines, or (b) in Scandinavian countries, which classify homes using calculated historical average bedroom fields based on transmission line current loading, "near" means historical average values over 0.2-0.3 ∝T (2-3 mG).

Both of these measures of proximity to power lines are surrogate measures of prolonged magnetic field exposures, and they combine information about distance to the line along with information about the line configuration and current loading. The distances of VHCC homes from representative distribution lines in the U.S. studies are less than about 40-60 feet, whereas the residential distance from the transmission lines in the Swedish studies is within about 50 meters. VHCC homes in the U.S. typically have bedroom magnetic fields higher than 0.2-0.3 ∝T (2-3 mG), as discussed in Chapter 2. No confounding exposures to other agents or factors that co-vary with these surrogates and that are known causes of these cancers could be identified, despite efforts to evaluate the most obvious factors. Until such factors are identified, the interim conclusion is that these surrogates of prolonged magnetic field exposure are a causative factor.

Two aspects of this interim conclusion need discussion: (a) the confidence that the association is real as opposed to being biased by improper epidemiologic methods and (b) what measurable magnetic field parameters correspond to the surrogate measures of prolonged exposure.

Before the Scandinavian studies were published in 1993, the results of the major studies that appeared to support the original observations of Wertheimer and Leeper, namely Savitz et al. (1988) and London et al. (1992), could be explained by the hypothesis that the positive associations might have been created by a biased selection of control populations, which were selected by random digit dialing. Since the Scandinavian studies did not have these potential biases and still showed results consistent with earlier findings, the overall opinion of several expert review panels is that there is a real association that cannot be explained away by improper epidemiologic methodology.

One difficulty in accepting the interim conclusion that prolonged magnetic field exposure (or its surrogates) is a causative factor is the consistent finding that the actual spot measurements of fields in some studies and 24-hour measurements in the London et al. (1992) study, which were made after the diagnosis, do not correlate at all or correlate only weakly with the disease. However, this difficulty becomes less serious when one realizes that the number of home measurements is typically smaller than the number of homes for which wire codes were available. This leads to a lower statistical power to detect population differences in measured fields.

Apart from the statistics of determining the magnitude of the fields, the interpretation of these data is complicated by the large time span of several years between the time the disease was presumably developing and the time of the measurement, which was after the diagnosis. To infer that the postdiagnosis data are relevant, one must be willing to assume that spot or 24-hour average measurements are well correlated with yearly average fields across several years and that spot measurements made during the day are well correlated with the 24-hour averages. Although the electrical current loading of the lines is known to vary systematically on a daily and seasonal basis, making an extrapolation back over several years is problematical.

In spite of these difficulties in accepting the measurement data as valid and interpreting them, as discussed above, one could nevertheless explore the consequences of accepting the hypothesis that measured fields have nothing to do with the disease, whereas prolonged field exposure does affect the disease. Then the attention is focused on the question of what parameters of the field are causing the effects and why the measurements do not reflect these parameters.

There are four different proposed classes of mechanisms of field-tissue interactions, each with some experimental support and each requiring different exposure conditions: (a) A coherent alternating field must be present for times on the order of 10 seconds or longer to be effective (Litovitz); (b) Fast transient fields with a time constant on the order of 25 milliseconds or less are required (Lerchl); (c) Prolonged exposure to narrowly defined intensity ranges of combinations of time-varying and static magnetic fields is necessary (Blackman and Blanchard); and (d) Exposure at night and not in the daytime is required to affect the nocturnal synthesis of melatonin (extension of Reiter's ideas). Of these four exposure mechanisms, only the first is actually measured by the spot or 24-hour average measurements, and it is also reflected in the surrogate measures of prolonged average field exposure. Therefore, if this were the predominant mechanism of disease, both measurements and surrogates for the average field should correlate with the disease. This is not the case, so either that mechanism is not operating or the hypothesis is wrong. If any of the other three mechanisms were operable, then the spot and 24-hour average measurements would not measure the relevant parameters, but the prolonged average would still correlate with the disease, since it decreases as one moves away from the source. In summary, all four of the potential metrics should correlate with the surrogates for prolonged exposure, and the last three mechanisms are not even components of the measurements. Therefore, the last three mechanisms are fully compatible with the observations, and the first mechanism might or might not be compatible with the observations.

One by-product of this line of reasoning is that all of the proposed mechanisms correlate with the prolonged field exposure surrogates, so a reduction of the average field will reduce the risk regardless of which mechanism or combination of mechanisms should eventually prove to be correct. If it is not practical to move away from the source, the different mechanisms require different exposure reduction strategies. Another difficulty in accepting the interim conclusion that prolonged magnetic field exposure is a causative factor is the fact that average fields of 0.2-0.3 ∝T (2-3 mG) induce extremely small electric fields and currents in body tissue, as explained in Chapter 6. These induced electric fields are smaller in magnitude than electric fields produced by thermal noise in single cells and by endogenous activity of the nervous system. However, the induced fields have a different spatial and temporal pattern on the single-cell level, and current theories are investigating how cells and/or tissues could detect these small fields and distinguish them from endogenous fields. These theories are just being formulated and have not been experimentally verified.

Regardless of which exposure metric explanation may eventually be accepted, the apparently real association of disease with surrogates of prolonged magnetic field exposure has been established, so that it

must be considered as one risk factor for the disease. An explanation of the physical nature of this risk factor cannot be established with epidemiologic studies alone.

Occupational Studies

A large number of occupational studies have shown excess risk of leukemia and central nervous system cancers in people occupationally exposed to electromagnetic fields. A smaller number of studies have shown lymphatic cancers and breast cancer in males. The early studies were associations based on job titles, but they have been confirmed in some but not all of the recent studies where identification of exposed people has been based on field measurements at the job site. The characteristic findings are similar to the childhood cancers in that the relative risks seldom exceed 3.0 (with the exception of male breast cancer, where the relative risk is 6 in one study). A recent study of electrical workers reported an exposure-dependent risk coefficient expressed as relative risk per 1 ∝T (10 mG) field exposure. This is the first report of a quantitative relation between relative risk and an exposure parameter.

Although childhood and adult cancers are different diseases, they are related closely enough that their occurrence in adult occupational settings lends support to the magnetic field causality postulate derived from childhood residential power line studies.

Breast Cancer

In many respects there is a more complete set of data indicating a risk of breast cancer in male workers than for residential childhood cancer, although the dimensions of the potential hazard are still far from clear. There are three case-control studies showing excess risk of male breast cancer in workers, two of which have relative risks ranging from 2.0-6.0. There are two rat studies of long-term exposure (90 days and 2 years) to 50 Hz magnetic fields subsequent to the initiation of tumors by chemicals. These studies show an increase in mammary carcinoma incidence, size, malignancy, and growth rate. There is a third, 90-day rat promotion study with 50 Hz, 1.0 ∝T (10 mG) fields showing a reduction of serum melatonin and, in the same animal group, a small, nonsignificant increase in mammary gland hyperplasia, indicating that even at this low flux density the tissue is being affected. This *in vivo* indication of possible carcinogenic activity has a plausible mechanism in the relatively well-established growth inhibition capability of melatonin in laboratory animals and in breast cancer cells in culture. An extremely large uncertainty in the validity of this mechanism in humans is the poorly understood relation between magnetic field exposure and the reduction of melatonin concentrations, especially in humans but also in experimental animals. There is a clear need for research to clarify these issues. This need is underscored by the recent, very preliminary results of Loomis and Savitz showing a slight excess of female breast cancer in electrical workers, a result that is too weak to establish a connection with female breast cancer but which is consistent with a hypothesis of causality.

HIGHLIGHTS

« Wireless Notes »

Another member of the bioelectromagnetics community is joining **Motorola** to work on product safety. On April 20, Dr. **C.K. Chou** will become the director of its corporate RF Dosimetry Lab in Plantation, FL. Norman Sandler, a company spokesperson, said that the addition of Chou is a "further enhancement of Motorola's widely recognized expertise in an area that is increasingly important to product testing and to RF biological research." Working at the City of Hope National Medical Center in Duarte, CA, over the last few years, Chou has developed a head-only exposure system for cellular phone radiation animal studies under a contract from **WTR** (see *MWN,* M/J95). This spring, Drs. **Henry Lai** and **N.P. Singh**, both of the University of Washington, Seattle, and Dr. **Ray Tice** of Integrated Laboratory Systems in Research Triangle Park, NC, are scheduled to go to Chou's lab at the City of Hope to repeat the Lai-Singh experiment on DNA breaks in the brains of rats (see p.1 and *MWN,* N/D97). (At press time, however, WTR had still not yet signed the contracts for this work.) Chou stressed that although he will be leaving California, he will see these experiments through until completion. "I will make sure the biology is all done," Chou told *Microwave News,* adding that doing so may require a bit of back-and-forth from Florida. Before moving to the City of Hope, Chou worked at the Bioelectromagnetics Research Lab at the University of Washington, Seattle, where he collaborated with Lai and Dr. **Bill Guy**, who became one of the three directors of WTR after his retirement from the university. As the cellular phone radiation issue has grown, Motorola has added more senior staff to work on safety issues, including Dr. **Mays Swicord**, formerly of the U.S. FDA and Dr. **Ken Joyner**, formerly of Australia's Telstra (see *MWN,* J/A95 and J/F97). Motorola also has a committee of five science advisors, who, according to Sandler, "advise Motorola on the direction and conduct of its research related, for the most part, to product safety." The science advisors include Dr. **Charles Stevens** of the Salk Institute in La Jolla, CA, who headed the NAS–NRC committee on the health effects of EMFs (see *MWN,* N/D96). The other members of the committee are: Dr. **Patricia Buffler**, University of California, Berkeley; Dr. **Marvin Goldman**, University of California, Davis (emeritus); Dr. **Roland Schmitt**, president emeritus, Rensselaer Polytechnic Institute, Troy, NY; and Dr. **Robert Weinberg**, MIT, Cambridge, MA.

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Like other countries, the Republic of **Ireland** has seen waves of local resistance to mobile phone towers. Last November 17, for instance, the *Irish Independent* quoted an irate resident of Carrick-on-Shannon, a site of planned **Esat Digifone** and **Eircell** transmitters, who wondered, "How can the government stand over the siting of these masts in a residential area with children playing nearby? It seems it has facilitated big business over us." And some of the public concerns have won some sympathy. For instance, *The Examiner,* a newspaper in Cork, ran an editorial on January 29, titled PHONE MASTS RAISE GENUINE HEALTH FEARS. Now, three departments of the Irish government are sponsoring a conference on possible health effects of radiation from wireless base stations, to be held in Dublin on March 6. The conference will "address the issues in an open and comprehensive manner" and "provide an open forum for debate," according to

the brochure. Among those who will be flown in are Drs. **Alastair McKinlay** of the U.K.'s NRPB, **Russell Owen** of the U.S. FDA, **Michael Repacholi**, head of the WHO EMF Project in Geneva, Switzerland, and **Thomas Tenforde** of Battelle PNL in Richland, WA. While the conference is primarily for "local authorities and health boards," it is also open to the public for a fee of approximately $105. Industry representatives must pay $490. For more information on the conference, *Communications Technology in the Community,* contact: Mary Bruton, Institute of Public Administration, 57-61 Lansdowne Rd., Dublin 4, Ireland, (353+1) 668-6233, Fax: (353+1) 668-9135, E-mail: <mbruton@ipa.ie>.

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Mobile-phone **base stations** "do not constitute any risk regarding radiation protection." So concludes the **Swedish Radiation Protection Institute**, known as SSI, in a flyer distributed with its December 1997 newsletter, *SSI News.* SSI radiation surveys indicate that approximately 10 meters from an antenna "the radiation intensity is very low." SSI notes that, "When an antenna is placed in a high position, the maximum radiation intensity at the ground level may be less than a tenth of the permitted level. In many cases when the general public has shown concern, radiation intensity has proved to be less than a thousandth of the permitted level," Under Swedish health standards, the general population can be exposed to up to 450 $\propto W/cm^2$. SSI does caution that, "The permitted levels are exceeded within a distance of one meter directly in front of the antenna's radiating surface." The full text of SSI's advice on base stations is on its Web site: <*www.ssi.se/english/index.html*>. For more information, fax SSI in Stockholm at (46+8) 729-7108.

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In the January 5 *Medical Journal of Australia (168,* p.48, 1998), Dr. **Andrew Davidson** of Fremantle Hospital in Murdoch proposes that a rise in brain cancer in **Western Australia** between 1982 and 1992 may be linked to the introduction of analog cellular phones. A 1992-1995 decline may be related to the introduction of digital models, his letter suggests. In 1996, Davidson asked **Telstra**, Australia's largest phone company, for access to data for an epidemiological study. "I am still waiting for [a] reply," he writes. Telstra's former chief medical officer, Dr. **Bruce Hocking**, comments in the journal that Davidson's case "is not clear-cut," as the number of analog phone users in Australia is about the same as in 1991. Still, he writes, research is needed and requires phone companies' help: "It is hoped their cooperation will be more forthcoming than Davidson has found." Telstra holds that customer data is private and its release would be illegal. The government's **National Center for Disease Control** in Canberra declares that "small scale, ad hoc research findings which are presented by some doctors as authoritative research projects" are "unnecessarily alarmist." The center calls for "a more rational debate" on mobile phone safety.

The FDA Calls for More Cellular Phone Safety Research, Suggests EMF RAPID Program as a Model

The U.S. Food and Drug Administration (FDA) wants more studies on the safety of hand-held cellular phones. As a model for the research, the agency has endorsed the congressionally mandated program known as EMF RAPID.

The FDA "believes additional research in the area of RF exposure is needed," it told Rep. Edward Markey (D-MA) in a January 14 letter. The FDA letter does not indicate whether it would request federal funds for such a program, but states that it considers safety research to be "the responsibility of the wireless technology industry."

Congress authorized the five-year, $65 million RAPID research program on EMFs in October 1992, stipulating that industry and the federal government pay equal shares of its cost (see *MWN,* S/O92). The program has been directed by the National Institute of Environmental Health Sciences and the Department of Energy.

The FDA letter, which was signed by Diane Thompson, associate commissioner for legislative affairs, was a response to a November 21 inquiry from Markey, the ranking Democrat on the House telecommunications subcommittee. Markey asked a series of detailed questions concerning the future of RF hazards research and the performance of Wireless Technology Research (WTR), the group set up by the Cellular Telecommunications Industry Association in 1993 in response to public concerns about brain tumors (see *MWN,* J/A93 and N/D97).

In his letter, Markey stressed that he feels "strongly" that it is "incumbent upon the government" to insure that the necessary research on the question of cellular phone safety is conducted. But Markey is still not ready to press for federally funded research on wireless safety (see *MWN,* M/J97).

Markey "will wait and see" whether the FDA requests funds for research in President Clinton's upcoming budget proposal for fiscal year 1999, according to his aide Colin Crowell. If not, "it would be difficult to second-guess the expert agency."

The FDA appears reluctant to endorse a continued role for WTR in investigating wireless health effects. While a WTR–funded study of cellular phone interference with cardiac pacemakers was "well done," the letter stated, "research in biological effects is...more complex." Therefore, WTR's pacemaker research "may not be an adequate model" for studying possible biological effects. In calling on the wireless industry to fund more research, the FDA offered no advice on how to raise the funding.

WTR announced last November 3 that it would not carry out any long-term animal studies, blaming a lack of funds (see *MWN,* N/D97). This decision runs counter to FDA's recommendation to WTR, in a March 13 letter, that lifetime animal studies be given "the highest priority" (see *MWN,* M/A97).

The FDA declined to take a position on whether WTR's audited financial statements should be made more publicly available, as recommended by WTR's peer-review board, based at the Harvard School of Public Health in Boston (see *MWN,* N/D97).

In response to a question on possible health hazards from cellular base stations, the FDA offered no opinion and simply referred Markey to the Federal Communications Commission.

Polish RF/MW–Cancer Data Show Dose-Response Trend

Polish military personnel exposed to radiofrequency and microwave (RF/MW) radiation at levels above 600 ∝W/cm^2 were almost five times more likely to develop cancer than unexposed personnel, according to a recent analysis. Those exposed to 100-600 ∝W/cm^2 had a cancer risk nearly twice that of controls.

This increase in cancer incidence with power density is the latest finding of Dr. Stanislaw Szmigielski's long-term research on cancer among Polish servicemen exposed to RF/MW radiation. Szmigielski is at the Center for Radiobiology and Radiation Safety and at the Military Institute of Hygiene and Epidemiology, both in Warsaw.

The new data "for the first time present a hint" of a dose-response relationship between exposure to high-frequency EMFs and cancer, Szmigielski told *Microwave News*. He presented his findings at the *2nd World Congress for Electricity and Magnetism in Biology and Medicine* in Bologna, Italy, last June and later gave *Microwave News* further details of his results.

In 1985, Szmigielski began collecting data prospectively on the types and intensities of RF/MW radiation to which servicemen are exposed. Each year from 1986 through 1990, approximately 3,850 out of 124,500 servicemen aged 25-59 were exposed to levels exceeding 100 ∝W/cm^2. Most of the sources emitted pulsed radiation, Szmigielski reported.

Szmigielski grouped the RF/MW–exposed cases into four categories. Approximately 1,900 servicemen had "low" exposures (100-200 ∝W/cm^2); 1,320 had "medium" exposures (200-600 ∝W/cm^2); some 350 had "above-medium" exposures (600-1,000 ∝W/cm^2); and 280 had "high" exposures (above 1 mW/cm^2).

The incidence of all cancers was 1.69 times greater in the low-exposure group than among the unexposed controls. Cancer incidence in the medium-exposure group was approximately the same (1.57 times greater).

In contrast, Szmigielski reported finding a "considerably higher" cancer rate in the two highest-exposure groups. In the above-medium group, the risk ratio jumped to 4.63. The highest-exposed group's cancer risk was 4.93 times that of controls.

The dose-response trend apparent in the 1986-1990 data is based on small numbers, Szmigielski cautioned: 36 cases in a "relatively small" group of exposed personnel. "Therefore, each case strongly influences" the risk ratios. A confirming study of a larger population is called for, Szmigielski concluded, in view of the significantly higher cancer rate observed for the two most-exposed groups of servicemen.

An analysis of cancer incidence among exposed and unexposed servicemen in various age groups indicated "considerably higher" cancer rates for the RF/MW–exposed segment of each group. This suggests, Szmigielski said, that cancers "develop faster, with a shorter latency period" in servicemen with occupational RF/MW exposures.

Szmigielski also reported on his latest analysis of retrospective data on cancer incidence in the Polish military, which confirms his earlier finding of substantially elevated cancer risk among personnel whose jobs involved exposure to RF/MW radiation (see *MWN*, Mr85, J/F87 and M/J95). For the 1971-1990 period, the risk of cancer of all types was 1.83 times greater for the exposed group than for the controls—a highly significant difference.

The morbidity rate for hematological and lymphatic cancers was 5.33 times greater for the exposed servicemen, also a highly significant increase. The higher incidence of brain cancer—2.7 times greater than expected—is also statistically significant.

Szmigielski told *Microwave News* he feels it is too early to publish results of the prospective study. He plans to extend the study with data through 1995.

Still No Solution to Cape Cod Breast Cancer Puzzle

The cause of a 20% excess of female breast cancer on Cape Cod remains a mystery, according to a three-year, $3.6 million study by the Silent Spring Institute (SSI) in Newton, MA.

The SSI focused on contaminated drinking water and exposure to pesticides, but found no link to the elevated breast cancer rates for 1982-1994. The SSI's report also discounts exposure to power-frequency EMFs and exposure to radiation from the U.S. Air Force's (USAF) PAVE PAWS missile defense radar as possible explanations for the excess.

"We felt there was no evidence that women's exposure to [EMFs or radar radiation] would be different on Cape Cod," Dr. Julia Brody, the institute's executive director and study leader, told *Microwave News*.

For the EMF analysis, Dr. Ann Aschengrau reviewed data from her and Dr. David Ozonoff's 1991 study of cancer on the up-

High-Field Magnetic Stimulation of Brain Reduces Depression

A study of 12 people with clinical depression found that they had a "significantly improved mood" after their brains were stimulated with extremely strong magnetic fields.

At the outset, participants had a mean score of 28.5 on the Hamilton depression scale. In the two weeks of active treatment, this improved by 5.3 points. But when the same people were given a "sham treatment" as a control, the mean score went down by 3.3 points. Which treatment came first was determined at random for each person.

Writing in the December 1997 *American Journal of Psychiatry (154,* pp.1,752-1,756), Drs. Mark George of the Medical University of South Carolina in Charleston and Robert Post of the National Institute of Mental Health in Bethesda, MD, explain that they administered 20 two-second, 20 Hz stimulations over a period of 20 minutes, at a field strength greater than 10,000 G. The sham treatment used the same fields, but with the electromagnet at an angle to the skull instead of alongside it. The researchers state that this "produces a similar sensation in the scalp but appears not to stimulate the brain"; they cite the inability of the angled fields to trigger signals causing muscle movement, and the lack of any changes observed through positron emission tomography.

There were no side effects on memory or attention, and no participants had seizures. Four subjects reported mild headaches after treatment, which were relieved by acetaminophen.

per cape (see *MWN,* J/F92). Both epidemiologists are at the Boston University School of Public Health. Aschengrau investigated occupational EMF exposures based on job classification and residential exposures based on proximity (less than 500 feet) to transmission lines 115 kV and higher. Aschengrau noted, however, "the lack of information on total personal exposure" to EMFs.

The SSI examined patterns of breast cancer incidence near the PAVE PAWS radar in Bourne, using radiation measurements made by the USAF in 1978 and 1986. (In the mid-1980s, the USAF was planning to raise the power output of the radar by a factor of four; see *MWN,* M/J87). While noting that higher cancer levels were reported for some census tracts, they found no overall pattern of increased incidence in areas that the USAF data suggested were exposed.

In the November/December 1996 issue of *Public Health Reports,* Brody wrote that, "The EMF hypothesis...was given low priority in our study." Radiation from PAVE PAWS was not cited there as a possible risk factor.

The study was sponsored by the Massachusetts Department of Public Health. To obtain a copy of *The Cape Cod Breast Cancer and Environment Study,* contact: SSI, 29 Crafts St., Newton, MA 02158, (617) 332-4288, Fax: (617) 332-4284, E-mail: <info@silent.shore.net>, Web site: <*www.silentspring.org*>.

IARC Embarks on Major Study of Cancer and Mobile Phones

The International Agency for Research on Cancer (IARC) in Lyon, France, is planning a multicountry, multimillion-dollar study of cancer among users of hand-held wireless phones. A feasibility study is under way and the main study is scheduled to start next year.

"Because of the huge increase in users, clearly we have a duty at the IARC to monitor the health impacts of mobile phones," Dr. Elisabeth Cardis, the study's principal investigator, told *Microwave News.* But, she added, "All the evidence to date points to the fact that there is no major health risk." Cardis, a biostatistician and epidemiologist, heads the IARC program on radiation and cancer.

The pilot study, costing approximately $250,000, will investigate tumors of the acoustic nerves and salivary glands, as well as two types of brain tumors—meningiomas and gliomas. "We want to focus on the most-exposed areas of the head," Cardis said. The researchers will then determine which types of cancer to include in the main study.

Cardis is satisfied that cellular phones have been in use long enough for any increase in cancer to be detectable. "You should be able to see a risk after five years," she contended. Cardis explained that the evidence indicates that while RF may be involved in promotion or progression of cancer, it does not cause it, and the latency period would therefore be shorter.

One potential problem, Cardis noted, is that "the technology of mobile phones keeps changing"—and with it, users' exposures.

To achieve a sufficiently large study population, Cardis will collaborate with researchers in Australia, Canada, France, Israel, Italy, Sweden and the U.K. An eighth country, which Cardis declined to name, may also participate.

Light Behind the Knee Shifts Circadian Rhythms

In a remarkable study, visible light applied to the back of the knee has been shown to cause significant shifts in human circadian rhythms.

Drs. Scott Campbell and Patricia Murphy of Cornell University Medical College in White Plains, NY, exposed the skin at the back of each participant's knee to a 13,000 lux light source for three hours. A fiber-optic pad was used to transmit the light without transmitting heat, and an opaque "skirt" was placed around the legs so that no light could escape. "Illumination at the participant's eye level never exceeded 20 lux," Campbell and Murphy write in the January 16 *Science (279,* pp.396-399).

In all 15 subjects, "there was a systematic relation between the timing of the light pulse and the magnitude and direction of the...shift" in circadian rhythms. Administering the light early in the normal sleep cycle caused a delay in the drop in body temperature and the rise in melatonin level that normally occur at night. When light was applied late in the normal sleep cycle, these rhythms began earlier.

It has long been known that light in the eye can be used to alter body rhythms. Campbell and Murphy note, however, that bright light can suppress melatonin levels in some humans who are completely blind. This and other evidence had led scientists to conclude that there must be other photoreceptor cells that are not involved in vision—but they had expected these cells to be located inside the eye.

In an accompanying commentary, Drs. Dan Oren of Yale University in New Haven, CT, and Michael Terman of Columbia University in New York City suggest that the effect of light behind the knee may be caused by "pigments [in the blood] such as hemoglobin and bilirubin." As Oren told Reuters on January 29, the idea is that "blood is a messenger for light, and that blood absorbs light through the eyes and in the skin."

Cardis believes the multicountry format will enable the study to identify even a small increase in risk. "My opinion is that we should have a sufficiently large population with sufficiently large exposures." Cardis said the study will look at a relatively young population.

Established in 1965, the IARC is a semi-independent agency of the World Health Organization (WHO) that coordinates and conducts epidemiological as well as *in vivo* and *in vitro* research.

The impetus for the study came from WHO's EMF project, which recommended a large-scale epidemiological study of cancer in cellular phone users at its meeting on RF health effects in Munich, Germany, in November 1996 (see *MWN,* J/A96). "We are doing this in response to the Munich meeting," said Cardis, who has participated in several EMF project workshops.

The IARC's Swedish collaborator for the study is Dr. Lennart Hardell of the Örebro Medical Center. Hardell is also leading a case-control study of cellular phone use among brain cancer patients, sponsored by the Swedish Work Environmental Fund. (For more on Hardell's study and other ongoing epidemiological studies see *MWN,* N/D97.)

public, Motorola contracted with Roti Roti to see if he could reproduce the effect (see *MWN,* N/D94 and J/F95). While Wireless Technology Research (WTR), which is sponsored by the cellular phone industry, has long talked about trying to repeat the Lai-Singh experiments, its studies have not yet gotten under way.

Both the Roti Roti-Malyapa and Lai-Singh labs used the comet assay—also known as microgel electrophoresis—to measure DNA breaks. In the assay, DNA fragments spread out like the tail of a comet.

But each lab favors a different variant of the technique. Roti Roti and Malyapa used the assay developed by Dr. Peggy Olive of the British Columbia Cancer Research Centre in Vancouver, Canada, while Lai and Singh used the assay developed by Singh himself.

Lai and Singh argue that the Olive assay cannot detect microwave effects. The Singh method uses proteinase K, an enzyme that digests proteins that may be bound to the DNA, while Olive's does not. "Digestion with this enzyme is an essential step," Lai said. "When we do not use proteinase K, we do not see an effect with microwaves either." Lai explained that microwaves can induce protein–DNA cross-links that must be broken up before the comet analysis is carried out.

"The use of proteinase K is not necessary to achieve a sensitive assay to determine DNA damage from ionizing radiation," Roti Roti told *Microwave News.* "It is only important if there are protein–DNA cross-links, and there is no mention of any such cross-links in the Lai-Singh published papers," he said.

There is also a heated dispute over the sensitivity of the Olive assay as reported by Roti Roti and Malyapa. Lai and Singh are troubled by what they say are Roti Roti and Malyapa's impossible claims that the Olive assay can detect damage by very low levels of ionizing radiation. Lai and Singh conclude that Roti Roti and Malyapa simply cannot be using the assay correctly and, if so, their results for microwaves, including cellular phone signals, cannot be trusted either.

Roti Roti and Malyapa contend that they can observe DNA breaks following gamma ray exposure at doses as low as 0.6 cGy (0.6 Rads). The sensitivity of their assay is much greater than Olive has claimed in her own papers. Roti Roti and Malyapa themselves point this out in *Radiation Research:* "This report is the first of its kind to measure DNA damage at low doses using the [Olive] method."

Singh does not believe that this kind of sensitivity is possible with the Olive assay. And Olive herself has doubts.

In an interview, Olive said that she "can't get down that far," while acknowledging that she is not using exactly the same method as Roti Roti and Malyapa. "While detecting DNA damage at 1 cGy is possible, 5 cGy is more realistic," she said.

Olive pointed out that for replicating cells, like the human brain tumor cells and mouse fibroblasts used by Roti Roti and Malyapa, " You have a high background of damage, which makes it difficult to see a small effect."

When asked about the reported sensitivity of his assay, Roti Roti responded that it is reasonable because his data fit with previous experimental results. "We are no more or less sensitive relative to dose-response curves published in the literature," he stressed.

Roti Roti further argued that Olive had in fact stopped collecting data at 50 cGy. "She did not push it to lower doses. She did not run out of sensitivity," he said. Malyapa was out of the country and could not be reached for comment.

Olive confirmed that she had not experimented with low levels. "We are interested in clinical doses in the Gy range," she said.

Roti Roti and Malyapa address the criticisms on the sensitivity of the Olive assay in a "short note" that has also been accepted for publication in *Radiation Research.* "It was handled by a different associate editor and new reviewers," Roti Roti said, adding that there were six reviewers for this note. Roti Roti declined to comment further or to make a copy available prior to publication, at the request, he said, of the editors of *Radiation Research.*

Martha Edington, the managing editor of *Radiation Research,* would not say when Roti Roti's note would appear: "I am not at liberty to provide information about any papers that may appear in upcoming issues of the journal," she told *Microwave News.*

"Both sets of data are confusing," Dr. Ray Tice of Integrated Laboratory Systems said in an interview from his office in Research Triangle Park, NC. "I am surprised by Roti Roti's ability to detect DNA damage in the cGy range using the Olive method. On the other hand, I am equally surprised by Lai and Singh's positive response with microwaves."

Tice is working with WTR to try to repeat the Lai-Singh experiments, but that effort is still on hold pending receipt of funding (see also p.8).

Tice said he is "very surprised" by the Roti Roti-Malyapa decision to use the Olive method. "Not too many scientists are using the Olive method. Most use Singh's," he said.

"It was my decision. I take the full responsibility for using the Olive method," Roti Roti said. "We could gain more information more rapidly than by using the Singh method." He added that, "There is no theoretical reason why the methods should give different results for measuring strand breaks."

"In any case," Roti Roti added, "at the time I designed this project with [Motorola's Dr.] Q. Balzano, WTR had announced it was funding three groups to repeat the Lai-Singh study. I thought there would be three other papers in the literature by now. They were way ahead of me when I started."

In their paper, Roti Roti and Malyapa write that the Olive assay was chosen "because it is simple and inexpensive and the results are reproducible." Olive is a consultant to his project, Roti Roti said.

Tice underscored the "apparent very good reproducibility" of the Roti Roti-Malyapa data. "Reproducibility is the hallmark of biological significance," he said.

But Lai and Singh are troubled by the similarity of Roti Roti and Malyapa's dose-response curves for the two different cell lines. In each case, the curves start to flatten out at relatively low levels of gamma radiation.

"The curves show saturation at 3-5 cGy," said Lai. "That's not possible. It is very strange." Singh agreed. "The curves look wrong," he said. "They should not be curving downwards."

Olive said that she too has a "problem" with the dose-response data. "There seems to be a different effect going on at low

Cellular Phone Radiation and Single-Strand DNA Breaks: Sensitivity to Very Low Levels—Beneficial Effects Seen

Dr. Jerry Phillips of the VA Hospital in Loma Linda, CA, has also been using the comet assay and he has some intriguing results.

First, Phillips has found that human cancer cells in culture respond to extremely low levels of microwave radiation—levels that are more than a thousand times below those assumed to be safe under current health standards. Second, he has observed potentially beneficial effects under a variety of exposure conditions, suggesting that microwaves could promote DNA repair.

Perhaps the most tantalizing aspect of Phillips's experiments is that a cellular phone signal that decreased single-strand DNA breaks *in vitro* at two different exposure levels had previously been shown to provide protection against brain tumors in exposed rats.

"Our studies indicate that microwaves have nonthermal, signal-specific effects that might sometimes do good and might sometimes do harm," Phillips told *Microwave News*. "They support the hypothesis that modulation and exposure duration are key determinants of a signal's biological impact."

Phillips exposed human leukemia cells to either of two different types of microwave radiation used in wireless communications: 813 MHz iDEN and 836 MHz TDMA signals. He used the comet assay developed by Dr. N.P. Singh.

Significantly decreased DNA damage was observed in cells exposed to the TDMA signal at an SAR of 2.6 mW/Kg for 2 hours or for 21 hours, as well as at an SAR of 26 mW/Kg for 2 hours. (Current standards assume exposures below 4 W/Kg are safe.)

When Phillips used the iDEN signal with an SAR of 2.4 mW/Kg for 2-hour and 21-hour exposures, he again found less DNA damage. But when the SAR was increased to 24 mW/Kg, he saw significantly more damage.

In 1996, Dr. Ross Adey reported that rats exposed to an 836 MHz TDMA signal at an SAR of 0.58-0.75 W/Kg had significantly fewer central nervous system tumors than did controls (see *MWN,* M/J96 and J/A96). When Adey used an FM continuous signal, like that used by analog cellular phones, he found no effect on tumor incidence (see *MWN,* M/A97). Adey recently stepped down as the head of the Loma Linda VA lab. Adey's and Phillips's studies were both sponsored by Motorola.

In explaining why he sometimes sees more DNA damage and sometimes less damage, Phillips said that the reactions that play a role in DNA damage and repair are not yet well understood.

"We believe the key to interpreting such data lies in understanding the balance that exists between DNA damage and the repair of that damage," he writes in a paper that has been accepted for publication in *Bioelectrochemistry and Bioenergetics.*

doses," she explained, adding that, "There are not enough data in the [Roti Roti] paper to draw conclusions about the shape of the curves at higher exposures."

In a paper she published in 1992, Olive reported that Chinese hamster fibroblasts showed a linear dose-response from 200 cGy to 100 Gy.

Roti Roti and Malyapa address these concerns in print. While they concede that their dose-response curves "appear to reach a plateau" at low doses, they write that they completed dose-response curves up to 10 Gy and that the comet length increased linearly with dose at higher exposures. These data are not shown in *Radiation Research.*

The second paper by Roti Roti's team, on exposures of rats at 2450 MHz with an SAR in the brain of 1.2 W/Kg, has also been accepted by *Radiation Research.* These data, which do not show a microwave effect, were presented last June at the *2nd World Congress for Electricity and Magnetism in Biology and Medicine* in Bologna, Italy. Roti Roti said that he did sometimes see an effect but that it was a function of the way the animals were sacrificed, not the microwave exposures.

The differences between the Washington University and University of Washington labs may be resolved as others run their own comet assays. For instance, Dr. Jerry Phillips of the VA Hospital in Loma Linda, CA, is seeing both microwave-induced DNA repair and breaks using the Singh assay (see box above).

In France, Dr. Bernard Veyret of the University of Bordeaux will begin exposing both cells and animals to microwaves in February. Veyret will be using the Singh assay. He told *Microwave News* that he expects to have some results before this summer.

Roti Roti said that he is committed to finding out what is going on biologically and to finding the reason for the discrepancy between his lab and Lai and Singh's lab. He expressed dismay at the lack of a resolution of a number of possible EMF effects in the published literature.

"Motorola will support our lab to get to the bottom of the issue," Roti Roti said. He and Motorola have recently completed negotiations on a contract renewal, which will allow his lab to do more experiments with digital microwave signals and with higher SARs and to pursue the differences between his results and those of Lai and Singh. "I believe in making the effort to try to resolve the differences," he said.

"The real bottom line is whether there is a health hazard," Roti Roti said.

Daryl Fairbairn, Peggy Olive and Kim O'Neill, "The Comet Assay: A Comprehensive Review," *Mutation Research, 339,* pp.37-59, 1995.

Robert Malyapa et al., "Measurement of DNA Damage After Exposure to 2450 MHz Electromagnetic Radiation," *Radiation Research, 148,* pp.608-617, 1997.

Robert Malyapa et al., "Measurement of DNA Damage After Exposure to Electromagnetic Radiation in the Cellular Phone Communication Frequency Band (835.62 and 847.74 MHz)," *Radiation Research, 148,* pp.618-627, 1997.

P.L. Olive et al., "Factors Influencing DNA Migration from Individual Cells Subjected to Gel Electrophoresis," *Experimental Cell Research, 198,* pp.259-267, 1992.

Narendra Singh et al., "A Simple Technique for Quantitation of Low Levels of DNA Damage in Individual Cells," *Experimental Cell Research, 175,* pp.184-191, 1988.

N.P. Singh, R.E. Stephens and E.L. Schneider, "Modifications of Alkaline Microgel Electrophoresis for Sensitive Detection of DNA Damage," *International Journal of Radiation Biology, 66,* pp.23-28, 1994.

FROM THE FIELD

Clippings from All Over

"[R]esearch on EMFs in the United States will take a big nosedive."

—Dr. Charles Graham, Midwest Research Institute, Kansas City, MO, quoted by Janet Raloff in "EMFs' Biological Influences," *Science News,* p.31, January 10, 1998

"We were all flabbergasted....For three days we tried to find flaws in the experiment and we couldn't."

—Dr. Michael Menaker, University of Virginia, Charlottesville, quoted by Sandra Blakeslee in "Study Offers Surprise on Working of Body's Clock," *New York Times,* p.20, January 16, 1998 (see p.11)

"The answer here is not for the heavy hand of federal government to just roll over local municipalities....I've told the wireless industry and the broadcasting industry that they've got to work with local governments to solve this problem....Until that dialogue takes place, preemption shouldn't even be considered."

—William Kennard, chairman, Federal Communications Commission, quoted by Jeffrey Silva in "Kennard: Compromise on Siting," *RCR,* pp.1,46, February 2, 1998

"We want to be a good neighbor, that's why we have our stealth policy."

—Mary Ann Noyer, spokesperson for AT&T Wireless, referring to the company's policy of hiding antennnas where possible and sharing sites with other companies, quoted by Andrew Revkin in "It's a Tree! It's a Cactus," *New York Times,* p.25, January 11, 1998

A[n] officer recounted [the mishap of] a driver who had dialed a pay-per-minute adult entertainment phone service. He lost control of his vehicle and hit a dump truck head-on. He was fatally injured and died with the cellular telephone still in his hand.

—National Highway Transportation Safety Administration (NHTSA), *An Investigation of the Safety Implications of Wireless Communications in Vehicles,* p.40, November 1997 (released January 1998) (see p.16)

[W]ireless doesn't cause accidents on the road. Subscribers with poor judgment do. They allow phone-number fumbling, dialing or conversing to subvert their primary duty: attention to the road.

—Rikki Lee, news editor, in an editorial on the NHTSA report, "Driven To Distraction," *Wireless Week,* p.40, January 19, 1998

"I don't use cellular phones…it's like sticking your head in a microwave oven. They're very bad for you."

—Keith Richards of the Rolling Stones, quoted by Chris Heath in "Keith Richards: 'Throw Me One of Those Bones, We'll Eat It Forever'," *Rolling Stone,* p.92, December 25, 1997-January 8, 1998

"He believes using [mobile] phones is like putting your head in a microwave oven."

—Michael Cole, spokesman for Mohamed Al Fayed, owner of Harrods, quoted by Robert Uhlig in "Health Fears But No Real Evidence," *Daily Telegraph* (U.K.), December 2, 1997 (see also *MWN,* N/D97)

"Anyone who uses a mobile telephone for more than 20 minutes at a time needs to have their brain tested."

—Roger Coghill, Coghill Research Labs, Gwent, Wales, U.K., quoted in "Mobile Phones Assailed," *International Herald Tribune,* p.9, January 12, 1998

On the evidence to date, there is no proven risk of brain cancer from mobile phones (or other communication devices), and the mechanism of effects at low levels of exposure to radiofrequency fields is unclear. However, mobile phones have been widely used for less than a decade and there are grounds to be cautious.

—Dr. Bruce Hocking, consultant based in Melbourne, Australia, and former chief medical officer of Telstra, in a letter to the *Medical Journal of Australia,* p.48, January 5, 1998 (see p.9)

"As far as mobile telephony is concerned, we have concluded that the compiled results of many years of international research do not show that the electromagnetic fields generated by base stations and mobile telephones cause any risk to health."

—Lars Ramqvist, chief executive, Ericsson, quoted by Helen Meredith in "Mobile Phones: the Fears That Can't Be Quelled," *Australian Financial Weekly,* p.22, January 10-11, 1998

The U.K. has over eight million mobile phone users. Teenagers are part of one of the largest groups of new mobile phone subscribers. Are governments and the industry doing all they can to safeguard their health?

—Editorial, "Time To Resolve Mobile Risks...," *Electronics Weekly* (U.K.), p.16, January 14, 1998

"MICROWAVE NEWS" FLASHBACK

Years 15 Ago

• The EPA announces that it will end its RF/MW research program, despite the agency's intention to develop an RF/MW safety standard.

• Dr. Nancy Wertheimer and Ed Leeper report an increase in cancer rates among adults exposed to power line EMFs.

• Robert Engell settles his $4.5 million lawsuit against ITT in which he alleged that his pancreatic cancer was caused by tactical air navigation equipment manufactured by ITT. The terms are not disclosed.

Years 10 Ago

• Concerns are raised that a large Voice of America shortwave transmitter could be a possible risk factor in the McFarland, CA, childhood cancer cluster.

• Writing in *Nature,* two engineering professors, Drs. Kenneth Foster and William Pickard, call for an end to research on RF/MW health effects. Dr. Samuel Koslov of the Johns Hopkins University Applied Physics Lab responds, "I get the impression that the authors have not bothered to follow the field for at least five years."

• An F-16 pilot who was accidently overexposed to radar radiation continues to complain of short-term memory loss long after other effects have disappeared.

Years 5 Ago

• The CTIA announces plans for a health research program to calm fears among the public and investors after David Reynard claims his wife's brain tumor was caused by her cellular phone.

• The Colorado Public Utilities Commission begins requiring that electric utilities exercise prudent avoidance by considering health impacts in siting new power lines.

• A jury rejects police officer Eric Bendure's claim that his non-Hodgkin's lymphoma was caused by a radar gun made by Kustom Signals Inc.

1998 Conference Calendar (Part II)

Web site addresses are in italics. Part I appeared in our last issue.

March 10-12: **Workshop on Control of Workplace Hazards for the 21st Century** (includes non-ionizing radiation), Hyatt Regency Hotel, Chicago, IL. Contact: Dr. Gregory Lotz, NIOSH, Mail Stop C-27, 4676 Columbia Parkway, Cincinnati, OH 45226, (513) 533-8153, Fax: (513) 533-8510, E-mail: <wgl0@niobbs1.em.cdc.gov>, <*www.cdc.gov/niosh/homepage.html*>.

April 9-10: **24th IEEE Northeast Bioengineering Conference,** Hershey Lodge and Convention Center, Hershey, PA. Contact: Seth Wolpert, Dept. of Electrical Engineering, Penn State-Harrisburg, 777 W. Harrisburg Pike, Middletown, PA 17057, (717) 948-6752, E-mail: <sxw33@psu.edu>.

June 7-11: **1998 Annual Meeting of the Bioelectromagnetics Society,** Trade Winds Hotel, St. Petersburg, FL. Contact: Dr. William Wisecup, W/L Associates, 7519 Ridge Rd., Frederick, MD 21702, (301) 663-4252, Fax: (301) 371-8955, E-mail: <75230.1222@compuserve.com>, <*biomed.ucr.edu/bems.htm*>.

June 7-12: **1998 IEEE MTT-S International Microwave Symposium** and **51st Automatic RF Techniques Group (ARFTG) Conference,** Baltimore, MD. For MTT-S, contact: Ed Niehenke, (410) 796-5866, Fax: (410) 796-5829, E-mail: <e.niehenke@ieee.org>, <*www.mtt.org*>. For ARFTG, contact: John Gregory Burns, Northrop Grumman, PO Box 1521, Mail Stop 3K13, Baltimore, MD 21203, (410) 765-7331, E-mail: <burns.john@postal.essd.northgrum.com>.

June 15-24: **RAPID Science Working Group Meeting,** Northland Inn and Conference Center, Minneapolis, MN. Contact: Dr. Mary Wolfe, NIEHS, PO Box 12233, Research Triangle Park, NC 27709, (919) 541-7539, Fax: (919) 541-0144, E-mail: <wolfe@niehs.nih.gov>.

June 21-26: **1998 IEEE Antennas and Propagation Society International Symposium** and **URSI North American Radio Science Meeting,** Renaissance Waverly Hotel, Atlanta, GA. Contact: Wilson Pearson, Dept. of Electrical and Computer Engineering, PO Box 340915, Clemson University, Clemson, SC 29634, (864) 656-3946, Fax: (864) 656-3946, E-mail: <apsursi98tpc.info@ces.clemson.edu>, <*seal.gatech. edu/EEED/AP-URSI98/ap-ursi98.htm*>.

June 23-25: **14th International Wroclaw Symposium and Exhibition on Electromagnetic Compatibility (EMC),** Wroclaw, Poland. Contact: W. Moron, EMC Symposium, Box 2141, 51-645 Wroclaw 12, Poland, (48+71) 728-812, Fax: (48+71) 728-878, E-mail: <emc@il.wroc.pl>.

June 24-26: **31st Annual Meeting of the Society for Epidemiologic Research (SER),** Marriott Downtown Hotel, Chicago, IL. Contact: Sandy Adams, SER, 111 Market Pl., Suite 840, Baltimore, MD 21202, (410) 223-1626, Fax: (410) 223-1620, E-mail: <stacey@caat.spharbor.jhu.edu>, <*www.sph.jhu.edu/pubs/jepi*>.

July 6-10: **1998 Conference on Precision Electromagnetic Measurements,** Renaissance Hotel, Washington, DC. Contact: Carla Battle, Courtesy Associates, 2000 L St., NW, Suite 710, Washington, DC 20036, (202) 347-5900, E-mail: <cbattle@courtesyassoc.com>, <*www.eeel.nist.gov/cpem98*>.

July 11-15: **33rd Microwave Power Symposium,** Inter-Continental Hotel, Chicago, IL. Contact: International Microwave Power Institute, 10210 Leatherleaf Ct., Manassas, VA 20111, (703) 257-1415, Fax: (703) 257-0213, E-mail: <AssnCtr@idsonline.com>.

July 12-16: **43rd Annual Meeting of the Health Physics Society (HPS),** Minneapolis, MN. Contact: HPS, 1313 Dolley Madison Blvd., Suite 402, McLean, VA 22101, (703) 790-1745, Fax: (703) 790-2672, E-mail: <hpsburkmgt@aol.com>.

July 12-16: **1998 IEEE Power Engineering Society Summer Meeting,** Sheraton Hotel, San Diego, CA. Contact: Terry Snow, San Diego Gas & Electric, PO Box 1831, San Diego, CA 92112, (619) 696-2780, Fax: (619) 699-5096, E-mail: <t.snow@ieee.org>, <*www.ieee.org/power*>.

July 13-17: **Progress in Electromagnetics Research Symposium (PIERS 1998),** Congress Center, Nantes, France. Contact: Dr. Le Toan, CESBIO, BPI 2801, 18 Ave. E. Belin, F-31401 Toulouse Cedex 4, France, Fax: (33+5) 61 55 85 00, E-mail: <thuy.letoan@cesbio.cnes.fr>, <*www.ireste.fr/piers98*>.

August 18-20: **International Conference on Microwave and Millimeter Wave Technology,** Beijing, China. Contact: Ms. Fang Min, Chinese Institute of Electronics, PO Box 165, Beijing 100036, China, (86+10) 682-83463, Fax: (86+10) 682-83458, E-mail: <shaz@sun.ihep.ac.cn>, <*www.cie-china.org*>.

August 23-28: **1998 IEEE International Symposium on Electromagnetic Compatibility,** Denver, CO. Contact: LRW Associates, PO Box 2530, Matthews, NC 28106, (704) 841-1915; or Dr. Matohisa Kanda, NIST, 325 Broadway St., Boulder, CO 80303, (303) 497-5320, Fax: (303) 497-6665, E-mail: <m.kanda@ieee.org>.

September 14-18: **1998 International Symposium on Electromagnetic Compatibility,** University of Rome "La Sapienza," Italy. Contact: Daniela Fioramonti, AEI–Ufficio Centrale, Piazzale R. Morandi 2, 20121 Milan, Italy, (39+2) 777-901, Fax: (39+2) 798-817, E-mail: <conferencesaei@aei.it>, <*www.aei.it/emc98roma.html*>.

September 24-25: **Mechanisms and Consequences of Power-Frequency Electromagnetic Field Exposure,** University of Bristol, U.K. Contact: Dr. Alan Preece, Medical Physics Research Centre, University of Bristol, Horfield Rd., Bristol BS2 8ED,U.K., (44+117) 928-2469, Fax: (44+117) 928-2470, E-mail: <a.w.preece@bristol.ac.uk>, <*www.bris.ac.uk/depts/medphys/*>.

October 14-16: **1998 International Conference on Harmonics and Quality of Power,** Athens, Greece. Contact: Conference Secretariat, National Technical University of Athens, Electric Energy Systems Lab, PO Box 26137, Athens 10022, Greece, (30+1) 772-3598, Fax: (30+1) 772-3659, E-mail: <harma@power.ece.ntua.gr>.

October 29-November 1: **20th Annual International Conference of IEEE Engineering in Medicine and Biology Society,** Convention and Exhibition Center, Hong Kong, China. Contact: EMBSU98, HKIE, 9/F, Island Center, No. 1 Great George St., Causeway Bay, Hong Kong, China (852) 2895-4446, Fax: (852) 2588-7791, E-mail: <embsc@ee.cuhk.edu.hk>, <*www.ee.cuhk.edu.hk/embs98.html*>.

November 9-12: **43rd Conference on Magnetism and Magnetic Materials,** Miami, FL. Contact: Diane Suiters, Courtesy Associates, 2000 L St., NW, Suite 710, Washington, DC 20036, (202) 973-8668, Fax: (202) 331-0111, E-mail: <magnetism@courtesyassoc.com>.

November 17-19: **10th International Symposium on Antennas (JINA 98),** Nice, France. Contact: JINA 98, France Télécom/CNET, Fort de la Tête de Chien, F-06320 La Turbie, France, Fax: (33+4) 92 10 65 19, E-mail: <jina.cnet@wanadoo.fr>, <*13s.unice.fr/JINA-98*>.

NIOSH Workshop on Technology for Controlling Non-Ionizing Radiation

The National Institute for Occupational Safety and Health (NIOSH) is cosponsoring a March 10-12 workshop in Chicago on controlling non-ionizing radiation (NIR) exposures and other workplace health risks. The spectrum from ELF through RF/MW radiation to infrared, visible and UV radiations, as well as lasers, will be covered.

"This represents a new area of interest for NIOSH. We have not focused on control technologies before," said Dr. Gregory Lotz, chief of NIOSH's Physical Agents Effects Branch.

One of the other major areas of discussion will be the use of protective clothing.

Dr. James Melius, a member of the National EMF Advisory Committee, will be a featured speaker. William Feero of Electric Research and Management in State College, PA, will address ELF EMFs. The speaker on RF/MW radiation had not been finalized at press time.

To set a framework for discussion at the workshop, NIOSH has released a four-page "white paper" on *Research Needs for Non-Ionizing Radiation*. A copy of the NIOSH white paper is posted on the institute Web site. For the Internet address and for more information, see the listing on the left.

CELLULAR PHONES & DRIVING

Some Added Risk, Says NHTSA... Does using a cellular telephone while driving increase the risk of a crash? The answer is, "Yes, at least in isolated cases," according to a new report from the National Highway Traffic Safety Administration (NHTSA). In response to public concern and the proliferation of legislative attempts to restrict wireless phone use while driving, the NHTSA reviewed more than 30 relevant epidemiological and behavioral studies. This is a polarized issue, Michael Goodman, the NHTSA's technical manager for the report, told *Microwave News* from his office in Washington, explaining that many drivers rely on phones for business reasons, while others feel endangered by phone-wielding drivers. The NHTSA, said Goodman, sought to present "an objective set of data" with which policymakers, the cellular industry and the public could "reach their own conclusions." Noting the "inherent distraction potential" of the phones, the report suggests that cellular phones increase the risk of accidents to an extent "similar to that associated with other distractions," such as reading a map. However, the report stops short of accepting the finding of a fourfold increase in accident risk reported by Canadian researchers last February in the *New England Journal of Medicine* (see *MWN,* M/A97). The NHTSA contends that the data are "insufficient" for such a conclusion. "We know cellular phones can cause crashes," Goodman commented. "What we don't know is how many crashes they cause." The report nevertheless predicts that the rapid spread of wireless technology will bring "an associated increase in related crashes" unless phone technology or motorists' habits change. The wireless industry cooperated with the NHTSA for the report, said Tim Ayers of the CTIA in Washington. But, he added, it presents "nothing conclusive." The NHTSA calls for improved reporting and data collection on the role of phones in accidents, further research on the problem, increased consumer education and more vigorous enforcement of laws against reckless or inattentive driving. The 274-page report also gives details of laws restricting cellular phone use while driving that have been adopted or proposed in 14 states in the U.S. and in many countries around the world. The NHTSA questions the value of laws requiring "hands-free" car phones—already in force in several countries—in view of evidence that phone conversations distract drivers more than placing or receiving calls. Copies of the report, *An Investigation of the Safety Implications of Wireless Communications in Vehicles,* are available from: U.S. Department of Transportation TASC, Subsequent Distribution Office, SVC-121.23, Ardmore East Business Center, 3341 Q 75th Ave., Landover, MD 20785, Fax: (301) 386-5394. Requests should include the report's title and document number: DOT HS 808-635.

MELATONIN

Try Counting Sheep Instead... Attempts to debunk the media hype on melatonin have focused on some of the more dubious claims—that it will make you younger or improve your sex life. Now comes word that it may not be all that useful as a sleep aid, either. A special section in the journal *Sleep (20,* pp.898-919, 1997), released in December, examines the data in three articles and an editorial. Dr. Wallace Mendelson of the University of Chicago's Sleep Research Laboratory writes that current evidence

does not support the general use of melatonin to combat insomnia. While several studies have found that melatonin can shorten the time needed to fall asleep, Mendelson states, they have not shown any clear effect on total sleep time or its quality. He notes that in a Consumer's Union survey, melatonin was rated "not at all helpful" more than any other sleep aid, and was called "very helpful" by only one quarter of respondents. In another article, Dr. Robert Sack of Oregon Health Sciences University in Portland gives a similar assessment of the literature. But Sack points out that melatonin supplements can shift the timing of an individual's circadian rhythm, and that "optimal alignment of the circadian phase with desired sleep time is a critical ingredient of good sleep." In fact, Sack argues that since melatonin is associated with awakening and activity in nocturnal animals, it would best be described as a "darkness hormone" rather than as a "sleep hormone" across all species. Another contributor, Dr. Irina Zhdanova of MIT in Cambridge, MA, contrasts melatonin with prescription sleep drugs: Unlike the latter, melatonin does not produce "unbearable tiredness and an irresistible sleep drive." Rather, in her studies, it produced "general relaxation...and an easier transition to sleep." Sack makes the same distinction, pointing out that increasing doses of a barbiturate or a benzodiazepine lead to "increasing degrees of sleepiness and eventually coma." But doses of melatonin over 1,000 times those that occur naturally never lead to loss of consciousness—in fact, they may not even make some people feel sleepy. Sack adds that the studies that show melatonin having the strongest soporific effect in the daytime were conducted with young subjects: "Many were presumably students and...probably somewhat sleep-deprived." He suggests that a built-up "sleep debt" may be necessary for melatonin to lead to "manifest sleepiness." Zhdanova warns that melatonin tablets sold in health food stores, "peculiarly labeled a 'dietary supplement'," produce levels many times higher than those normally found in the body, and that this hormone affects tissues as diverse as the brain, pituitary gland, gonads and blood cells. An editorial by the section editor, Dr. Meir Kryger of the University of Manitoba in Winnipeg, Canada, points out that melatonin supplements are a totally unregulated product, and that "one cannot be comfortable that the pill contains what it says it contains." In fact, in Canada and Europe, melatonin cannot be purchased over the counter.

Herbal Sources... Researchers have found that several herbal remedies contain melatonin, including the popular St. John's Wort, as well as feverfew and Huang-qin. In the November 29, 1997, issue of the *Lancet,* a team from the University of Guelph in Ontario, Canada, reports that St. John's Wort contains melatonin at levels of up to 4.39 ∝g/g. Huang-qin had the highest concentration—7.11 ∝g/g—and feverfew up to 2.45 ∝g/g. The December 14, 1997, *New York Times* reports that demand for St. John's Wort, most often used to treat mild despression, has jumped in recent months. Feverfew has been found effective in treating migraine and Huang-qin is recommended for nervous system ailments.

OCCUPATIONAL HEALTH

EPRI Reviews Exposure Guidelines... Standard-setting bodies should "strengthen and clarify" the scientific basis for the limits

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New Scientist (U.K.), October 7, 1995

MWN

Microwave News, July/August 1994

"Digital Cellular Phones Can Disrupt Implanted Pacemakers"

"Cellular Phones May Affect Use of Pacemakers"

Wall Street Journal, April 28, 1995

MWN

Microwave News, November/December 1995

"Higher Leukemia Rates Among Those Living Near Australian TV Towers"

"Living Near TV Towers a Leukemia Risk for Children, Claims Researcher"

Sydney Morning Herald (Australia), December 10, 1996

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they prescribe—so concludes EPRI's *Evaluation of Occupational Magnetic Field Exposure Guidelines*. The 141-page report surveys the scientific rationales and operational guidelines for power-frequency exposure limits issued by the U.S.'s ACGIH, the U.K.'s NRPB, Germany's DIN/VDE, CENELEC and IRPA. None takes into account "potential long-term effects, such as cancer"; rather, all are intended to insure that induced current densities in tissue do not exceed 10 mA/m^2, the threshold for cardiac and nervous stimulation. The EPRI report, authored by Dr. Dan Bracken, a consultant based in Portland, OR, also compiles data on utility workers' exposures to fields above 500 mG from five utility-sponsored studies. For copies of the report, contact: EPRI Distribution Center, 207 Coggins Dr., PO Box 23205, Pleasant Hill, CA 94523, (510) 934-4212.

PACEMAKER EMI

ELF Fields and Pacemakers... Power-frequency EMFs can interfere with the function of implanted pacemakers and defibrillators, according to a literature review sponsored by EPRI. Although present-day pacemakers are better shielded than earlier designs, some vulnerability to EMI is "inevitable," writes Dr. Antonio Sastre of A.S. Consulting & Research in Kansas City, MO, the report's author. (Sastre is also a senior scientist at the Midwest Research Institute.) But, "It is possible to devise engineering solutions that minimize risk," Sastre told *Microwave News*. Threshold intensities for interference vary widely among manufacturers and design types, according to the report. Most susceptible are dual-chamber units, including those operating in monopolar mode, which can malfunction in 50/60 Hz fields as low as 2 G or 1.5 kV/m. While this is far above any EMF levels found inside most homes, Sastre pointed out that 1.5 kV/m fields are "not uncommon" in the U.S. "You have that under 115 kV and 230 kV power lines in many residential areas." The most immune models can function normally in magnetic fields as strong as 12 G and in electric fields up to 20 kV/m. EMI–induced malfunctions are "mostly benign," the report states, and usually involve reversion to fixed-rate pacing. Most devices return to normal operation when the EMI event is over. Malfunctions can be serious, however, in wearers who depend on their pacemakers to maintain cardiac rhythm, who have units operating in inhibited mode or who are prone to episodes of reduced cardiac blood flow. Ten years ago, an EPRI study found that some unipolar pacemakers could malfunction in 60 Hz fields above 2 kV/m (see *MWN,* Jun85). The introduction of new designs, including more sensitive dual-chamber models, and of implantable defibrillators prompted EPRI to revisit the EMI question, focusing on potential hazards to utility workers. The report, issued in August, notes that defibrillators can also malfunction in fields above 2 G and warns that an EMI–triggered pulse occurring in the "vulnerable" period in the cardiac cycle could cause "life-threatening" ventricular fibrillation. While cautioning that "no data currently exist" on threshold electric field intensities for EMI in defibrillators, the report suggests that they are likely to be similar to those for pacemakers. To obtain a copy of the 68-page report, *Susceptibility of Implanted Pacemakers and Defibrillators to Interference by Power-Frequency Electric and Magnetic Fields,* contact EPRI's Distribution Center (see p.17).

VIEWS ON THE NEWS

The Price of Ignorance: Hidden Risks and Absent Benefits

It's time to close the book on EMF health concerns—so say the *New England Journal of Medicine,* the American Physical Society and the utility industry.

And recent events have certainly seemed to favor this position. When physicists said there was no need to worry about EMFs, they got widespread and favorable press coverage. Next, PBS' *Frontline* asked if it was not time to shut down EMF research. Then the National Academy of Sciences (NAS) panel minimized the chance of a cancer risk, and the National Cancer Institute said that it had done the definitive study of childhood leukemia and found nothing. EMF lawsuits are on the decline. Three recent animal studies are now also part of the trend (see p.4).

Who in Congress, surveying this landscape, would want to spend another dime on EMFs and public health?

The problem is that the many studies that point to a health risk are still standing. The evidence against EMFs is in fact stronger today than it was in 1990, when EPA experts labeled EMFs "a probable human carcinogen." When one epidemiological study after another finds a relative risk above 1.0, it's hard to dismiss this as an imaginary hazard.

Even the industry-sponsored Electric Power Research Institute (EPRI) has conceded that there is evidence in favor of an EMF–cancer connection. An EPRI meta-analysis of 29 occupational studies found that EMF exposure increased brain tumor risk significantly—by about 20% (see *MWN,* J/F96). EPRI's analysis of 38 studies on leukemia and EMFs at work had similar results (see *MWN,* N/D97).

In this issue we publish a long-suppressed report drafted by the EPA in 1994, which again concluded that EMF exposure probably leads to more cancer (see p.1). Surprisingly, several observers think that EPA's summary of the data is similar to that of the NAS panel (see p.6), which was widely interpreted as saying that EMFs and cancer are unrelated.

The difference is one of perspective. If you are looking for *conclusive proof* that EMFs harm human health, as the NAS panel did, the evidence looks weak. But from a public health viewpoint, the question is whether an increased risk is *likely*—and then the data paint a different picture.

As a participant at the January NIEHS epidemiology review told us, "We are somewhere in the messy middle. The evidence is not strong enough to say that EMFs are definitely harmful, but the data are disconcerting. You cannot say there is nothing there." In short, the evidence for a health risk is strong enough that it would be a mistake to ignore it.

Some will grant that there could be a small risk attached to power line EMFs. But since it is either small or nonexistent, they argue, we should not spend scarce research dollars on EMF health research. There are other, more pressing threats to human health, they say, and the money would be better spent elsewhere.

This argument loses sight of the ubiquity of electricity and electronic technology in modern life. Those concerned about public health cannot afford to be so complacent. Even a small risk, spread over a large population, can have a high social cost.

And the risk may not be so small. It is true that the increases found in most epidemiological studies have not been large. But if researchers are measuring the wrong kinds of exposures, they will miss the true size of the effect.

Take the case of Agent Orange. A contaminant in Agent Orange, dioxin, is orders of magnitude more toxic than the herbicide itself. And dioxin concentrations vary widely from one batch of Agent Orange to another. So you cannot just study exposure to Agent Orange—you must also look at the levels of dioxin.

The NAS panel recognized "the possibility that some characteristic of the electric or magnetic field is biologically active at environmental strengths." But which characteristic? EMFs are not just one thing. They are a complicated mix of frequencies, modulations and polarizations. At power frequencies, transients and harmonics are part of the mix, and little-studied.

This is also an issue for animal studies. The clean, perfect sine waves of the 60 Hz fields used in the lab are never encountered in the real world. Studying "pure" 60 Hz fields may be a little like studying "uncontaminated" Agent Orange—without the dioxin. If there is a low-level EMF–cancer risk, current animal studies could be "controlling it out."

This distinction might explain the paradox of recent studies of EMFs and melatonin, a hormone thought to be important in fighting cancer. As Dr. John Reif of Colorado State University in Fort Collins noted last year, "Most natural observations appear to find melatonin changes, while controlled lab studies tend not to....I'm concerned that the controlled lab trials may not mimic exposures in the real world" (see *MWN,* M/A97; also N/D97).

We are faced with a knotty problem, and not one that will be solved quickly. But often the hardest problems lead to the biggest breakthroughs.

We pay for our ignorance of bioelectromagnetics in two ways. It is not just the unknown dangers, but also the missed opportunities. We are as much electromagnetic as we are chemical beings and, in principle, EMFs could be used far more widely in the kinds of therapeutic roles played by drugs today. Recent medical research suggests the range of benefits we have been missing: treatments not just for broken bones, but for ailments from migraine headaches to multiple sclerosis to cancer itself.

But to assume that electromagnetic fields, as a class, can only have beneficial effects would be as foolish as to make the same assumption about drugs. We cannot afford to ignore the risks *or* the benefits. For both these reasons, cutbacks in EMF research undermine public health.

MICROWAVE NEWS is published bimonthly. • ISSN 0275-6595 • PO Box 1799, Grand Central Station, New York, NY 10163 • (212) 517-2800; Fax: (212) 734-0316; E-mail: <mwn@pobox.com>; Web site: <www.microwavenews.com> • Editor and Publisher: Louis Slesin, PhD; Senior Editor: Peter Hogness; Associate Editor: Douglas Barnes; Copy Editors: Jim Feldman, Roy Thomas Jr.; Intern: Vijay Baliga; Circulation Assistant: Diana Cooper • Subscriptions: $325.00 per year ($350.00 Canada & Foreign, U.S. funds only); Single copies: $60.00 • Copyright © 1998 by Louis Slesin • Reproduction is forbidden without written permission.

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European Parliament Debates Strict EMF–EMR Exposure Limits

ALARA Approach Draws Support

The European Parliament is discussing a proposal for extremely strict limits on electromagnetic field and radiation (EMF–EMR) exposures for the general public. The proposal is not likely to pass, but Italy's health minister is expected to call for prudent avoidance measures when the Council of Ministers of the European Union (EU) meets in June.

"It is not clear if or when these limits might be adopted," parliament member Gianni Tamino told *Microwave News*. "Our goal is to start a debate."

Tamino, who is also a professor of biology at the University of Padova in Italy, proposed the new rules in a draft report for the parliament's committee on the environment (see p.9). On February 18, the committee rejected the tight numerical limits in the report, but supported its call for applying the "ALARA" approach to non-ionizing radiation issues. Under ALARA, exposure is to be kept "as low as reasonably achievable." The proposed limits will be reintroduced when the full parliament meets in March, Tamino said.

The European Parliament took up the issue after the European Commission (EC) proposed a common standard for all 15 member states of the EU to replace the current patchwork of country-by-country rules (see *MWN*, J/A98). The EC proposal is based on the guidelines adopted by the International Commission on Non-Ionizing Radiation Protection (ICNIRP), which Tamino's

(continued on p.9)

Sony Recalls Mobile Phones That Exceed FCC RF/MW Limits

Sony Electronics Inc. announced on December 1 that it would recall 60,000 cellular phones that may violate federal radiation standards. This is the first time that a manufacturer is recalling cellular phones because they exceed the radiofrequency and microwave (RF/MW) radiation limits set by the Federal Communications Commission (FCC).

Sony predicted that only "a very small number" of the 60,000 hand-held phones would actually turn out to violate FCC rules. It stated that the problem can be fixed by installing new software, and asked users to bring in their phones for testing and adjustment.

These phones exceed federal limits by only "a minimal amount," said Sony spokesperson Rick Clancy in Park Ridge, NJ. "Our recommendation to the FCC was that this action wasn't necessary at all," he said in an interview. "It's not as if there's any question of anything harmful here." He refused, however, to give any detailed exposure information such as the phones' specific absorption rates (SARs).

"Any noncompliance with the commission's emissions guidelines is a very

(continued on p.4)

HIGHLIGHTS

« Wireless Notes »

Add **South Africa** to the list of countries where wireless phone users have charged that microwave radiation from their phones made them sick. On December 17, businessman **Terry Hutchings** of Pretoria sued **Vodac** and **M-Tel**, contending that his brain cancer was caused by mobile phone use. M-Tel is South Africa's largest wireless carrier, and Vodac markets cellular phones. Both companies are based in Johannesburg. "I have had a cell phone since the day the networks switched them on," Hutchings told the *Sunday Times* of Johannesburg (December 27), adding that he used his phone "a few hours a month." Surgeons removed a malignant tumor last summer, and Hutchings, who is 47, now expects to live five more years at most. His suit seeks 2.5 million Rand (approximately US$400,000) for personal injury and 500 million Rand (US$80 million) to pay for public warnings on wireless health hazards and to compensate others "who have been adversely affected" by cellular phones.

«« »»

Wireless telephone carriers are selling their mobile phone towers to independent companies that specialize in tower construction and management. Outsourcing "seems to be the trend," said **John Bensche**, an analyst at **Lehman Brothers**, an investment bank in New York City. On December 9, **Bell Atlantic Mobile** (BAM) in Bedminster, NJ, announced it will transfer its 1,400 towers, valued at $650 million, to a joint venture with **Crown Castle International Corp.** in Houston. And Nextel, Sprint and Powertel, among others, are looking for buyers, Bensche told *Microwave News*. A driving force behind the trend, he said, is the desire to generate more revenue from towers through collocation — placing several carriers' antennas at each site. Carriers are more willing to rent space on a tower that is not owned by a competitor, he explained. In fact, BAM has said that its new joint venture will actively market space to other carriers. Another factor that may have prompted the deal is that cellular sites have been lightning rods for local controversy and unfavorable publicity. For example, the battle over a proposed BAM tower in Vermont became so heated that it drew the attention of **FCC Chairman William Kennard**. Last March, Kennard, along with Sens. **Patrick Leahy** (D-VT) and **James Jeffords** (R-VT), attended a town meeting in Hardwick, VT, to hear public concerns (see *MWN,* M/A98). The BAM–Crown Castle joint venture, as yet unnamed, will build hundreds of new towers, securing sites and pursuing and obtaining all regulatory approvals on BAM's behalf. Crown Castle will own 62.3% of the joint venture, but BAM will retain ownership of its transmitters and other equipment (see p.18).

«« »»

Two and a half weeks before the opening session, **Wireless Technology Research** (WTR) canceled plans for its February 1-2 meeting in Washington to review cell phone research. WTR announced that "logistical difficulties" had forced it to reschedule the meeting for this coming June. But numerous sources told *Microwave News* that they suspected the problem was an expected lack of attendance. Many balked at the $500 registration fee. The *2nd State of the Science Colloquium on the Public Health Impact of Wireless Technology* is now slated for June 19-20 in Long Beach, CA, immediately prior to the Bioelectromagnetics Society's annual meeting....Meanwhile, WTR has published the papers from its first state of the science meeting, held more than three years ago in Rome (see *MWN,* S/O95). Edited by WTR's Dr. **George Carlo**, *Wireless Phones and Health: Scientific Progress* includes sections on dosimetry, biological effects, epidemiology and EMI with medical devices. In his "Colloquium Summation," Carlo contended that, "A new paradigm is needed" for assessing product safety, and stressed the importance of "post-market surveillance." Copies of the 432-page volume are available for $159.00 each, including shipping and handling, from: Kluwer Academic Publishers, 101 Philip Dr., Assinippi Park, Norwell, MA 02061, (781) 871-6600, Fax: (781) 871-6528, E-mail: <kluwer@wkap.com>.

European Health Research Effort Planned; Wireless Industry To Pay Half the Costs

The European Union (EU) has decided in principle to fund studies on wireless phone safety, but it will pay for only half the costs. In response, mobile phone makers are organizing a research consortium that aims to combine EU and industry funding.

The health effects of mobile phones is one of many topics in the EU's Fifth Framework Program for Research and Technological Development (known as FP5), approved by the EU's Council of Ministers on December 22. FP5 has a five-year budget of 15 billion euros (US$16.8 billion), of which 160 million euros (US$179 million) will be spent on "Environment and Health" — including studies of cellular phones.

But FP5 does not guarantee any specific amount for wireless phone research. Kirsi Haavisto of the European Commission (EC) in Brussels, Belgium, told *Microwave News* that all proposals on environmental health will be weighed against one another, and those of the highest merit will be funded. "It will be competitive," said Haavisto, who is with the EC's Directorate General 12 on Science, Research and Development. EU funding for proposals that are approved will cover only 50% of the costs; researchers will have to raise the rest from other sources.

The wireless industry is preparing to fill the funding gap. Its response is being led by a group formed last June, called the Mobile Manufacturers Forum (MMF). The MMF's chair, Peter Harrison of Nokia in Camberley, U.K., said in an interview that the MMF was formed "to discuss and cooperate on basic research in the field of health and safety of radio equipment." Members include Alcatel, Ericsson, Mitsubishi, Motorola and Nokia.

"In the summer of 1998, the MMF established a research

planning committee," Harrison said, "to help industry put some details onto the World Health Organization's [WHO] research recommendations and develop a specific research plan in anticipation of FP5." The committee's members are Dr. Alastair McKinlay of the U.K.'s National Radiological Protection Board (NRPB); Dr. Mays Swicord of the MMF and Motorola; Dr. Bernard Veyret of the European research group COST 244 and France's University of Bordeaux; and Joe Wiart of the GSM Association, a service providers' organization, and France Telecom. They developed a list of study priorities, which they presented to the WHO in December.

Based on that list, the MMF placed an ad in several scientific journals announcing "funding opportunities" on "possible human health effects of microwave exposure." The ad cites ten studies that the MMF wants to see carried out (see box at right), and explains that selected labs "will be grouped into a larger consortium (with the cellular telephone industry as a funding partner) to collectively respond to a call for proposals" from the EC.

Harrison noted that the MMF has held discussions with the GSM Association about both "technical and financial collaboration on [health] research." So far, however, only the MMF has pledged to provide funding.

The head of the WHO's EMF research program, Dr. Michael Repacholi, praised the MMF's list of studies. "The MMF has been working with the EC to promote the WHO's highest-priority RF research," Repacholi told *Microwave News*.

At the MMF's request, the WHO is forming a peer-review panel to judge responses to the ad and decide which labs will be part of the industry-sponsored consortium. Repacholi, who will be a member of the panel, stressed that it would be "independent of the industry funders" and that the MMF would accept its decisions. The panel will meet in Geneva, Switzerland, March 8-9.

The EC's call for proposals on environmental health research is due out in March. Its wording will be general, with cellular phone health effects listed as one of several areas of interest.

The consortium of laboratories envisioned by the MMF will have an advantage over individual labs in seeking EU funding. FP5's rules give preference to joint proposals from separate research institutions in different EU countries. "There's nothing to prevent someone from the University of X doing something totally independent of us," said one observer employed by an MMF member company. "But realistically, if the industry doesn't organize this, then these major studies won't get funded."

In 1996, an EC expert group on mobile phone health issues called for a five-year, 24 million euro (US$27 million) research program (see *MWN,* M/A97), with the cost to be shared by industry. It urged a "fire wall" between industry and the planning of any research effort. It argued that industry "should neither have nor be seen to have any influence over the choice of research studies funded, the conduct or outcome of such studies."

The group's chair, the NRPB's McKinlay, now serves on the MMF-initiated research planning committee. McKinlay told *Microwave News* that the lack of such a fire wall in the MMF effort is not a problem. The independence of EU-funded research will be ensured by the EC's "open call for research proposals, selection assessment and other research administrative procedures within FP5," McKinlay stated.

Cell Phone Makers' List of Research Priorities

The MMF wants to see ten different laboratory studies carried out on cellular phone health effects. They include replication of several studies showing nonthermal effects from RF/MW radiation.

The MMF is asking for two-year cancer studies of rats and mice exposed to GSM digital phone signals, and a shorter rodent study on effects of RF/MW exposure on breast cancer initiated with the chemical carcinogen DMBA. It is also seeking replication of Dr. Michael Repacholi's study with genetically altered mice, which linked RF/MW exposure to a higher risk of cancer (see *MWN,* M/J97 and S/O98).

Also on the list is replication of *in vitro* studies that found RF/MW exposure to be associated with chromosome instability (see *MWN,* M/J92) and with increased activity of the growth hormone ODC (see *MWN,* N/D87 and J/A98).

On noncancer effects, the MMF calls for human provocation studies of headaches, sleep disturbances, skin irritation and hearing problems. In addition, the industry group plans to support an animal behavior study, to measure effects on spatial learning and memory.

The ad that the MMF has placed in various journals (see article on facing page) does not include one item that its research planning committee considered a priority: a large-scale epidemiological study of cancer among cellular phone users. As the committee itself noted, such a study is already being organized by the International Agency for Research on Cancer (see *MWN,* J/F98 and S/O98).

FP5 is strongly oriented toward commercial research, and one of its goals is to "make inroads on the lead taken by the EU's major competitors in their research." FP5's rules on ownership of research results take special care to protect the interests of companies developing new technologies that they may wish to market. Although the rules call for publication of research in scientific journals, it is unclear whether corporate funders of FP5 research could restrict discussion of results prior to publication.

The MMF's Harrison said that, "The research will be conducted according to established EC processes, which include EC monitoring, peer review and publication in scientific journals."

Industry Forms Global Group on Wireless Health Issues

Wireless industry trade associations around the world have joined to form a new organization, the Wireless Information Network (WIN). The group will focus on "health and environmental issues related to the wireless industry," according to Jo-Anne Basile of the Cellular Telecommunications Industry Association (CTIA) in Washington.

WIN, said Basile, will be "a vehicle to exchange information worldwide" through which wireless industry groups can "share the techniques they find to be most effective in responding to media inquiries and the public." The group will neither

sponsor nor attempt to coordinate research.

Established at a meeting in London on December 10, WIN includes industry representatives from Australia, Austria, Canada, Denmark, France, Germany, Ireland, Italy, New Zealand, Norway, Sweden, the U.K. and the U.S. Basile told *Microwave News* that the London meeting was initiated jointly by the CTIA and the U.K.'s Federation of the Electronics Industry (FEI).

Basile stated that WIN was formed because "this is a global industry, and scientific research knows no geographic boundaries." More immediately, she explained, it was spurred by "increased attention to wireless issues by the media." That attention has been especially acute in the U.K., where, Basile noted, the FEI "has been on the front lines for a while now" (see also *MWN,* J/A98 and N/D98).

Those at the meeting discussed the state of wireless health and environmental issues in each country represented. According to minutes of the meeting, participants from Canada and Italy reported that the concept of prudent avoidance has become part of the public debate, and they expressed concern that the term "electrosmog" is now used frequently. In contrast, a representative from the U.S. stated that the question of health effects has been replaced by issues of electromagnetic interference and safe driving. Local government control and public participation were identified as hot topics in Austria, Canada and Sweden, and base stations were cited as flash points in many countries.

Gerd Friedrich of Germany's Forschungsgemeinschaft Funk (FGF), in Bonn, gave a presentation on public perception of RF/MW issues in Germany. Friedrich warned that "'opposition' groups have become sophisticated in their geographical organization and communication methods (e.g., Internet)," according to the minutes.

In a presentation on current health research, Dr. Mays Swicord of Motorola in Ft. Lauderdale, FL, reported that most studies to date are reassuring, but that "some positive unreplicated results" need further investigation. Swicord said that the 2003 IARC review of cancer evidence and the 2004 WHO review of noncancer health effects will each have a major impact.

Basile told *Microwave News* that WIN plans face-to-face meetings at least once a year. She said these could be timed to coincide with other meetings that WIN members may attend, such as the annual meetings of the Bioelectromagnetics Society.

WIN includes the following industry groups: the Australian Mobile Telecommunications Association, Austria's Forum Mobilkommunikation, the Canadian Wireless Telecommunications Association, Denmark's Association of Telecommunications Hardware Suppliers, Germany's FGF, the New Zealand Telecommunications Organization, Norway's Elektronikkbransjen, the U.K.'s FEI, the U.S.'s CTIA, the Mobile Manufacturers Forum (an international manufacturers group) and the GSM Association (an international group of service providers). Three individual companies — France Telecom/CNET, Ireland's Eircell and Italy's Telecom Italia Mobile — are also members, with the understanding that each will aim to represent its country's wireless industry as a whole.

Sony Recalls Noncompliant Phones *(continued from p.1)*

serious matter," declared an FCC statement. "We will closely monitor Sony's [recall] program," it continued, "and will not hesitate to take additional action if necessary."

Sony initially argued that the phones were close enough to the limit that they did not pose a clear-cut violation of FCC rules. "We felt there was some gray area with regard to the regulations," said Sony spokesperson Scott Westover in San Diego, "but the FCC clarified for us that this was not the case."

Kwok Chan of the FCC said that it is a matter of black and white. "An FCC limit is like a speed limit — you can't go above it," Chan told *Microwave News*.

Clancy stressed that when Sony did take action, it was voluntary — not the result of a federal order. "We're not calling it a recall, we're calling it a notification program," he said. "It's up to consumers to decide whether or not they want to take any action." In contrast, the FCC's December 1 statement held that Sony "has a responsibility to ensure that consumers have phones that adhere to the...guidelines," and noted that it had so advised the company.

The problem first came to Sony's attention in late August, according to Clancy, when some phones were brought in for service for unrelated problems. Technicians found that four models had been manufactured with power settings that were sometimes too high, which Westover ascribed to "an internal error on Sony's part." All four models were "dual-mode" phones produced jointly with Qualcomm Inc. of San Diego, designed to use Qualcomm's digital CDMA technology where it is available and analog service elsewhere. The problem affects the phones only in the analog mode.

Under the FCC's self-certification program, Sony had already submitted test results to the FCC claiming that these phones met federal exposure standards. Such a submission is required of any manufacturer before it puts a new phone on the market.

After the excessive power levels were discovered, Sony hired a succession of labs to evaluate whether the phones really do violate FCC limits, said Gretchen Griswold of Sony in San Diego. Sony first went back to PCTEST Engineering Laboratory in Columbia, MD, which had done the original compliance testing on these phones. Next it hired the lab run by Dr. Om Gandhi at the University of Utah in Salt Lake City. Finally, Sony contracted with Schmid & Partner Engineering AG (SPEAG) in Zurich, Switzerland.

All three labs came up with different results, according to both Sony and the FCC. Dr. Niels Kuster of the ETH in Zurich, who is a principal in SPEAG, told *Microwave News,* "I am bound by a nondisclosure agreement, and therefore cannot comment on the test results." But Gandhi said in an interview that "some phones did exceed the [FCC] standard" in measurements by his laboratory.

"This is a general problem in compliance testing," said Chan. "It's not just Sony." Gandhi said conflicting results occur because, "There is not a standard protocol to test these devices." Now the Sony recall has brought this issue to a head. Two days after the recall was announced, FCC Chairman William Kennard

FCC Moves To Tighten Compliance Testing Methods

The FCC is concerned about the lack of agreed-upon methods for testing RF/MW exposure from mobile phones. The commission is pressing its own staff and a standards-setting committee to resolve the problem.

The FCC is revising its own guidelines for determining compliance with exposure limits, with a new version due out by March. In addition, FCC Chairman William Kennard wrote to the IEEE subcommittee on certification of wireless handsets, urging that it complete its work as soon as possible.

The importance of the compliance problem was underscored by Sony's cellular phone recall (see p.1). "Certain recent events have made us acutely aware of the need for immediate and specific guidance" on compliance testing, Kennard wrote on December 3 — two days after the Sony recall was announced. In his letter to the IEEE group, known as Standards Coordinating Committee 34 Subcommittee 2 (SCC-34 SC-2), Kennard highlighted the inconsistent results among different labs, and urged SC-2 to complete its testing protocols as quickly as possible (see also *MWN,* M/A97 and N/D98).

A response from SC-2, obtained by *Microwave News,* stated that subcommittee members would "expedite the progress of their work." In a January 21 letter to Kennard, SC-2 chair Howard Bassen predicted that a first draft on measurement procedures would be ready by early spring, and invited the FCC to adopt it as an interim measure. Bassen, who is with the Food and Drug Administration's Center for Devices and Radiological Health (CDRH) in Rockville, MD, added that SC-2 would complete its final draft later this year and expects approval by the IEEE in 2000.

"The intent of the letter was to prompt the subcommittee to work faster — and it seems to have succeeded," Dr. Robert Cleveland of the FCC's Office of Engineering and Technology (OET) said in an interview. The fact that the letter was signed by Kennard, he noted, "made a lot of people sit up and take notice."

"I'm sure the Sony recall was what prompted Kennard's letter," said the chair of SCC-34, Ron Petersen of Lucent Technologies in Murray Hill, NJ. "In a way it was good, because people are starting to realize that this is a serious problem," Petersen told *Microwave News*. "Most phones have SARs on the order of 1 W/Kg, so you don't have a lot of leeway. If there are large uncertainties, you really need to know about it."

FCC rules for mobile phones limit SARs to 1.6 W/Kg, and Bassen's letter noted that very small changes in measurement procedures can change SARs "by a factor of two or more."

In a January interview, OET's Kwok Chan stressed that this problem was much bigger than the Sony recall. In the two years since the FCC adopted RF/MW limits for cellular phones (see *MWN,* J/A96), Chan said, it has been "not uncommon" for two labs testing the same phone to have varying results. The FCC's testing guidelines were "originally worded in a loose way so that things could get done," he noted. "We've learned quite a bit since then, and now it's time to tighten it up."

But the Sony recall clearly raised the FCC's concern to a new level. "The chair of the FCC doesn't normally write to standard-setting committees," a member of SC-2 told *Microwave News*. "The only reason the letter was sent to us was because there was a problem — the Sony recall."

Some of the key factors that the FCC and SC-2 must consider are the position in which a phone should be tested, the shape of the model head and the dielectric properties of the material inside. Of these, said Petersen, the position is the most important (see *MWN,* N/D97). Petersen said that SC-2 should come to an initial agreement on these issues at its next meeting, February 25-26, at the CDRH in Rockville. "We really want to move forward on this," he said.

The revision of the FCC's own testing guidelines, contained in Supplement C to OET Bulletin 65 (see *MWN,* S/O97), is not moving as quickly as originally hoped. The revised supplement "should be issued in January," according to Kennard's letter. But in January Chan said that late February was "a good target."

"The Sony incident is very important," said another member of SC-2, Dr. Jacek Wojcik of Aprel Laboratories in Nepean, Ontario, Canada. "The cost of recalling 60,000 phones is small compared to the cost of planting a seed of doubt in the public mind. Something like this can happen only because we still don't have the proper engineering tools for compliance testing."

took action to ensure that testing labs produce consistent and repeatable results (see box above).

Howard Bassen, chair of an IEEE subcommittee on compliance testing, has commented that SAR measurement is "an extremely complex process." Bassen recently told the FCC that "even small variations" in testing parameters "can lead to a change in the total measurement results by a factor of two or more."

Sony's mistake, according to Chan, was that its engineers were interpreting FCC rules in the same way that they would an internal industry standard. "Companies agree on industry standards so their systems can work together," Chan explained. "They have to meet those standards within a certain tolerance, plus or minus." But, he said, "FCC limits are different — a limit is a limit."

The recalled phones were produced in the first half of 1998, and are no longer on the market. About 52,000 of them went to customers of PrimeCo Personal Communications, whose main markets are in Florida, Illinois, Louisiana and Wisconsin. The rest were used by Sprint PCS customers in markets across the country.

Sony has established what it calls "software upgrade centers" to handle the recall; most are located in hotels. Sony's Westover said that 44 such centers have been set up in PrimeCo's service area. As an incentive to get users to bring in their phones, Sony is offering a $50 credit towards airtime. Users who do not respond will be sent follow-up mailings.

Although industry publications such as *Mobile Phone News* (December 8) suggested that the recall might bring more attention to wireless safety issues, the story has been ignored by the mass media. "It's been very quiet," commented Sony's Clancy.

The phones being recalled are model numbers CM-B3200, CM-B3200PRC, CM-B2200PRC and CM-B1201SPR. They carry either of the FCC identification numbers L5ACMDB and L5ACMDB2.

Magnets Help Foot Pain Among Diabetics, Claims New Study

Pain, numbness and tingling in the feet are common complications of severe diabetes. Now Dr. Michael Weintraub, a neurologist practicing in Briarcliff Manor, NY, reports that his recent study suggests that a static magnetic field may reduce these symptoms.

The study was published in the January issue of the *American Journal of Pain Management (AJPM, 9,* pp.8-17, 1999) and was covered by both the Associated Press and the *New York Times* on January 6.

Weintraub, who is clinical professor at New York Medical College in Valhalla, NY, told *Microwave News* that he chose to study diabetic peripheral neuropathy (DPN) for two reasons. "Pain is heterogeneous," he said. "It has a lot of different causes. But here the cause is clearly diabetes, so there are no other variables." Also, he said, "most patients with DPN don't respond to any established therapy."

In an earlier, 14-person pilot study published last year in *AJPM (8,* pp.12-16, 1998), Weintraub found that foot pads with a 475 G static magnetic field produced significant improvement among those with DPN, but smaller gains among those with other types of foot pain. The current study, with ten diabetics and nine volunteers with other types of foot pain, used the same type of foot pads and tried to examine a possible placebo effect — but both participants and the researcher could tell which pad was magnetic and which was the placebo.

In the first month, participants wore a sham magnet on one foot and a real one on the other. In the second month, the pads were reversed, and in the last two months, only real magnets were used. At the end of the study, 90% of the diabetics but only 33% of the nondiabetics showed improvement. In contrast, the two groups' responses to the sham magnets were lower and more closely matched.

"It is unlikely that the beneficial effects over four months represent [a] placebo effect," Weintraub contended. He explained that if they did, "both groups should have improved the same amount" with the real magnets. Instead, he said, diabetics showed significantly more improvement.

Weintraub conceded that there were many weaknesses in his study, especially its small size. He is now planning a larger one with an improved design, which would involve 300 to 400 participants, all diabetics. Controls would use only sham magnets for the duration of the study.

New Investigation into Norwegian Birth Defects Cluster

The Norwegian government has opened a new investigation into a cluster of birth defects among children born to men who served aboard the torpedo boat *Kvikk*.

Inge Sellevåg of *Bergens Tidende,* the daily newspaper in Bergen, Norway, reports that the new investigation will be led by STAMI, the National Institute of Occupational Health. Sellevåg says that no decision has yet been reached on the mandate of the new study, or on the status of the original report by the Norwegian navy.

The navy's report, issued last year, found no link between the birth defects and exposure to radar and communications radiation aboard the ship. But a subsequent investigation by *Bergens Tidende* uncovered numerous inconsistencies and omissions in the navy's study (see *MWN,* M/J98 and N/D98).

Cell Towers Prompt Debate in U.K. Parliament

Members (MPs) of the U.K. Parliament are concerned about the siting of wireless telephone towers and about possible health effects of RF/MW radiation from such installations.

In a January 18 House of Commons debate, Phil Willis, a Liberal Democrat from northern England, criticized the government's tower siting guidelines as "weighted too much in favor of industry and not of the environment." Willis called instead for a precautionary approach to tower siting, arguing that, "Any minister would be foolish to rule out the possibility of a health risk" from RF/MW radiation.

Other MPs expressed similar concerns. Jackie Lawrence, a Labor member from Pembrokeshire, added that the U.K. National Radiological Protection Board's (NRPB) guidelines in some cases allow RF/MW exposures several times higher than ICNIRP's recommended limits (see also p.9). The NRPB "is becoming increasingly isolated in its approach" to limiting public exposures, she warned.

Nick Raynsford, who is Parliamentary Under-Secretary of State for Environment, Transport and the Regions, responded for the Labor government, declaring that it is aware of public concern about "alleged adverse health effects" associated with cellular towers, and that it "takes that concern seriously." But, Raynsford contended, wireless base stations operate "typically some thousands of times inside the exposure limit" set by the NRPB. And Raynsford defended the NRPB's limits, maintaining that, "Their basis is broadly consistent with other international guidelines, such as those of ICNIRP."

Apart from modifications to permitting procedures, such as requiring carriers to post a public notice when they plan to build a new tower, Raynsford gave no indication that the government is considering changes in tower siting policy. He did promise that the U.K. will continue to pursue research on RF/MW health effects by supporting the WHO's International EMF project (see *MWN,* J/F97).

The Liberal Democrats' Willis proposed a mandatory independent health risk assessment for each new tower, to be made at the carrier's expense, as well an independent evaluation of the need for a new tower to fill a coverage gap.

At times, Willis's knowledge of the issue appeared to be shaky. For instance, he incorrectly claimed that in the U.S., "Thirty-nine states have stopped erecting masts until the authorities have greater confidence in the technology."

NIEHS Draft Report on RAPID Program Ignores Cancer Risk

There are now strong indications that the National Institute of Environmental Health Sciences (NIEHS) will tell Congress that EMFs do not pose cancer risks. Essentially all federal funding of EMF health research ended last September 30, and the NIEHS appears likely to argue that there is no need for a new EMF research program.

As of late February, a report to Congress from NIEHS Director Dr. Kenneth Olden was still under internal review. But a preview of the advice Olden is getting from his staff may have been provided in December.

NIEHS staff distributed a 352-page document, *EMF RAPID: Program Report,* at the final meeting of the National EMF Advisory Committee (NEMFAC), held jointly with the EMF Interagency Advisory Committee in Washington on December 14. The draft report describes studies carried out under the EMF RAPID research program that Congress mandated in 1992 (see *MWN,* N/D92), and concludes that they "provide substantial evidence that there is not a robust biological effect of EMF exposure at environmentally relevant levels."

The draft report was written by four NIEHS staffers led by Dr. Gary Boorman, who heads the EMF RAPID program at the NIEHS in Research Triangle Park, NC. It goes on to state that, "These data, when taken together with the National Academy of Sciences report, provide a basis for concluding that environmental EMF exposures, at the levels at which human exposure occurs in the environment, do not demonstrate an effect on critical biological processes and functions that could be expected to adversely affect human health." It also opposes earmarking any more funds for EMF research.

Boorman's report never mentions the conclusions of an NIEHS Working Group on EMFs, which met last June 16-24 near Minneapolis (see *MWN,* J/A98). The 30-member international panel voted 19 to 9 in favor of categorizing EMFs as "possible carcinogens." That designation was based largely on the results of epidemiological studies pointing to higher rates of leukemia among children exposed at home and among workers exposed on the job. The Working Group classified EMFs as presenting a cancer risk similar to that from carbon tetrachloride, chloroform, DDT and lead.

Many members of NEMFAC were dismayed by Boorman's decision to leave out the advice of NIEHS' own experts. It is "shocking," said Shirley Linde, NEMFAC's chair. Margaret Seminario, director of the AFL–CIO's Department of Occupational Safety and Health in Washington, called it "stunning." Dr. Peter Bingham, recently retired from Philips Laboratories, said, "You would think we were in a different universe."

The Boorman report does note that the NIEHS spent more than $2,500,000 to run the Working Group meeting and three previous science review symposia — close to 10% of all funds spent under the EMF RAPID program. But while it states that the Working Group issued a report of its own, it contains no reference to the Working Group's conclusions.

There appears to be some dissent within the NIEHS, however. Dr. Christopher Portier, an NIEHS risk analyst who organized the Working Group meeting, refused to endorse the draft report — even though he is listed as its coauthor. When asked directly whether he agreed with the report's conclusion, he replied, "I have no comment."

Several members of NEMFAC observed that Boorman's report could easily be mistaken for Olden's forthcoming report

Meta-Analysis Finds "Relatively Strong and Consistent Support for a Somewhat Weak Elevated Risk of Leukemia for Children"

Dr. Daniel Wartenberg did a meta-analysis of 11 childhood leukemia studies for the National Academy of Sciences (NAS) panel on EMFs (see *MWN,* N/D96). He has now published it in the December *American Journal of Public Health (88,* pp.1,787-1,794, 1998), adding some data from four more recent studies.

Overall, the 15 studies "provide relatively strong and consistent support for a somewhat weak elevated risk of leukemia for children living in proximity to power lines," Wartenberg writes. "The data cannot be explained statistically on the basis of random fluctuations alone." He points out that the overwhelming majority of studies show an increase in risk. And in his analysis of combined data from the original 11 studies, he found statistically significant risks nine times more often than would be expected due to chance. "For [this] observed excess to be due to publication bias," Wartenberg adds, "there would have to have been at least a dozen unpublished, negative studies."

Wartenberg, of the Environmental and Occupational Health Sciences Institute in Piscataway, NJ, reports that the results for each exposure metric are relatively consistent. Childhood leukemia studies based on wire codes, distance from power lines or historically reconstructed field measurements tend to show an increased risk, while those based on direct magnetic field measurements do not.

The contradiction between spot measurements and other metrics "remains an enigma," writes Wartenberg. "Exposure misclassification, which typically biases the results towards the null [i.e., no effect], may play a role." Alternatively, he writes, some other factor unrelated to magnetic field strength may be involved. But he notes that various candidates for this "Factor X" have been investigated, and none explained the association.

The four studies published since the release of the NAS EMF report in 1996 include one by the National Cancer Institute (see *MWN,* J/A97, N/D97 and M/J98). "When the results of these studies are included in the meta-analysis," writes Wartenberg, "only small changes are found." The risks associated with wire codes, distance and calculated historical exposure decline, but only slightly. "The spot-measure results moved from slightly protective...to slightly risky," due mainly to NCI's results.

"Another case-control study would likely be very expensive and only marginally informative," Wartenberg concludes. Instead of more general studies, he argues for research that would focus on "high-exposure individuals."

to Congress. It includes a cover letter from Olden, which begins: "I am pleased to provide this report on the Electric and Magnetic Fields (EMF) research and communication activities that have been conducted over the past six years...."

In response to NEMFAC criticism, Boorman agreed to make some changes in his report. But many observers see Boorman's draft as an indicator of what Olden will say.

The National Electrical Manufacturers Association (NEMA) declared that, "This draft report will figure prominently in the final report to Congress." NIEHS DRAFT REPORT FINDS NO LINK BETWEEN EMF, CANCER was the headline on the front page of NEMA's magazine, *Electroindustry,* of January 15. The president of NEMA, Malcolm O'Hagan, called the Boorman report "very encouraging news."

Olden's report is required by law. With the end of the EMF RAPID program, the NIEHS must report to Congress on whether "exposure to EMFs produced by the generation, transmission or use of electric energy affects human health."

Last summer, in its press release announcing the Working Group's decision to classify EMFs as possible carcinogens, the NIEHS featured a quotation that if EMFs did in fact present a health risk, it would be a small one — even though risk assessment was never discussed by the Working Group. At the time, some NEMFAC members expressed concern that the press release was an early indication that the NIEHS would try to bury the EMF question (see *MWN,* J/A98; also J/F98).

[Dr. Louis Slesin, editor of Microwave News, *was a member of both NEMFAC and the NIEHS Working Group on EMFs.]*

New Epidemiology on Brain Tumors and Breast Cancer

Swedish Study of Occupational EMFs

EMF exposure at work was associated with an increased risk of brain cancer in a case-control study by Drs. Anders Ahlbom and Susan Preston-Martin and colleagues.

Men who had ever worked in a job with average exposures above 4 mG showed a risk of glioma that was twice as high as that of others, as well as a 50% higher risk of meningioma. Those with five years or more of such exposure were twice as likely to develop glioma, but only half as likely to have meningioma.

Writing in the *European Journal of Epidemiology (14,* pp.563-569, 1998), Ahlbom, of the Karolinska Institute in Stockholm, Sweden, and Preston-Martin, of the University of Southern California in Los Angeles, note that a weakness of their study is "the small number of exposed subjects, which results in wide confidence intervals." But overall, they conclude, the results "give some support to previous findings" linking brain tumors with EMF exposures on the job (see also *MWN,* J/F97). "Information was available regarding several potential confounders," they add, "but none of them seemed to be of any importance."

The researchers used cancer registry data and hospital records to examine every case of the two types of brain cancer diagnosed from 1987 to 1990 among half a million men aged 25 to 74 living in central Sweden near Uppsala. The study included 84 men with glioma, 20 with meningioma and 155 controls. The study is one of ten on adult brain tumors that are part of the Surveillance of Environmental Aspects Related to Cancer in Humans (SEARCH) program of the International Agency for Research on Cancer in Lyon, France.

For exposure assessment, Ahlbom and Preston-Martin used a common list of "electrical occupations" as well as measurements of typical exposures for different jobs from a previous study by Dr. Birgitta Floderus. Most men in their study who worked in high-exposure jobs, according to the Floderus measurements, were not listed as electrical workers. These included forestry and logging workers, railway workers and mail carriers.

Ahlbom and Preston-Martin found higher brain cancer risks among welders and those working at VDTs. They note that a previous SEARCH study of VDT users in Australia found an increased brain cancer risk among women but not among men (see *MWN,* J/A92), and that an earlier study by Preston-Martin found an excess risk among male computer programmers in Los Angeles (see also *MWN,* M/A90).

Breast Cancer on Cape Cod

A study of breast cancer on Upper Cape Cod has revealed some increases in risk among women with occupational or residential EMF exposures, but the increases are far from statistically significant. The researchers conclude that the data "did not support" a link between breast cancer and 60 Hz magnetic fields.

Women who had ever lived within 500 feet of a power transmission line or substation had a 50% greater breast cancer risk than did controls, Drs. Patricia Coogan and Ann Aschengrau report in the October 1998 *Archives of Environmental Health (53,* pp.359-367). The authors, both of the Boston University (BU) School of Public Health, found an increase of 70% for those who lived near a power line or substation for over five years.

Two other sources of residential exposure, electric blankets and electric heat, were not associated with any increased risk.

Among women who held jobs likely to involve high EMF exposures, Coogan and Aschengrau found a 20% greater breast cancer risk. The combination of high exposures on the job and above-average residential exposures did not result in any further increase in risk.

The authors do not view the elevated risks as evidence of a causal relationship. "There wasn't really anything there," Aschengrau told *Microwave News*. She and Coogan write that the study is "limited by small numbers." It included 259 women from breast cancer cases on the Upper Cape reported to the Massachusetts Cancer Registry from 1983 through 1986, and 738 controls.

The study was part of a three-year, $3.6 million investigation of breast cancer on Cape Cod led by the Silent Spring Institute in Newton, MA, and used data from an earlier study of the incidence of various cancers on the Upper Cape by Aschengrau and Dr. David Ozonoff, also of BU (see *MWN,* J/F92 and J/F98). The Massachusetts Department of Public Health funded both studies in an effort to identify the cause of elevated cancer rates on Cape Cod. To date, no explanation has been found for the 20% excess of breast cancer in the area for 1982-1994.

report criticizes for ignoring nonthermal and long-term effects.

Some industry groups oppose the ICNIRP limits as too restrictive, and are lobbying against the EC proposal. "A huge number of products would need to be withdrawn from the market" if ICNIRP's limits are adopted by the EU, according to a statement from Philips, Sensormatic, Siemens and several other companies. As examples, they cite "kitchen appliances, welding equipment, retail anti-theft systems, airport security devices...etc."

The fate of the EC's proposal will be decided by the EU Council of Ministers. The powers of the European Parliament are limited, and in this case its role is only advisory. But its review of the EC proposal is required by law, and last July the issue was assigned to the parliament's Committee on the Environment, Public Health and Consumer Affairs. Tamino, a committee member who is also vice chair of the parliament's Green Group, was asked to prepare a report.

Tamino's draft report, dated November 6, 1998, notes that the European Parliament's 1994 resolution on EMF–EMR issues (see *MWN,* J/A94) supports ALARA and "the precautionary principle, which states that in the event of doubt, risks should be avoided." The draft report objects to the fact that the EC proposal is "less strict than the legislation already existing in various member states," such as Italy, Luxembourg and Sweden. It sharply criticizes the EC proposal for ignoring research studies that support the existence of nonthermal effects.

"Risks start appearing on chronic exposure (for example, eight hours per day) to EMFs at levels above 0.3 μT," Tamino concludes. His report therefore advocates that a limit of 0.25 μT (2.5 mG) be phased in over a ten-year period for the 1 Hz-2 kHz frequency range. Equally severe restrictions are proposed for higher-frequency fields.

Tamino's proposed rules "do not appear to have any health basis," declared Dr. Michael Repacholi, who heads the World Health Organization's (WHO) EMF program. "It is likely that if any health consequence of EMF exposure is found, it will be quite subtle," Repacholi stated in a letter to a parliamentary staffer which was obtained by *Microwave News*. Tamino's limits "are between 10 and 10,000 times lower than the levels suggested by ICNIRP," he wrote, and they would cost "hundreds of billions of dollars." Repacholi was the chair of ICNIRP when the limits now proposed by the EC were developed.

As for the Tamino report's support for ALARA and for the precautionary principle, Repacholi stated that the WHO has no position on either one. "While it makes good public hygiene sense to keep EMF levels down to those actually needed to allow the technology to function," he wrote, limits that are much stricter than ICNIRP's "will probably have no health benefit."

Last year, Repacholi declined to endorse prudent avoidance measures, saying that "it is not WHO's job" to make such recommendations (see *MWN,* N/D98).

Tamino's report was also opposed by the German mobile phone company Mannesmann Mobilfunk, which warned that it would result in "destroying the basis of mobile telecommunications." The European Broadcasting Union objected that the limits in the draft report "could cause significant changes in lifestyle to become necessary."

Philip Whitehead, a member of the environment committee who is part of the European Parliament's Socialist Group, had a more mixed reaction. In an interview, Whitehead expressed skepticism about Tamino's proposed numerical limits, saying they are "so drastic" that they would "entirely stop the use of domestic appliances." On the other hand, he said, not enough is known about the health effects of EMFs: "Over the long term, we are part of an experiment, and the jury is still out." Whitehead, who represents Staffordshire East and Derby in the U.K., called for more research and "active monitoring of the facts."

When the environment committee voted on February 18, the limits proposed by Tamino were defeated. But language on ALARA and the precautionary principle was approved, as well as amendments offered by Whitehead that call for regular review of the issue in the future, by both the parliament and the EC.

Whitehead told *Microwave News* he is particularly concerned about mobile phones, which he called "the major subject of debate in the committee." The committee approved an amendment by Whitehead stating that limits should be reviewed in the future, "in light of increased patterns of usage of devices" that emit electromagnetic radiation.

In the wake of the committee vote, Tamino said that the parliament's Green Group would reintroduce the lower limits when the full parliament meets in March. He added that he will try to find a majority for an amendment dealing with possible long-term effects.

But whatever position the parliament takes, it is not binding on the Council of Ministers. Before the ministers take a vote on June 8, a council working group will discuss its own amendments to the EC proposal. Tamino said that he expects the Italian delegation to propose language on possible long-term effects and the precautionary principle. He noted, however, that the U.K. and France are completely against this, and would probably vote against the EC's ICNIRP-based guidelines if they are changed to reflect the Italian position.

Although Tamino hopes that the EC proposal will be modified to take a step in his direction, he said that, "It's not possible to get the proposal changed a lot." As a result, the Italian minister of health will probably vote against the proposal in June, on the grounds that it is too weak.

Tamino said that the lack of clear lines of political responsibility has made progress more difficult. For example, on the national level, the EMF–EMR health issue is assigned to the health ministry in Italy, the environment ministry in Germany, and in Austria to the ministry for consumers' and women's affairs.

Companies and industry groups opposed to the EC proposal have focused their criticism on the ICNIRP limits. The U.K.'s Electricity Association (EA) has argued that ICNIRP's standards are stricter than those of Britain's National Radiological Protection Board (see p.6). For electric fields, the EA stated that 15%-50% of its aboveground transmission lines would not meet this standard, and would require expensive modifications, even though most are in sparsely populated areas.

The environment committee passed an amendment that partly addressed the EA's concern, calling for limits focused only on areas "where the public live and spend significant [amounts of] time."

The joint statement by Philips, Siemens and others rejected

the EC's argument that adoption of the ICNIRP standard would strengthen public confidence: "The public's concern about EMFs...is almost entirely related to worries about long-term effects, which are NOT the subject of the [EC] proposal." Where the ICNIRP standard is stricter than existing national limits, the companies contended, it deals only with short-term effects "such as tingling feelings or overheating," and the latter can be dealt with by "the normal thermoregulatory mechanisms of the body."

Whatever happens to the EC proposal, Tamino said, "This is just the beginning of the debate." That prospect appears to worry Britain's EA, which complained that modifications to its transmission lines required by the EC proposal would force public hearings. Such hearings, it warned, "could have a needlessly alarmist effect, by creating unnecessary doubts in people's minds."

Excerpt from the Draft EMF–EMR Report of the European Parliament's Committee on the Environment

Below is the "Explanatory Statement" from Draft Report on the Proposal for a Council Recommendation on the Limitation of Exposure of the General Public to Electromagnetic Fields, 0 Hz-300 GHz, *prepared for the European Parliament's Committee on the Environment, Public Health and Consumer Protection by Prof. Gianni Tamino, member of the European Parliament from Italy, who served as rapporteur.*

November 6, 1998

1. Introduction

EMFs have been in the news for many years now — particularly since 1979, when Nancy Wertheimer carried out an epidemiological study on 344 children who had died of cancer in Denver, CO — and people exposed to sources of electrical, magnetic and electromagnetic fields are extremely concerned about their possible effects. It has now been established that such sources are to be found not only outside people's houses (electricity transmission lines, radar, television transmitters, etc.), but also inside, where such fields are also generated by electrical appliances such as microwave ovens, hair dryers, electric razors, television sets, VDUs and cellular phones.

It is precisely for the above reasons that, in response to a motion for a resolution tabled by Mr. Vernier, Mr. Santos and Mr. Pimenta, Parliament has already considered a report on the matter by Mr. Paul Lannoye and, on May 5, 1994, adopted a resolution on combating the harmful effects of non-ionizing radiation. This resolution covered both low frequency sources (electricity transmission lines) and high frequency sources (electrical appliances, VDUs, communications systems, etc.) and called on the Commission to propose measures, including regulations and standards, to limit the exposure of workers and the public to non-ionizing electromagnetic radiation. It also called for the revision of Directives 90/220/EEC and 92/75/EEC, on the health and safety of workers exposed to VDUs and the labeling of household appliances, respectively. In response to that resolution, on June 11, 1998, the Commission submitted a proposal for a Council Recommendation on the limitation of exposure of the general public to electromagnetic fields 0 Hz-300 GHz.

2. The Commission Proposal

In addition to listing the various sources and types of electromagnetic fields and outlining the provisions taken at national and Community levels, the proposal for a recommendation and the opinion of the Scientific Committee, which was consulted by DG XXIV, focus mainly on assessing the effects which EMFs have on health, which may be considered from a standpoint of both field frequency and the type of effect produced (thermal, nonthermal, acute or long-term).

1) Thermal Effects

These are acute effects, which are easily measurable, [of] exposure to high frequency EMFs. The most common effect is heating, which occurs when cellular phones are used for long periods. Tissues become heated as a result of the action of electromagnetic waves on electrically charged molecules, and this process therefore depends on the types of tissues through which the waves travel. These are the only effects about which researchers have no doubts and for which DG XXIV's Scientific Committee proposed, at its meeting of June 25 and 26, 1998, that threshold values be adopted, owing to the fact that these effects were borne out by sufficiently conclusive scientific evidence. The same conclusion was reached by ICNIRP and is also endorsed in the explanatory memorandum to the Commission proposal.

2) Nonthermal Effects

Both the explanatory memorandum to the proposal for a recommendation and the opinion of the Scientific Committee conclude that there is insufficient scientific evidence to establish a clear link between exposure to electromagnetic fields and long-term nonthermal effects. The recommendation therefore lays down exposure limit values only for acute thermal effects and makes any future preventive action against long-term effects, such as cancer and leukemia (particularly among children) and alterations to the workings of the nervous, endocrine and immune systems and the production of melatonin and cellular activity, dependent on the production of more convincing scientific evidence.

3. Scientific Research into the Biological and Health Effects of Electromagnetic Fields

A broad survey of the findings of research into the biological and health effects of non-ionizing radiation has already been submitted to Parliament in the Lannoye report, which I feel can be taken as read by Parliament. That report states that, "All these results undoubtedly help to provide a reliable scientific basis on which the decision-makers must rely in defining standards and regulations." It also points out that even if the mechanisms causing biological injury have not been clearly elucidated, we have today sufficient information to adopt the standards and regulations on the basis of two guiding principles:

1. The precautionary principle, which states that, in the event of doubt, risks should be avoided, *inter alia,* by adopting the zero option;

2. The WHO's ALARA principle, under which exposure to radiation must be as low as reasonably possible, which excludes avoidable exposure to radiation.

Since 1994, the views set out in the Lannoye report have been endorsed by authoritative, well-publicized scientific studies which, however, appear to have been ignored both by the author of the proposal for a recommendation and by the experts on DG XXIV's Scientific Committee (as is apparent from the bibliography which appears in the committee's opinion).

No mention is made of the effects of low frequency EMFs (generated by electricity transmission lines) on cell membrane receptors, which pass on into the cell itself and trigger off enzymatic activity and the production of chemical messages which can activate genetic transcription. The relevant data are, nonetheless, to be found both in the conclu-

sions of the European Community symposium on *Electromagnetic Transmissions: The Latest Scientific Evidence, Potential Threats and Strategies To Reduce Risk,* held in London on October 27, 1994, and in the collective work published by Springer Verlag in 1995 under the title *On the Nature of Electromagnetic Field Interactions with Biological Systems* (edited by A.H. Frey).

These effects are of fundamental importance in understanding exactly how EMFs may be involved in the process of carcinogenesis, which is considered to involve two stages: *initiation,* when the initial genetic damage occurs (to DNA) and *promotion* of the proliferation of cancerous cells.

Normally, the agents involved in the process of initiation (ionizing radiation, alkylating agents, etc.) are not active in the subsequent promotion stage, which is triggered by agents which may either interact with membrane receptors or inhibit natural mechanisms designed to eliminate cancerous cells (for example, the immune system).

A large number of laboratory studies indicate that EMFs are instrumental in the promotion of tumors (see, *inter alia,* the research by W. Löscher and others, referred to in the Scientific Committee's opinion, which concludes that there is limited evidence from laboratory studies in support of the theory that EMFs promote tumors).

Furthermore, research has shown that 50 Hz EMFs have the effect of depressing the immune system and reducing melatonin secretion, which are of vital importance in understanding how EMFs might promote tumors. In this connection, the work carried out by R. Liburdy (which is described in the aforementioned book edited by Frey) is of particular interest, in that it demonstrates that melatonin continues to have an oncostatic effect at an exposure level of 0.2 μT, while that effect is blocked at 1.2 μT.

These *in vitro* and *in vivo* studies provide us with a better understanding of the findings of epidemiological research. The research conducted by Maria Feychting of the Karolinska Institute in Stockholm is of particular interest in this connection, in that it points to a link between EMFs and child leukemia, thus backing up similar findings in other parts of the world, and, more recently, between EMFs generated by electricity transmission lines and breast cancer.

Other research work has highlighted a link between EMFs and nervous depression, which may be caused by an imbalance in the calcium ions in nerve cells — an effect which has been identified *in vitro* in cells exposed to EMFs.

All such research indicates that risks start appearing on chronic exposure (for example, eight hours per day) to EMFs at levels above 0.3 μT. In this connection, it might be useful to analyze the report which M. Linet published for the U.S. NCI on July 3, 1997, which has sometimes been used as evidence to back up the claim that there is no relationship between child leukemia and electricity transmission lines. In actual fact, the report excludes only one type of child leukemia, while in general demonstrating that at 0.2 μT there is an increase of 52%, which is insignificant, but which becomes more significant at 0.3 μT (72%) and extremely significant between 0.4 μT and 0.5 μT (600%).

Many of the effects of exposure to low frequency EMFs which have been described have recently also been found to be caused by high frequency EMFs, such as those generated by communications systems, cellular phones and many household appliances (see the book by R. Santini entitled *Telephones Cellulaires: Danger?,* published by M. Pietteur in 1998, which contains an extensive bibliography).

4. Conclusions

The conclusions reached by the Commission and the committee of experts are clearly at odds with a large number of scientific publications, which have apparently been ignored. While realizing the need for due caution in this matter, the rapporteur feels that attention should be drawn to the recent report by the U.S. NIEHS, quoted in the *British Medical Journal* of July 4, 1998, which states that EMFs can be carcinogenic, even though the risk is perhaps not very high.

It is obvious from a very large number of research findings that one cannot dismiss the oncogenic risk nor the various biological effects. Therefore, as was already stated in the Lannoye report, it is necessary to apply the precautionary principle and the ALARA principle.

Rather than doing so, however, the Commission proposal goes so far as to state that, "There is no convincing experimental evidence that ELF electromagnetic fields cause genetic damage, and it is therefore extremely unlikely that they could have any effect on the initiation of cancer," totally ignoring the possibility of them having a tumor-promoting effect, and concludes that, "[T]he epidemiological data are insufficient to allow the recommendation of an exposure limit." The provisions of the Commission proposal are therefore less strict than the legislation already existing in various Member States, such as Sweden,[1] the Grand Duchy of Luxembourg[2] and Italy.[3]

Your rapporteur takes the opposite view that, in compliance with the precautionary principle (Article 130r of the Treaty), the recommendation should include exposure limits for nonthermal effects which may become apparent in the long term.

In view of the above and taking account of the most recent research findings and of national and regional standards which have already been adopted, the rapporteur proposes that the Commission text be amended to lay down a maximum permissible exposure level, to be achieved over a ten-year period, of a magnetic flux density of 0.25 μT and an electric field strength of 25 V/m in the 1 Hz-2 kHz frequency range and, respectively, 0.03 μT and 2.5 V/m in the 2 kHz-400 kHz frequency range and, lastly, 0.01 μT and 1 V/m in the 400 kHz-300 GHz frequency range.

He also proposes that the Commission be called upon to submit by December 31, 1999, a proposal for the amendment of Directives 90/270/EEC, 73/270/EEC and 92/75/EEC, with a view to protecting the health and ensuring the safety of workers exposed to electromagnetic fields from VDUs, establishing safety standards for electrical equipment likely to produce electromagnetic fields and labeling such products so as to provide consumers with information on the fields generated thereby as a function of distance and the types of uses to which they are put. Lastly, the Member States should lay down minimum safety distances from public buildings, housing and workplaces for the siting of electricity lines, radar and broadcasting and rebroadcasting transmitters, including cellular phone repeaters.

1. The MPR/TCO 92 standard for VDUs.

2. Internal Ministry Circular No.1644 26/94.

3. Decree No.381, of September 10, 1998, published in the Official Journal of November 4, 1998, *Regulation Laying Down Standards for the Determination of Radio Frequency Ceilings Compatible with Human Health,* which will enter into force on January 2, 1999, provides for an exposure limit of 6 V/m for broadcast and cellular phone transmitters [for] buildings in which people live or work for more than four hours per day.

Abbreviations

ALARA — As Low As Reasonably Achievable
VDU — Visual Display Unit
DG — Directorate General
EMF — Electromagnetic Field
ICNIRP — International Commission on Non-Ionizing Radiation Protection
NCI — National Cancer Institute
NIEHS — National Institute of Environmental Health Sciences
WHO — World Health Organization

Note: 0.1 μT = 1 mG

Hot New Papers

David Savitz et al., "Magnetic Field Exposure and Cardiovascular Disease Mortality Among Electric Utility Workers," *American Journal of Epidemiology, 149,* pp.135-142, January 15, 1999.

"The consistency of risks found for continuous dose measures and for categorical analyses and the large numbers of events strongly suggest that the pattern we have observed is not a product of random error." (See *MWN,* J/A98 and S/O98.)

P. Cocco et al., "Case-Control Study of Occupational Exposures and Male Breast Cancer," *Occupational and Environmental Medicine, 55,* pp.599-604, 1998.

"An association between occupational exposure to EMFs and risk of breast cancer has been reported. In experimental animals, EMFs can influence circadian rhythms, which are accompanied by undulatory patterns of melatonin secretion, which suppresses the growth of estrogen-receptor-positive tumors in laboratory experiments. A speculative link between exposure to EMFs and risk of breast cancer was therefore established as due to a reduced synthesis of melatonin. However, we found no association with either probability or intensity of occupational exposure to EMFs. There has been considerable discussion about which method of assessing exposure to EMFs is most suitable for epidemiological use. Our job exposure matrix was not detailed enough to discriminate between various types of EMFs. Therefore, the role of occupational exposure to EMFs in the etiology of breast cancer cannot be ruled out based on the present findings."

David McCormick et al., "Exposure to 60 Hz Magnetic Fields and Risk of Lymphoma in PIM Transgenic and TSG–*p*53 (*p*53 Knockout) Mice," *Carcinogenesis, 19,* pp.1,649-1,653, September 1998.

"The results of the present study demonstrate that the development of hematopoietic neoplasia in PIM and hemizygous TSG–*p*53 mice is not accelerated or increased by exposure to pure, transient-free, linearly polarized 60 Hz magnetic fields. The 60 Hz sine wave is the fundamental component of magnetic fields [associated] with the production, transmission and use of electricity in the U.S. As such, the present data do not demonstrate significant oncogenic or tumor-promoting activity of the major component magnetic fields to which humans are exposed in the U.S. An important limitation to these data, however, is the known presence of harmonics, high frequency transients and other electromagnetic components in environmental magnetic fields; the design of the present studies does not address the possible biological activity of these magnetic field exposure parameters." (See *MWN,* J/F98 and M/A98.)

Nonthermal Millimeter Wave Effects

Andrei Pakhomov et al. [of Brooks Air Force Base, San Antonio], "Current State and Implications of Research on Biological Effects of Millimeter Waves [MMW]: A Review of the Literature," *Bioelectromagnetics, 19,* pp.393-413, 1998.

"The studies reviewed demonstrate effects of low-intensity MMW (10 mW/cm^2 and less) on cell growth and proliferation, activity of enzymes, state of cell genetic apparatus, function of excitable membranes, peripheral receptors and other biological systems. In animals and humans, local MMW exposure stimulated tissue repair and regeneration, alleviated stress reactions and facilitated recovery in a wide range of diseases (MMW therapy). Many reported MMW effects could not be readily explained by temperature changes during irradiation."

U.K. Team Sees Changes in Gene Expression at 80 mG

David Tipping et al., "Observations on the Effects of Low Frequency Electromagnetic Fields on Cellular Transcription in *Drosophila* Larvae Reared in Field-Free Conditions," *Bioelectromagnetics, 20,* pp.129-131, 1999.

"*Drosophila* larvae reared inside a μ-metal box with an internal field strength [of] 0.004 μT [0.04 mG] were treated with a magnetic field of 50 Hz, 8.0 μT [80 mG] for 20 minutes. Controls experienced 0.004 μT....The low frequency EMFs very significantly decreased transcript levels, indicating that experimental responses may be influenced by previous exposure or lack of previous exposure....The magnitude and significance of these data are unusual and may be due to our use of intact organisms compared to cultured cells....Field-free rearing conditions are unnatural, but allow a uniformity of past exposure to EMFs between all larvae. The responses of our larvae compared to those grown in ambient fields [do] not preclude the possibility that EMFs have an effect in nature, because the laboratory conditions required for its elucidation may be subtle. Further experiments may determine whether the responses observed in this study are due to the effects of shielding from EMFs during rearing and may also determine the physiological significance of our findings. Our data indicate that experimental transcription effects of low frequency EMFs may be influenced by previous exposure."

Elizabeth Balcer-Kubiczek et al., "BIGEL Analysis of Gene Expression in HL60 Cells Exposed to X Rays or 60 Hz Magnetic Fields," *Radiation Research, 150,* pp.663-672, December 1998.

"We screened a panel of 1,920 randomly selected cDNAs to discover genes that are differentially expressed in HL60 cells exposed to 60 Hz magnetic fields (2 mT) or X rays (5 Gy) compared to unexposed cells.... In contrast, BIGEL analysis of the same 1,920 cDNAs revealed no differences greater than 1.5-fold in expression levels in magnetic-field compared to sham-exposed cells."

Daniel Read and Granger Morgan, "The Efficacy of Different Methods for Informing the Public About the Range Dependency of Magnetic Fields from High Voltage Power Lines," *Risk Analysis, 18,* pp.603-610, October 1998.

"These results confirm our earlier findings that lay people significantly underestimate the rate at which magnetic field strength decreases with distance from a field source. They also demonstrate that a wide range of educational materials can successfully be used to 'calibrate' these erroneous intuitions, and that these changed intuitions persist for at least 24 hours."

Wolfgang Löscher, Meike Mevissen and Alexander Lerchl, "Exposure of Female Rats to a 100 μT, 50 Hz Magnetic Field Does Not Induce Consistent Changes in Nocturnal Levels of Melatonin," *Radiation Research, 150,* pp.557-567, November 1998.

"Our data for rats are in line with previous studies showing a lack of suppressive effects of 50 Hz or 60 Hz magnetic fields on melatonin levels in hamsters, sheep, baboons and human volunteers....[T]he present study failed to demonstrate a consistent effect of 100 μT, 50 Hz magnetic field exposure on melatonin levels in rats. As yet we have no ex-

planation for this lack of robust effects of magnetic field exposure on the function of the pineal gland, which appears to be in contrast to previous reports using the same or similar flux densities."

A.W. Wood et al., "Changes in Human Plasma Melatonin Profiles in Response to 50 Hz Magnetic Field Exposure," ***Journal of Pineal Research, 25,*** **pp.116-127, 1998.**

"The effects of power frequency magnetic fields on nighttime plasma melatonin were studied in a group of 30 adult male human subjects. Exposure consisted [of] 20 μT (200 mG) at 50 Hz (circularly polarized) at certain times in relation to the predicted time of onset of rise in melatonin concentration for a particular individual....When exposure preceded onset of rise, a significant delay in onset time relative to sham exposure of approximately half an hour was observed, with indications (marginally significant) of a reduction in maximum melatonin level....Magnetic fields generated by square-wave currents produce more marked reductions in the maximum level when compared to sinusoidal waveforms, but there was no significant difference in onset time."

J.-L. Chagnaud and B. Veyret, ***"In Vivo*** **Exposure of Rats to GSM-Modulated Microwaves: Flow Cytometry Analysis of Lymphocyte Subpopulations and of Mitogen Stimulation,"** ***International Journal of Radiation Biology, 75,*** **pp.111-113, January 1999.**

"For the first group of 15 rats exposed at 55 μW/cm^2 and 15 sham-exposed rats, no differences were observed between the activation level of cells from exposed and sham-exposed rats, irrespective of the concentration of ConA. For the second group of ten rats exposed at 200 μW/cm^2 and ten sham-exposed rats, the results were the same. Furthermore, both methods (MTT assay and flow cytometry) gave the same results. This suggests that *in vivo* exposure to GSM-modulated MW did not alter the normal ConA response in lymphocytes. Overall, the results show that GSM-modulated MW did not affect the integrity of the immune system under the conditions used. This is in agreement with current literature, which offers little convincing evidence of the effects of MW on the function of the immune system that are not directly or indirectly related to thermal load."

MRI and EMFs: A Review and Advice

Jerome Beers, Jerry Phillips, Frank Prato and Indira Nair, "Biologic Effects of Low-Level Electromagnetic Fields: Current Issues and Controversies," ***MRI Clinics of North America, 6,*** **pp.749-774, November 1998.**

"Given the ambiguity of the evidence...the authors believe that blanket statements about the safety [of the] MR [magnetic resonance] environment are inappropriate other than that there is no compelling, specific evidence of any hazard if the usual precautions are taken. The authors also believe that, however, in keeping with the concept of informed consent, people who work with MR imaging should, rather than relying on quasi-official declarations, make themselves more familiar with bioelectromagnetics. For example, people who work with MR imaging might reasonably want to know that several epidemiological studies — all intelligently conducted but with obvious and considerable limitations — link electromagnetic occupations with Alzheimer's disease. Similarly, people in imaging departments, which are filled with cables, wires and electromagnetic devices, might want to follow the questioned link of electromagnetic occupations to leukemias and gliomas, even if those possible links prove spurious or prove to have to do with a confounder (a chemical associated with wire insulators, for example)....The authors therefore suggest that radiology organizations and large imaging departments make efforts to track ongoing developments in bioelectromagnetics by following the literature in study groups, by participating in meetings and by inviting to radiology meetings bioelectromagnetic researchers who articulate diverse perspectives; and that radiology journals consider publishing annual or semiannual reviews describing recent developments."

"MICROWAVE NEWS" FLASHBACK

Years 15 Ago

• In a draft report, the EPA finds that RF/MW radiation can cause significant biological effects at specific absorption rates (SARs) as low as 1 W/Kg, four times lower than the threshold used as the basis for ANSI's 1982 exposure guidelines.

• In order to assess the economic impact of possible RF/MW exposure limits, the EPA asks 1,000 broadcasters about public exposures from their FM radio transmitters.

• A federal judge halts work on the U.S. Navy's Project ELF submarine communications system pending the completion of an environmental impact statement.

Years 10 Ago

• The New Jersey Department of Health drops its investigation of a cluster of birth defects in Vernon Township. Local activists believe that the many satellite uplinks in the area may be responsible for the high incidence of Down's syndrome.

• A U.S. Navy electromagnetic pulse (EMP) simulator 15 miles off the North Carolina coast would pose no significant threat to public health, the congressional Office of Technology Assessment (OTA) concludes, but it notes that elevated cancer rates among workers exposed to EMP are a "cause for concern."

• Seattle City Light issues a policy statement saying, "The fact that some studies even suggest a link between [EMFs] and health requires assertive steps by the utility industry and government agencies to answer questions pertaining to possible health effects."

Years 5 Ago

• Leonard Glazer of Coral Gables, FL, sues Florida Power & Light Co., claiming that power lines outside his bedroom caused the leukemia that killed his wife and now threatens his own life (see p.18).

• Questioning whether it would be "sufficiently protective," the EPA advises the FCC not to adopt RF/MW exposure limits based on the 1992 ANSI/IEEE standard.

• In a suit against his employer, Motorola engineer Robert Kane contends that RF/MW exposures from a prototype cell phone caused his brain tumor.

Todd Richards et al., "Bioelectromagnetic Applications for Multiple Sclerosis [MS]," *Physical Medicine and Rehabilitation Clinics of North America, 9,* pp.659-673, August 1998.

"It is possible that [electromagnetic] fields could be developed into a reproducible therapy for both symptom management and long-term care for MS. The long-term care for MS would have to include beneficial changes in the immune system and in nerve regeneration."

Lyle Sasser et al., "Lack of a Copromoting Effect of a 60 Hz Magnetic Field on Skin Tumorigenesis in SENCAR Mice," *Carcinogenesis, 19,* pp.1,617-1,621, September 1998.

"Statistical evaluation of the effects of the magnetic field on tumor incidence and multiplicity did not reveal any statistically significant effects; thus...no promotional or copromotional effect of a 2 mT magnetic field on skin tumor development in SENCAR mice could be demonstrated."

Clippings from All Over

"The reality is that they're an absolute, total and complete waste of time."

— Dr. Alan Bender, Minnesota Department of Health, on investigations of cancer clusters, quoted by Dr. Atul Gawande in "The Cancer-Cluster Myth," *The New Yorker,* p.37, February 8, 1999

"Exactly why it works, we do not know."

— Dr. Orrin Devinsky, New York University-Mt. Sinai Comprehensive Epilepsy Center, New York City, on a device that controls epileptic seizures by stimulating a nerve, quoted by Susan Ferraro in "Implant Can Change the Lives of Epileptics," *Daily News* (NY), p.31, January 25, 1999

"We have no idea how or why the magnets work."

— Dr. Paul Rosch, president, American Institute of Stress, Yonkers, NY, quoted by Holcomb Noble in "Magnets Lessen Foot Pain of Diabetics, a Study Finds," *New York Times,* p.A16, January 6, 1999 (see p.6)

Sawyer: This is Victor Sheymov, a Soviet defector. His job — communications security for the KGB. He told us how Russia has been developing RF devices for years. This is the first time he's given a television interview on the subject. And has the KGB ever used it against the United States?

Sheymov: Yes.

Sawyer: Sheymov told us something shocking — that years ago, the KGB used a primitive RF weapon to start a fire at the U.S. Embassy in Moscow. Was the KGB aware that's what would happen?

Sheymov: Oh, they hoped it would. And it did....

Sawyer: The Swedes sent word to us of something. They have been testing all of these electromagnetic weapons, and they told us that they recently blasted a car from 3,000 feet away with microwaves and not only disabled it, [but also] blew up the headlights. So this new world is at hand.

— Diane Sawyer interviewing Victor Sheymov on *20/20,* an ABC television news show, February 10, 1999

In terms of time and effort, the industry's approach to this subject needs to be modelled on a marathon rather than a sprint.

— From the minutes of the formative meeting, in London, U.K., of the Wireless Industry Global Information Network, now called the Wireless Information Network, an international industry group dealing with mobile phone health and safety concerns, December 10, 1998 (see p.3)

A South African newspaper reports that a man has sued over his brain tumor, claiming cell phone usage caused it. A legal decision in the man's favor...would be worth a lot to activists in the arena of public perception, particularly given the almost total lack of laboratory results from CTIA's moribund $25 million, five-year research program on health effects.

— Dr. Peter Polson, wireless industry consultant, Alameda, CA, in a guest opinion piece, "Public Opposition Expected To Rise About RFR Radiation," *RCR,* p.34, February 8, 1999 (see p. 2)

Adey Speaks Out

Malarek: Professor Ross Adey thought he was onto something as well. While doing research for Motorola, one of the world's largest cell phone companies, he discovered microwave radiation had an effect on the brains of rats. It was actually a good effect, but for Motorola any effect at all was bad news. Adey's contract with Motorola was not renewed.

Malarek: So why did they terminate the support?

Adey: My colleagues say because we were too inquisitive. We were of a scientific turn of mind, and we'd turn over the rocks to find out what was underneath.

Malarek: But that's the job of a scientist, to be inquisitive.

Adey: Of course it's the job of a scientist.

Malarek: And you're tough as a scientist.

Adey: Yes, I think I'm tough — too tough, some people say.

Malarek: As a result, you and your team lost your contract.

Adey: That's correct.

Malarek: Motorola claims it had nothing to do with his results, they simply found a better deal somewhere else. That better deal was with Battelle, a private research group known for keeping its mouth shut. In one celebrated case from the 1960s, Battelle conducted studies showing how nicotine affected the brain, but never talked about it.

— Dr. Ross Adey, University of California, Riverside, formerly of the VA Hospital, Loma Linda, CA, interviewed by Victor Malarek on *The Fifth Estate,* a Canadian Broadcasting Corp. television news show, February 9, 1999 (see *MWN,* M/J96 and J/A96)

"Carriers want to have their cake and eat it too. They want to control their towers but not own them."

— Thomas Lehr, vice president, Airadigm Communications Inc., Little Chute, WI, on the trend toward letting others manage their mobile telephone towers, quoted by Kristen Beckman in "Tower Industry Argues Importance of Size," *RCR,* p.14, January 11, 1999 (see p.2 and p.18)

It would seem, though, the telecommunications industry does not really want to be a good neighbor. If it did, its representatives would not be so quick to make in-your-face comments like, "It's okay if the city wants to do monitoring (of radiofrequency emissions) at its own expense, we're just not going to pay for it." There has been some concern that emissions from cell towers are harmful, just as there has been concern that power line emissions are harmful. While studies of electromagnetic fields have been inconclusive, the concern of some scientists and many parents is still quite real. A responsible company surely would want to take precautions. Asking for emissions monitoring is not unreasonable.

— From an editorial, "Cell Phone Industry Needs To Grow Up," *Boca Raton News* (FL), p.8A, January 29, 1999

CONFERENCES

1999 Conference Calendar (Part II)

Part I appeared in our last issue.

February 3-4: **National Seminar on Low-Level Electromagnetic Field Phenomena in Biological Systems (BIOSYS '99),** Jawaharlal Nehru University, New Delhi, India. Contact: Prof. J. Behari, School of Environmental Sciences, Jawaharlal Nehru University, New Delhi 110 067, India, (91+11) 610-7676, ext.2323, Fax: (91+11) 616-5886, E-mail: <jbehari@hotmail.com>.

March 17-18: **The Effects of Ions, EMFs and Magnetism on the Human System (Fred Soyka's 1999 International Symposium),** Toronto Convention Center, Toronto, Canada. Contact: Ticketmaster, (416) 870-8000, Web: <www.ticketmaster.ca>.

March 23-25: **International Exhibition with Workshops on Electromagnetic Compatibility,** Düsseldorf Convention Center, Düsseldorf, Germany. Contact: Dunja Tonnemacher, MESAGO Messe & Kongress GmbH, Rotebuehlstr. 83-85, D-70178 Stuttgart, Germany, (49+711) 619-4675, Fax: (49+711) 661-9775, E-mail: <dunja@mesago.de>.

April 12-14: **1st International Symposium on Nonthermal Medical/Biological Treatments Using Electromagnetic Fields and Ionized Gases,** Norfolk, VA. Contact: Marcie Blanchard, KDH 231, Old Dominion University, Norfolk, VA 23529, (757) 647-6497, Fax: (757) 588-3527, E-mail: <electromed99@ece.odu.edu>, Web: <www.ece.odu/~emed99>.

April 28-30: **1999 International Wireless Communications Expo (IWCE '99),** Las Vegas Convention Center, Las Vegas, NV. Contact: IWCE '99, PRIMEDIA Intertec Exhibitions and Conferences, 9800 Metcalf Ave., Overland Park, KS 66212, (800) 288-8606, Fax: (913) 967-1900.

May 24-26: **Instrumentation and Measurement Technology Conference (IMTC/99),** Venice, Italy. Contact: Robert Myers, 3685 Motor Ave., Suite 240, Los Angeles, CA 90034, (310) 287-1463, Fax: (310) 287-1851, E-mail: <bob.myers@ieee.org>, Web: <www.ims.unico.it/conferences/conferenze/1999imtc>.

June 13-19: **1999 IEEE MTT-S International Microwave Symposium** and **52nd Automatic RF Techniques Group (ARFTG) Conference,** Anaheim, CA. Contact: Robert Eisenhart, Eisenhart & Associates, (818) 716-1995, Fax: (818) 713-1161, E-mail:<r.l.eisenhart@ieee.org>, Web: <www.mtt.org/ims1999>. For ARFTG, contact: Gary Simpson, Maury Microwave, (909) 987-4715, Fax: (909) 987-1112, E-mail: <gsimpson@maurymw.com>.

June 14-18: **Southport '99 International Symposium,** Southport, U.K. Contact: Society for Radiological Protection, Ramillies House, 1-9 Hills Pl., London W1R 1AG, U.K., (0171) 287-4955, Fax: (0171) 287-4906, E-mail: <admin@srp-uk.org>, Web: <www.srp-uk.org/servsouth.html>.

June 22-24: **International Conference on Lightning and Static Electricity (ICOLSE '99),** Centre des Congres Pierre Baudis, Toulouse, France. Contact: Jim Brahney, Society of Automotive Engineers, 400 Commonwealth Dr., Warrendale, PA 15096, Fax: (724) 776-1830.

June 29-30: **7th International Symposium on Performance of Protective Clothing,** Seattle, WA. Contact: Cherilyn Nelson, Dept. of Environmental Sciences, Eastern Kentucky University, 102 Burrier, Richmond, KY 40475, (606) 622-3445, Fax: (606) 622-6274, E-mail: <hesnelso@acs.eku.edu>.

July 11-16: **1999 IEEE Antennas and Propagation Society International Symposium** and **URSI National Radio Science Meeting,** Renaissance Resort, Orlando, FL. Contact: Christos Christodoulou, (407) 823-5831, Fax: (407) 823-5835, E-mail: <cgc@ece.engr.ucf.edu>, Web: <www-ece.engr.ucf.edu/apursi99>.

July 17-21: **34th Microwave Power Symposium,** Washington, DC. Contact: International Microwave Power Institute, 10210 Leatherleaf Ct., Manassas, VA 20111, (703) 257-1415, Fax: (703) 257-0213, E-mail: <info@impi.org>, Web: <www.impi.org>.

July 18-22: **1999 IEEE PES Summer Meeting,** Edmonton, Alberta, Canada. Contact: Ken Warren, (403) 412-3506, Web: <www.ieee.org/power>.

July 18-23: **11th International Congress of Radiation Research,** University College, Dublin, Ireland. Contact: Congress Secretariat, Radiation Science Center, Dublin Institute of Technology, 40-41 Lr. Kevin St., Dublin 8, Ireland, (353+1) 402-4666, Fax: (353+1) 475-6793, E-mail:<icrr@iol.ie>, Web: <www.cjp.com/radres/html/icrr.htm>.

July 26-31: **World Conference on Breast Cancer,** Congress Center, Ottawa, Canada. Contact: World Conference on Breast Cancer, 841 Princess St., Kingston, Ontario K7L 1G7, Canada, (613) 549-1118, Fax: (613) 549-1146, E-mail: <brcancer@kos.net>.

August 2-6: **1999 IEEE International Symposium on Electromagnetic Compatibility,** Seattle, WA. Contact: Janet O'Neil, (425) 868-2558, Fax: (425) 868-0547, E-mail: <j.n.oneil@ieee.org>.

August 13-21: **26th General Assembly of URSI,** University of Toronto, Canada. Contact: URSI GA '99 Secretariat, National Research Council Canada, Ottawa, Ontario K1A 0R6, Canada, (613) 993-7271, Fax: (613) 993-7250, E-mail: <ursi99@nrc.ca>, Web: <www.nrc.ca/confserv/ursi99/welcome.html>.

August 23-27: **12th General Meeting of the Nordic Society for Radiation Protection,** Skagen, Northern Jutland, Denmark. Contact: Dr. Anders Damkjaer, Risö, NUK-114, PO Box 49, 4000 Roskilde, Denmark, E-mail: <a.damkjaer@risoe.dk>.

August 31-September 4: **15th Scientific Meeting of the International Epidemiological Association,** Palazzo dei Congressi, Florence, Italy. Contact: Scientific Secretariat IEA Florence '99, c/o Dipartimento Statistico, Viale G.B. Morgagni 59, 50134 Florence, Italy, (39+55) 4223561, Fax: (39+55) 414277, E-mail: <iea99@stat.ds.unifi.it>, Web: <iea99.ds.unifi.it>.

September 5-8: **11th Conference of the International Society for Environmental Epidemiology and 9th Conference of the International Society of Exposure Analysis (ISEE/ISEA '99),** Athens, Greece. Contact: Institute for Social and Preventive Medicine, 32 Skoufa Str., 106 73 Athens, Greece, (30+1) 645-0870, Fax: (30+1) 360-4894, E-mail: <ISPM@compulink.gr>, Web: <www.uoa.gr/news/isee-isea99>.

September 22-24: **Microwave and RF Fields: Medical Applications and Safety,** Hammersmith Hospital Postgraduate Center, London, U.K. Contact: Dr. Alan Preece, Medical Physics Research Center, University of Bristol, Horfield Rd., Bristol BS2 8ED, U.K., (44+117) 928-2469, Fax: (44+117) 928-2470, E-mail: <a.w.preece@bristol.ac.uk>.

September 25-27: **15th International Symposium on Bioelectrochemistry and Bioenergetics,** Strasbourg, France. Contact: Claude Nicolau, Blood Research and Development Laboratories, Harvard Medical School, 1256 Soldiers Field Rd., Boston, MA 02125, (617) 787-9257, Fax: (617) 787-8977, E-mail: <cnicolau@aol.com>.

October 11-13: **15th International Conference on Applied Electromagnetics and Communications (ICECOM '99),** Dubrovnik, Croatia. Contact: Juraj Bartolic, Faculty of Electrical Engineering, University of Zagreb, Unska 3, HR-10000 Zagreb, Croatia, E-mail: <juraj.bartolic@fer.hr>, Web: <www.rasip.fer.hr/korema>.

October 13-16: **1st Joint Meeting of the Biomedical Engineering Society and the IEEE Engineering in Medicine and Biology Society,** Hyatt Regency, Atlanta, GA. Contact: Web: <bmes-embs99.gatech.edu>.

November 1-4: **1999 International Conference on Computational Electromagnetics and Its Applications (ICCEA '99),** Beijing, China. Contact: Meng-Qi Zhou, PO Box 165, Beijing 10036, China, (86+10) 6828-3463, Fax: (86+10) 6828-3458, E-mail: <mqzhou@public.bta.net.cn>, Web: <www.CIE-China.org>.

November 15-18: **44th Conference on Magnetism and Magnetic Materials,** Fairmont Hotel, San Jose, CA. Contact: Courtesy Associates, 2000 L St., NW, Suite 710, Washington, DC 20036, (202) 973-8668, Fax: (202) 973-8722, E-mail: <magnetism@courtesyassoc.com>, Web: <www.magnetism.org>.

November 20-30: **International Seminar on Biological and Health Effects and Standards for Pulsed Radiofrequency Fields,** Majorana Center, Erice, Sicily, Italy. Contact: Dr. Michael Repacholi, Office of Global and Integrated Environmental Health, World Health Organization, CH-1211 Geneva 27, Switzerland, (41+22) 791-3427, Fax: (41+22) 791-4123, E-mail: <repacholim@who.ch>, Web: <www.who.ch/emf/>.

November 30-December 3: **Asia Pacific Microwave Conference,** Westin Stamford and Westin Plaza, Singapore. Contact: APMC '99 Secretariat, Conference and Travel Management Associates Pte Ltd., 425-A Race Course Rd., Singapore 218671, Republic of Singapore, (65) 299-8992, Fax: (65) 299-8983, E-mail: <ctmapl@singnet.com.sg>, Web: <www.ee.nus.edu.sg/~apmc99/>.

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UPDATES

BOOKS

Radar Reference...*Jane's Fighting Ships* was first published in 1898, and today the Jane's Information Group publishes almost 70 different volumes on a multitude of topics. One of them is the most detailed radar reference available without a security clearance. The company describes its yearbooks as "information collected overtly from unclassified sources — although much could be regarded as extremely sensitive or not publicly accessible," and the Tenth Edition of *Jane's Radar and Electronic Warfare Systems* does not disappoint. It presents current military radar systems around the world in great detail, with information such as the range of a unit, the size of its antenna and the frequency and peak power of its radiation. The volume describes air-, land- and sea-based systems, manufactured in countries from Australia to Yugoslavia. They range in size from a portable device that weighs only 4 Kg to an over-the-horizon radar with an antenna 1,500 meters long. Some may be familiar, such as the PAVE PAWS missile tracking system on Cape Cod (see *MWN,* N/D98), while others are obscure. Clearly written introductions help the lay reader understand the basics of radar and electronic warfare, with definitions of dozens of terms. The foreword reviews new technological trends, such as systems that use multiple radar sweeps to penetrate foliage or camouflage. *Jane's Radar and Electronic Warfare Systems* costs $350.00. To order, contact: Jane's Information Group, 1340 Braddock Pl., Suite 300, Alexandria, VA 22314, (703) 683-3700, Fax: (800) 836-0297, E-mail: <info @janes.com>, Web: <www.janes.com>.

Coghill on EMFs, AIDS and Atlantis... Roger Coghill gained a lot of attention from the British press with his lawsuit demanding that cellular phones be labeled with health warnings, which was dismissed last November (see *MWN,* N/D98). A consultant based in Gwent, Wales, Coghill has now put some of his more unusual views before the public in a self-published book, *Something in the Air.* It is an eccentric view of the effects of electromagnetic energy, which includes both widely accepted scientific research and Coghill's unsupported personal theories. Coghill speculates that EMF or RF/MW exposure is causing AIDS, mad cow disease and sudden infant death syndrome. He also argues that Atlantis actually existed and that its inhabitants may well have used electric batteries. The last nine pages of the book are devoted to Coghill's own translation, from the Greek, of the Gospel according to St. John, in which he purports to show that John the Baptist was "offering a highly compressed account of how the natural electromagnetic fields of the planet were once before recognized and harnessed." On a different theological note, the copyright page includes this statement: "The author acknowledges the inspiration of the great god Poseidon, shaker of the Earth, and lord of all waves and vibrations."

CELL PHONE SARs

More on Wall Boost... Three years ago, Italy's Dr. Paolo Bernardi showed that using a cellular phone near a metal wall could increase radiation exposures (see *MWN,* S/O96). Now a German team has experimental measurements that support Bernardi's computer models. When a dipole antenna emitting a 900 MHz signal is placed between a spherical mannequin "head" and a

metal wall, specific absorption rates (SARs) can rise significantly, report Justin Cooper and Völker Hombach, both of Deutsche Telekom in Darmstadt. In some cases, the Telekom researchers observed SARs greater than the 2.0 W/Kg limit specified in current European and international guidelines, while their transmitter met this standard when there was no wall nearby. "If the maximum SAR values in free space are close to the limits specified in a [standard], the presence of the wall may cause those limits to be exceeded," they write in the November issue of *IEEE Transactions on Electromagnetic Compatibility (40,* pp.377-382, 1998). Significant increases in SARs occurred only when the wall was on the antenna side of the mannequin and perpendicular to a line connecting the mannequin to the antenna. These results are in accord with the calculations by Bernardi, who is at the University of Rome "La Sapienza." Cooper and Hombach observed the greatest increases — up to 60% when averaged over 10 g of tissue, and even higher for smaller averaging volumes — when the mannequin was 15 mm from the antenna and 30 mm from the wall. They contend, however, that such increases are unlikely in real world conditions, noting that the highest SARs occurred when the antenna's radiated power was held constant (at 0.25 W). When an antenna is close to a metal wall, they explain, much more current is required to maintain constant power output than in free space — more, in fact, than a mobile phone's battery is capable of delivering.

OFFICE EMFs

Exposures Can Vary Widely... Despite the proliferation of electronic equipment in the office, EMF levels can still be very low in some settings. Employee concerns about a cancer cluster in a Washington office building led the federal government to commission a study by Dr. Patrick Breysse — who found that average EMF levels were lower than in many homes. Past studies of office environments have found ambient fields as strong as 900 mG and some office workers with average exposures as high as 27 mG (see *MWN,* M/J91 and J/F94). Breysse and colleagues at Johns Hopkins University's school of public health in Baltimore focused their investigation on a six-story building where the Department of Education employs more than 350 people. The team recruited 247 volunteers to wear EMDEX personal exposure meters, which took readings at ten-second intervals throughout the workday. They also measured ambient field levels in each participant's work area and characterized the fields produced by computer monitors, copiers and other office equipment. Full-shift exposures averaged 1.0 mG, Breysse reports in the November issue of *Applied Occupational and Environmental Hygiene (13,* pp.776-781, 1998). More than 65% of the participants had full-shift average exposures below 1.0 mG, and less than 3% had exposures above 2.0 mG. Last spring, Dr. Luciano Zaffanella of Enertech Consultants in Lee, MA, reported in his national assessment for the EMF RAPID program that managers' and professionals' workplace EMF exposures averaged 1.6 mG (see *MWN,* M/J98). In a 1994 study of a group of payroll office workers, Breysse found that exposures averaged 3.2 mG (see *MWN,* J/F94). "Detailed exposure assessments of additional office building environments are needed" to put his latest findings in perspective, Breysse writes.

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PEOPLE

Barbara Klein, who had long served as the media contact at EPRI in Palo Alto, CA, took early retirement at the beginning of 1999. EMF queries will now be handled by **Jackie Turner**....Dr. **Dan Bracken**, a consultant based in Portland, OR, and **Patrick Reilly** of Metatec Associates in Silver Spring, MD, have been elected fellows of the IEEE. Reilly is the author of *Electrical Stimulation and Electropathology*....On February 6, **Leonard Glazer** died of leukemia at 63. He and his late wife, Elsa, both developed the same rare form of the disease. They blamed EMFs from Florida Power & Light Co. lines, but failed to make their case in court (see p.13 and *MWN,* J/F94 and J/A97).

PLANT GROWTH

EMFs as 'Physical Fertilizer'?... According to the Chinese government news agency, Xinhua, scientists in northern China have used EMFs and certain frequencies of visible light to make plants grow faster and larger. A February 1 dispatch from Xinhua stated that exposed plants matured about a week faster than unexposed plants and showed a 20%-30% increase in growth in experiments by Prof. Xu Jingzhi of Hebei University. Specific frequencies of light used "in conjunction with" EMFs and sound waves reportedly caused plants to produce more growth hormone. Xinhua's correspondent in Shijiazhuan provided few details, but cited local government interest in "the promising 'physical fertilizer,' which might possibly replace conventional chemical fertilizers in some areas during the 21st century." In the mid-1990s, a study for the U.S. Navy linked EMF exposure to increased growth in red maple trees, a finding that was later hotly contested (see *MWN,* J/F95 and J/A97).

Keeping Current: Follow-Up on the News

◆ On June 10, Dr. Dimitrios Trichopoulos of the Harvard School of Public Health in Boston will deliver the keynote address at the *32nd Annual Meeting of the Society for Epidemiologic Research* in Baltimore. More information is available on the Web: <www.jheph.edu/pubs/jepi/serdates.htm>.

◆ It's the law — for now. The new regulatory framework introduced on February 1 by the Australian Communications Authority (ACA) gives legal force to the 200 $\mu W/cm^2$ "flat" limit for public RF/MW exposures reaffirmed by Standards Australia last year (see *MWN,* M/J98). But the ACA notes that Standards Australia is "currently reviewing the standard" and may drop it in favor of ICNIRP's less stringent limits.

◆ In a letter to *Occupational Medicine (48,* p.472, 1998), Australia's Dr. Bruce Hocking describes two cases in which women suffered a stroke after using a cellular phone. Hocking noted one of the cases in a paper on symptoms associated with mobile phone use, which appeared in an earlier issue of *Occupational Medicine* (see *MWN,* N/D98).

◆ The GOP's loss is the wireless industry's gain: The CTIA has named Christina Martin, who previously was press secretary to then House Speaker Newt Gingrich, as its new vice president for communications.

◆ Esso, a subsidiary of the oil giant Exxon Corp., announced in January that it will prohibit the use of wireless phones at its gas stations in Finland to ensure that radiation from a phone does not ignite gasoline or gas fumes (see *MWN,* M/J98).

◆ The scientific panel assembled by the Massachusetts Department of Public Health to address concerns about the U.S. Air Force's PAVE PAWS missile defense radar on Cape Cod held its first public meeting on February 16 (see *MWN,* N/D98). For information, contact Kevin Costas at (617) 624-5757.

◆ The court date for the challenge to the FCC's limits for RF/MW exposure, which was slated for mid-January, has been postponed yet again (see *MWN,* N/D97 and N/D98). It is now scheduled for April 5.

As We Go to Press

◆ ◆ On February 11, wireless carrier Nextel Communications Inc. announced that it will sell its cellular towers — some 2,000 sites — to SpectraSite Communications Inc. for 17% of SpectraSite's stock and $560 million. Nextel plans to lease space for its antennas from SpectraSite (see p.2). ◆ ◆

VIEWS ON THE NEWS

The Action Moves to Europe

The U.S. government is getting ready to bury the EMF issue (see p.7) — at the same time that the European Parliament is discussing prudent avoidance measures like ALARA (see p.1). The European Union is also likely to fund important studies on cellular phone safety (see p.2) — studies that the U.S.'s WTR has not carried out in six years, with a budget of over $25 million.

There's no doubt about it. On power line EMFs, on cellular phone safety — the action has moved to Europe. But will Europe avoid the mistakes made in the U.S.? Right now it's hard to say.

The debate in the European Parliament is encouraging: The issue of EMF health effects has been placed in a public health context. In America, it has more often been treated as a battle best left to individuals and their lawyers.

The U.S. is so averse to regulation of business activity that the standard response to an uncertain level of danger to public health is to do nothing. In America, industry is generally given the benefit of the doubt. Unfortunately, this too often means that the public ends up serving as guinea pigs, even when low-cost precautionary measures are available.

The European Parliament holds out the possibility of a better approach. The substantial support for ALARA points to a different relationship between public health, private profit and uncertainty. Europe is at least considering a more intelligent response to an uncertain level of risk: "be careful," rather than "do nothing." Ironically, the idea of prudent avoidance was born in the U.S., at Carnegie Mellon University. But it seems to have taken firmer root across the Atlantic.

Uncertainties about health effects can only be resolved through more research. In the U.S., that research has been badly handled. Research on cellular phone safety, for example, has been left in the hands of industry. The result has been a lot of delay, little science and too much spin.

Unfortunately, Europe does appear to be flirting with one of the worst American errors. Two years ago an EC expert group called for a "fire wall" to prevent industry from influencing "the choice of research studies funded, the conduct or the outcome of such studies" (see *MWN,* M/A97). That is a good description of what is needed — but the idea has now been abandoned.

Instead, it has been left to industry to define what a wireless health research plan should cover. And even though half the funding will be public, corporations might be able to restrict researchers' discussion of results prior to publication. Corporate PR departments could then be guaranteed advance notice of troublesome findings, the better to spin the news.

The phone manufacturers say they do not want industry to influence the course of research. They argue that their research agenda is based on that of the WHO, and point out that a WHO panel is to decide which labs will take part.

But the WHO's EMF project has shown that it is not independent of corporations or the military. After a conference on mobile phone safety in Austria, an industry representative escorted the head of the WHO project, Dr. Michael Repacholi, to a meeting with the press at which he downplayed the concerns raised at the conference (see *MWN,* N/D98). The U.S. military has had too much influence on the WHO project's deliberations (see *MWN,* M/A97 and M/J97). And when Repacholi himself found that mobile phone radiation was linked to an increased cancer risk, he gave the experimental results to his corporate sponsor, Telstra, several months before they were made public (see *MWN,* M/J97 and J/A97).

Concerned about this sort of coziness with vested interests, we urged the EC not to delegate its wireless research effort to the WHO. Repacholi responded that, "WHO has neither the resources nor the desire to run such a program" (see *MWN,* M/A97 and M/J97). But now industry is following the WHO's lead on which studies to conduct, and the WHO will choose the labs to conduct them. True, the WHO is not "running" the program; that has been left to the cellular phone industry itself.

European citizens should be uneasy about this sort of corporate influence over research. When scientists receive public funds, private interests must not be allowed to restrict when or how results can be discussed. In each country and Europe-wide, health officials must define and support their own research agendas on non-ionizing radiation. It should not be left to industry to choose which studies are needed to assure the safety of the public.

The U.S has fumbled the issue of non-ionizing radiation and public health. We hope that Europe finds a better way.

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In the past, we have taken Dr. George Carlo to task for his claim that Wireless Technology Research was "moving at the speed of light" (see *MWN,* M/A98). But on February 18, the *New York Times* reported that a Harvard University physics team has succeeded in slowing light down to a speed of 38 miles per hour. According to the *Times,* the team expects "to slow the pace of light still further, to a glacial 120 feet an hour — about the speed of a tortoise." Thus, Carlo's claim may soon prove to be correct.

Wertheimer Wins BEMS Award

We are pleased to report that Dr. Nancy Wertheimer will receive the d'Arsonval Award, the highest honor of the Bioelectromagnetics Society (BEMS). The presentation will be made at the BEMS annual meeting, to be held in Long Beach, CA, in June. Wertheimer is best known for her 1979 hypothesis linking power line EMFs to childhood cancer. Based in Boulder, CO, she has long collaborated with Ed Leeper.

MICROWAVE NEWS is published bimonthly. • ISSN 0275-6595 • PO Box 1799, Grand Central Station, New York, NY 10163 • (212) 517-2800; Fax: (212) 734-0316; E-mail: <mwn@pobox.com>; Web: <www.microwavenews.com> • Editor and Publisher: Louis Slesin, PhD; Senior Editor: Peter Hogness; Associate Editor: Douglas Barnes, PhD; Copy Editors: Jim Feldman, Roy Thomas Jr.; Intern: Robin Marcus; Circulation Associate: Diana Cooper • Subscriptions: $325.00 per year ($350.00 Canada & Foreign, U.S. funds only); Single copies: $60.00 • Copyright © 1999 by Louis Slesin • Reproduction is forbidden without written permission.

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MICROWAVES IN MOSCOW

At its August 26, 1980 meeting, the Electromagnetic Radiation Management Advisory Council (ERMAC) concluded that an investigation, such as the formal study of the health of Americans exposed to microwave radiation in the U.S. embassy in Moscow, would be pointless. Without dissent, members of ERMAC agreed that, based on current knowledge, there are no scientific or theoretical grounds to predict potential health impacts of the Moscow signal.

A consequence of the ERMAC finding may well be that the State Department will do no further epidemiological research on the 1,827 employees who worked at the embassy during the 22 year period when the Russians irradiated the upper floors with low levels of mostly continuous and some pulsed microwaves. As Stephen Cleary of Virginia Commonwealth University, an ERMAC member, explained, the sample population is too small and the dose too low for anything but a grave risk to show up, and therefore any money allocated to such research could be better spent elsewhere. One ERMAC member went so far as to say that he would not hesitate to expose himself or his family to those levels of microwaves found in the embassy.

ERMAC is an advisory committee to the Administrator of the National Telecommunications and Information Administration, Mr. Henry Geller.

(continued p. 7)

ANSI News

Meeting Scheduled

There will be a meeting of the C95 Committee on Radio Frequency Radiation Hazards of the American National Standards Institute (ANSI) on Thursday, February 26, 1981 at the ANSI headquarters in New York City (1430 Broadway). The main purpose of the meeting is to seek final approval of the new subcommittee IV standard on radiofrequency and microwave safety levels. Other business will include the new standards on measurements (subcommittee I) and hazard signs (subcommittee II/III).

Standard Nears Completion

The ANSI safety standard went out for C95 Committee vote last July. Although the standard was accepted by a majority vote of the Committee three important organizations withheld their approval: the Bureau of Radiological Health, the Environmental Protection Agency, and the Electronic Industries Association.

At a meeting in Bethesda in late October, the subcommittee was able to satisfy BRH objections and it is now very likely that the Bureau will cast a positive vote on the new standard. While an attempt was also made to win EIA's approval, it is not yet clear how EIA will vote. Apparently EPA does not intend to vote at all.

Microwave News will present an in-depth look at the new ANSI standard in a forthcoming issue.

GOVERNMENT

CONGRESS

The Congressional Research Service of the Library of Congress has updated its issue brief on "Radiation Health and Safety Issues of Congressional Interests." The brief written by Christopher Dodge of the Science Policy Research Division covers both ionizing and non-ionizing radiation and includes a listing of legislative authorities, federal regulatory authorities, pending legislation, hearings, and a chronology of events. (Brief Number IB77062, October 23, 1980.)

AGENCIES

Air Force

The Air Force wants to develop new and improve existing hardening techniques for its systems exposed to a nuclear electromagnetic pulse (EMP). See *Commerce Business Daily*, November 7, 1980.

Bureau of Radiological Health (FDA)

BRH promulgated a final rule amending the performance standard for microwave ovens in the *Federal Register* on November 28, 1980 (45 *FR* 79028). The rule, which becomes effective on November 30, 1981, deletes the error limit and effective aperture requirements for instruments used to detect leaks from microwave ovens.

The rule was on the agenda of the Technical Electronic Product Radiation Safety Standard Committee (TEPRSSC) meeting held on December 3-4 in Washington.

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BRH proposed a performance standard for microwave diathermy products in the July 29, 1980, *Federal Register* (45 *FR* 50359). A summary of the comments on the standard submitted to BRH will appear in our February issue.

Department of Commerce

The Commerce Department ruled in early December that the Toshiba Corporation of Japan sold countertop microwave ovens at prices so low that they were unfair and violated the Tariff Act. The case has been forwarded to the US International Trade Commission, which will determine whether Toshiba ovens injured domestic production. If the ITC makes such a finding, penalty duties will be assessed.

According to the December 3 *Federal Register* (45 *FR* 80157) notice, ovens made by the Matsushita Electric Industrial Company, the Sanyo Electric Company, and the Sharp Corporation were not dumped in the American market. The four companies accounted for 98% of the 740,000 ovens imported into the United States from Japan in 1979 at a value of $149 million.

Environmental Protection Agency

EPA sponsored a workshop on RF measurements in Las Vegas last November 3-5. Thirty government officials and a limited number of outsiders held intensive discussions on the current status of measuring electromagnetic fields. According to Richard Tell of EPA, the workshop organizer, "This was the first time all the instrumentation experts from the government were in the same room at the same time."

The participants agreed to two sets of recommendations:

1. That a group, such as the American National Standards Institute (ANSI), should set the following standards for broad band RF survey instruments: a) minimum, uniform reporting requirements of performance characteristics for existing instruments; b) minimum testing procedures for evaluating instrument performance; and c) performance characteristics for future instruments.

2. That standardized measurement techniques be developed based on: a) existing instrumentation, b) applicable safety standards, and c) specific exposure situations.

The second set of recommendations arose from the lack of uniformity in the way measurements are taken.

The recommendations will be published at a later time, though the form of publication has yet to be decided, perhaps an EPA technical report or a journal article.

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The Nonionizing Radiation Surveillance Branch of EPA is providing all the Agency's regional offices with a new Holaday electric field probe to permit local surveys of radiofrequency levels. According to Branch Chief, Dave Janes, "We are providing only the training and equipment, the time and resources devoted to this are up to each individual regional office."

EPA is also buying higher frequency probes: one of five or six Narda probes will be lent to a regional office when requested as soon as they are delivered by the manufacturer. A single field intensity meter and associated antennas which can identify the frequency of a particular source will also be available for loan. A four day training course for regional personnel was held by EPA in mid-December in Las Vegas.

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Department of Energy

The DOE's Office of Electric Energy Systems held its annual contractors review meeting on the biological effects of electric fields from overhead transmission lines in Washington DC last November 18-19. Researchers from about a dozen on-going projects in the multi-million dollar program reviewed their progress.

The DOE program is now focused on AC work, but in the years ahead the emphasis will change to DC lines.

For a copy of the abstracts presented at the November meeting contact: Mr. Alec O. Bulawka, US DOE/EES, Mail Stop 3344, 12th and Pennsylvania Avenue, NW, Washington DC 20461, (202) 633-8638.

Federal Communications Commission

At the end of January, the FCC will issue a statement in response to the comments received on its 1979 Notice of Inquiry (NOI) [44 *FR* 37008, June 25, 1979] concerning the biological effects of radiofrequency radiation.

The FCC has decided not to issue any interim radiation standards, according to Robert Cleveland of the Commission's Technical Planning Staff. But the FCC will participate in the rulemaking proceedings of other agencies on RF issues. The statement will include a summary of the some 25 comments submitted to the FCC in response to the NOI.

Cleveland said that the FCC issued the NOI to meet its duties to promote safety under the Communications Act, and to satisfy its responsibilities under the National Environmental Policy Act.

National Cancer Institute

NCI has issued a request for proposals for the synthesis and evaluation of radiosensitizers, chemicals which selectively sensitize hypoxic (oxygen deficient) tumor cells to radio-therapy. A three year project is planned. RFP NCI-CM-17485 is available from Maria Decker, NCI, Treatment Contracts Section, Blair Building, Room 228, NIH, Bethesda, MD 20205.

National Institute for Occupational Safety and Health

The schedule for the NIOSH criteria document on radiofrequency and microwave (RF/MW) radiation is still slipping. Drafts of the document were released in 1979, but were withdrawn due to unfavorable reviews. NIOSH is now aiming for a substantially shorter document, one that is less encyclopedic with more critical analysis. NIOSH's consultants are in the process of evaluating the RF/MW biological data. This phase of the operation is going slowly, and the agency cannot proceed until it is completed. A review draft may be finished by the spring.

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The NIOSH procurement office in Cincinnati has issued a request for quotation [RFQ 81-12; November 14, 1980] for the writing of two television scripts on the health risks associated with Video Display Terminals (VDT's).

NIOSH, BRH, OSHA

A team from NIOSH, BRH and OSHA is developing a bulletin on control technologies for dielectric heaters, including RF sealers.

Preliminary tests indicate that shielding can have a significant effect on both the magnitude and direction of the impinging field. The team is not yet ready to make firm recommendations on control technologies.

The joint bulletin is due to be out in late Spring.

National Telecommunications and Information Agency

The Electromagnetic Radiation Management Advisory Council (ERMAC), the advisory committee to NTIA, is anticipating holding a meeting at the end of January or early February in Washington.

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The BENER Task Force report, "Nonionizing Electromagnetic Radiation Safety: A Program of Coordinated Federal Activities Related to Biological Effects of Nonionizing Electromagnetic Radiation (0-300 GHz)," was published last summer, but has yet to receive any official attention.

Dr. Howard Clark of the National Bureau of Standards who served as the Task Force chairman hoped that the report would provide "a frame of reference for examination of the various agency programs and budgets that relate to the coordinated federal BENER program," and would be "useful to federal agencies in planning or describing their individual activities as related to a common goal."

The Task Force was set up by Henry Geller, the Administrator of NTIA at the request of Dr. Frank Press, the President's science advisor. Nevertheless, the report has not been officially forwarded to Press, nor does it seem to be a planning tool of the individual agencies involved in bioeffects research.

Occupational Safety and Health Administration

Bob Curtis of OSHA's Salt Lake City office organized a training session for two members of each of OHSA's ten regional offices to teach them how to measure radiofrequency and microwave radiation levels in the workplace. As a result of the December 3-4 sessions, held in Salt Lake City, workers will have a greater opportunity to check their on-the-job exposures to non-ionizing radiation.

Helping Curtis were Michael Larsen and Alfred Owyand of OSHA and Edward Aslan of Narda.

Radiation Policy Council

The US Radiation Policy Council, the interagency group created by the President in February 1980, has issued its "Progress Report and Preliminary 1981-1983 Agenda." (No. RPC-80-001, September 30, 1980).

The Report concentrates on ionizing radiation to the virtual exclusion of non-ionizing radiation. Beyond intending to grapple with general radiation policy which may (or may not) spill over

(continued p. 4)

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BIOLOGICAL RESEARCH

Frey Reworks BBB Data

Allan Frey of Randomline Inc. believes he has resolved some of the contradictions in the experimental results of the blood brain barrier (BBB) research. Writing in the November 1980 issue of the *Bioelectromagnetics Society Newsletter*, Frey argues that the use of inappropriate statistical analysis explains why many researchers erroneously concluded that microwaves do not change the permeability of the BBB.

At least three teams of researchers, including one led by Frey himself, have shown that microwaves can cause certain dyes to pass through the BBB into the brain. In one of the most significant studies, Oscar and Hawkins discovered that pulsed 1.3 GHz radiation could change the permeability of the BBB at average power densities of only 0.03 mW/cm² (*Brain Research, 126*, 281, 1977).

However, three groups of scientists cast doubt on these results by reporting no microwave effects on the BBB for various exposure conditions. Frey has taken the published data of two of the groups, and, by applying what he thinks are more appropriate statistical tests, found that the opposite conclusions hold: they demonstrate increased permeability. One set of results by Merritt *et al.* now supports Frey's original paper, and another by Preston *et al.* confirms Oscar and Hawkins' work. Frey also speculates that the third group, Spackman *et al.*, may have also used inappropriate statistical analyses and a faulty experimental design.

As Frey concludes: "The supposed conflicting and controversial data actually are quite consistent and indicate that something is happening in the brain under low intensity microwave energy exposure."

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New Review Article

Richard Lerner has published a comprehensive review of current research on health effects of non-ionizing radiation, with special emphasis on low-level effects, in the December 1980 issue of *IEEE Spectrum*: "RF Radiation: Biological Effects." The article also details some of the controversy surrounding the new ANSI standard.

EPA Funds Teratological Study

The Environmental Protection Agency's Health Research Laboratory has awarded Dr. Mary Ellen O'Connor and Dr. Robert Strattan of the University of Tulsa a contract to study the teratological effects of microwave radiation.

The two-year, $230,377 study will consist of exposing mice *in utero* throughout the gestation period with 2450 MHz continuous wave radiation. The irradiation will stop after they are born. The experiment will begin with exposures to power levels of 30 mW/cm²; the levels will decrease to 10, 1, and 0.1 mW/cm² until no effects are observed. The mice will be monitored for fetal weight and developmental abnormalities.

Dr. O'Connor is with the Department of Psychology and Dr. Strattan is with the Electrical Engineering Department.

New Idea about Cataract Formation

A new explanation for cataract formation has been developed by a group of physiologists at Rush University in Chicago (*Science, 209*, 1007, August 29, 1980). The group has rejected the view that the lens of the eye is a homogeneous mass. Instead, based on a combination of biophysical techniques and mathematical models, the scientists have proposed that the interior cells of the lens have imperbeable membranes that block the entry of small ions. These fibrous cells can stop the flow of sodium and water into the lens' interior, thereby preserving its volume and transparency.

Microwave Hearing

How do people hear pulsed microwaves? The mechanism for the perceived buzzing or clicking sound is still a mystery; various hypotheses continue to be proposed, rejected, and defended. In a tart exchange of views in *Science* (*209*, 1143, 5 September 1980), two opposing camps reaffirmed their positions. One group led by C.K. Chou of the University of Washington Medical School maintains that hearing results from a tiny pressure wave in the head when the radiation pulse is converted to thermal energy. Allan Frey and Elaine Coren of Randomline, Inc. continue to offer the hypothesis that microwave hearing is the result of the thermoacoustic expansion within the cochlea, the small snail-shaped region of the inner ear.

GOVERNMENT *(continued from p. 3)*

to the non-ionizing portion of the spectrum, the RPC agenda promises little attention to microwave, radiofrequency, or ELF radiation.

Included in the report are summaries of the RPC public meetings held across the country during 1980, and the public comments submitted to the Council.

Three of the public comments address non-ionizing radiation:

- AFL-CIO, Food and Beverage Trades Department: strengthen occupational exposure standards for microwave and radiofrequency radiation from microwave ovens and sealing equipment, and radiation emanating from video display terminals. (p. E-12)
- Natural Resources Defense Council: Examine both ionizing and non-ionizing radiation since many of the problems that have hindered past work on ionizing radiation are also obstacles in the study of non-ionizing radiation. (p. E-4)
- Raytheon Corporation: Encourage EPA to develop a mandatory Federal standard on exposure of the general public to non-ionizing radiation or recommend a definition of current consensus standards (ANSI C95) by Congress as a mandatory national standard until formal Federal standards are developed. Ensure active participation by federal agencies in legitimate efforts of public education in the area of non-ionizing radiation. (p. E-8)

If you want to be on the RPC mailing list, write to: US Radiation Policy Council, Room 3026, New Executive Office Building, 726 Jackson Place, NW, Washington, DC 20503.

RF Radiation, A New Tool in Cancer Treatment

Radiofrequency radiation is a promising weapon against cancer, according to a December 1980 *IEEE Spectrum* article. "RF Therapy for Malignancy" explains how this treatment works and describes equipment design and function, tissue models used in research, and various hyperthermia methods.

Radiofrequency induced heating of tissue (42 to 43.5°C) is used alone or in conjunction with radiation (ionizing) therapy or chemotherapy to treat malignancies. A range of frequencies is used; higher ones—up to 2450 MHz—are easier to focus than the lower frequencies which can penetrate more deeply into the body. Because solid tumors generally have poor blood circulation, a tumor can be selectively heated without significantly increasing the temperature of surrounding, healthy tissue. The authors state that for localized treatment, there are no serious side effects from radiofrequency hyperthermia.

VDT's

The *Columbia Journalism Review* will feature a story on VDT's in the newsroom in its January-February issue. The article looks at both the health hazards associated with the machines and the reporting of this story by the press.

Electrotherapy Controversy

New York Magazine, in a two-part article that ran November 23 and December 1, detailed the controversy over the use of low-level electricity for bone healing.

The story began as a profile of Arthur Pilla, a chemical engineer at Columbia University. Pilla, who claimed to have played a major role in developing the electrical technology to treat fractures that previously would not heal, piqued the reporter's interest by claiming that the device was now being tested for its efficacy in treating cancer and that human applications could start within the year.

Dr. Andrew Bassett, a doctor at Columbia's medical school, cautioned that Pilla was overstating the prospects and further, downgraded Pilla's contributions in their research.

Bassett had worked with Dr. Robert Becker, then at the VA Hospital in Syracuse, New York, to show that stress applied to any bone is translated into electricity. Bassett's later cooperation with Pilla resulted in a practical, non-invasive electrical coil device, which Pilla and another colleague patented. They all formed a private corporation, Electro-Biology, Inc. of Fairfield, New Jersey with the financial backing of Wall Street entrepreneurs.

Zimmer-USA, Inc. and Telectronics Proprietary Ltd. offer other bone-growth stimulators, although Electro-Biology's is the only one which does not require implanting an electrode under the skin.

Dr. Bassett received more than $1 million in government grants in the course of his research. The writer, Lally Weymouth, raised questions about transferring medical research paid for by public funds to profit-making private companies. She noted that the government gets a share of Zimmer-USA royalties because its product was underwritten by the Navy.

New Reports

Two major studies of the Department of Energy's SPS system are nearing completion. Each will contain an analysis of the impact of microwave radiation on human health and the environment.

One study by the National Research Council (NRC) is due to be completed by the end of June 1981, with a draft report by early January 1981. The other by the Congressional Office of Technology Assessment (OTA) was due to be published by the end of January 1981, but is running late.

NRC

The Environmental Studies Board (ESB) of the NRC appointed a Committee on Satellite Power Systems to provide an independent review of DOE's assessment of the SPS concept. Towards this end, the ESB organized a "Workshop on Mechanisms Underlying Effects of Long-term, Low-level, 2450 MHz Radiation on People." A workshop summary, prepared by Christopher Dodge of the Science Policy Research Division of the Library of Congress, was released last fall. (See box for conclusions of workshop participants.)

OTA

The two-year OTA project was requested by the House Committee on Science and Technology. The completed study will compare the impacts of beaming energy from collecting satellites by lasers, microwaves, and reflected light. With respect to microwaves, the study will look at both the DOE reference system and a solid state system which would use lower power densities and smaller rectenna sites.

SRI

Last summer, SRI International completed a study for the Environmental Protection Agency, "An Assessment of the Potential Impact of Microwave Radiation from a Solar Power Satellite." This then became the basis for a chapter in the DOE report, "Environmental Assessment of the Satellite Power System (SPS) Concept Development and Evaluation Program (CDEP)," prepared by Anthony Valentino of Argonne National Laboratory (No. DOE/ER-0069, August 1980).

CONCLUSIONS OF SPS-NRC WORKSHOP

A. There are relatively little microwave health and bioeffects data available of direct relevance to the radiation parameters of the proposed SPS. What data are available are difficult to evaluate in terms of a potential health impact of the SPS.

B. There is no presumptive evidence in the data available that exposure of the general public to 0.1 mW/cm² or lower at the frequency of 2450 MHz generated by the SPS will result in any health decrements. However, because a number of functional phenomena of known significance have been reported in response to exposure to low-intensity microwaves, further research and evaluation...is necessary in order to decrease present uncertainties about potential low-level microwave health effects.

Georgia Power Challenged on Microwaves

A group of 27 residents of rural Clayton, Georgia, have filed suit in county court to prevent Georgia Power Company from erecting a 180-foot microwave tower on top of nearby Screamer Mountain. Citizens Against Microwaves, led by homeowner David Kraft, brought the case in September, shortly after the Rabun County Commission approved the tower in a 2-1 vote before a packed hearing room.

The suit, which names the power company and the two county commissioners who approved the tower, charges that allowing Georgia Power to build on land seized by the county for nonpayment of taxes is a violation of covenant, will create a health hazard and constitutes an improper disposal of county property. *Atlanta Weekly*, the Sunday magazine of the *Atlanta Constitution*, ran a long article on the controversy in its November 23, 1980 issue.

HBO Cancels Out

In late November, Home Box Office (HBO), Time-Life's subscription TV network, withdrew its application to build a satellite communications complex in Rockaway Township, New Jersey.

The HBO proposal was under intense scrutiny by the Rockaway Board of Adjustment which had to grant a variance before construction could begin. The Concerned Citizens' Committee of Rockaway Township was formed to oppose the HBO proposal. The Committee was worried about the siting of a major source of microwave radiation in a residential area, only 1000 feet from a neighborhood school. The Board had held 16 hearings since last spring, and another 30 were scheduled.

Edward Horowitz, HBO vice-president of studio and network operations, explained that while "the local Board was responsive and HBO was overcoming the local opposition, we could not afford the delay."

The cancellation will not hurt HBO's immediate programming. The Rockaway site would have provided the pay TV system with added flexibility. As for a new site, Horowitz said that HBO will look for suitable areas across the country: "The primary interest is in the New York-New Jersey Metropolitan area, but once away from here, it doesn't really matter where you go."

California OSHA

California's Occupational Safety and Health Standards Board has proposed a substitution in the State's General Industry Safety Orders on non-ionizing radiation. The standard remains at 10 mW/cm^2; the purpose of the change is to make it more enforceable. Cal OSHA held a public hearing on the proposal on November 19, 1980.

Dr. Daniel Cahill of the Environmental Protection Agency's Health Effects Research Laboratory in Research Triangle Park, North Carolina, has been awarded the Public Health Service Commendation Medal. Dr. Cahill, the Director of the Lab's Division of Experimental Biology was cited for: "Outstanding research and research management in the areas of ionizing and non-ionizing radiation health effects in the environment."

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Mays Swicord, Chief of the Electromagnetics Branch at the Bureau of Radiological Health, was awarded his doctorate last month from the Electrical Engineering Department at the University of Maryland. He completed the thesis: "Studies of Microwave Absorption in Liquids by Optical Heterodyne Detection of Thermally Induced Refractive Index Fluctuations" in November. The objective of the research was to develop a spectroscopic method, flow spectroscopy, to look at microwave absorption of specific molecules. Swicord investigated DNA and found enhanced absorption as predicted by E.W. Prohofsky of Purdue University.

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COMAR wants to make a movie about microwaves. **John Osepchuk** of the Raytheon Corporation and **Don Justesen** of the VA Medical Center in Kansas City, two active members of the Institute of Electrical and Electronics Engineers' (IEEE) Committee on Man and Radiation (COMAR), are exploring the idea of producing a 30-minute film on non-ionizing radiation for public television. The project is in its early stages of development and must still be approved by the IEEE. Once the go ahead is given, Dr. Osepchuk estimates that it will take a year and a half to complete.

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Over a hundred colleagues and friends of Professor **Herman Schwan** gathered at the University of Pennsylvania in Philadelphia last November 24-25, to wish him a happy 65th birthday.

Those who attended the two-day *Festschrift*, "The Interaction of Acoustical and Electromagnetic Fields with Biological Systems," funded by the Office of Naval Research, heard twenty presentations. The proceedings will be published in a special issue of *Bioelectromagnetics*, the Journal of the Bioelectromagnetics Society.

Professor Schwan is currently on sabbatical at the Max Planck Institute of Biophysics in Frankfurt, Germany.

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A profile of **Dr. Andrew Marino** of the Veterans Administration hospital in Syracuse, New York, "Law with a Spark," appeared in the September 29, 1980 issue of the *National Law Journal*. Marino, who is both a biophysicist and an attorney, does research on the bioeffects of ELF and at the same time is participating in various cases involving high voltage transmission lines. The article was written by Jill Jonnes.

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MOSCOW *(continued from p. 1)*

Follow-Up Studies

If the State Department decides to discontinue formal follow-up studies of Moscow employees, the decision would be at odds with the earlier advice of Professor Abraham Lilienfeld of Johns Hopkins University who completed an epidemiology of the Moscow employees in 1978, and of the Senate Commerce Committee. Both urged the State Department to pursue the health studies.

Dr. Herbert Pollack, a medical consultant to the State Department, did say, however, that he and Dr. Charles Brodine were continuing to monitor those employees present during the period of maximum exposure (May 1975-February 1976). "We have a complete roster of all those exposed, and every time they get a medical check up, one of us reviews their complete medical history," Pollack emphasized.

"a follow-up would buy a sense of security."
— Lilienfeld

In a recent interview, Professor Lilienfeld agreed that from a scientific point of view he would not expect to see any deleterious effects at such low doses. But from a political and personal point of view, he felt that continued examinations would be a "prudent thing to do." "It's a matter of judgment," he said, "a follow-up would buy a sense of security." Professor Lilienfeld pointed out that the major costs had already been spent and future surveys would be comparatively cheap.

The ERMAC advice could have some effect on pending claims by former embassy workers. John Parker Hills, an attorney who is handling four claims, said that up to now the State Department has been basically "ignoring" him. Hills has two claims before the Workmen's Compensation Board and two before the State Department, one of which is a class action on behalf of all women irradiated in Moscow. According to Justice Department and Veterans Administration spokesmen, neither agency has any Moscow-related claims pending.

ERMAC took up the question of a follow-up to the 1978 epidemiology at the request of the State Department, which paid the expenses for the ERMAC meeting. In a January 16, 1980 letter to Henry Geller, the State Department asked whether there was any basis for continued study. Mr. Geller referred the matter to ERMAC. According to Pollack, the State Department is waiting for the ERMAC recommendation before responding to any Moscow claims.

Before debating the merits of a follow-up investigation, ERMAC heard R.C. Mallalieu of Johns Hopkins University's Applied Physics Laboratory describe the results of his attempt to reconstruct the radiation levels on the upper floors of the embassy. According to Mallalieu's report ("A Model of the Microwave Intensity Distribution Within the US Embassy in Moscow, 1966 to 1977," No. FS-80-166, JHU-APL, August 1980), the most intense microwave exposures occurred between May 1975 and February 1976, with average levels of continuous wave radiation of 3.5 to 5.0 uW/cm² and average peak intensities due to multiple reflections of 7 to 10 uW/cm². The largest recorded power density was 24 uW/cm². From 1966 to 1975, the average signal strengths for those rooms with the greatest exposure was about 1.5 uW/cm² with maximum levels of 4 uW/cm², though there were transient peaks of as high as 20 uW/cm². Areas more distant from the radiation sources had microwave levels of less than 0.1 uW/cm². In February 1976, protective shielding was installed which reduced all exposures to 0.1 uW/cm² or less. Based on these data, the State Department has estimated that over a 22 year period, about 240 employees were exposed to average power levels of about 1.5 uW/cm² for about 2 hours during the workday. ("Exposure of Model Personnel," State Department, August 26, 1980.)

Lilienfeld Study

The Lilienfeld epidemiology failed to identify any major differences in either mortality or morbidity between Moscow embassy personnel and a comparative population working in other embassies in Eastern Europe. Lilienfeld had only minimal information on the signal strength inside the embassy building, though he did know that the maximum exposure took place during the nine months ending in February 1976. The radiation surveys were classified until after his study was released. Since only a short time has elapsed between the period of maximum exposure and his study, Lilienfeld recommended that "it would seem desirable that this particular study population should be contacted at periodic intervals, of 2 to 3 years, within the next several years, in order to ascertain if any health effects would appear." He went on: "it would be important to develop a surveillance system for deaths in the entire study population to be certain that no mortality differences occur in the future and to monitor the proportion of deaths due to malignancies, especially among the women."

"every time they get a medical check up, one of us reviews their complete medical history," — Pollack

In an April 1979 report, the Senate Committee on Commerce, Science and Transportation "urged" that the State Department pursue this Lilienfeld recommendation, especially for those people exposed between June 1975 and February 1976. ("Microwave Irradiation of the U.S. Embassy in Moscow") The Committee noted that its recommendation reflected a "precautionary attitude."

A subcommittee made of Dr. Marylou Ingram (chairwoman), Professor Cleary, Professor Mary Ellen O'Connor and George Wilkening wrote up the ERMAC recommendations, which are now circulating among the full ERMAC membership. A statement is expected to be released in January.

CONFERENCES

NEWS

BEMS

More than 300 people attended the second annual meeting of the Bioelectromagnetics Society in San Antonio, Texas, last September. Some 160 papers were presented providing a rich blend of new research findings and open discussion.

In the months ahead, *Microwave News* will feature a series of articles on some of the important topics covered in San Antonio. The first in this series, "Microwave-Drug Synergy," will appear next month. Later, we will run a piece on Professor A.W. Guy's long-term experiment which began last fall at the University of Washington in Seattle.

VDT's

A one day conference on "Health Hazards of VDU's" was held at the Human Sciences and Advanced Technology Research Group, Department of Human Sciences, Loughborough University in Leicestershire, England on December 11, 1980. (VDU is the European equivalent of our VDT.) Among the papers presented were two reports of skin rashes among VDT operators in England and Norway.

IMPI

The International Microwave Power Institute (IMPI) held a symposium on "The Washington Impact: How It Affects Microwave Users" on November 13-14, 1980. A host of government officials briefed the more than two dozen attendees on what the government agencies are doing.

The proceedings of the symposium will be available from IMPI for $40.00 for members and $50.00 for non-members. Order from: IMPI, 211 East 43rd Street, New York, NY 10017.

PROCEEDINGS

Now Available:

Proceedings of a Workshop on Thermal Physiology, held in Rockville, Maryland, March 29, 1979. Edited by Dr. T. Whit Athey, Bureau of Radiological Health, sponsored by the Radiofrequency and Microwave Committee of the Interagency Regulatory Liason Group. Dated March 1980. Available from BRH, Rockville, MD 20857.

Non-Ionizing Radiation, Proceedings of a Topical Symposium held in Washington D.C., November 26-28, 1979, sponsored by the American Conference of Governmental Industrial Hygienists. Order from: ACGIH, P.O. Box 1937, Cincinnati, OH 45201.

Proceedings of the International Symposium, *Electromagnetic Waves and Biology,* held in Jouy en Josas (outside Paris) France, June 30-July 4, 1980. Send $40.00 to Dr. A.J. Bertaud, CNRS, 2 rue H. Dunant, 94329 Thiais, France.

CALENDAR

• January 12-16: *National Radio Science Meeting,* University of Colorado, Boulder, CO. Sponsored by the US National Committee of IEEE Societies. Contact: Center for Conferences and Management/Technical Programs, 970 Aurora Avenue, University of Colorado, Boulder, CO 80302.

• February 16-17: *Treatment of Cancer by Radiofrequency and Microwave Thermotherapy,* Princess Kaiulani Hotel, Honolulu, HI. A short course arranged by the Bioelectromagnetics Corporation of Rockville, MD. Fee: $495. Contact: Dr. S.S. Stuchly, Department of Electrical Engineering, University of Ottawa, Ottawa, Canada K1N6N5.

• April 13-15: Annual *Conference and Trade Show of the International Association of Satellite Users,* Washington Hilton Hotel, Washington DC ($95 IASU Members; $195 Others). Contact: A. Fred Dassler, IASU, 6845 Elm Street, Suite 710, McLean, VA 22101.

• June 9-12: 16th Annual *Symposium of the International Microwave Power Institute,* Royal York Hotel, Toronto, Canada. Contact: IMPI, 211 East 43rd Street, New York, NY 10017.

• June 15-19: *IEEE and URSI Symposium,* Bonaventure Hotel, Los Angeles, CA. Sponsored by the Antenna and Propagation Society and the Microwave Theory and Techniques Society of the IEEE and four Commissions of URSI. Contact: IEEE, 245 East 47th Street, New York, NY 10017.

• June 30-July 4: *International Symposium on Biomedical Thermology,* Palais de la Musique et des Congres, Strasbourg, France. Includes sessions on hyperthermia in cancer treatment (July 3) and bioelectromagnetics (July 1). Simultaneous translation in English, French, and German. Contact: Dr. M. Gautherie, Laboratoire de Thermologie Biomedicale, Faculte de Medicine, Universite Louis Pasteur, 11 rue Humann, 67085 Strasbourg, France.

• August 10-12: 3rd Annual *Bioelectromagnetics Society Meeting,* Washington DC. Contact: BEMS, P.O. Box 3651, Arlington, VA 22203.

• August 10-19: 20th *General Assembly of the International Union of Radio Science (URSI),* Hyatt Regency Hotel, Washington DC Includes a series on "Interaction of Electromagnetic Waves with Biological Systems," on August 13-14, chaired by Professor Saul Rosenthal of Polytechnic Institute of New York, and an "Open Symposium on Millimeter and Submillimeter Waves." Contact: Mr. Richard Y. Dow, Organizing Committee of URSI General General Assembly, National Academy of Sciences. 2101 Constitution Avenue, NW, Washington DC 20418.

• August 19-21: 3rd Annual *Satellite Communications Users Conference,* Regency Inn, Denver, CO ($145 pre-paid; $195 at the door). Contact: SCUC '81. Satellite Communications Magazine, 3900 S. Wadsworth Blvd, Denver, CO 80235.

MICRO WAVE NEWS

Vol. I No. 6 A Monthly Report on Non-Ionizing Radiation June 1981

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Microwave News is changing its publication schedule and will now appear ten times a year, monthly except for January and July. This year, Volume I will consist of eleven issues; next year, Volume II will have ten.

All current six-month and annual subscribers will have their subscriptions extended by one and two months respectively to reflect our initial commitment to a twelve issue year.

New orders received by June 15, 1981 will still be based on the twelve issue year; subsequent orders will follow the new schedule. The domestic and foreign subscription prices remain unchanged.

As a special offer to our current subscribers, we will accept renewals according to the old schedule (12 issues—14 months and 6 issues— 7 months) through the end of July. Beginning in August, the new rates will apply to all subscribers.

Our next issue will appear in mid-August.

We have recently computerized our mailing list. We ask our subscribers to check their mailing labels and inform us of any errors.

CHINA ADOPTS 50 uW STANDARD BASED, IN PART, ON U.S. STUDIES

Chinese microwave experts will soon recommend the promulgation of the provisional 50 uW/cm² occupational standard as the formal non-ionizing radiation standard for the People's Republic of China, according to Allan Frey of Randomline, Inc. in Huntingdon Valley, PA. The 50 uW/cm² standard is based, in part, on the published US literature, Frey told *Microwave News* in a telephone interview soon after his return from China.

Some 80 Chinese research scientists and representatives of civilian and military users met to discuss the standard at a national conference held in Hangchow the week of April 20.

The Chinese standard, which is not frequency dependent, stands in sharp contrast to the current NIOSH, ANSI and ACGIH proposals. These proposals are a factor of 20 less restrictive at the most stringently regulated frequencies—in the 30–300 MHz range—and 100 times weaker at the higher GHz frequencies. The Chinese standard is similar to the 50 uW/cm² population stan-

(continued p. 7)

SUBCOMMITTEE FINDS RF SEALERS HAZARDOUS, CASE AGAINST VDTS STILL UNCERTAIN

Some 30 experts from government, labor and business tried to sort out the potential hazards associated with VDTs and RF sealers at congressional hearings held May 12-13. At their conclusion, there was a general consensus that RF heaters and sealers present a serious health risk to their operators. Radiation from VDTs was deemed less hazardous, though a number of important questions remain unanswered.

After the hearing, Albert Gore, Jr. (D-TN), the chairman of the Subcommittee on Investigations and Oversight of the House Committee on Science and Technology, said: "We believe that there are serious problems associated with RF sealers and heaters, and plan to vigorously pursue research and standards with the appropriate agencies." With respect to VDTs, he said, "The preponderance of evidence suggests that VDTs are safe, but we will encourage the Bureau of Radiological Health to set appropriate standards for VDTs and do more research on low frequency effects."

VDTs: More Research Needed?

An overflow crowd jammed the room to hear about the radiation emissions from VDTs, their health effects, and their possible regulation. Armed with his Bureau's recent report, *An Evaluation of Radiation Emissions from Video*

(continued p. 2)

GORE SUBCOMMITTEE HEARINGS

(continued from p. 1)

Display Terminals (see *MWN,* May 1981), John Villforth, the BRH director, told the subcommittee that VDTs "do not pose a significant radiation hazard to persons who operate them," and that BRH is not "currently planning a regulatory standard for [VDT] radiation."

Ophthalmologist Dr. Milton Zaret, of Scarsdale, NY, offered a different view. In a slide presentation, he showed the subcommittee examples of what he believed to be radiant energy cataracts caused by VDTs. In his prepared statement, Zaret called BRH's conclusion that there were no significant health effects from 15 to 125 kHz radiation "unwarranted."

There was considerable debate over the merits of an epidemiology of VDT operators. Representatives of the Newspaper Guild urged a "fullfledged government-funded study, unhampered by financial limitations...to determine whether VDT operators are developing cataracts or other health damage attributable to radiation."

Dr. Vilma Hunt of EPA's Office of Health Research expressed skepticism that a suitable study population could be identified. And John Rankine of IBM said that, through a "combination of conservative safety criteria, careful design—which incorporates numerous fail-safe features—rigid design testing, manufacturing checks, and company-sponsored research," he was sure VDTs do not present a radiation hazard.

Sealers: A "Shocking" Situation

The sharpest exchanges came the second day when there were smaller crowds and no TV cameras. After hearing how little enforcement is going on at RF sealer work sites, freshman Congressman Bob Shamansky (D-OH) said that he was "almost flabbergasted" by the situation and that it was "frankly shocking."

Earlier, when Gore found out that NIOSH intended to cut off funding for a long-planned epidemiology of RF sealer workers, he responded, "It's an outrage." Now, however, due to the congressional interest, NIOSH officials are planning to reinstate the funds for the study, according to knowledgeable sources.

In one of the most forceful presentations, Dr. Joseph Lary, a research biologist at NIOSH, told the subcommittee, "It is apparent that many sealer/heater operators are being exposed to hazardous levels of RF energy," and said that the OSHA standard "must be reexamined to assure that sufficient protection is afforded the worker." At one point Lary told Gore he would not want his wife exposed to RF sealer radiation.

But on the basis of the NIOSH and OSHA testimony, it became clear that it will be a long time before a new standard is proposed and promulgated. The NIOSH criteria document will only be ready for external review in December, three months later than the last estimated date. And OSHA officials said that the agency would need a considerable amount of time to do economic, feasibility and cost-benefit analyses. Then public hearings will have to be held. Dr. Bailus Walker, director of health programs for OSHA, would not specify how long this work will take.

Nor is a performance standard for new RF machines in the offing. Villforth told Gore that BRH did not "believe that a regulatory performance standard by FDA, applicable to new sealers, would be the most effective approach." Instead, he endorsed the enforcement of exposure standards.

Despite the projected delays, Sheldon Samuels, director of health at the Industrial Union Department, AFL-CIO, said he was "delighted" with the hearings: "It was one of the most useful hearings that I have attended. The subcommittee saw itself in a role of forcing action in the public interest." He said that he did regret not having more hard data on those exposed to RF sealer radiation. Indeed, over and over again, the subcommittee was frustrated by the absence of data on the number of machines in the workplace, the number of people exposed, and the incidence of harm.

Howard Samuel, president of the IUD, recommended that an RF/microwave standards advisory committee be set up at OSHA to expedite the completion of the NIOSH criteria document and the setting of a new occupational standard.

The one spokesman for the RF sealer manufacturers, Angelo Vassallo of the Solidyne Corp. in NY, said that it may be possible to shield machines that now exceed OSHA emission standards. RF sealers that do not meet FCC specifications, however, are too old and should be replaced, he advised.

DOD Controversy

Perhaps the greatest controversy was generated by the Department of Defense's role in health research. Captain Paul Tyler, director of DOD's Radiobiology Research Institute, was scheduled to testify on the first day. Instead, Colonel Phillip Winter, who is responsible for the Tri-Service Electromagnetic Radiation Bioeffects Program, accepted the subcommittee's invitation.

Paul Brodeur, of the *New Yorker,* was scornful of the subcommittee's acceptance of the substitution. He told *Microwave News* that Dr. Ian Marceau, of the subcommittee staff, had indicated to him, after lengthy background discussions, that Tyler would be called to answer questions about his long-time role in setting bioeffects research policy for the military. "It was a sell out," Brodeur said. "The subcommittee had a tiger by the tail and could have exposed a large part of the cover-up in bioeffects research for the last 20 years. The Gore subcommittee furnishes a prime example of how the Congress is weakened by timidity in the performance of its oversight duties on DOD." Brodeur cited a memorandum written by Tyler on the 1975 Tri-Service Research Plan and excerpted in his book, *The Zapping of America* (p. 239). In it, Tyler recommends studies be done to "disprove" the claim that microwaves can cause delayed cataracts. "The fact that a high-ranking military doctor could call for such studies is a travesty of the intellectually honest scientific approach," Brodeur said.

When asked why he did not testify, Tyler said that he was not directly involved with DOD microwave/RF work and that DOD wanted to pick its own spokesman. When they learned the subcommittee "had invited me, there was panic at DOD," Tyler said. DOD selected Winter, he went on, because he represents the whole research program for all the services.

According to Marceau, the Congressional Liaison Office of DOD had recommended Winter over Tyler because the Radiobiology Institute deals only with ionizing radiation and because Tyler had been out of non-ionizing radiation research for three years. Tyler, however, said that he still considered himself an expert on RF and microwaves. He did agree that the

Institute no longer had any active research on non-ionizing radiation.

Winter also provided some excitement when he announced, on questioning, that he had "access to brand new data" suggesting that there may be other than thermal effects on the lens of the eye. Winter promised to supply the new information to the subcommittee on June 1. Reached in his office at the end of May, Winter said that he had been "mistaken," and that the evidence in question had already been published in the IEEE Microwave Theory and Techniques Society's *1980 International Symposium Digest*: "Microwave and Temperature Effects on the Murine Ocular Lens *In Vitro*," (pp. 341-344) by six authors, including P. Jill Stewart-DeHaan of the University of Western Ontario and L.E. Larsen of the Walter Reed Institute of Research in Washington, DC.*

Other Highlights

Agency witnesses also made the following points about RF sealers:

- NIOSH surveys of more than 200 RF heaters and sealers revealed that emission from about 60 percent of the units created fields which exceeded the current OSHA standard, with maximum levels as high as 2,500 V/m for E-fields and 13 A/m for H-fields. Also, the fields can vary by a factor of ten over the human body.
- Three cases of birth defects and one of fetal development problems have been reported to NIOSH. Gore requested additional data on other types of reported injuries, including one death, two miscarriages and a case of blindness.
- NIOSH and the FCC agree that the approximately 21,000 registered heaters and sealers represent only a fraction of the machines in use. "At least 100,000 workers, and probably many more, have been exposed," OSHA's Mark Cowan reported.
- OSHA now has 20 trained investigators and ten new probes for monitoring workplace exposure levels of non-ionizing radiation. OSHA had to wait a year and a half to receive the meters.
- OSHA made 57 on-site inspections in the past two years. Six citations were issued during 33 inspections carried out under the federal compliance program. OSHA found equipment problems in 30 percent of the 57 sites.
- RF shielding costing $300 to $1,000 for a $12,000 sealer can reduce RF exposures by one to three orders of magnitude.
- OSHA's Cowan said that there is no question that exposure to RF radiation is a serious health hazard, but the government must determine the extent of the problem before establishing priorities.

Another Hearing Planned

The subcommittee had originally planned a third session on a new Department of Agriculture report, which warned consumers that microwave ovens may fail to kill pathogenic organisms in pork. See story p. 7.

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The published record of the hearings will not be available for some months. For a copy, write to Congressman Albert Gore, Jr., Subcommittee on Investigations and Oversight, Committee on Science and Technology, US House of Representatives, Washington, DC 20515.

*In that paper, the authors state: "Preliminary observations on lenses exposed to either [pulsed or continuous wave] microwave radiation indicate that both types can apparently cause an additional effect—holes in the cell membranes—when compared to unirradiated controls at the same temperature."

WITNESSES BEFORE THE SUBCOMMITTEE ON INVESTIGATIONS AND OVERSIGHT

(In Order of Appearance)

May 12, 1981

Charles Perlik, Jr., President, The Newspaper Guild

David Eisen, Research and Information Director, The Newspaper Guild

John Villforth, Director, Bureau of Radiological Health (BRH)

Dr. Alan Anderson, Associate Director, Division of Biological Effects, BRH

Bill Herman, Associate Director, Division of Electronic Products, BRH

Dr. Milton Zaret, Director of Research, The Zaret Foundation

Colonel Phillip Winter, Military Assistant for Medical and Life Sciences, Office of the Under Secretary of Defense for Research and Engineering

Dr. Elliot Postow, EMR Program Manager, Research and Development Command, National Naval Medical Center

Dr. Joe Elder, Chief, Cellular Biophysics Branch, Environmental Protection Agency (EPA)

John Rankine, Director of Standards and Data Security, IBM Corp.

Dr. Bruce Dickerson, Corporate Director for Health and Safety, IBM Corp.

George Mine, Advisory Engineer, IBM Corp.

Vico Henriques, President, Computer and Business Equipment Manufacturers Association (CBEMA)

Dr. Myron Wolbarsht, Professor of Ophthalmology, Duke University Medical College

William Hanrahan, Senior Director, CBEMA

May 13, 1981

George Cashau, Coordinator of Operations, American Newspaper Publishers Association Research Institute

Howard Samuel, President, Industrial Union Department, AFL-CIO

Sheldon Samuels, Director of Health, Industrial Union Department, AFL-CIO

Dr. Joseph Lary, Research Biologist, Division of Biomedical and Behavioral Science, National Institute for Occupational Safety and Health (NIOSH)

Dr. Barry Johnson, Director, Division of Biomedical and Behavioral Sciences, NIOSH

Dr. Richard Lemen, Acting Director, Division of Criteria Documentation and Statement Development, NIOSH

Dr. Ezra Berman, Research Biologist, Experimental Biology Division, EPA

Dr. Ralph Smialowicz, Chief of Immunology Section, Experimental Biology Division, EPA

Dr. Vilma Hunt, Deputy Assistant Administrator, Office of Health Research, EPA

Dr. David Conover, Research Physicist, Division of Biomedical and Behavioral Science, NIOSH

Mark Cowan, Special Assistant for Regulatory Affairs and Director of Policy, Occupational Safety and Health Administration (OSHA)

Robert Curtis, Senior Industrial Hygienist, OSHA

Dr. Bailus Walker, Director of Health Programs, OSHA

Stephen Finan, Acting Director of Legislation, OSHA

Angelo Vassallo, Technical Consultant, Solidyne Corp.

CONGRESSIONAL HEARINGS: EXCERPTS

VDTs

Perlik: "If *we* are going to be the guinea pigs in front of the VDT screens, then we want some early answers.... [The situation requires] a fullfledged government-funded study...of a large population of VDT users.

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Villforth: [Based on the BRH survey which found that VDTs] do not pose a significant radiation hazard...we are not currently planning a regulatory standard for radiation.

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Albert Gore (D-TN) questioned Villforth about VDT emissions in the 15 to 125 kHz range:
Gore: Well, if there is no standard for the emissions in that range, why is it reassuring to you that the non-existent standard is not violated?
Villforth: The voluntary scientific community has not felt a need for standards in this area based on non-observance of biological effects.
Gore: But you say yourself...[that] research on bioeffects for the 15 to 125 kHz range is lacking....It may be that your reassurance is valid, but it doesn't appear to be based on any scientific evidence at all.

Gore posed the same question to Zaret:
Zaret: It's idiotic, sir...you have no standard, you don't need a standard, we don't need it because there is no research to show that you need it. But we haven't done the research. It makes no sense.

Gore sought a response on this point from Anderson:
Anderson: In the region of say 10 to 100 kHz...we have both a theoretical analysis of the way in which both the electric field and the magnetic field will interact with biological material and we also have just recently done a modeling calculation which indicates the level of absorption of radiation that you would expect in something the size of a human being.
Gore: In other words, you don't have any actual tissue tests.
Anderson: From the standpoint of work we've conducted in house, no, we do not.
Gore: All you have is some theoretical work that has led you to believe that it is probably not a problem.
Anderson: The theory is corroborated by the admittedly small but nonetheless real bit of information that comes from those researchers who have attempted to expose laboratory animals to radiation....

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Gore: Why have you not promulgated standards for performance and testing?
Villforth: Because we don't think there is a problem.

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Bob Shamansky (D-OH) and Gore questioned Winter: Should the public be assured there are no low frequency radiation problems despite little data?

Winter: Yes...The best available evidence, in my opinion, warrants a statement that, so far as we know, there is no appreciable risk at those frequencies....
Shamansky: How good is the best evidence available? You didn't give me a value judgment on that.
Winter: I would agree that the data in the frequency range in question is very sparse, and one, I think, is forced, given the need to come to a judgment at the moment, to extrapolate from what data as exist in nearby frequency ranges—this is the basis on which the ANSI standards are established, in any case.
Shamansky: But isn't there another alternative: to refuse to give such a judgment? So you don't have enough to give a valid judgment?
Winter: Certainly that's an option.
Shamansky: Isn't it a medically more sound option?
Winter: I'm not sure that I'd agree with that....We are often called upon to make judgments in the absence of adequate information.... At the moment we have no firm reason to believe that there is a hazard. However, the possibility exists and further study in the area is warranted.
Shamansky: It seems to me that the brunt of Dr. Zaret's testimony is exactly that.
Winter: It is sir, if you accept the data at face value.
Shamansky: Hearing the testimony, do you think that at this point there is enough circumstantial evidence, enough clinical evidence, to warrant a study?
Winter: Yes sir.

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Gore asked Hunt if EPA supports the need for an epidemiological study of VDT users:
Hunt: The basic question is the extent to which it is a feasible and practical approach...To identify an appropriate population large enough for good statistical analysis of the data comes to be probably not a good use of resources when compared with all the research that can be done under more controlled circumstances. That is not to say that if a population is available we should not make every endeavor to insure that the exposure assessment goes forward with the best methods available, with the best quality control available....

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Robert Walker (R-PA) asked Cashau if the newspaper publishers regard VDT safety as a high priority issue to resolve with their employees:
Cashau: Yes. We certainly regard any health and safety issue as a matter of high priority...and yet we use approximately one percent of the total VDTs in the US.

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Henriques: In view of the work that has been going on in our industry for many years, it comes as no surprise to us that this recent FDA testing program and a similar NIOSH testing program conclude what we have known for some time, that radiation from VDTs is well within safe levels.

RF HEATERS AND SEALERS

Exposed Population

The subcommittee had been informed that as many as one million workers are exposed to radiation from RF heaters and sealers. Gore asked Samuels for his figures:
Samuels: In one industry—and we are just now beginning to add up the numbers—namely the lumber and plywood industry...we are making a very rough estimate that the 40,000 RF sealers expose about 80,000 workers.
Gore: Well now, that is one industry among a hundred or so where these instruments are used. Is that correct?
Samuels: That's correct. In the plastics industry, where you have a larger percentage of female employees, you would find a substantial number of women exposed....I think a million is reasonable.

Biological Effects

Smialowicz: Whereas chronic stress can lead to physiological disorders including immune dysfunction, whether significant dysfunctions in the immune system occur under chronic exposure conditions remains to be determined....

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Berman: It is my opinion that only RF levels which cause very high body temperatures are associated with birth defects. It is also my opinion that it is only the high temperature which causes RF-induced birth defects.

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Lary: Most RF induced birth defects occur only after significant elevation of maternal body temperature. However, there have been reports of minor developmental deviations, increased embryonic death, delayed development, and decreased fetal weight in animals exposed during pregnancy to levels at or below 10 mW/cm².

Numerous disturbances attributed to RF/microwave exposure have been reported in endocrine, nervous, auditory, ocular, cardiovascular, hematologic, and immunological systems in animals. Many of the changes noted were reported at levels at or below the current 10 mW/cm² standard....

Since NIOSH and OSHA measurements indicate that unshielded RF heaters and sealers commonly emit radiation in the vicinity of the operator which far exceeds the current OSHA standard, it is apparent that many sealer/heater operators are being exposed to hazardous levels of RF energy....

We are currently conducting research to determine if protracted exposure of pregnant rats to lower intensity RF radiation at a level which causes no measurable rise in body temperature is teratogenic or embryotoxic. In addition, cooperative research with teratologists at the University of Cincinnati Medical School is being conducted to determine the mechanisms of RF-induced fetal malformations and death.

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Villforth: We have also undertaken research to determine the feasibility and cost of a full-scale study of the risk of psychological disorders resulting from exposure to RF sealer radiation. This study is complementary to an effort being planned by NIOSH to review reproductive histories in such exposed persons.

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Gore: If you had a pregnant woman operating one of these machines, would you feel comfortable?
Lary: Frankly, I wouldn't feel comfortable at all.... I can say on the basis of my research and on the basis of an analysis of the literature that if significant heating of the maternal body during pregnancy occurs, you run the risk of having a birth defect. But I cannot state with any degree of certainty that women being exposed to RF heaters and sealers indeed run a significant risk of having birth defects under the conditions in which they are exposed. In a broader sense, not considering just the possibility of birth defects, but considering the possibility of any health effect, I would not want my wife exposed to the radiation.

Toward a Regulatory Decision

Villforth: Considering the large number of sealers already in use, their long working lifetimes, and the relatively low rate at which new sealers are being manufactured, we do not believe that a regulatory performance standard by FDA, applicable only to new sealers, would be the most effective approach to solving this problem. Another important drawback in promulgating a standard aimed at the manufacturer of sealers is that the units are often modified by the user. Thus, the most effective enforcement of standards would be in the workplace rather than at the place of manufacture. This is the approach taken in the IRLG plan.

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Gore: I hope that OSHA doesn't take a go slow attitude to it, because we are talking about serious effects.
Cowan: The last impression we would like to leave you with today is that we do not consider this a serious problem. If we felt it was not a problem we would not be enforcing it.... When we receive the NIOSH criteria document... then we will proceed to reexamine our current standard.... I understand it will be presented to us some time near the end of the year in December, NIOSH suggests.

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Lary: Until the NIOSH review process is completed, we cannot predict what maximum permissible exposure levels NIOSH will recommend.

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Gore: If [NIOSH] gets it to you by the end of September, how long will it take you to deal with it? To act as a result?
Walker: I don't want to talk in terms of months, but it will take us a considerable amount of time because we have to do an economic analysis. We have to examine the whole question of feasibility as required by the Act and under the President's executive order. We now have to look at the whole cost/benefit question. So there is a lot of activity that will have to take place even before we can go to a public hearing and get public input on such a document.

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Gore asks Cowan how long it will take OSHA to decide on the most efficient regulatory option after the NIOSH criteria document is in hand:
Cowan: I would like to ask our economists... Until our economists can look at the data provided... to determine what they would have to do further, I certainly am not in a position to say how long it will take our economists to do a cost/benefit analysis of this issue or that issue.

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Gore: What is your reaction to all this today?
Cowan: My personal reaction is that it is somewhat confusing in several regards. One is that there seems to be a delay... in the final compilation of data.... Another concern I have, being in the position I am, is when you start dealing with figures and someone says there are 20,000 workers and, of course when we start talking about significant risk, this is obviously a factor we have to consider when we have 20 or 30 items on the plate and we have to pick one or two or three at a time. One figure is that there are 20,000 workers; our colleagues at NIOSH suggest that there are 100,000 workers... another one million.... We have to determine how broad this problem is. There is no question that there is a problem, and that there is a serious health hazard involved in exposure to radiation.

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Gore: In light of the testimony that you've heard, Mr. Curtis, on bioeffects and based on your own test results, do you agree with the conclusion of NIOSH that there is a serious risk to operators of some RF heaters and sealers?
Curtis: In fact, yes, I do. And it is on that basis that we enforce the standard under the general duty clause, and we have to declare that we feel that it is a serious risk. And that is our policy and that is my position.

Current Action

Shamansky tried to determine who has the authority to require manufacturers to supply shielding and who is currently attempting to enforce OSHA standards. Cowan said that of the 1,200 OSHA enforcement officers in the field and the five and a half million workplaces to monitor, there are 20 trained equipment inspectors with the authority to cite and attach penalties to manufacturers and to require them to retrofit equipment. Shamansky was frustrated by the OSHA representatives' explanations of why shielding is not now required and why so little enforcement has been done.
Shamansky: I'm almost flabbergasted. It's frankly shocking.
Later:
Shamansky: Having probed behind the surface of your [Cowan's] statement, I am not at all pleased. I'm disturbed by that. In fact, there is more form than substance to what you are actually doing in the market place where the things are going on. So it's a very nice statement, it's very reassuring, if you only read what you are saying. In fact, the performance is not very reassuring.

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Vassallo: It is our belief that enforcement of the present standards and the continued self-monitoring of the industry is sufficient to protect users of RF equipment from harmful effects unless there is evidence to the contrary.

BIOLOGICAL EFFECTS

Microwaves and the Lens: A New Report

Working Group 35 of the National Research Council's Committee on Vision has issued a six-page report, *Effects of Microwave Radiation on the Lens of the Eye.* Among the findings and conclusions are:

- "Existing evidence does not suggest that microwave fields of less than 10 mW/cm² can induce cataracts."
- "Existing evidence does not suggest that routine screening for cataracts of all Air Force personnel working in the vicinity of microwave devices is justified at this time."
- "More research is needed to characterize the effects of low-level microwave radiation, particularly for chronic exposure."
- "Laboratory research is required to elucidate the mechanisms of ocular damage from microwave exposure."
- "A well-designed prospective study, with careful matching of test and control groups, could provide valuable information about possible effects on humans of low-level microwave exposure. However, such a study, if adequately designed, would be expensive."
- "A study of the use of microwave diathermy devices might be useful."

The Membership of Working Group 35 is: Stanley Ballard (Chairman), University of Florida; Russell Carpenter, BRH; Stephen Cleary, Medical College of Virginia; Arthur Guy, University of Washington; William Ham, Medical College of Virginia; Heinrich Rose, retired, Stanford University Medical School; and Myron Wolbarsht, Duke University Medical Center.

Key Dismukes was the study director. The work was done under a contract from the Office of Naval Research. Copies are available from the Committee on Vision, 2101 Constitution Avenue, NW, Washington, DC 20418, but supplies are limited.

Membrane Break in Cataract Formation

Professor Abraham Spector and his research group at Columbia University's College of Physicians and Surgeons in New York City have refined their model, first proposed approximately two years ago, detailing the mechanism of cataract formation in the human lens (*Proceedings of the NAS, 78,* 1892, March 1981). On the basis of new experimental studies, Spector now postulates that the lens fiber plasma membrane may be *ruptured* in the cataract lens, in conjunction with the accelerated oxidation of membrane proteins.

Spector told *Microwave News* that "any energy source of sufficient power, including appropriately focused microwaves, could potentially perturb the membrane, and set off the sequence described in the model." He warned, however, that "I don't know of any evidence that microwaves do break the membrane."

Research in Utah

The University of Utah has won a number of research grants and contracts in recent months. They include:

- Approximately $150,000 from EPA/ORD to Professors Om Gandhi and John D'Andrea of the Electrical Engineering Department for a four month chronic exposure study of male rats to 0.5 mW/cm², 2450 MHz radiation. The rats, exposed seven hours a day, seven days a week, will undergo blood and urine analyses, as well as tests for susceptibility to electric shock. The study, begun last October, will include some dosimetry and computer modeling at 2450 MHz.
- A $153,000 grant from the Air Force to Gandhi on the bioeffects of millimeter waves, specifically 26.5–90 GHz. He will investigate the mutagenic effects of mm waves on E. coli and other biological organisms, Raman and Brillouin spectra of biological molecules in order to understand the mechanism of interaction and the dielectric properties of biological tissues at mm wavelengths.
- A three-year, three-phase, $160,000 (approx.) NIEHS grant to D'Andrea, begun last February, to (i) develop a computer model to predict whole body absorption and local "hot spots" in rats at frequencies in the range of 300–5,500 MHz; (ii) study acute behavioral effects at those frequencies that create hot spots and those that do not; and (iii) compare the effects of chronic exposure, three to six months, seven days a week, seven hours a day, at two different frequencies, with and without hot spots, but with equivalent SARs.
- A $130,329 contract from the AF to Professor Carl Durney, also of the EE Department, for theoretical and experimental comparisons of RF absorption. Predictions from computer models will be compared to results from experiments using prolate spheroid and human-shaped phantoms. The contract, awarded in April, is a continuation of previous work, which will allow Durney to extend his calculations to the near field.
- A $107,547, one-year contract from the Office of Naval Research to Professor Lester Partlow and Larry Stensaas of the School of Medicine and Gandhi for (i) new work on calcium efflux in monolayers cultures of embryonic chick brains. The team will use a quantitative autoradiographic technique (described in a forthcoming paper in *Bioelectromagnetics*), which can measure quick changes in calcium concentrations; (ii) continuation of a study involving the irradiation of whole rats and the investigation of the deposition of microwaves in the central nervous system. Here the group will look at the heating patterns in different portions of the brain at different frequencies and different orientations, calorimetric measurements of dead animals to learn heat gain data, and studies of the uptake of 2-deoxy-D-glucose to determine the pattern of electrical activity in the brain.

Cleary Begins New Project

The Office of Naval Research has awarded Professor Stephen Cleary, of Virginia Commonwealth University Medical College in Richmond, $110,000 for a 20-month study of cellular effects of X-band radiation. Working with 8–10 GHz pulsed and continuous wave microwaves, Cleary will investigate changes in cell-to-cell communication in culture under far field conditions. He is finishing up his work with blood cells to pursue this new line of research.

Bioeffects Research at BRH

BRH has released its *Annual Report of the Division of Biological Effects, Bureau of Radiological Health, Fiscal Year 1979, October 1, 1978–September 30, 1979* (HHS Publication FDA 81-8152, dated June 1980, but released April 1981). The report includes brief abstracts of active research as of September 30, 1979 on ionizing, light, RF and microwave radiation and ultrasound, and of epidemiological and experimental studies. In many cases unpublished results are presented.

Among the abstracts are updates on: "The Effect of Prenatal Microwave Exposure on the Development of Behavioral Responses in the Mouse," "Mutagenic, Chromosomal, and Reproductive Effects of Microwaves—Chromosomal Effects of Low-level Microwaves," "The Effect of Millimeter Wave Radiation on Induction Phenomena in E. Coli," "Evaluation of the Effects of Long-Term, Low-Level Microwave Exposure on the Absorption of Calcium Ions Across Cell Membranes," and "Effect of 10 GHz Pulsed Electromagnetic Radiation in E. Coli."

In "Measured Modulation Waveform of Leakage Radiation from Microwave Ovens," Henry Ho and W.P. Edwards note that "leakage radiation from microwave ovens is known to be low-frequency amplitude-modulated because of the effect of the modestirrer built into the ovens."

There is also a report of a study by Dr. Asim Jamakosmanovic from the University of Sarajevo, Yugoslavia, on the "Effect of Microwave Radiation on the Nervous System."

The report for FY80 is scheduled for November 1981.

Medical and Legal Seminar

Bell Labs, RCA and Raytheon jointly sponsored a seminar on medical and legal aspects of microwaves at the Homestead in Hot Springs, VA, this May 7–8. Ron Peterson of Bell Labs, the seminar's co-organizer with Howard Johnson of RCA and John Osepchuk of Raytheon, reports that about 100 lawyers, engineers and doctors attended tutorials on the biological effects of RF and microwave radiation. The seminar was patterned after the New York Institute of Medicine's April 1979 "Symposium on Health Aspects of Non-Ionizing Radiation," according to Peterson. The registration fee was $200.

GOVERNMENT

USDA Issues Alert on Cooking Pork in MW Ovens

Uneven microwave heating could fail to kill harmful microorganisms in pork, according to the Department of Agriculture. Preliminary, unpublished studies by Professor William Zimmerman of the Veterinary Medical Research Institute in Ames, IA, prompted the May 8 notice cautioning consumers that pork must reach 170°F throughout to ensure killing trichinae parasitic worms and other pathogenic bacteria present in a very small number of US hogs. Donald Houston, administrator of the USDA's Food Safety and Quality Service, said the Department is in the process of verifying the results.

No cases of illness have been linked to microwave-cooked pork. "Consumers who follow prudent cooking procedures face no health hazard," assured Houston. Specifically, USDA recommends that dishes be rotated during cooking and that meat be allowed to stand for several minutes after cooking. In this way, cold spots created by variations in water distribution, uneven deposition of microwaves and potential blockage by bones in the meat can be eliminated.

The report was to be the subject of congressional hearings by the Gore subcommittee in mid-May (see p. 1), but they were delayed until later this summer because of the preliminary nature of the findings.

EMP News

Electromagnetic pulse radiation was the subject of a flurry of popular articles last month. *Science News* ran a two-part series on EMP: "A Sleeping Electronic Dragon," May 9, and "Defensive Strategies," May 16, by Janet Raloff. Eric Lerner's "Electromagnetic Pulses: Potential Crippler" was featured in the May issue of *IEEE Spectrum*. *Science* began a three-part series by William Broad with "Nuclear Pulse (I): Awakening to the Chaos Factor" in the May 29 issue. And Richard Schaffer highlighted EMP vulnerability in the *Wall Street Journal*'s May 29 technology column. They all focus on EMP's potential disruption of electronic devices, everything from communications networks to power grids and protective "hardening" strategies.

In her first article, Raloff states: "EMP is presumed to be no more harmful to humans than a flash of distant lightning." *Microwave News* is interested in learning about studies on the biological effects of EMP. We invite readers to send us relevant scientific information.

In EMP contract news, the AF Systems Command, Norton AFB, CA, is negotiating a contract with EG&G, Albuquerque, NM, on the construction of a horizontal shelter site for EMP hardness tests, and the Defense Nuclear Agency is issuing a RFP on the development of technical reports supporting DNA's EMP simulation test effects (*Commerce Business Daily*, May 18).

Oven Variance

BRH has granted a two-year variance to microwave ovens used in combination microwave and electric or gas self-cleaning ranges, manufactured by the Caloric Corp. of Topton, PA (46 *Federal Register* 23810, April 28).

The ovens sold under the names Caloric, Montgomery Ward, Sharp Electronics and Amana Refrigeration will have three safety interlocks, instead of the usual two, and may still be operated if the first two fail, as long as the third and its monitor are functioning.

BRIEFS

The latest, semi-annual summary of EPA's agenda of forthcoming regulations indicates that a notice of proposed rulemaking on public exposure to RF radiation will be issued in December 1981, with a final rule in December 1982 (46 *Federal Register* 23696, April 27)....The FDA is seeking nominations for membership on the Technical Electronic Product Radiation Safety Standards Committee (TEPRSSC). The Committee gives advice on radiation performance standards for electronic products. Nominations are due July 21. For more information contact: Zory Glaser, Executive Secretary, TEPRSSC at BRH, (301) 443-3429....The Air Force Office of Scientific Research has awarded Professor Arthur Oliner, of the Polytechnic Institute of New York, $290,000 to continue research on "microwaves, electromagnetic theory and information processes"....The International Communications Agency has signed an estimated $75,000 contract with the Institute of Telecommunication Sciences in Boulder, CO, for "Radio Propagation Predictions"....The Rome Air Development Center in NY is seeking R&D proposals on the development of a terrestrial microwave line-of-sight radio system (*Commerce Business Daily*, May 7)....The Bureau of Mines wants to fund a study on the use of a narrow band pulsed audio tone transmitter to detect and locate trapped miners (*CBD*, May 1)....The Naval Research Lab, Washington, DC, is negotiating a contract with Norden Systems, Melville, NY, for measurements related to spurious emissions from AN/SPS-40B, C&D radars.

CHINA ADOPTS 50 uW STANDARD

(continued from p. 1)

dard proposed by Dr. Leonard Solon of the New York City Bureau for Radiation Control in 1978.

Two Chinese scientists, Drs. Huai Chiang and K.C. Yee of Chechiang Medical College, toured some of the leading US labs last year. At a seminar on research and standard setting in China reported to the Bureau of Radiological Health in Rockville, MD, last June, Dr. Chiang discussed the then-provisional standard, which Frey understands the Chinese will soon formally adopt with essentially no change. The standard specifies an average power density of 50 uW/cm² during a six-hour working day. For an eight-hour shift, the exposure has to be less than 40 uW/cm², with an integrated dose for a whole day of 300 uW.hr/cm². The maximum exposure can never exceed 5 mW/cm². The standard makes no distinction between pulsed and continuous wave exposures.

Frey found the Chinese experts well versed in the US literature but their labs light on equipment. He also notes that researchers are doing interesting epidemiological studies of factory workers. Frey says the Chinese have devised innovative medical applications for microwave energy—for instance, they are treating uterine cancer with an antenna inserted within the uterus during treatment.

Frey was invited to China to lecture in various cities on the biological effects of microwave radiation. Frey, a prominent member of the bioeffects research community, is well known for his work on the blood brain barrier and microwave hearing.

MICROWAVE NEWS is published monthly, except in January and July. • ISSN 0275-6595. • P.O. Box 1799, Grand Central Station • New York, NY 10163 • (212) 794-9633 • Editor: Louis Slesin, Ph.D., Associate Editor: Martha Zybko • Subscription: $165 per year (overseas $200) • Copyright © 1981 by Louis Slesin • Reproduction in any form is forbidden without written permission.

UPDATE

VDTs....The Norwegian Labor Directorate has introduced draft rules that would prevent workers from working in front of VDTs for more than two hours without a break, according to the *New Scientist,* May 7. The regulations would also require that operators spend no more than half their time doing straight input typing, that their eyes be checked every two years up to the age of 45, and annually thereafter, and that high frequency sound be eliminated....The National Research Council's Committee on Vision is sponsoring a public symposium to be held in Washington, DC, August 20–21, as part of its study of the impact of VDTs on the vision of workers. For more information, contact the Committee at (202) 389-6068. Experts from abroad will be invited....The HUSAT research group at Loughborough University in England has published the papers presented at its second conference, *Health Hazards of VDTs? 2, Some Solutions to the Common Problems,* held March 19, and has scheduled a third meeting for July 2, *A Positive Approach to the Future*....The Health Advocacy Unit of Toronto's Department of Public Health has published *Health Effects of Video Display Terminals: The Non-Radiation Problems,* by Linda Rosenbaum, May 1981....A revised version, Legislative Document No. 1612, of the Maine VDT bill was released May 15....A report of the April 24 hearing on VDT safety held by the Joint Standing Committee on Labor of the Maine Legislature appeared in the May 8 issue of the *Guild Reporter*....The same issue notes that a tentative pact between the Guild and the *New York Times* and the *Daily News* has a provision that requires monitoring of VDTs and the reporting of the data to the Guild....Meanwhile, according to an article in the *New York Times,* May 29, Harvey Siegel, the *Times*'s safety director, described the paper's policy on VDTs: they should not emit any detectable levels of RF radiation. The article also outlined a paper, delivered at the AIHA meeting in Portland, OR, May 28, by Siegel and Otto White, of Occupational Environmental Health Analysts in Upton, NY: a survey of 437 VDTs (15 models) at the *Times,* with "sensitive detectors," found power densities indistinguishable from background levels for 420 of them. (No mention was made of the now infamous 1 mW/cm² background level found by NIOSH in its 1977 survey of the *Times*.) The 17 machines that emitted "low levels" of RF were modified to eliminate the emissions.

Technology....Xerox Corp. has dropped its Xten project, the planned data communications network for major cities. Despite FCC's allocation of 130 MHz for the service at about 10.6 GHz (*MWN,* February 1981), the company scrapped Xten last month, citing economic reasons....A blue-green laser has successfully sent messages from an aircraft to a submerged submarine, according to *Aviation Week & Space Technology* (May 25). The laser system has now passed three tests. The Senate added $20 million to its FY82 budget, for a total of $42 million, but this authorization must still win approval in a House-Senate conference. The system is described in the fifth part of Roland Starkey's series on submarine communications: "Blue-Green Laser/Satellite Technology: The Search for the Rainbow," in the March issue of *Military Electronics/Communications.* Whether DOD will substitute the new laser for the ELF antenna is still an open question....Dr. F. Kristian Storm's Magnetrode hyperthermia unit, still seeking FDA market approval (*MWN,* May 1981), is described by Denise Grady in the June *Discover*....Rakesh Jain of Carnegie-Mellon University told *Science News* (May 2) some good and some bad news about his research team's work on hyperthermia. Tests show that glucose therapy can lower the blood flow rate and increase pH differences between normal and cancerous cells, and help shrink tumors in rats when used with hyperthermia treatment. Unfortunately, metastases—cancer cells that create new tumors elsewhere in the body—grow much more easily with the glucose treatment. The result is a shorter lifespan for the rat....The National Weather Service has plans to convert its conventional radar system to Doppler radar by 1990 with a $340 million program (*Wall Street Journal,* May 29). The new radar would enable forecasters to predict approaching tornadoes 20 minutes before they hit, compared with the present system which cannot provide an early warning.

Litigation....Attorneys working on microwave injury cases are planning a meeting at the American Trial Lawyers Association, to be held in San Francisco the last week of July. For more information, contact Matthew Shafner of Groton, CT (203) 445-2463 or Seymour Ellison of San Francisco, CA, (415) 392-1884....Shafner also reports that the Engel case (see *MWN,* April 1981) is moving slowly: no trial date has yet been set.

LETTERS

To the Editor: Let me bring to your attention a point of information. In *MWN,* January 1981, you mention the exchange between Chou, *et al.* and me about microwave hearing (*Science, 209,* 1143, 5 September 1980). You noted that we disagreed about the mechanism for microwave hearing. You indicated that we differed in that they contended the hearing was due to thermoacoustic expansion occurring in the head with consequent bone conducted acoustic waves stimulating the cochlea and that I contended it was due to thermoacoustic expansion occurring in the cochlea. That's not quite correct.

The problem was that Chou, *et al.* concluded that they had explained the microwave hearing phenomena and that it was all wrapped up. In a paper published in *Science* (*206,* 232, 12 October 1979), I pointed out that there were five lines of evidence indicating that an explanation based on thermoacoustic expansion in the head was not particularly satisfactory and showed that the results of their experiments could be attributed to uncontrolled variables such as microwave induced vibration in the foam on which the animal lay. However, my key point was that microwave hearing had not been explained and wrapped up.

A few weeks after the exchange between us appeared in *Science,* the Bioelectromagnetics Society Annual Meeting was held in San Antonio. At that meeting, Wilson, *et al.* and Lebovitz presented evidence from independent experiments that showed, with some microwave energy parameters, that the microwave hearing phenomena can be attributed to specific effects within the cochlea. Thus, it would appear that the question of the mechanism for microwave hearing is not all wrapped up.

Allan H. Frey
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To the Editor: We have a position available for a research associate with an MD or PhD degree and at least two years of clinical, neuroanatomical and neuropathologic training. Knowledge of microwave and biological tissue interactions is desirable.

Dr. Ernest Albert
Professor of Anatomy
The George Washington University
Medical Center
2300 I Street, NW
Washington, DC 20037

Microwave News *invites letters from its readers. We ask writers to be brief, and we reserve the right to edit contributions for length.*

MICRO WAVE NEWS

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Yannon Decision Upheld; NY Telephone To Appeal Again

A New York court has upheld a workers' compensation award to Samuel Yannon's widow. In a May 6 decision, the State Supreme Court Appellate Division found sufficient evidence to link the New York Telephone Company technician's death to microwave radiation exposure. The action affirms previous rulings from an administrative law judge and a 1981 appeal before a state Workers' Compensation Board. New York Telephone is now requesting another appeal.

The case, brought by Mrs. Nettie Yannon in 1975, is the first establishing chronic exposure to microwave radiation as a cause of death. Yannon spent 15 years adjusting microwave relay equipment for the phone company on the 87th floor of the Empire State Building before being terminated for medical reasons in 1970. Yannon died four years later from what his doctor diagnosed as "chronic brain syndrome with psychotic overtones due to biological brain changes resulting from prolonged exposure to short wave radiation." (See *MWN,* April 1981.)

In its unanimous decision, the appellate division court concludes that there was "substantial evidence to establish the necessary causal relationship" between Yannon's exposure and the development of an occupational disease ending in his death. Addressing New York Telephone's contention that there is no evidence of unsafe radiation levels, the opinion states that data on Yannon's exposure are not available and that "the present state of scientific knowledge has not advanced to the point where exactitude exists in fixing the limits of microwave radiation on the human body." (See page 2 for full text.)

Charles Herndon from the New York Telephone's legal department announced that the company will seek an appeal but would not comment on the

(continued p. 2)

Radiation Control Officials Meet

A new task force has been set up within the Conference of Radiation Control Program Directors to investigate model state regulations for non-ionizing radiation. Word of the new effort came at the conference's 14th annual meeting in Portland, ME, during the week of May 24.

Among the other items disclosed at the meeting were:

- The Bureau of Radiological Health (BRH) intends to investigate the possible effects of ultrasound on the fetus, according to BRH Director John Villforth. He said that about 60 percent of all deliveries now use ultrasound to diagnose abnormalities. Potential risks include increased fetal activity, delayed neural motor response and reduced birth weight.
- Villforth noted that BRH is having problems publishing technical reports due to budgetary pressures.
- BRH's William Herman reviewed the control of radiation from RF sealers. He said that the machines, though operating in the 27 MHz band, give off "parasitic" radiation at higher frequencies. Interestingly, in some cases these harmonic signals have been found to be stronger than the fundamental

(continued p. 3)

Yannon Appeal Decision *(continued from p. 1)*

case while it is before the court. The phone company has maintained that Yannon suffered from pre-senile dementia, probably Alzheimer's disease.

Because the decision is unanimous, the phone company must seek permission from the appellate division to take the case to the Court of Appeals, the state's highest court. Angelo Gucciardo, the New York City lawyer handling Mrs. Yannon's case, does not think there are grounds for another review.

After the February 26, 1981, compensation board appeal ruling, Mrs. Yannon received $29,000 in retroactive benefits from the phone company and an award of $45 per week for life or until she remarries.

Pleased with the recent decision, Mrs. Yannon said, "This has been a long ordeal, but at last my husband's disease will be on the books as an occupational problem."

A second suit brought by Mrs. Yannon against RCA, the manufacturer of the relay equipment her husband used, is still in its early stages. Filed in 1976 in the New York State Supreme Court, Richmond County, the $3.5 million action charges RCA with breach of warranty and negligence.

Text of Appeal Decision

Claimant is the widow of Samuel Yannon, a former employee of the New York Telephone Company, who died on June 10, 1974. From 1955 until the early part of 1968, decedent was a radio technician assigned to a special service unit which monitored and repaired microwave transmission units at the employer's Television Transmission Facility located on the 87th floor of the Empire State Building. Except for rare occasions when decedent worked on units in the field, he worked exclusively at this facility on a daily basis, with considerable overtime. The tenure of his co-workers generally did not exceed three years.

There were 25 microwave units at the facility, spaced about five feet apart, each with its parabolic reflecting dish facing the outer glass wall of the building. Protruding from the center of each reflecting dish was a "feedhorn" antenna from which microwave transmissions could be beamed out to or received from other locations. Behind the center of each dish, enclosed in a housing, was a klystron tube, which was the power source of the unit that emitted the microwave transmissions. Among decedent's duties was the tuning, repairing and aligning of these microwave units. Access to the "feedhorn" antennas was by means of a "walkable area" between the glass wall of the building and the parabolic reflecting dishes, while the klystron tubes could be reached from the interior console area. The tuning process was performed two or three times each day and required approximately 20 minutes on each occasion. The tube emitted microwaves as it was tuned, while the antenna was supposed to be turned off during such adjustments. One of the crucial questions presented, and one which resulted in conflicting views, was the amount of microwave radiation to which decedent was exposed; whether it exceeded permissible standards and whether those standards themselves are within acceptable levels.

Prior to 1968 decedent's health was good. However, early that year, at the age of 57, he began to suffer a drastic deterioration of his hearing, sight and coordination to such an extent that he was unable to perform his duties, requiring his placement on disability leave. He was retired on July 7, 1971, and died three years later after a prolonged period of progressive physical and mental deterioration. The hospital records where decedent was confined indicate that he suffered from an "organic brain syndrome" or a "degenerative central nervous system disease" or a "chronic brain syndrome" of unknown etiology. There were, however, references in the record, by attending physicians, that decedent's symptomology could be related to microwave exposure. On January 11, 1975, the claimant widow filed her claim for death benefits, contending that decedent's death resulted from his exposure to microwave radiation.

The testimony at the numerous workers' compensation hearings, both lay and expert, was lengthy and conflicting. The Administrative Law Judge awarded claimant benefits and the board affirmed, finding that decedent's death resulted from an occupational radiation disease, one within the meaning of section 3 (subd. 2, par. 30) of the Workers' Compensation Law, and that said disease and his ultimate death were directly related to his exposure to microwave radiation while employed by the New York Telephone Company.

On this appeal, we must first consider whether the record demonstrates the existence of a recognizable occupational disease identified as "microwave radiation sickness" and, if so, whether decedent was so inflicted. In order to be so identified, such a disease must actually be caused by the employment and from the particular work the employee is performing. It must result from the nature of the employment and as a natural incident thereof (*Matter of Goldberg* v. *954 Marcy Corp.*, 276 N.Y. 313). It cannot be founded upon the aggravation of a pre-existing condition which is not occupational in nature. In other words, "there must be a recognizable link between the disease and some distinctive feature of the claimant's job" (*Matter of Detenbeck* v. *General Motors Corp.*, 309 N.Y. 558).

Claimant's leading expert, Dr. Milton Zaret, provided the board with ample evidence of the existence of a disease identified as "microwave or radiowave sickness." Dr. Zaret's own studies, including those performed for the United States Government, and excerpts of reports from the Warsaw Conference of 1973 which documented the diagnosis of such a disease in other countries, substantiate this conclusion. The board was entitled to credit his testimony and that of other experts supporting this view.

Whether claimant was so inflicted with this disease presents a more difficult question. The employer's experts, also eminently qualified, steadfastly maintained that decedent suffered from Alzheimer's disease which caused pre-senile dementia, retinitis pigmentosa and generalized arteriosclerosis. This conclusion also finds ample support in the record. However, our review is limited to whether there is substantial evidence in the record to support the board's decision, not whether upon this record the court would have come to a different conclusion (*Matter of Palermo* v. *Gallucci & Sons*, 5 N Y 2d 529).

The requisite proof that decedent's death was causally related to exposure to microwave radiation during the course of employment presents another troublesome issue. The employer contends that there is no evidence of exposure to unsafe levels of radiation. However, the accuracy of the measurements of radiation taken by the employer is in issue, as well as the number of microwave units in operation when measurements were taken. Moreover, there was expert testimony that even at permissible levels, exposure over a prolonged period of time could produce long-term harmful effects. Here, the exact proof of the amount of radiation to which decedent was exposed is not available (see *Matter of Murphy* v. *Beaunit Fibers*, 42 A D 2d 1009). However, the present state of scientific knowledge has not advanced to the point where exactitude exists in fixing the limits of microwave radiation on the human body. This does not mean that the testimony of recognized experts should be rejected where their views are supported by a record that presents arguable issues as to the degree of radiation, as long as there is substantial evidence to support these views after a study of all the salient material available (*Matter of Besner* v. *Kiddie Nuclear Lab.*, 24 A D 2d 1045; *Matter of Matthews* v. *General Elec. Co.*, 2 A D 2d 623; *Matter of Zaepfel* v. *du Pont de Nemours & Co., Inc.*, 284 App. Div. 693, affd. 309 N.Y. 962).

Finally, upon the entire record and with the assistance provided by the applicable presumption, we conclude that there is substantial evidence to establish the necessary causal relationship between decedent's exposure to microwave radiation, the development of the within [sic] occupational disease and his ultimate death (Workers' Compensation Law, § 47; *Matter of Lapinsky* v. *Ardom Bake Shop*, 18 A D 2d 850, affd. 13 N Y 2d 1163). While the hospital records indicate preliminary conclusions that decedent's condition was idiopathic, the record, as developed, supports the board's decisions.

The decisions should be affirmed, with costs to the Workers' Compensation Board.

Opinion per Kane, J.
Mahoney, P.J., Sweeney, Casey and Mikoll, JJ., concur.

State of New York Supreme Court
Appellate Division, Third Judicial Department May 6, 1982

BOOK REVIEWS

Robert O. Becker and Andrew A. Marino, *Electromagnetism and Life.* Albany, NY: State University of New York Press, 1982, 211 pp., $33.50 (hardcover), $10.95 (paper).

Becker and Marino present a comprehensive review of the influence of electromagnetic fields (EMFs) on living systems. Beginning with an overview of the scientific and political history of bioelectrical phenomena, they go on to discuss what is known about intrinsic and natural EMFs, and the effects of man-made EMFs on the nervous, endocrine, cardiovascular, hematological, immune and reproductive systems.

The authors, well known for their work on regeneration, develop the hypotheses that intrinsic EMFs control biological functions, while natural EMFs convey information to living organisms. Artificial fields, meanwhile, act as stressors—stimuli that elicit a common physiological, adaptive response. In this well-referenced book, Becker and Marino argue that "the present abnormal electromagnetic environment can constitute a health risk."

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Arthur D. Bloom, ed., *Guidelines for Studies of Human Populations Exposed to Mutagenic and Reproductive Hazards.* White Plains, NY: March of Dimes Birth Defects Foundation, 1981, 163 pp., $10.00.

In 1980, people living near Love Canal were driven into a frenzy as scientists argued about the validity of a study that showed that they had an increased incidence of damaged chromosomes. The study turned out to be a dud. In an effort to avoid future confusion, a conference was organized to set up some guidelines on how to do such investigations. This volume is the product of that meeting.

Today, at a time when a number of clusters of birth defects and miscarriages have been reported among VDT operators, there is growing anxiety about what in fact constitutes a significant grouping of adverse effects. This book could serve as a tutorial for those uninitiated in epidemiological research. One chapter, "Guidelines for Reproductive Studies in Exposed Human Populations," is especially useful: it explains, in simple English, the different types of studies, the "normal" incidence rates for major malformations, the statistics of sample size and many other key issues.

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Lowell L. Klessig and Victor L. Strite, *The ELF Odyssey: National Security Versus Environmental Protection.* Boulder, CO: Westview Press, 1980, 310 pp., $27.75.

Klessig and Strite use the history of the Navy's proposed ELF communications system for sending messages to submerged submarines as a case study of citizen action. The book provides an interesting and clearly written account of the massive antenna system's evolution and the stormy politics surrounding it. Successively known as Sanguine, Seafarer and finally ELF, the project has met strong opposition on ecological grounds in proposed host states since 1968.

The authors maintain that "the ELF experience is an example of the bewildering technology and mammoth bureaucracy that threaten to obliterate democratic decision-making." Advocating citizen involvement, they use ELF to show how government functions and how the public can influence its decisions.

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John N. Ott, *Light, Radiation & You.* Old Greenwich, CT: Devin-Adair, 1982, 174 pp., $14.50.

Those who have read Ott's previous book, *Health and Light,* will find themselves on familiar ground. Ott announces his objective at the outset: he wants to take decisions about lighting away from the janitor and place them firmly "under scientific control." He cites examples of what he calls malillumination (exposure to light which has biologically important wavelengths missing), the potentiating effects of visible radiation on drugs, hyperactivity caused by fluorescent lights and the healing power of full spectrum light. One intriguing hypothesis is that fetal monitoring equipment can weaken muscles, thus forcing a Caesarian birth.

Some readers may be put off by Ott's chatty and anecdotal style, and there is much here that probably will not stand up to the rigors of the scientific method. But Ott is no doubt correct in his view that specific wavelengths have specific biological functions and that these will soon be the subject of greater experimental scrutiny.

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Ronald T. Pretty, ed., *Jane's Weapon Systems, 1981–82.* 12th edition, 1006 pp., $140.00.

R.J. Raggett, ed., *Jane's Military Communications, 1981.* 2nd edition, 629 pp., $125.00.

Both volumes are published in the US by Jane's Publishing, Inc., New York, NY, and distributed by Franklin Watts, Inc., New York, NY.

These are extraordinary reference books. They are indispensable to anyone trying to sort out the different kinds of military radar and communications systems now in use all over the world. Each system is described in detail, including operating characteristics (such as frequency, power and waveform), use, manufacturer and history. The indexes make it easy to find any listing, and both volumes are profusely illustrated.

Radiation Directors *(continued from p. 1)*

at 27 MHz. A possible explanation is that the fundamental may be better controlled inside the machine. It adds up to a "very tricky" measurement problem, Herman said. He also reported that the National Institute for Occupational Safety and Health (NIOSH) had found average exposures of 591 V/m at the operators' necks and 1.04 A/m at their chests. The highest readings were 2500 V/m and 13 A/m.

• The Environmental Protection Agency has sponsored a study, *Identification of Potential Human Study Populations for Non-Ionizing Radiation Health Effects,* to help in future epidemiological research. The contractor, JRB Associates of McLean, VA, pinpointed eight such groups and outlined the pros and cons of each. The study is now being peer reviewed.

• NIOSH's William Murray said that the agency had not yet been able to set up an epidemiology of RF sealer workers.

• Robert Watkins of Massachusetts' radiation control program explained the state's reasoning for deriving public exposure standards from occupational standards. He said that they had considered a factor of ten but had found that it would have too great an impact, and had therefore settled on a factor of five. The state will soon propose a frequency-dependent population standard of 200 uW/cm^2, at its most stringent level. (See *MWN,* March 1982.)

The new task force on model state standards, chaired by Robert Hallisey of the radiation control program at the Massachusetts Department of Public Health, is the radiation control directors' third group dealing with non-ionizing radiation. This new effort complements the radiation directors' on-going work on model standards for laser safety. Charles Tedford of the Arizona Radiation Regulatory Agency heads one on measurement and instrumentation, and Lawrence McDonnell of the Wisconsin Department of Health and Social Services is in charge of a group that is studying setting priorities for radiation-emitting consumer products.

Some 325 radiation officials from 49 states attended the meeting. Only the radiation director from Idaho was unable to come to Maine because of restrictions on out of state travel. The briefing on RF sealers was requested by a number of states including Vermont, which asked for assistance in evaluating RF hazards.

HIGHLIGHTS

ASME Decision: Impact on Voluntary Standard Setting Committees

In a decision that could have wide ranging impact on all voluntary standard setting organizations, the United States Supreme Court has ruled that the American Society of Mechanical Engineers (ASME) is liable for the actions of its committee members. The Supreme Court supported a lower court's finding that the ASME had violated the antitrust laws when a member of one of its technical committees had "successfully used his position within the ASME in an effort to thwart" a competitive challenge.

The case was brought by Hydrolevel Corp., which began competing with McDonnell & Miller, Inc., (M&M) for a share of the market for water boiler safety devices in the 1960's. Members of a subcommittee of the ASME's Boiler and Pressure Vessel Committee worked with M&M executives to discourage customers from buying Hydrolevel's product. Hydrolevel eventually went out of business and all the parties to its suit alleging violation of the antitrust laws settled except for the ASME.

Under the court's ruling, the society is now liable for treble damages under the Sherman Act. The district court entered a judgment against ASME of more than $7 million; whether this amount will in fact be awarded will be decided later. The ASME has some 90,000 members and an annual budget of approximately $12 million a year.

The ruling has caused a chill within voluntary standard setting organizations. Most of the standards dealing with non-ionizing radiation are set by such bodies. Whether the decision would affect committee work on health and safety is not clear at this time. A number of experts contacted by *Microwave News* thought that the impact would be determined by future litigation.

Eric Herz, the executive director and general manager of the Institute of Electrical and Electronic Engineers (IEEE), expressed "serious hope that we can do things in such a way that we do not discourage volunteer participation." He said that the IEEE would review its procedures in order to see if improvements were needed.

William Rockwell, legal counsel for the American National Standards Institute (ANSI), issued a statement which read in part: "It is clearly evident that the Hydrolevel case is not an indictment of voluntary standards development or accreditation. It is confined to the question of the authority of volunteer committee participants to interpret a standard and the liability of the developing group for such actions." He went on to note that ANSI has already revised its procedures to prevent such cases.

Justice Harry Blackmun wrote the majority decision for a divided court. He concluded:

> When ASME's agents act in its name, they are able to affect the lives of large numbers of people and the competitive fortunes of businesses throughout the country. By holding ASME liable under the antitrust laws for the antitrust violations of its agents committed with apparent authority, we recognize the important role of ASME and its agents in the economy, and we help to ensure that standard-setting organizations will act with care when they permit their agents to speak for them.

The six-to-three decision in *American Society of Mechanical Engineers, Inc.*, v. *Hydrolevel Corp.* was issued on May 17.

Multnomah County Delays Standard

Multnomah County, OR, has delayed adopting a radiofrequency/microwave exposure standard. The County Board of Commissioners decided not to approve a draft ordinance setting criteria for siting broadcast antennas in unincorporated Multnomah, next to Portland, because of concern over potential health hazards. To avoid placing new transmission towers in urban areas, allowed under the proposed rules, the board has suggested creating an antenna farm in the undeveloped Dixie Mountain area.

The draft ordinance submitted to the board last month by the county planning commission would have set exposure limits at 200 uW/cm^2 for 30–300 MHz, rising to 1 mW/cm^2 for frequencies above 1500 MHz and to 20 mW/cm^2 for those below 3 MHz. New broadcasters would have been required to share towers because of a lack of suitable locations and an anticipated increase in demand for transmitters.

According to Larry Epstein of the commission staff, by clustering sources only two new towers would be needed in the next five to ten years. Epstein said putting towers on Dixie Mountain could cause transmission losses that would be expensive to overcome. The Federal Aviation Administration has declared that the site would pose hazardous radiofrequency interference problems for aircraft.

The planning commission must now expand its six-month effort to develop a standard that can win board approval. In the interim, the county is continuing its moratorium on applications for new facilities. The freeze was imposed last December when the county decided to commission studies on the environmental impact of transmission towers. (See *MWN*, January/February 1982.) The board has scheduled hearings for June 8 and 15.

Swedish Physiotherapists: Pregnancy Study

An epidemiology of female physiotherapists suggests that exposure to non-ionizing radiation during pregnancy can increase the incidence of malformations and fetal death. The statistical finding is only "borderline," according to the researchers; they warn that it may only be a random phenomenon.

Dr. Bengt Kallen and Gert Malmquist of the Department of Embryology and Dr. Ulrich Moritz of the Department of Physical Therapy at the University of Lund in Sweden reviewed the histories of 2,043 infants born to 2,018 women between 1973 and 1978. Then they studied the 37 women who had seriously malformed or perinatally dead infants, investigating their use of X-ray, shortwave, microwave, ultrasound and electrostimulator equipment during pregnancy.

While as a group the women had fewer problem pregnancies than statistically expected, the researchers did find that "there are indications of a higher degree of shortwave use (and perhaps of ultrasonic waves also) among those females who gave birth to a malformed or perinatally dead infant." No data on radiation exposure were available, nor was it possible to separate exposure to ultrasound from shortwave radiation. Microwaves were used so rarely that no inferences on their potential hazard could be drawn.

Writing in the March/April *Archives of Environmental Health*, the Swedish team notes the possibility that "repeated exposure to non-ionizing radiation in the form of shortwaves (and perhaps also microwaves) could slightly increase the risk

for fetal damage," but that "it is difficult to reject, without further discussion, the finding as a random phenomenon."

Congress: Glenn Bill, RFI and Radio Marti

The subcommittee on energy, nuclear proliferation and government processes of the Senate Committee on Governmental Affairs held hearings on Senator John Glenn's (D-OH) Federal Radiation Protection Act of 1982 (S. 2284) on April 29. The bill would set up a Federal Council on Radiation Protection and a Federal Conference on Research Into the Biological Effects of Radiation to coordinate regulation and research respectively. (See *MWN,* May 1982.)

Witnesses were split on the merits of the proposal. For instance, the General Accounting Office's J. Dexter Peach supported the measure while Assistant Secretary for Health Dr. Edward Brandt spoke against it. Some, like Robert Minogue of the Nuclear Regulatory Commission, thought that the present Interagency Radiation Research Committee could effectively deal with the proposed conference's mandate. In his comments supporting the bill, Warren Sinclair of the National Council on Radiation Protection and Measurements asked that the scope of the proposed council and conference include non-ionizing radiation.

Both the chairman of the subcommittee and the committee have been asked to schedule a mark up for the bill. No response has yet been received.

The Communications Technical Amendments Act of 1982 (H.R. 5008) was reported out of the House subcommittee on telecommunications, consumer protection and finance on May 5. An amendment was approved that authorizes the Federal Communications Commission to set "minimum performance standards for audio and visual electronic equipment to reduce their susceptibility to interference from radio-frequency energy." Parallel language is contained in Senator Barry Goldwater's (R-AZ) bill (S. 929). The measure was scheduled to go before the Committee on Energy and Commerce on May 27, but was delayed until early June.

The telecommunications subcommittee held hearings on Radio Marti on May 10. On May 20, the subcommittee voted to prohibit the Reagan Administration from using AM frequencies for broadcasting information to Cuba. If this is approved by the full committee, Radio Marti would have to use shortwave frequencies.

Satcom Stations Booming in New York

Work will soon begin on three major satellite communication stations in the New York City metropolitan area. Home Box Office (HBO) has won approval for its station in Smithtown on Long Island. The City Planning Commission is expected to act favorably on an application by Hughes Aircraft to build the first station of its new Galaxy communication system in the Spring Creek section of Brooklyn. And a joint venture between the Port Authority of New York and New Jersey (PA) and Merrill Lynch to develop a huge "Teleport" complex in Staten Island is in the process of assembling the necessary approvals.

The PA-Merrill Lynch plan is by far the most ambitious, calling for at least ten receive and transmit antennas on a 350-acre site on Staten Island, with connections via a fiber optic cable to Jersey City, NJ, and the World Trade Center in downtown Manhattan. The complex will have the capability to communicate with all satellites in the Northern Hemisphere's orbital arc. The legal details of the "partnership" between Merrill Lynch and the PA are in the process of being negotiated.

Merrill Lynch's Stanley Welland predicted that the satellite antenna farm would serve a wide range of clients including broadcast networks, cable TV, banks, and financial institutions. Joseph Milano of the PA said that construction on Staten Island could begin as early as late this summer, with services beginning next year. Expansion would continue over the next decade.

Representatives of Hughes Aircraft presented their case for the first station in their new domestic communication network at a hearing before the New York City Planning Commission on May 19. According to the environmental impact statement, the maximum public exposure would be 1–2 uW/cm^2 at the property line. (See *MWN,* April 1982.) Peter Berle, an attorney and the former head of the state's Department of Environmental Conservation, called his client's review "the most comprehensive analysis that has ever been done." He said that the radiation levels would be "far below any known standard."

Speaking for the city's Public Development Corp., Jed Marcus said that "any neighborhood would be proud of the Hughes project." Commission approval is expected in June. Hughes only needs permission from the city's Board of Estimate before construction can begin.

The Smithtown Board of Zoning Appeals approved the building of up to seven 45-foot antennas for HBO in Suffolk County, Long Island, on February 11. The site will be connected to the Gulf + Western building in midtown Manhattan by a combination of microwave line-of-sight and cable relays. John Rosenblum of Telspec in Hauppauge, NY, said that his radiation analysis indicated that the maximum radiation exposure, estimated on a worst case basis, would be 10.9 uW/cm^2 at the HBO property line. The board hired John Baum of Brookhaven National Laboratory to review the HBO application.

The cable entertainment company had originally planned to build the station in Rockaway, NJ, but gave up in the face of strong community opposition. (See *MWN,* January 1981.) Scientific Atlanta is expected to build the station for HBO.

IRPA Occupational Exposure Guideline

The International Non-Ionizing Radiation Committee of the International Radiation Protection Association (IRPA) is circulating a review draft of its occupational exposure standard for 100 kHz to 300 GHz radiation. The frequency-dependent guideline proposes a 1 mW/cm^2 limit for exposure to 10 MHz–1 GHz radiation and recommends up to a tenfold additional safety factor for general population exposures. The committee also recommends that "under all circumstances exposures should be kept as low as readily achievable."

In the other frequency ranges, the proposed levels are: 25 mW/cm^2 for 100 kHz–1 MHz; 10 mW/cm^2 for 1 MHz–10 MHz; and 5 mW/cm^2 for 1 GHz–300 GHz. For all frequencies, a six-minute averaging time for measuring exposures is suggested.

The IRPA guideline closely parallels the new ANSI standard, except that the exposure limit for different frequency bands changes as a step function rather than as a continuous function of frequency. The draft claims the step approach is "more desirable from a compliance viewpoint."

No recommendation is made for a peak power limit for radiation with a pulse width on the order of milliseconds or less. The committee does advise, however, that "pulsed repetition rates at extremely low frequencies (8–16 Hz) and intermittent exposures repeated with the same frequencies should be avoided."

UPDATES

Biological Effects....Dr. Joe Elder of EPA's Environmental Biology Division reports that he has received four reviews of Dr. William Morton's study, which found a correlation between three types of cancer and RF/MW radiation among residents of Portland, OR. (See *MWN*, January/February and May 1982.) On the basis of these reviews, Elder has asked Morton to "extensively revise" and resubmit his study. No new timetable has yet been worked out. Elder refused to comment on the study itself....A new draft of EPA's health effects document, *Biological Effects of Radiofrequency Radiation*, will be ready for review by the agency's Scientific Advisory Board (SAB) this summer. As soon as it goes to the SAB, it will be available to the public. The document will be the basis for EPA's "guidance," or recommended safety level, for public exposures to RF/MW radiation. The formal notice of an intent to issue a guidance is still waiting for Administrator Anne Gorsuch's approval....The papers presented at the *Festschrift* for Professor Herman Schwan, held in November 1980, have been published in Volume 3, Number 1 of *Bioelectromagnetics*. The collection, *The Interaction of Acoustical and Electromagnetic Fields with Biological Systems*, edited by Shiro Takashima and Elliot Postow, is also available as Volume 86 of *Progress in Clinical and Biological Research* for $28 from Alan R. Liss, Inc., 150 Fifth Avenue, New York, NY 10011....EPA is negotiating a contract with researchers at the University of Illinois, Urbana, on the effects of whole body and local exposure to microwaves on local tissue blood flow. Dr. Kenneth Holmes of the Department of Veterinary Biosciences and Dr. Richard Magin of the Department of Electrical Engineering are the joint principal investigators. They will use 2450 MHz radiation at both thermal and subthermal levels, though the exact power densities have still to be worked out....Drs. Norman Rosenthal and Thomas Wehr at the National Institute of Mental Health have found that exposure to visible light — special bright lights—can relieve depression, according to an item in the May 21 *Washington Post*. The lights fooled the participants into thinking it was still summer in the middle of winter, helping them fight off what the researchers have called "gray sky syndrome."

Communications....The FCC has allocated 3 MHz of spectrum space for one-way paging systems. The recent action makes room for 80 paging channels in the 929–932 MHz band....Commission rules for low-power television are in the May 18 *Federal Register* (47 *FR* 21468)....In response to petitions from the Local Digital Distribution Company and Satellite Business Systems, the commission has reconsidered its spectrum allocation decision for digital termination systems (DTS) (see *MWN*, February 1981). DTS power limits are now calculated by power spectral density rather than absolute power. So far 29 applicants are seeking DTS licenses....The interconnection, which phone companies will provide for cellular systems operated by non-wireline companies, will be discussed at an FCC public meeting June 16. Contact the commission's Tom Gutierrez at (202) 632-6450 for details....The Justice Department has filed for a partial stay of the FCC's authorization for cellular radio service. The department asked that the commission accept applications on June 7 as planned but be restrained from processing those from local phone companies until completion of a legal review....AT&T, GTE, MCI Communications, LIN Broadcasting, Associated Communications Corp. and Western Union are among the companies seeking licenses....Metromedia Inc. is acquiring Radiofone Corp. and plans to finance the radio paging operator's cellular action....The May 10 *Electronic News* reports on joint ventures among radio common carriers for entry into cellular markets. Up to $20 million in start-up costs may be required for a single market....Away from the cellular front, GE wants 9 MHz of the 900 MHz band for personal radio communications services (PRCS). A "base" station tied in to customers' home phones and a "mobile" unit installed in their cars would allow drivers to make calls 5 to 15 miles from home. GE is seeking a mass, general consumer market with a system priced at around $400....Stock market quotes sent via FM radio will soon flash across handheld receiver display screens. Dataspeed Inc. of San Francisco plans to introduce a small gadget in December that can receive all prices from major stock exchanges in 70 seconds.

Compatibility & Interference....The Bureau of Mines is worried about the possibility that communication and control devices, installed to improve safety and productivity, may interfere with each other. The bureau has issued a RFP (J0123038) to identify those devices, including mining machines, shuttle cars, conveyor systems and radio communication systems, which may interact. The contractor will develop solutions to minimize any harmful RFI....The FCC has acted favorably on a petition by the Computer and Business Equipment Manufacturers Association (CBEMA), which sought certain exemptions from RFI verification procedures. The FCC decided to allow the operation of Class A and B computing devices at trade shows and at the manufacturer's site prior to verification of compliance with the commission's RFI regulations. Class A devices, generally large mainframe computers, can also be tested at the users' sites; Class B computers, such as personal computers, were not exempted however. The CBEMA petition was filed on December 8, 1980; the commission issued its decision on March 22....Inverters that convert DC from solar cells to AC emit radiation over a broad frequency range which can interfere with AM radio reception. An item in the May 15 *Science News* cites tests performed by NBS's John Adams that indicate photovoltaic cells will probably need shielding ....The FCC is seeking further public comment on rules to alleviate interference caused by noncommercial, educational FM stations in the 88–92 MHz band to the operation of Channel 6 (82–88 MHz) in the same area. For more information contact FCC's Gordon Godfrey, (202) 632-9660....The commission is also soliciting comments on how to implement the agreement reached on AM broadcasting at the 1981 Rio de Janeiro conference. See 47 *FR* 18009, April 27, or contact Louis Stephens, (202) 632-7792, on legal issues or Larry Olson, (202) 254-3394, on engineering matters....Comsearch, Inc., of Reston, VA, is now offering free literature on "Interference Protection for Cable TV Systems from Low Power TV Stations." For more information contact: Jerry Schulman, (703) 620-6300.

EMP....*Science* magazine's William Broad took his arguments against increased funding of space weapons in the face of EMP threats to the op-ed page of the *New York Times* (May 13)....The piece prompted a reply (May 23) from Frederick Jacobs, who, basing his views on articles in the January 18 and March 15 *Aviation Week and Space Technology*, believes that DARPA is now aware of the EMP problem and addressing it. Jacobs is a freshman at the University of Chicago....The papers to be presented at the July 23 *Conference on Hardened Electronics and Radiation Technology* at Nellis AFB, Las Vegas, NV, will be published in a special issue of the *Journal of Defense Research*....The Army Construction Engineering Research Lab in Champaign, IL, is looking for a contractor to revise technical manuals on the effects of EMP with emphasis on protection and shielding.

Government....EPA has announced the appointment of a new director of its Office of Radiation Programs. Glen Sjoblom, the assistant director for environmental controls in the navy's reactor program, will soon replace Dr. Gordon Burley, who has been serving as the office's acting director since the departure of Dr. David Rosenbaum....At OSHA, Dr. R. Leonard Vance has been named the head of the Directorate of Health Standards Programs. Vance, a chemist and lawyer, was an assistant attorney general in Virginia. He replaces Dr. Bailus Walker, who resigned last year....An NTIA spokeswoman said that there have been no new developments on finding a new home for ERMAC. NTIA wants to transfer the responsibility for coordinating federal activities on the bioeffects of RF/MW radiation, but it is not clear who, if anyone, will pick up the advisory committee's work. (See *MWN*, May 1982.) Meanwhile, the House Energy and Commerce Committee approved an FY83 budget of $13.4 million for NTIA while the Senate Commerce Committee supported the Reagan Administration's request of $12.4 million. A conference committee will settle the difference; a compromise of $12.9 million is expected. The extra $500,000 would be allocated to continued funding of NTIA's public telecommunications program, contrary to the administration's plan to phase it out....On another front, NTIA is

soliciting proposals for a study to see which parts of its Spectrum Management and Federal Systems program can be contracted out to the private sector. The Electromagnetic Compatability Analysis Center which is operated by the IIT Research Institute for DoD is one example of such outside assistance. Solicitation No. SA-82-RSB-0029 was issued May 6.... BRH's Technical Electronic Product Radiation Safety Standards Committee (TEPRSSC) is once again looking for new members to fill four vacancies coming up on December 31. Those persons nominated last year but not elected will be reconsidered. New nominations are due by July 12. For more information contact: Dr. Zory Glaser, (301) 443-3429.

Litigation.... A local citizens group in Coventry, CT, has filed suit in the state's Superior Court to block a relay transmission tower proposed by US Telecommunication Systems, an ITT subsidiary. Citizens Against the Tower is appealing the town Zoning Board of Appeals' April 20 approval for the 20-watt facility because of concern over potential radiation health hazards. Lawrence Bates, the group's attorney in Coventry, has also requested a temporary restraining order to prevent construction until the case is settled. A hearing on the request is scheduled for June 16. According to ITT's attorney, William Hall, the company has offered to delay construction plans in exchange for dropping the restraining order request and quickly taking the case to court this summer. The Coventry site is one of four towers being planned to link New Jersey and Boston. Hall explained that "the company is anxious for speedy disposition of the case so that the whole system can be built." ITT has already completed a system with over 100 towers between Houston and New Jersey. At zoning board hearings last month, Dr. Herbert Pollack testified as a medical consultant for ITT and Dr. Sol Michaelson appeared for the board.

Medical Applications.... Francis Smith of the Department of Nuclear Medicine at the Aberdeen Royal Infirmary in Aberdeen, Scotland, reports in the April 24 *Lancet* that no short or medium term ill-effects have been found after the examination of 548 patients and healthy volunteers, ranging in age from two weeks to 84 years, with an NMR imager. The imager used was designed and developed in Aberdeen. He believes that NMR imaging is a "safe technique at the magnetic fields used for imaging and that it does not cause any ill-effect."... Dr. Ian Pykett, a member of the research team on NMR imaging at Massachusetts General Hospital in Boston, has written a review article, "NMR Imaging in Medicine," for the May issue of *Scientific American*.... An "electric Band-Aid" could speed up the healing of wounds, according to a presentation by Oscar Alvarez of the University of Pittsburgh School of Medicine at the Society for Investigative Dermatology meeting in Washington, DC, and reported in the May 22 *Science News*. An electrode made of silver impregnated cloth, which was placed over surface scrapes, reduced the healing time from 4.6 to 2.9 days, compared with no treatment. More work is needed before any firm conclusions can be reached.

Ovens.... Congressman Richard Ottinger's (D-NY) subcommittee on energy conservation and power of the House Committee on Energy and Commerce held hearings on DOE's decision not to set efficiency standards for appliances, including microwave ovens, on May 21. (See *MWN*, May 1982.) Ottinger, with the support of 50 co-sponsors, has introduced H.R. 6202, which would amend the Energy Policy and Conservation Act to eliminate the preemption of state standards. Ottinger attacked DOE's analysis supporting the "no standard" approach as "manipulated" and an example of "voodoo economics." His position was supported by a recently released GAO report, *Appliance Efficiency Standards: Issues Needing Resolution by DOE* (GAO/EMD-82-78, May 14, 1982), which concludes that the basis for DOE's proposal is "highly questionable." Representatives of DOE testified that the agency's position was that "mandatory federal standards would place unnecessary restraints on manufacturers." The Association of Home Appliance Manufacturers (AHAM) endorsed the DOE decision, arguing that the marketplace would accomplish the goal of energy efficiency.... Meanwhile, DOE cancelled its May 11-12 public hearing in Chicago on the standards due to lack of interest. Only two requests to speak were submitted and both parties agreed to participate at the hearings in Washington, DC, scheduled for May 18-21.... The Society of Plastic Industries is sponsoring a seminar on microwave oven cookware on July 26 as part of the annual meeting of the International Microwave Power Institute to be held in San Diego, CA. (See conference calendar.) ... AHAM reports that shipments of microwave ovens were down 13.4 percent in April compared to April 1981. Factory shipments for the year now stand at 1,213,100, more than 10 percent fewer than last year.

Radar.... Dr. Jack Verona of the Defense Intelligence Agency testified on technology transfer from the US to the USSR before the permanent subcommittee on investigations of the Senate Committee on Governmental Affairs on May 5. He argued that Soviet radar development was hastened by US lend-lease equipment sent after World War II, the unclassification of MIT Radiation Laboratory's volume on radar theory and the acquisition of American microcircuitry.... Stephen Johnson published a reply to Thomas Amlie's article on the dangers of over-reliance on radar (see *MWN*, April 1982) in the May *IEEE Spectrum*.... *Science News* features a report on the accuracy of police traffic radar in its May 22 issue.... The Rome Air Development Center at Griffis AFB, NY, is negotiating a contract with Raytheon Co. for a feasibility demonstration of HF radar.

Satellite Communications.... The FCC voted to cut off processing new applications for orbital slots at a meeting last month. To avoid delay in assigning slots, it will now consider only the ten applications already in for approval. New applications will be processed as a separate group.... Most people would not buy a new television to get a better quality picture, according to a study by Frank N. Magid Associates. On May 17, *Broadcasting* magazine reported that this survey supports a push by United States Satellite Broadcasting, a direct broadcasting services applicant, for allocating spectrum to DBS rather than high resolution TV.... COMSAT's Satellite Television Corporation (STC) is making plans for a DBS satcom station in Las Vegas.... Meanwhile, FCC approval for the company's DBS satellites is pending.... Tandem Computers Inc. and American Satellite Co. have joined forces to market Infosat, a system for sending computerized information via satellite. An article in the May 13 *Wall Street Journal* reports that the system will be available next year.... On the same day, the *Journal* examines the policy issues surrounding satellite links between the US and Canada. Growing commercial demands for communications services have prompted US satcom operators to request the links, which are now not permitted.... The May 3 *Aviation Week and Space Technology* details features of the new Intelsat VI satellites.... Hughes Communications International will build Australia's first satcom system. The company recently signed a $175 million agreement with Aussat Proprietary Ltd., the national satellite company.... The FCC has approved COMSAT's plans for six satcom stations in Micronesia and the Marshall Islands.

Standards.... Approval of the new health and safety RF/MW standard is still under consideration at ANSI... On another front, ANSI is seeking comment on a new standard, *Recommended Practice for the Measurement of Spurious Emissions from Land-Mobile Communication Transmitters* (No. BSR/IEEE 377-1980). It covers definition of terms, controlled test conditions, test apparatus and test methods in the range 25 MHz to 1000 MHz. For a copy send $6 to: Board of Standards Review, ANSI, 1430 Broadway, New York, NY 10018. Comments are due July 13.... ANSI has also published a 16-page booklet, *Directory of International and Regional Standards Organizations*. Send $3 to the ANSI Sales Dept.... The International Electrotechnical Commission has issued a technical report on *Methods of Measurement of Wideband Noise Radiated from Motor Vehicles — Appendix A: Measurement and Performance Specifications for a Standard NAD Measuring Equipment — Appendix C: Overlay Method for Assessing Receiver Degradation in the Presence of Impulsive Noise*, Publication No. 489-9, Section 2. A copy is available for $7 from the ANSI Sales Dept. The IEC has also proposed a number of amendments to the International Special Committee on Radio Interference's Publication No. 14. For more information, contact ANSI.

Technology....A team from the Johns Hopkins University School of Medicine describes the use of 1 kV/cm electric pulses for 50 microseconds to fuse 3T3 cells in monolayer culture, in the April 30 *Science*. The researchers proposed that "transient pore formation and energization of cell membranes brought about by the electric field are responsible for the fusion of cells in close contact."...A satellite system using pulse-doppler radar could control global air traffic in the next century, according to designers at the Aerospace Corp. in El Segundo, CA. The system is described in the May 17 *Electronic News*. ...The US Army Armament R&D Command in Dover, NJ, has announced three new contracts for the development of railgun technology. Negotiations are being conducted with Sandia National Labs in Albuquerque, NM, GT Devices of Alexandria, VA, and Vought Corp., of Dallas, TX.

VDTs....A summary of VDT radiation test results from Dayton T. Brown is due in June. The firm has been testing units used by Darleen Weiss, a VDT operator who sought workers' compensation for cataracts allegedly induced by radiation from the terminals. (See *MWN*, October 1981.)...Canada's Radiation Protection Bureau retests of Bell Canada VDTs reported to emit X-rays have found nothing. Bureau director Dr. Ernest Latourneau said that the high readings taken by the company last year were the result of procedural errors....A VDT safety bill introduced in the Massachusetts legislature is not likely to be considered this year. (See *MWN*, April 1982.) A spokeswoman for the House Committee on Commerce and Labor that had begun review of House Bill 2910 said the measure would probably be reintroduced next year....The city of Toronto has agreed to grant women working on VDTs alternate work during pregnancy. The option is part of a contract between the city and the Local 79 of the Canadian Union of Public Employees.

Etc....Bernard Schwartz, the chairman of Loral Corp., has given the City College of the City University of New York $165,000 to set up a microwave laboratory at its School of Engineering. The money, which will be used to buy equipment, is a step toward establishing a major center for microwave research at CCNY....Physicists at Stanford University, CA, believe they have finally detected a magnetic monopole, a single north or south magnetic pole. The discovery is causing much excitement and promises to intensify the search by other scientists....Dr. Merle Tuve, one of the leading developers of radar, died in Bethesda, MD, on May 20.

LETTERS

To the Editor: Upon reading your report of our work ("Low-Intensity Pulsed Magnetic Fields Stimulate Release of Noradrenaline," *MWN*, May 1982), there is one inaccuracy I would like to correct. You state that "they suggest that weak magnetic fields could damage the surface of cell membranes" whilst we stated that "irreversible membrane damage has not occurred."

We were able to draw this conclusion because we designed part of the protocol to specifically check this possibility. The observations that elevated Mg^{++} levels inhibit the stimulated release and that prior exposure to our magnetic field does not alter high K^{+} stimulated release both strongly suggest that the stimulation we observed is of the normal vesicle mediated stimulus coupling pathway found in these cells. Indeed, we believe that reversible co-operative interactions between surface bound glycoproteins may well mediate this response, which is a model that has been developed by Ross Adey in his recent publications.

Richard Dixey
Department of Medical Electronics, St. Bartholomew's Hospital, West Smithfield, London EC1A 7BE, England

Microwave News *invites letters from its readers. We ask writers to be brief, and we reserve the right to edit contributions for length.*

CONFERENCE CALENDAR

• June 15-17: IEEE MTT-S *International Microwave Symposium*, Hyatt Regency Hotel, Dallas, TX. Contact: J.R. Griffin, Texas Instruments, Mail Stop 3432, PO Box 405, Lewisville, TX 75067. On June 18 immediately after the conference, there will be a one-day workshop on *Medical Applications of Electromagnetic Energy*. Contact: Dr. Gordon Short, BSD Medical Corp., 420 Chipeta Way, Salt Lake City, UT 84108.

• June 28-July 1: *Conference on Precision Electromagnetic Measurements*, University of Colorado, Boulder, CO. Contact: Robert Kamper, National Bureau of Standards, Boulder, CO 80303.

• June 28-July 2: 4th Annual *Bioelectromagnetics Society Meeting*, Beverly Wilshire Hotel, Beverly Hills, CA. Contact: BEMS, 1 Bank Street, Suite 307, Gaithersburg, MD 20878.

• July 20-22: IEEE Annual Conference on *Nuclear and Space Radiation Effects*, Caesars Palace, Las Vegas, NV. Contact: A. Ochoa, Jr., Div. 2144, Center for Radiation-Hardened Microelectronics, Sandia National Laboratory, Albuquerque, NM 87185. This meeting will be followed on July 23 by the *Hardened Electronics and Radiation Technology Conference* hosted by the Defense Nuclear Agency. A Secret security classification is required to attend. Contact: Director, DNA, Attn: ISSO/Barbara Perkins, Washington, DC 20305.

• July 25-30: 17th Annual Symposium of the *International Microwave Power Institute*, Town and Country Hotel, San Diego, CA. Contact: IMPI, 301 Maple Ave. W., Tower Suite 520, Vienna, VA 22180.

• August 11-13: 4th Annual *Satellite Communications Users Conference*, Regency Inn, Denver, CO. Contact: Satellite Communications Magazine, 3900 S. Wadsworth Blvd., Denver, CO 80235.

• August 16-18: 1st Annual *Meeting of the Society of Magnetic Resonance in Medicine*, Boston, MA. Contact: Deedee Correia, NMR Laboratory, Research 501, Massachusetts General Hospital, Boston, MA 02114.

• September 5-11: *World Congress on Medical Physics and Biomedical Engineering*, including the 13th *International Conference on Medical and Biological Engineering* and the 6th *International Conference on Medical Physics*, Congress Center, Hamburg, Germany. Contact: MPBE 82, Congress Organization, PO Box 302360, D-2000 Hamburg 36, Federal Republic of Germany.

• September 6-10: 7th *Colloquium on Microwave Communication*, Budapest, Hungary. Contact: Secretariat of the 7th Microcoll, H-1525, Budapest 114, POB 15, Hungary.

• September 8-10: *International Symposium on Electromagnetic Compatibility*, Marriott Hotel, Santa Clara, CA. Contact: Dr. Andrew Nalbandian, 20617 Debbie Lane, Saratoga, CA 95070.

• September 13-17: 12th *European Microwave Conference*, Helsinki, Finland. Contact: Prof. M. Tiuri, Helsinki University of Technology, Radio Lab, Otakaari 5A, 02150 Espoo 15, Finland.

• September 14-16: 4th *International Workshop on Biomagnetism*, Rome, Italy. Contact: Dr. G. Spissu, Istituto di Elettronica dello Stato Solido del C.N.R., Via Cineto Romano, 42-00156, Rome, Italy.

• September 20-21: 4th Annual *Conference of the IEEE Engineering in Medicine and Biology Society*, Marriott Hotel, Philadelphia, PA. Contact: Dr. Alfred R. Potvin, Department of Biomedical Engineering, PO Box 19138, University of Texas, Arlington, TX 76019.

• September 20-22: 2nd Annual *Meeting of the Bioelectric Repair and Growth Society*, Oxford, England. Contact: Dr. B.F. Sisken, Wenner Gren Research Laboratory, University of Kentucky, Lexington, KY 40506.

• September 22-24: 35th Annual *Conference on Engineering in Medicine and Biology*, Marriott Hotel, Philadelphia, PA. Contact: ACEMB, 4405 East-West Highway, Suite 210, Bethesda, MD 20814.

• October 26-28: 1st *International Symposium on Medical Imaging and Image Interpretation*, Berlin, West Germany. Contact: Dr. Judith Prewitt, c/o IEEE Computer Society, PO Box 639, Silver Spring, MD 20901.

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MICRO WAVE NEWS

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Pulsed Magnetic Fields: Conflicting Results

Low frequency magnetic fields are becoming a focal point for bioeffects research. One of the major objectives is to replicate the experiments of Dr. Jose Delgado, who has shown that very low intensity, pulsed magnetic fields can have a dramatic effect on a developing chick embryo. Scientists are anxious to repeat and explain Delgado's experiments because, if confirmed, his results could shed new light on how radiation interacts with living systems and could force a major reassessment of radiation hazards.

At least three research groups are trying to replicate Delgado's experiments, with varying success. One team has failed, another has partially succeeded and a third will start work later this summer. In addition, workshops to exchange research ideas are being planned and funds are being set aside to allow scientists on both sides of the Atlantic to visit each other's labs.

Delgado's Experiment

In 1982, Delgado and his associates at the Centro Ramon y Cajal Hospital in Madrid, Spain, showed that pulsed magnetic fields at frequencies of 10, 100 and 1000 Hz can have a "consistent and powerful" effect on the growth and development of chick embryos at intensities ranging from 1.2-120 milligauss (see *MWN*, March 1983). In a follow-up study, Delgado's group concluded that pulse shape could be the decisive parameter for determining whether magnetic fields modified embryonic development, though the precise mechanism remained unknown (see *MWN*, November 1983).

(continued on p.2)

EPA Delays Decision on Releasing RF/MW Guidance

The Environmental Protection Agency (EPA) has delayed the release of its proposed radiofrequency/microwave (RF/MW) radiation exposure guidance, which was scheduled for this month. In the first official statement to indicate rule making may be abandoned, EPA Assistant Administrator Joe Cannon announced in early June that the agency is considering a number of options for the guidance, including putting it on ice.

As we go to press, agency officials would only say that an active "internal debate" is in progress and that a decision should be reached later this summer.

Meanwhile, the Office of Research and Development's report on RF/MW bioeffects has received final approval from EPA's Scientific Advisory Board. The document was prepared as the basis for standard setting (see Standards Update, p.12).

Miller Fails

Dr. Morton Miller, of the University of Rochester in New York, has completed his attempts to duplicate the effects reported by Delgado. "We found absolutely nothing," he said in a telephone interview. Miller studied only the two highest frequencies (100 and 1000 Hz) and the two highest intensity levels (12 and 120 milligauss) used in Delgado's original experiment. Professor Edwin Carstensen of the university's department of electrical engineering and Sandra Maffeo, a lab technician, collaborated with Miller on the study. Miller is with the department of radiation biology and biophysics at the School of Medicine and Dentistry.

Miller used 0.5 millisecond pulses with rise times of approximately 10 microseconds.

He noted that the study had been run "blind," but that there was one difference between his set up and that of Delgado's. The eggs in the two experiments had different orientations with respect to the coils. Thus, according to Miller, the induced electric fields in Delgado's eggs were "slightly higher."

Miller expressed disappointment about coming up empty-handed. "I haven't a clue why we did not get any results in comparison with Delgado's massive effects," he said.

A paper describing Miller's results has been accepted by the *Journal of Anatomy*, the same journal that published Delgado's two papers. In it, the Rochester team concludes: "Our failure to replicate the results of [Delgado's] earlier report cannot be said to invalidate that work. It does imply that if there are effects of magnetic fields on embryogenesis, they must be very subtly related to the conditions of exposure. In view of the obvious importance of the observations, we strongly encourage other independent investigators to try to replicate the observations." The paper should appear later this year.

Mild's Partial Success

Dr. Kjell Hansson Mild, of Sweden's National Board of Occupational Safety and Health in Umea, has had some success where Miller failed. In a telephone interview from Sweden, Mild said that he had detected the Delgado effect: "We seem to have confirmed the same general trend, but with a lower rate of malformation." Mild noted that the effect he observed was statistically significant.

In his original paper, Delgado reported that nearly 80 percent of the eggs developed abnormally when exposed to pulsed magnetic fields. Mild said that he was finding an abnormality rate of about 30 percent. He added that more of the control eggs in his experiment were developing normally than in Delgado's.

There was at least one minor difference between Mild's and Delgado's experiments. Mild pointed out that, "We have slightly different techniques for preparing the embryos."

Mild used a 10 milligauss peak field, with pulses that were 0.5 milliseconds wide with 40 microsecond rise and fall times. The pulse repetition rate was 100 pulses per second (100 Hz).

Mild said that he is preparing a short communication describing his results for submission to *Bioelectromagnetics*.

EPA-NIEHS' Attempt

The third attempt to repeat Delgado's experiment will be made by a team from the Environmental Protection Agency (EPA) and the National Institute for Environmental Health Sciences (NIEHS) in Research Triangle Park, NC (see *MWN*, January/February 1984). According to the current schedule, the study will begin later this summer.

Before the power is turned on by the EPA-NIEHS team, EPA's Richard Tell and Dr. Ezra Berman will visit Delgado's lab in Madrid. "I want to understand all of Delgado's field parameters before we start," Tell said. The EPA trip will be sponsored by the Office of Naval Research (ONR).

According to ONR's Dr. Michael Marron, Dr. Tom Rozzell has visited Delgado's lab and was impressed with what he saw there. (Rozzell is on a two-year assignment at ONR's London office.) Using funds from ONR's visiting scientist program, the Navy is planning to fly two of Delgado's associates to the US later this year.

CW Fields

Dr. H.B. Graves would also like to try to repeat Delgado's experiment. He recently completed a study in which he exposed some 20,000 chicken eggs to continuous wave (CW) 60 Hz fields ranging from 100 V/m to 100 kV/m, and found no effects on a large number of end points, including growth, body weight and behavior. The study was sponsored by the Electric Power Research Institute (EPRI).

Graves, who is a professor of biology and poultry science at Pennsylvania State University, said that he had asked both EPRI and the US Department of Energy (DOE) for funds to attempt a Delgado replication with no success. "I feel like the Delgado study has implications that are too important to ignore," Graves said in a telephone interview. "We must seize upon this to try and understand how such a signal can couple with a living system."

Dr. Rob Kavet at EPRI told *Microwave News* that the institute has no immediate plans to fund a Delgado-type study because that kind of pulsed signal does not show up in transmission line environments.

Graves opposed this view. He maintained that, "It's an error for EPRI not to fund a replication. If Delgado's effect is robust, it has implications for utilities and many other industries." (Miller said that his study had been supported by DOE and the Empire State Electrical Energy Research

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Corp., a consortium of New York state private utilities modeled after EPRI.)

Why is Replication Difficult?

A number of scientists were asked why they thought it was so difficult to repeat Delgado's experiment. A common reply was that Delgado had not provided detailed descriptions of his study design in his published papers. For instance, in his first paper, Delgado does not specify the rise time of the pulses he used, a variable he claims in his second paper may be the "decisive parameter." In that latter paper, he reported finding a maximum effect with a rise time of 42 microseconds and an intensity of 10 milligauss.

Although Miller and co-workers claim to have attempted a replication of Delgado's experiment, they used a different pulse shape with a 10 rather than 42 microsecond rise time.

If Delgado's hypothesis that there are windows in the teratogenic effects of electromagnetic fields proves to be correct, the differences in pulse shape and field intensity could be decisive.

Others suggested that a number of variables could be critical: the orientation of the exposed eggs to the Earth's magnetic field, the temperature at which the eggs are incubated and the way the eggs are handled during the course of the experiment. Mild speculated that, "There may be some other parameter that we are not controlling for."

According to Marron, Rozzell noted in a report on his visit to Delgado's lab that he had been told that the orientation of the exposed eggs to the Earth's magnetic field is a crucial variable. Neither Miller nor Mild took this factor into account in their experiments — because it is not cited in Delgado's papers.

Delgado was in Sweden in May, and Mild met with him. Mild reports that Delgado is now exposing live, pregnant rodents to pulsed magnetic fields and investigating changes in the brain chemistry of the embryos.

Workshops

ONR's Marron told *Microwave News* that he is considering organizing a workshop on low frequency fields for this fall.

In addition, there will be a symposium on "Magnetic Fields and Biological Systems" on the evening of July 15 at the Bioelectromagnetics Society (BEMS) meeting in Atlanta, GA. Among the papers to be presented is a review of preliminary attempts by Tell and co-workers to duplicate Delgado's results.

Delgado, Mild and Miller will not be at the BEMS conference; Mild and Miller are planning to attend the Hanford ELF symposium in Richland, WA, in early October. ●

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This new report reviews basic aspects and all latest research from ELF to microwaves, including 60 Hz power installations. Practical advice on health/environmental impacts. $60 plus $2 postage (US). Robert O. Becker, MD, Star Route, Lowville, NY 13367.

A Guide to FCC Equipment Authorizations

The updated second edition of the original book by William K. Roberts, former Assistant Chief Engineer of the FCC. Tells what type of authorization is required for your product and the procedure to use in obtaining FCC authorization. To be released in the second quarter of 1984. Send check or p.o. for $79.50 to the EMXX Corp., 6706A Deland Drive, Springfield, VA 22152, (703) 451-4619.

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HIGHLIGHTS

Computers on Aircraft: RFI More Likely

New test results from the Federal Aviation Administration (FAA) and the Boeing Airplane Co. indicate that electronic devices can interfere with an airplane's navigation and communications systems. According to Frank White, the chairman of a study panel investigating the potential dangers of radiofrequency interference (RFI) aboard aircraft, "There is now a definite possibility for RFI."

Although two incidents of RFI aboard aircraft have been reported, concerns over interference have been discounted by experts. Nevertheless the Radio Technical Commission for Aeronautics' (RTCA) Special Committee 156 (SC156) on Potential Interference to Aircraft Electronics Equipment from Devices Carried Aboard, under White's leadership, has been pressing computer manufacturers, aircraft companies, airlines and government agencies to generate data on the nature and scope of the problem (see *MWN*, October 1983 and April 1984).

In a memorandum prepared for the next meeting of RTCA SC156, Boeing reported that measurements made aboard one of its 757s indicated "that devices radiating at the specification limits produce interfering signal levels far above the receiver sensitivity threshold and therefore are a potential interference threat." Boeing concluded that, "In view of the results...we cannot rely on the inherent shielding of the aircraft fuselage to provide sufficient shielding effectiveness to protect airborne receivers from levels permitted for a class B device."

Previous FAA tests had shown that there was little likelihood of interference when the radiating source was placed in the aisle of the plane. More recent FAA measurements confirmed the Boeing findings: the mean minimum path loss for a radiating antenna against the window and in the aisle is 51.41 and 59.12 dB respectively. These new findings could affect the use of computers and other electronic devices on airplanes; as Boeing wrote to RTCA, "it is not practical to restrict the use of personal computers to those sitting in aisle seats."

In another memorandum to RTCA, David Hanttula of Apple Computer argues that the immunity of aircraft electronic equipment to RFI has not yet been fully characterized. "We must know what the immunity thresholds of the equipment are," he told *Microwave News*. Hanttula also wants RTCA to characterize the "interior electromagnetic ambients" aboard aircraft "to determine what RF levels are present without the presence of carried aboard electronic devices." (Hanttula is leaving Apple as of June 1, but he said that he plans to attend at least one more SC156 meeting.)

When asked in a telephone interview how serious the RFI problem might be, RTCA's White answered that, "We must see if the signals are strong enough and stable enough to cause RFI." To that end, White wants committee members to carefully characterize potentially interfering emissions. He added that the FAA and Boeing tests reflected worst case rather than actual operating conditions.

More data will be generated before the next SC156 meeting on June 12-13. As White put it, "We have a lot of learning to do and I'm not drawing any conclusions yet."

Yannon v. RCA Suit Continues

The widow of a former New York Telephone radio technician has successfully appealed the dismissal of her $3.5 million product liability suit against RCA. Mrs. Antoinette Yannon alleges long-term occupational exposure to microwave radiation caused her husband's illness and eventual death, a claim for which she won workers compensation benefits (see *MWN*, April 1981 and June 1982). RCA's motion for dismissal will now be reheard.

Samuel Yannon worked on microwave relay equipment at the Empire State Building for 15 years before being transferred to another site in 1968. The phone company forced him to retire in 1971 for medical reasons. Yannon died in 1974.

Mrs. Yannon's New York State workers compensation case was the first to present "substantial evidence to establish the necessary causal relationship" between exposure to microwave radiation and occupational disease ending in death. The current product liability case, however, will be much more difficult to win. Should RCA's motion for dismissal be denied, Mrs. Yannon must then prove that her husband's condition was causally linked to radiation exposure and that RCA, as the manufacturer of the equipment he worked on, was at fault.

In an April 30 decision, the Appellate Division of the New York State Supreme Court, Second Department, in Brooklyn reversed a July 1982 ruling by Supreme Court Judge Richard Goldberg which granted RCA's motion for dismissal based on the statute of limitations (see *MWN*, July/August 1982). A new hearing on the motion will be scheduled before the Supreme Court, Richmond County, for some time this year.

The key issue in this pre-trial action is whether Samuel Yannon was mentally capable of filing suit in 1968, the last year of his exposure to radiation. RCA maintains he was legally sane, and that therefore the statute of limitations had expired before Mrs. Yannon filed suit in 1976. Mrs. Yannon claims that by 1968 her husband was suffering from "chronic brain syndrome" caused by radiation exposure which left him incapable of managing his own affairs or defending his legal rights (see *MWN*, April 1982).

Brian Shoot, one of the attorneys representing Mrs. Yannon, told *Microwave News* that she has a good chance of defeating RCA's motion at the next hearing. The appellate court ruling will allow Mrs. Yannon to submit important evidence which was disallowed by Judge Goldberg. Shoot is a member of the New York City law firm of Schneider, Kleinick and Weitz, which was hired by Mrs. Yannon's personal attorney, David Paully, to handle the appeal and to act as trial counsel.

RCA refused to comment on the case.

Non-Union Fractures: PEMFs Ineffective?

Preliminary results from the first double-blind study of the efficacy of pulsed electromagnetic fields (PEMFs) for the treatment of non-union bone fractures indicates that immobilization without weightbearing may be more effective than PEMF therapy.

In the May 5 issue of *Lancet*, a team led by Dr. A.T. Barker of Sheffield University in England reports interim results on their study of tibial fractures that suggest that "conservative management of non-union is effective and this may explain much of the success attributed to pulsed magnetic field therapy." Conservative management involves stopping all movement and not placing any weight on the fracture.

The number of patients treated was small: nine received PEMF treatment, with seven controls. The fractures of five of the nine who had active coils had united at the end of 24 weeks, while five of the seven controls had also healed. All those participating in the study had fractures that were at least a year old.

One patient in the control group had been injured 11 years before the trial; his fracture was united after 24 weeks.

Those who wore active coils received 5 millisecond pulses with a peak field of 1.5 millitesla, repeated at 15 Hz for approximately 12-16 hours a day for 24 weeks. Although the authors do not specify that they used Electro-Biology, Inc.'s coils, they credit the signal to Dr. C.A.L. Bassett, one of the company's founders.

The English researchers cite a number of possible explanations for their results, which they call unexpected: "high efficacy of long-term immobilization of the limb and avoidance of weightbearing, the placebo effect of the patients 'treating' themselves for extended periods each day, the limits on patient activity during waking hours caused by being connected to the machine with a cable approximately two meters long, the additional attention they received on their frequent visits to the clinic or any combination of the above."

Barker and his co-authors, Drs. R.A. Dixon, W.J.W. Sharrard and M.L. Sutcliffe, reported these "early" or interim results because only a small number of patients had come to their clinic. They recommend a multi-center study be undertaken with about 150 patients.

The researchers conclude, "Although long-term immobilization and conservative management is not common practice at present...it appears...that conservative management of non-union should be reappraised as a treatment of choice..."

(continued on p.6)

SHORT COURSES

July 9-12: *Antenna Systems for Radar, Communications and Avionics,* Los Angeles, CA. Fee: $895. Contact: Continuing Education Institute, 10889 Wilshire Blvd., Los Angeles, CA 90024, (213) 824-9545. Repeated ***July 30-August 2:*** Boxborough, MA.

July 16-20: *Microwave Antenna Measurements,* Atlanta, GA. Fee: $800. Contact: Dept. of Continuing Education, Georgia Institute of Technology, Atlanta, GA 30332, (404) 894-2400.

July 17-18: *Radar Principles for the Non-Specialist,* Washington, DC. Fee: $625. Contact: George Harrison, Continuing Engineering Education, George Washington University (GWU), Washington, DC 20052, (800) 424-9773, or (202) 676-6106 in DC.

July 17-19: *Advances in Magnetic Resonance Imaging,* Andover, MA. Fee: $655. Contact: Dick Murray, Institute for Graphic Communication, 375 Commonwealth Ave., Boston, MA 02115, (617) 267-9425.

July 17-22: *Grounding & Shielding,* Boulder, CO. Fee: $815. Optional fourth day for $235. Contact: Don White Consultants, Inc. (DWCI), Star Route 625, PO Box D, Gainesville, VA 22065, (703) 347-0030. Repeated ***August 14-17:*** Ottawa, Canada; ***September 18-21:*** San Diego, CA; ***October 23-26:*** Atlanta, GA.

July 31-August 3: *Antenna Theory and Design,* Myrtle Beach, SC. Fee: $645. Contact: Ann Beckman, Southeastern Center for Electrical Engineering Education (SCEEE), Central Florida Facility, 11th & Massachusetts Ave., St. Cloud, FL 32769, (305) 892-6146.

August 6-10: *Non-Ionizing Radiations: Biophysical and Biological Basis, Applications and Hazards in Medicine and Industry,* Cambridge, MA. Fee: $950. Contact: Office of Summer Session, Room E19-356, MIT, Cambridge, MA 02139.

August 7-9: *Grounding & Interference Control in Buildings and Electrical/Electronic Facilities,* Philadelphia, PA. Fee: $785. Contact: DWCI, see July 17 above.

August 13-17: *Antennas and Arrays,* Ottawa, Canada. Fee: $875. Contact: GWU, see July 17 above. Repeated ***October 22-26:*** Washington, DC.

August 14-15: *EMI Diagnostics & Fixes,* Virginia Beach, VA. Fee: $635. Contact: DWCI, see July 17 above.

August 21-24: *EMC Engineering,* San Mateo, CA. Fee: $770 (3 days); $955 (4 days). Contact: Edith Webb, Center for Professional Advancement, PO Box 964, East Brunswick, NJ 08816, (201) 249-1400. Repeated ***September 24-27:*** East Brunswick, NJ.

August 27-28: *Grounding, Bonding & Shielding,* Washington, DC. Fee: $625. Contact: GWU, see July 17 above.

August 27-29: *Electromagnetic Pulse and Its Effects on Systems,* San Diego, CA. Fee: $695. Contact: GWU, see July 17 above. Repeated ***November 19-21:*** Washington, DC.

September 10-11: *EMI Testing Workshop: Commercial,* Philadelphia, PA. Fee: $595. Contact: Michele Elkes, R&B Enterprises, 20 Clipper Rd., West Conshohocken, PA 19428, (215) 825-1965. Repeated ***October 29-30.***

September 10-14: *EMC Design & Measurement for Control of EMI,* Philadelphia, PA. Fee: $995. Contact: DWCI, see July 17 above.

September 17-21: *Modern Radar Technology and Applications,* Los Angeles, CA. Fee: $895. Contact: UCLA Extension, 6266 Boelter Hall, UCLA, Los Angeles, CA 90024, (213) 825-1295.

September 17-21: *Microwave Systems Planning,* Washington, DC. Fee: $875. Contact: GWU, see July 17 above.

September 20-21: *EMI Testing Workshop: Military,* Philadelphia, PA. Fee: $595. Contact: R&B, see September 10 above.

September 24-25: *Grounding, Bonding & Shielding,* Chicago, IL. Fee: $495. Contact: R&B, see September 10 above. Repeated ***October 9-10:*** Boston, MA; ***November 13-14:*** Washington, DC.

Immunity and ANS C63 Committees: Progress Reports

The work of the American National Standards Institute's (ANSI) Ad Hoc Committee on Public Law 97-259 has entered a new phase. The committee, which is developing voluntary standards to enhance the immunity of home electronic equipment, is now attempting to define the relationship between given levels of immunity and the resulting volume of consumer complaints.

According to committee chairman Don Heirman of AT&T Information Systems Labs, one of the next objectives of the committee is to come up with "protection distances" for TVs and VCRs from sources of interference. In this way, it is possible to suggest configurations that will reduce unacceptable RFI. This task, Heirman says, is very complex and will be difficult.

In an April 27 status report, Heirman notes that a draft standard on conducted (via the antenna) immunity of TV receivers in the 535 kHz-30 MHz frequency range has been circulated among members of the Electronic Industries Association's (EIA) Consumer Electronics Group. EIA Bulletin No.10 received general approval except from the American Radio Relay League (ARRL). ARRL wants to build in more protection from amateur radios.

Manufacturers are continuing their testing to determine the radiated immunity of TVs and VCRs. Preliminary data indicate that a target of 3 V/m is still out of reach, and some manufacturers are asking if the 3 V/m level is too strict.

An immunity level of 1 V/m may be sufficient to deal with CB radio radiofrequency interference (RFI). This problem area is diminishing because of the decreased use of CBs, improved TV receiver design and increased use of cable TV. The 1 V/m level may not take care of RFI from amateur radios, however. The question of immunity from signals above 30 MHz must still be addressed.

As the work on TVs and VCRs continues, a new working group on cordless telephones has been set up within the ad hoc committee under the chairmanship of Peter Bennett of EIA. The group's first order of business is to determine whether an electromagnetic compatibility (EMC) problem exists and, if so, how it should be approached. Interference to home security devices will be taken up later.

One of the objectives of the ANSI committee is to devise voluntary standards to reduce the number of interference complaints from consumers so that the Federal Communications Commission (FCC) can comply with the Communications Amendments Act of 1982 (PL 97-259) without setting mandatory standards (see *MWN*, October 1982 and May 1983). To make sure that the needs of the FCC are being met by the ANSI committee, an executive steering committee has been established. Its members are Don Heirman, Harold Gauper of General Electric, Dr. Ralph Showers of the University of Pennsylvania and E.N. Skomal of the Aerospace Corp.

The next meeting of the ad hoc committee is scheduled for June 12 in Washington, DC.

ANS C63

The American National Standards Committee (ANS) C63 Committee met in San Antonio, TX, on April 27 and officially changed its name to the C63 Committee on Electromagnetic Compatibility (instead of Committee on Radio-Electrical Coordination). The committee also redefined its scope:

> Development of definitions and methods of measurement of electromagnetic noise and signal strengths (radiated and conducted), determination of levels of signal strength and levels of unwanted sources, limiting ratio of noise and/or unwanted sources to signal and development of methods of control of, and guidelines for, influence, coupling and immunity. *Note:* Where subjects dealt with overlap those of other national committees, appropriate liaison will be established.

Work is continuing on the revision of C63 standards. A vote on amending C63.4-1981 on measurement methods to include open area test sites was generally positive, but a number of semantic and technical problems remain unresolved. A task group under the chairmanship of Edwin Bronaugh of Electro-Metrics will tackle these details.

Within subcommittee 1 of C63, Al Smith, Jr., of IBM has completed the first draft of a two-part report on medical device EMC. Part I on emissions covers medical diathermy and ultrasound therapy equipment; Part II on immunity covers cardiac pacemakers, electroencephalographs (EEG) and electromyographs (EMG).

Meanwhile, Howard Bassen, of the Food and Drug Administration's (FDA) Center for Devices and Radiological Health, will no longer lead efforts to develop susceptibility limits for medical devices within C63. In a telephone interview, Bassen explained that there had been little support for past FDA work on medical device EMC and there was insufficent evidence that this area was a priority compared to other medical device problems.

The next meeting of the C63 Committee is tentatively scheduled for September in Washington, DC.

Bigger FY85 Research Budgets at EPA and DOE

Both the Environmental Protection Agency (EPA) and the Department of Energy (DOE) are requesting bigger budgets for their non-ionizing radiation research programs for fiscal year 1985 (FY85). Given the significant cuts in recent DOE budgets and the protracted battle to save EPA's entire radiofrequency and microwave (RF/MW) bioeffects program last year (see *MWN*, June 1983), the modest increases in the current proposals are encouraging for researchers in this field.

EPA

At EPA's Experimental Biology Division in Research Triangle Park, NC, Acting Director Dr. Joe Elder reports, "We're back and we expect to have our program continuing over the next few years." If approved, the new budget will