The center received these three applications, among others, before its advisory board had outlined a research program. On March 5, a formal written request for proposals was issued.

In addition to Matanoski's 1989 report, three subsequent studies—by Dr. Paul Demers of the Fred Hutchinson Cancer Research Center in Seattle (see *MWN*, J/A90 and S/O91), by Drs. Tore Tynes and Aage Anderson of the Cancer Registry of Norway in Oslo (see *MWN*, J/F91) and by Dr. Dana Loomis of the University of North Carolina, Chapel Hill (see *MWN*, J/A92) —found an excess of breast cancer among men exposed to EMFs at work.

In January 1991, a panel of epidemiologists at a National Institute for Occupational Safety and Health (NIOSH) workshop recommended further research on EMFs and female breast cancer (see *MWN*, J/F91). Last year, a team of researchers from the Hutchinson center and from the Battelle Pacific Northwest Lab in Richland, WA, began investigating whether power line EMFs are a risk factor for female breast cancer (see p.4 and *MWN*, N/D91 and M/J92).

Gray told *Microwave News* that the center does not have a particular interest in breast cancer, and that it is "just a coincidence" that two of the three proposals being considered by the center address it. As many as ten projects a year will receive grants—up to $50,000 apiece—for pilot studies or for add-ons to existing studies.

If the Liburdy, Marcus and Matanoski studies are approved, funding would probably begin in May or June, Gray said. Meanwhile, preliminary plans for a summer workshop on VDT EMF exposure assessment are being reviewed, according to Patrick Breysse, associate director of the center.

The VDT Health Research Foundation (HRF), which established the research center last fall (see *MWN*, M/A92 and S/O92), is still being supported only by Apple Computer Inc., Compaq Computer Corp. and IBM Corp.; no other companies have stepped forward since the HRF was announced last March, according to Philip Shellhaas, executive director of the foundation and director of public policy programs for IBM. The HRF's budget remains at $2.25 million over three years.

UPDATES

CELLULAR COMMUNICATIONS

Radiation Protection Devices... Products designed to reduce users' exposures to emissions from hand-held cellular telephones are being rushed to market after the recent outburst of health concerns (see *MWN*, J/F93). Dynaspek Inc. of Westmont, IL, and Ixcel Innovations Inc. of Bellingham, WA, have both introduced curved shields that cover one side of the phone antenna. Quantum Laboratories in Renton, WA, has begun selling Cellguard, which consists of a sleeve that slips over the phone's antenna and a separate part that covers the earpiece. Press reports indicate that additional products may not be far behind. So far, however, there is little support for the claim that these devices provide a practical way for users to protect themselves. Only Dynaspek has provided independent test results to support the claim that its shield reduces exposures. These show that radiation measuring 1.45 mW/cm^2 two inches from a Motorola Ultra Classic phone in operation was cut to 0.038 mW/cm^2 on the side of the phone nearest the operator with Dynaspek's Cell Shield installed. But Elite Electronic Engineering of Downers Grove, IL, which performed the tests, also found that the shield may reduce the efficiency of the phone's signal. The cellular industry has sharp criticism for all the new products, arguing that anything that interferes with the signals the phones transmit could actually make radiation exposures worse. The output power of cellular phones is controlled by the base station, and hand-held phones seldom operate at full power (0.6 watts), according to Bob Ratliffe, a spokesman for McCaw Cellular Communications Inc. in Kirkland, WA. "The shields may cause the phone to increase its power and operate at full power output all the time," Ratliffe said. "One needs to be extremely careful to make sure they don't do more harm than good," he added.

COMPATIBILITY & INTERFERENCE

Electronic Devices Aboard Planes... It's déjà vu all over again. Momentum is building for restrictions on the use of portable electronic devices on commercial aircraft, following a flurry of press reports about potentially catastrophic effects of EMI on aircraft communication and navigation systems (see, for example, *Time*, February 22). Concerns over EMI were raised ten years ago, prompting a five-year study by the Radio Technical Commission for Aeronautics (RTCA) (see *MWN*, S83 and O83). In its final report, the RTCA concluded that the probability of interference is "small," but to play it safe, it recommended that the use of laptop computers, FM radio receivers and other portable electronics be prohibited during takeoffs and landings and that the use of cellular phones and remote-control devices be banned altogether (see *MWN*, N/D88). Now, the FAA has prepared a "Proposed Advisory Circular," which is intended to provide "information and guidance" to help determine whether portable electronic devices will interfere with airplane communication or navigation systems. The circular does not change the underlying rules, which leave the decision on what is allowed to the airlines —not surprisingly, policies vary from company to company— but it does state that all airlines, "for reasons of potentially hazardous interference to critical aircraft systems," must prohibit the use of cellular phones while a plane is airborne and that airlines should, at a minimum, prohibit operation of portable electronic devices "when their use could interfere with the ability of the flight crew to give necessary instructions in the event of an emergency." The FAA circular explains that cellular phones may be used once a plane has landed and is taxiing to the terminal, but not after it has left the gate on departure. In response to the FAA advisory, the Cellular Telecommunications Industry

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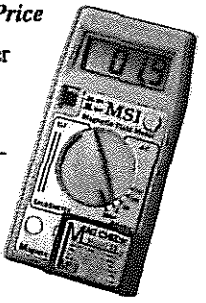


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Association endorsed the existing rules and advised against any tighter restrictions. Anthony Broderick, associate FAA administrator for regulation and certification, told the *Washington Post* (February 12) that the advisory was intended primarily to remind airlines about the cellular phone procedures and should not be understood as an indication that the FAA thinks other devices may be dangerous. The International Air Transport Association (IATA) in Montreal, Canada, recommended to its members on April 8 that "passengers should not be allowed to use transportable electronic devices during the takeoff and landing phases of flight," essentially following the RTCA's 1988 advice. Many members have put this restriction in place, according to IATA.

MEETINGS

Russian Proceedings...A five-volume collection of papers presented at the *11th International Conference on Microwave Ferrites*—held in Alushta on the Crimean peninsula, October 16-20, 1992—is now available. Many of the papers are on gyromagnetic electronics and electrodynamics, but a number address biological effects. Three of the volumes are in Russian and two are in English—each is approximately 200 pages long. The few papers that are both on biology and in English are in volume 4. Each volume costs $7.00 (U.S.), which includes postage. Orders must be prepaid by sending funds in U.S. dollars to: Inkombank, Account No.005070859, Moscow, Russia; specify "Moscow Power Engineering Institute, XI–ICMF." Orders will be processed when a copy of the receipt of the payment is received. Send orders to: Dr. L.K. Mikhaylovsky, Moscow Power Engineering Institute, Krasnokazarmennaya, 14, 105835 Moscow, E-250, Russia, (7+95) 362-7534, fax: (7+95) 361-1620.

POLICE RADAR

Second Trial in May...A case in California may be the next police radar–cancer claim to go before a jury. Judge William Orrick has set a trial date of May 3 in U.S. District Court in San Francisco for the lawsuit brought by Officer William McGuigan of the Belmont, CA, Police Department. McGuigan used traffic radar manufactured by Kustom Signals Inc. of Lenexa, KS, the defendant, from 1984 until mid-1991, when he had a malignant tumor removed from his left thigh and began to suspect that there was a link between the use of the radar and his cancer, according to court papers. The case must first survive a motion by the defendants for dismissal, however. This is scheduled to be heard on April 29. The first police radar claim to go to trial—brought by Officer Eric Bendure against Kustom—was rejected by a jury in February (see *MWN*, J/F93)....Meanwhile, Kustom has dropped the lawsuit it filed in Connecticut last August challenging the state's ban on hand-held radar guns (see *MWN*, S/O92). Kustom's dismissal notice was filed quietly last fall, according to a story by Don Michak in the March 25 *Journal Inquirer*, which is published in Manchester, CT. William Ruppert, Kustom's president, confirmed that the suit has been withdrawn, but neither he nor Lawrence Connelli of the Hartford, CT, firm of Reg-

nier, Taylor, Curran and Eddy, who represents Kustom, would comment further.

RESOURCES

CMU Publications... Over the years, Carnegie Mellon University's (CMU) Drs. Keith Florig, Granger Morgan and Indira Nair have written extensively on EMFs. (They are best known for proposing the policy of prudent avoidance.) Now they have assembled 28 of their publications in one volume, which includes their influential 1989 report for the Office of Technology Assessment (see *MWN*, J/A89), as well as their 1985 and 1990 articles for *IEEE Spectrum*. Papers from some hard-to-get journals and proceedings are included, as are Morgan's and Nair's separate reviews of Paul Brodeur's book, *Currents of Death*. In a number of cases, only the abstracts of articles are reprinted, however. Copies of *Selected Writings on Power-Frequency Fields* are available for $16.00 each, plus shipping, from: Department of Engineering and Public Policy, CMU, Pittsburgh, PA 15213, (412) 268-2670....In addition, CMU's newest EMF booklet, *What Can We Conclude from Measurements of Power Frequency Fields?*, is now available. The booklet is a companion to *Measuring Power Frequency Fields*, which was released last year (see *MWN*, S/O92). These two booklets are being sold as a set for $5.50 (prepaid). Multiple-copy discounts are available. Order from the above address and mark your envelope "Attn: EMF Brochure." Telephone orders are not being accepted.

STANDARDS

FCC Seeks To Adopt 1992 RF/MW Limits... On March 11, the FCC announced a proposal to adopt the new ANSI RF/MW exposure standard. When the FCC first set RF/MW rules in 1985, the agency based them on the ANSI C95.1-1982 guidelines (see *MWN*, Ap85, M/A87 and J/A88). Now that the IEEE has updated the 1982 limits and ANSI has accepted them (see *MWN*, N/D91 and N/D92, respectively), the FCC plans to follow suit. If the commission adopts the 1992 ANSI limits, it would, among other changes, dictate a tougher stand on the automatic exclusion of many low-power devices such as cellular phones and mobile radios. The FCC is inviting public comments on its proposal, the full text of which was released on April 8; they are due by August 13, with reply comments due by September 13. The FCC is specifically seeking opinions on a number of issues, such as the definitions of "controlled" and "uncontrolled" environments, the exclusion of hand-held devices and the discontinuity in the induced current limits within the FM broadcast band (see *MWN*, J/F93). Also on April 8, FCC Commissioner Ervin Duggan released a statement that was clearly in response to the recent flap over cellular phone health risks (see *MWN*, J/F93). "Press scares and media hype are poor substitutes for the careful processes of science and government," he said. "The FCC and other government agencies, as well as the cellular phone industry, will work energetically to resolve questions

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REQUEST FOR PROPOSALS

The Center for VDT and Health Research at the Johns Hopkins University, School of Hygiene and Public Health, invites investigators to submit proposals for research on the health effects of VDT use. The Center has particular interest in supporting innovative studies of the following issues:

a) Methodologies for the measurement of electromagnetic field (EMF) exposures associated with VDTs, and the contribution of VDTs to total field exposures;
b) The association between VDT use and reproductive health problems or risks of neoplasia;
c) The measurement of physical stresses/forces associated with VDT use and the effects on cumulative trauma disorders (CTDs);
d) The moderating influence of psychosocial stress on b) and c) above;
e) The biological effects of EMFs at the cellular or subcellular level.

The Center primarily provides support for pilot studies or for additions to existing studies. The average award is approximately $50,000 per year for direct costs, and indirect costs should not exceed 15%. Funds can be awarded for up to three years, subject to annual review.

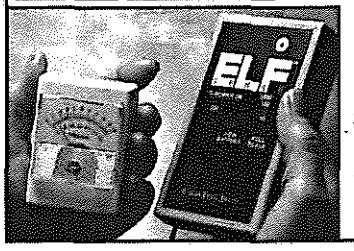
Investigators are invited to submit a two page pre-proposal to Dr. Ronald H. Gray, Room 4028, Johns Hopkins University, School of Hygiene and Public Health, 615 North Wolfe Street, Baltimore, MD 21205, (Fax 410-955-0792). Instructions for preparations of pre-proposals can be obtained on request. Pre-proposals should be received by Friday, June 11, 1993. After review by the Center's Scientific Advisory Board in July, selected investigators will be asked to submit full proposals by September, for final review and funding.

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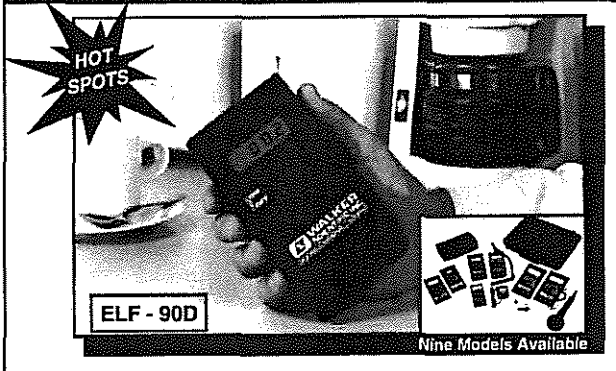
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about the safety of all RF devices. Meanwhile, it is important to keep such safety questions in perspective: *Any* new technology presents risks and uncertainties, which must be weighed intelligently against the obvious benefits that new technology brings. Modern life challenges us to balance those risks with courage and calm analysis, and to avoid hysteria." For more information, contact: Dr. Robert Cleveland, Office of Engineering and Technology, FCC, 1919 M St., NW, Washington, DC 20554, (202) 653-8169.

ETC...

Broadcast v. Radar Radiation... Dr. Bill Guy, formerly of the University of Washington, Seattle, who was one of the expert witnesses for the defense in the Bendure police radar lawsuit (see *MWN*, J/F93), offers the following comments on public concerns over police radar radiation: "It is ironic that the broadcast industry continuously exposes the North American population to tens of megawatts of electromagnetic radiation at frequencies in the bands of maximum absorption by the human body—and with modulated signals, which often are reported to cause biological effects. It is ironic because TV programs like CBS's *60 Minutes* will fill the ether with its megawatt radiations in questioning the safety of an unmodulated 50 milliwatt continuous wave police radar that operates at a frequency at which the energy is absorbed mostly in the skin. The public is indeed misinformed when police radars can be banned...." See Arthur Guy, "Electromagnetic Fields and Health: Some Thoughts About the Past and Future," *Bioelectromagnetics, 13,* pp.601-604, 1992.

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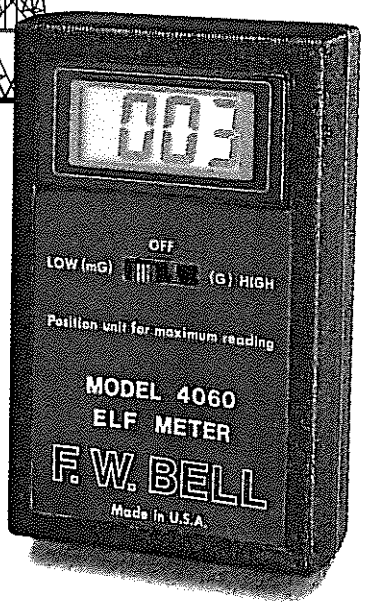
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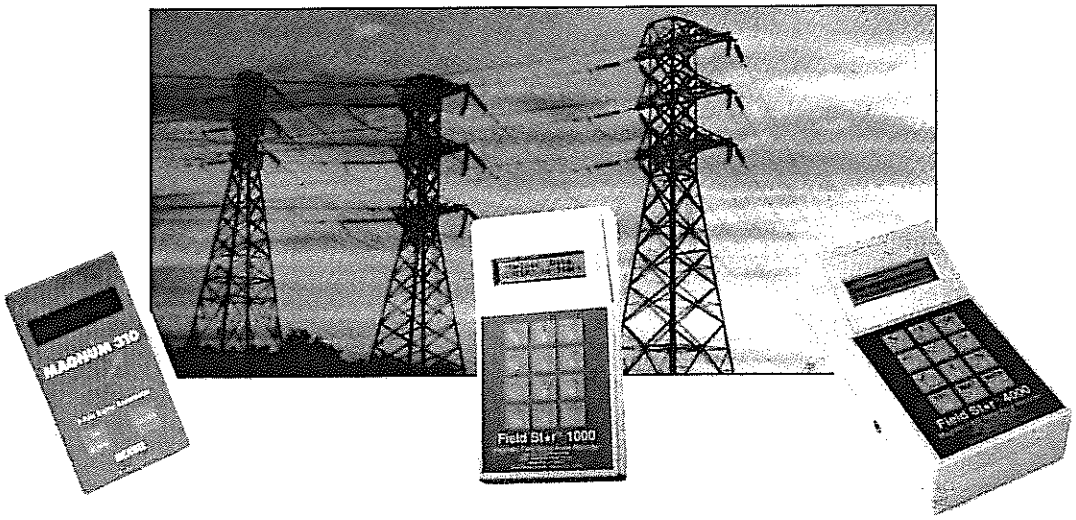
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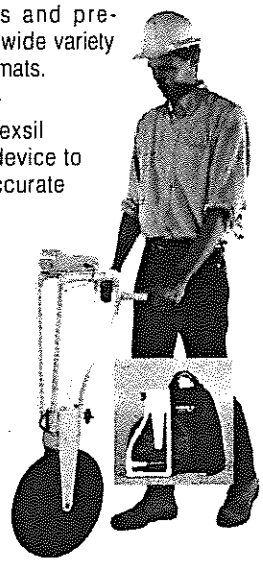
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Canadian–French Study Supports Occupational Leukemia Risk

Weaker EMF Link to Brain Tumors

A $3 million, industry-sponsored study has found that utility workers with greater than average cumulative magnetic field exposures were three times more likely to develop acute myeloid leukemia (AML) than less-exposed workers. But, because no dose–response relationship was observed, the Canadian and French epidemiologists advised that "caution must be exercised in interpreting the present results as evidence of a causal association."

The case–control study, which appears in the March 15 *American Journal of Epidemiology* (see abstract, p.12), also showed that workers who had the greatest exposures to magnetic fields had twelve times the expected rate of astrocytomas, a type of brain tumor, but this finding was based on a small number of cases. Although a dose–response relationship was not observed for leukemia, a statistically significant trend was found for astrocytomas.

Men who had worked over ten years for the three utilities that participated in the study—Electricité de France-Gaz de France (EDF), Hydro-Québec (HQ) and Ontario Hydro (OH)—and who had been exposed to an average magnetic field of 2 mG or greater had more than twice the risk of acute nonlymphoid leukemia (ANLL) and AML, a type of ANLL, than those with lower exposures.

"Our study speaks further in the direction of an association between AML and occupational exposure to electromagnetic fields (EMFs)," Dr. Gilles Thériault of the Department of Occupational Health at Montreal's

(continued on p.13)

Transient EMFs May Be a Key to the Mechanism of Interaction

A second study by some members of the Canadian–French team may soon steal the spotlight. Thériault's published paper only analyzes 50/60 Hz magnetic field exposure data, but still to come is a separate report from a group at McGill University on high frequency transients—short, intense pulses or sparks of energy that are common in electrical environments.

The transient results could open a new chapter on the possible EMF–cancer risk. Indeed, a new Swedish–American animal study points to the potential importance of transients in understanding the EMF–cancer link. In addition, pulsed electromagnetic fields, which have long been used to speed bone healing, share some characteristics with high frequency transients—for instance, fast rise times.

"Some effects were found in relation to the transients," Dr. Paul Héroux

(continued on p.15)

« Power Line Talk »

Since the fall of 1992, when passage of the Energy Policy Act launched the **National EMF Health Research and Communications Program** (NERP) and put health studies in the hands of **NIEHS**, the fate of ongoing **DOE** research has been in question (see *MWN,* N/D92 and J/A93). So far, the DOE program has survived—actually receiving more money in fiscal year 1994 than the NERP (see *MWN,* N/D93). Now, however, the influential **Senate Energy and Natural Resources Committee** has decided that the DOE program should not have continued. "The existing [DOE] program should be phased out as soon as practicable as the new program is implemented," states a March 9 committee report on the 1995 DOE budget. "The new program created by the Energy Policy Act was intended to subsume the old one," according to the committee, which is chaired by Sen. Bennett Johnston (D-LA). The committee "supports a funding level for the EMF program of $10 million, with no more than $3.5 million of that amount to be used to phase out the old initiative." This leaves $6.5 million for the NERP—the funding level Congress originally set—and would give the program $13 million, with industry matching funds. It is a substantial cut, however, from the amount specified in the President's budget, released in February, which would have provided $10 million for the NERP alone *and* $6 million for the DOE program, or a total of $26 million for EMF research when the matching funds were included (see *MWN,* J/F94).

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There was a moment of drama at the March 2 National EMF Advisory Committee meeting when NIEHS' Dr. **Michael Galvin** announced that if the NIEHS did not receive $25,000 from the DOE within a couple of weeks, peer review of the applications for grants under the NERP would be delayed until the fall and, by implication, research grants would not be awarded until fiscal year 1995. There were a number of stumbling blocks. The NIEHS had yet to collect any funds for the program from the DOE—by law, all money for the NERP is routed through the DOE—and industry had not yet contributed its half of the $8 million due the research program in this fiscal year. DOE's **Marvin Gunn** pointed out that before any money could be transferred, the NIEHS and the DOE had to sign a memorandum of understanding (MOU) that outlines the broad policy issues and an interagency agreement that details the specifics on how the two agencies will work together. Gunn warned that it could take from two to six months to move an interagency agreement through the bureaucracy. And then there was the key substantive issue: the approval of the program's implementation plan. By early April, the industry contributions to the EMF research plan had topped $3 million, the MOU was close to final approval and NIEHS' senior management agreed to advance Galvin the money for the review of the 50 applications for cellular studies and the 40 applications for animal studies. Meanwhile, by mid-June, the DOE will issue a request for proposals on engineering studies, covering measurement standards for personal and environmental exposures, as well as for some occupational settings. As we go to press, **Dan Vander Meer**, one of the NIEHS EMF program managers, said that he is certain that researchers will have the funds to start their experiments by September 30, the end of the 1994 fiscal year. Still unclear, however, are when a final implementation plan will be approved and whether the industry will come up with another $1 million in matching funds.

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"In my judgment, we are 90-95% certain that there is a link between EMFs and cancer," Dr. **David Carpenter**, dean of the School of Public Health at the New York State Department of Health in Albany, said in a talk on March l4. After reviewing the major epidemiological studies linking EMFs with leukemia and brain tumors, he told an audience of lawyers at the **New York City Bar Association** that it would still "be many years before we have all the answers." Nevertheless, Carpenter, who served as the executive secretary of the New York State Power Lines Project, said he believes policymakers should "involve the public in the debate. We should *not* wait until all the research is done." Setting standards can be a contentious process, he said, but "the logical number is 1 mG."

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Jury selection is expected to begin April 14 in the case of **Nancy Jordan** versus two Georgia utilities, **Oglethorpe Power Co.** in Tucker and **Georgia Power Co.** in Atlanta. The trial should be under way by April 18 and is expected to last up to three weeks, said Jordan's attorney, **Bruce DeBoskey** of Silver & DeBoskey in Denver. Jordan, whose suit was filed on July 24, 1991, claims her non-Hodgkin's lymphoma was caused by EMFs from power lines owned by the two utilities (see *MWN,* S/O91, S/O93 and N/D93). The trial, in Georgia Superior Court for Douglas County in Douglasville, was postponed on November 29, 1993, because of the illness of Dr. Peter Wright, an oncologist with The Poly Clinic in Seattle. Wright died in December, but his testimony was videotaped. Oglethorpe Power is being represented by **James Orr** of the Atlanta firm of Sutherland, Asbill & Brennan. **Robert Pennington** of the Atlanta firm of Troutman Sanders is representing Georgia Power. Meanwhile, the trial of **John Altoonian**'s case against **Atlantic Electric Co.** of Pleasantville, NJ, scheduled for April 18, is expected to be postponed (see *MWN,* N/D93). An assistant for **Gerald Corcoran** of Megargee, Youngblood, Franklin & Corcoran in Pleasantville, who is the attorney representing Atlantic Electric, said discovery has not been completed. Altoonian is claiming that EMFs were responsible for his chronic myelogenous leukemia, diagnosed in October 1990. Altoonian's deck and backyard are above an underground 69 kV power line operated by Atlantic Electric.

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The business of legal conferences is booming. The latest offering is the EMF Regulation & Litigation Institute's *Anticipating, Avoiding and Managing EMF Claims,* sponsored by

Business Development Associates in Washington and the Pittsburgh-based law firm of **Kirkpatrick & Lockhart**. A brochure promoting the meeting, scheduled for April 14-15 in Orlando, FL, warns that, "U.S. industry is on the verge of a litigation and regulatory morass that could dwarf Superfund and asbestos." Speakers will include Dr. **Robert Adair**, the Yale University physicist. A few weeks later, May 12-13, the publisher of the *EMF Litigation Reporter* is sponsoring its own conference in Philadelphia. The program was developed by **Paul Gupta** of the Boston law firm of Nutter, McClennen & Fish and **Tony Roisman** of the Washington law firm of Cohen, Milstein, Hausfeld & Toll. Dr. **Abe Liboff**, a physicist at Oakland University, and Dr. **Charles Poole**, an epidemiologist, are among the speakers.

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Tom Watson has applied for membership in the **National EMR Alliance**, but his application probably will not be approved. The New York-based, grass-roots anti-EMF group is not sure the prominent utility attorney is quite whom it wants on its rolls. "We're not cashing his check. It's framed on my wall," said **Cathy Bergman** of the EMR Alliance. Membership would require Watson to agree that "exposure to EMF is hazardous to life and constitutes a significant threat to the public's health," according to the group's bylaws. For his part, Watson, a partner at the Washington law firm of Crowell & Moring, now says he is no longer "avidly seeking" membership—especially not after the alliance sent out a press release advertising his application. "I got a kudzillian copies of the press release faxed to me with comments, some from judges, some from public service companies, some from those in the news media. Some were pretty funny," he told us. Watson maintains he originally sought membership because he "always likes to know what's going on from all perspectives" and not to gather information on the opposition—a possibility suggested in the alliance's press release.

Commentary

The Social Costs of Spin Control

If anyone still thinks it's a good idea for electrical utilities to manage health studies, the handling of the Thériault study should convince them otherwise. The three utilities used their access to suit their own short-term interests—without regard for occupational and public health, or indeed for their own long-term interests.

Electricité de France, Hydro-Québec and Ontario Hydro were privy to the results months ago and spent that time, with the help of public relations specialists, preparing to convince the media and the public that Thériault's results shed little new light on the EMF problem. (The utilities followed the example set by the Electric Power Research Institute's release of the Peters–London study in 1991.) Reading the joint Canadian–French press release, it is hard to see that the study supported the researchers' *a priori* hypothesis of a link between EMFs and leukemia and brain cancer. As Dr. Sam Milham told us, these were not chance findings, but what the researchers were looking for.

The electric utility industry as a whole had access to Thériault before the rest of us, and some, such as the Edison Electric Institute (EEI), abused it. EEI's release had Thériault saying: *"A significant association between exposure to EMF and leukemia and brain cancer has not been obtained"* (EEI's emphasis). The press had to wait a week after the results were announced to talk to Thériault, but EEI, which had advance information, misquoted him.

Those reporters who covered the study got it right for the most part—the *Wall Street Journal*'s headline, "Magnetic Fields Linked to Leukemia," was typical—but others decided it was not newsworthy. For instance, the *Washington Post* ran a short Associated Press wire story, and the *New York Times* let the story pass unnoticed.

It is perhaps a reflection of the utilities' spin control that, on April 5, less than a week after the release of the Thériault study, Nigel Hawkes of the London *Times* wrote: "Occupational studies, among workers exposed daily to high levels of [EMFs], have so far failed to show any damaging effects."

Hawkes may have been thinking of Jack Sahl's study of utility workers, paid for by Southern California Edison. It was ballyhooed as evidence of EMF safety. Now, as Thériault's group points out, Sahl may simply have been looking in the wrong place. Do utility epidemiologists have an incentive to look in the right places?

Thériault's published paper is the official record. But if the utilities had been forced to wait for it, like the rest of us, there would have been less opportunity to spin the results and a better chance that his study would speak for itself.

The epidemiological results of the last 15 years still do not give us a clear picture of the EMF–cancer link. But, despite the carping of a few physicists, there can be little doubt that there is some cancer risk associated with some aspect of EMF exposure. The pressing questions are: "What is causing it?" and "What should we do about it until we know?"

With the possible exception of Dr. David Savitz's soon-to-be-published study of utility workers, no "definitive" experiment capable of resolving the current impasse is on the horizon. Without a major breakthrough, decisions will have to be made with the current data.

The Canadian and French utilities say that the new results do not warrant a change in EMF policies, but we doubt that the public will agree—especially those who are fed up with the utilities' impossible quest for "conclusive" evidence. All this sets the stage for sharper polarization.

Unless the utilities can point to more biologically potent EMF parameters—transients or something else—they will be increasingly forced to meet a 1 mG guideline for 50/60 Hz magnetic fields, which is rapidly becoming the *de facto* standard among those who believe in the EMF–cancer link. If, because of their foot-dragging, the utilities end up wasting a lot of money fixing the wrong EMF problem, they will have only themselves to blame.

Breast Cancer Victim Sues Utility, Blames Office Wiring

A former employee of CBS Inc. in New York City is suing Consolidated Edison Co. of New York, blaming the electric utility for her breast and ovarian cancers, which she said were caused by EMFs emitted by electrical transformers near her work area.

Shirley Marano, who worked in CBS' headquarters building in Manhattan, was diagnosed with cancer in December 1990. Her complaint, filed in November 1993 in the Supreme Court of the County of New York, alleges that Con Ed and as-yet-unidentified manufacturing and maintenance companies failed to warn her of what she contends are health hazards caused by EMFs. CBS, the television and radio network, was not named as a defendant in the suit.

Marano claims that the defendants were negligent in installing the transformers, that they did not comply with reasonable standards and that they did not use construction materials that block EMFs.

Leopold Kaplan of New York City, Marano's attorney, declined to discuss details of the case.

"We think her charges are without merit," said Con Ed spokesman Martin Gitten. "In the future, can we expect more cases like this? I would assume yes. But we're neither worried nor concerned. If they occur, we'll handle them."

Marano's case is unusual: It is one of the first both to link breast and ovarian cancer and EMFs and to cite a building transformer as the source of the exposure. Acknowledging the uncommon allegations, Tom Watson of the Washington firm of Crowell & Moring, who is representing Con Ed in this litigation, said, "It seems to me it's a fairly new type of case and in that sense it's worthy of some note. Beyond that, not a lot more can be said at the moment."

Concerns over EMFs in buildings have been raised consistently during the past few years. A number of recent cancer clusters in office buildings have been studied, although no causal link with EMFs has been established (see *MWN,* M/A93 and S/O93).

EMF exposure in office buildings can be sharply reduced, a costly task in existing offices, less so in new buildings (see *MWN,* M/A93). Con Ed does not shield its equipment in response to customer requests because, Gitten said last year, it is impossible to know what a safe magnetic field exposure is.

Based on extensive magnetic field surveys, Richard Tell, a consultant based in Las Vegas, found that people in commercial office buildings working near conductors may be exposed to very strong magnetic fields, even stronger than those in the work environments of many electrical employees (see *MWN,* M/J91). The ambient magnetic fields in offices may be as high as 3,000 mG, depending on the layout and type of wiring, according to Tell.

"Electrical conductors, then, can be responsible for very high whole-body magnetic field exposures among office workers without their knowledge," Tell noted.

BPA's New Booklet

The Bonneville Power Administration (BPA) has published a new booklet, *Electric Power Lines, Questions and Answers on Research into Health Effects,* but the 3,000 print run is already out of stock. Updated booklets should be available in May.

Topics covered in the booklet range from cancer clusters and EMF regulations to melatonin studies and ways to limit EMF exposure. The updated edition will contain information about the new Canadian–French epidemiological study (see p.1).

The booklet is similar in approach to the now classic *Electric and Magnetic Fields from 60 Hertz Electric Power: What Do We Know About Possible Health Risks?* published four years ago by Carnegie Mellon University (CMU) in Pittsburgh (see *MWN,* M/A89 and S/O92). Over 120,000 of the CMU booklets have been distributed.

The BPA, which serves the Pacific Northwest, is part of the U.S. Department of Energy. The booklet may be obtained by calling (800) 622-4519 or (503) 230-3478, or by writing to Dr. Jack Lee, EFB, BPA, PO Box 3621, Portland, OR 97208.

U.K.'s Doll Is of Two Minds About EMF–Cancer Link

Sir Richard Doll, Britain's best-known epidemiologist, now believes there is a need to investigate the possible link between EMFs and cancer. "Two years ago, I would have said that I am pretty confident that there really isn't an association," Doll said during the British Broadcasting Co.'s *Panorama* program, which was televised on January 31. "Now I am not confident of that at all. I think there is a possibility that there is, and we therefore must investigate it very urgently."

Doll added, "If it turned out that there was a hazard it would be one which would affect a great many aspects of life, but it's not going to be, it certainly is not going to be, a large risk for anybody. It might be a small risk that would be spread very widely which people want to try to avoid."

During a March 9 telephone interview on another television program, Doll again refused to dismiss the possibility of a cancer risk. "The biological evidence is still quite clearly negative; there's no way in which really one could see how it could cause cancer. But there is some much better epidemiological evidence which now certainly suggests the possibility that a risk might exist," Doll said on *Live Wire,* broadcast by a local station in the Bristol area. *Live Wire* is not aired nationally.

Doll gained stature as an epidemiologist during the 1950s when he became the first to link smoking and lung cancer. On *Live Wire,* he conceded the link was made in the absence of a biological mechanism. He went on to say he would do the same for EMFs and cancer today, if the evidence were "correspondingly substantial."

Doll's recent statements reflect a certain ambivalence,

which stands in contrast to position papers prepared for the U.K. National Radiological Protection Board (NRPB). In March 1992, an advisory group, chaired by Doll and convened by the NRPB, released a report stating that there was "no firm evidence" of a cancer risk from exposure to extremely low frequency EMFs (see *MWN,* M/A92). As recently as late last year, the group reaffirmed this stance, allowing that new Scandinavian studies provide "weak evidence" of a childhood cancer risk (see *MWN,* N/D93).

Furthermore, in February, a top U.K. health official told Parliament that existing evidence does not support the adoption of a prudent avoidance policy (see below).

The *Panorama* program, a respected and well-watched show, focused on the Studholme family in Manchester, whose 13-year-old son Simon died in late 1992 of leukemia. The family had moved into their home 19 months before. A lawsuit brought by Simon's parents against Norweb, the local utility, alleges that EMFs from a nearby substation, buried power lines and household wiring caused the cancer (see *MWN,* J/A93 and S/O93).

"As public interest in this issue has grown, other families with childhood cancer cases have come forward intent upon pursuing proceedings against their local electricity boards," Martyn Day, the Studholmes' solicitor, wrote in an article in the London *Times* on March 15.

Day also is representing 50 children from northeast London who are taking Michael Heseltine, the U.K.'s Secretary of State for Trade and Industry, to court to stop activation of six 275 kV power lines. The lines are being installed underground along a six-mile route in a densely populated area. Legal aid to pursue the case was granted by the government in late March. In the U.K., legal aid is provided to those who can demonstrate an economic need and who can show that their claim has merit.

"For Mr. Heseltine not to take action while further studies are ongoing is effectively gambling with children's lives," Day said the day after nearly 100 residents from the affected area met to discuss what they perceived as the lack of concern by the National Grid Co., which is installing the power lines. The National Grid estimates exposure levels at many, if not most, of the homes along the route will be well in excess of 2 mG, according to Day.

Meanwhile, U.K. electricity companies are spending £1.5 million (about $2.25 million) each year on EMF research, according to a letter in the *Times* (March 24) from Philip Daubeney, chief executive of the Electricity Association.

Against this backdrop of widespread public debate, Doll's latest advice has taken on a more personal note. In an April 5 article in the *Times,* Doll said, "If I had grandchildren living near electricity pylons, I wouldn't insist on them moving."

Three Studies Fail To Agree on EMF–Depression Risk

Electrical workers were no more depressed than other workers overall, although some groups showed a slight increase in depressive symptoms, according to a new study led by Dr. David Savitz. Two earlier studies on the possible link between depression and residential power line EMFs had conflicting results. Only one of the three supports the link between EMFs and depression first observed by Dr. Stephen Perry, an English general practitioner, over a dozen years ago.

Savitz, of the University of North Carolina School of Public Health, Chapel Hill, and colleagues at the Centers for Disease Control and Prevention in Atlanta report in the *American Journal of Industrial Medicine* (*25,* pp.165-176, February 1994) that electrical workers who stayed less than ten years on the job suffered more depression than long-term workers. They also found slightly more depression among electricians,

U.K. Government Rejects Prudent Avoidance

On February 21, Alex Carlile, a member of the U.K. Parliament, asked if the government planned to adopt a policy of prudent avoidance. Thomas Sackville, undersecretary of state for health, replied that the need for such action was not supported by research. Their exchange follows:

> *Alex Carlile:* To ask the Secretary of State for Health [Virginia Bottomley] if she will make it her policy to encourage the enactment of a prudent avoidance policy with regard to electrical power line work, which ensures that all future power lines will be sited away from schools and houses until the possible link between [EMFs] and cancer is disproved; and if she will make a statement.
> *Thomas Sackville:* The National Radiological Protection Board [NRPB] and Committee on Medical Aspects of Radiation in the Environment have considered this question and concluded that the available information does not establish that [EMFs] cause cancer. The significance of an epidemiological study depends, among other things, on the strength of the association, the presence of a dose–response relationship, supporting experimental evidence and a credible biological explanation. These tests for causality are not satisfied for the link between [EMFs] and cancer. On the basis of present evidence, the two bodies have not recommended the adoption of a policy of prudent avoidance. The position is being kept under review.

One clue as to the advice the government may have received from the NRPB may be found in an editorial by Dr. Kenneth Duncan, NRPB's medical adviser, which appeared in the board's March 1994 *Radiological Protection Bulletin*:

> Prudent avoidance [may be seen as] an intellectually indolent term to avoid proper assessment of risk and benefits and to escape the opposition that positive decision making sometimes provokes....If we are to come to sensible conclusions in times of scientific and technical advance we must be prepared to have an underlying philosophy which accepts that some risks have to be accepted....Some of these judgments may be unpopular but should not be avoided. It is not prudent to be indecisive, intellectually lazy or cowardly.

a category of electrical workers.

The increases were small and generally not statistically significant, however, and the researchers concluded that electrical workers as a group were no more prone to depressive illness than other workers.

In 1992, Dr. Charles Poole, an epidemiologist in Cambridge, MA, and coworkers reported a stronger link between EMFs and depression (see *MWN,* J/A92). In their paper, which appeared in the *American Journal of Epidemiology (AJE) (137,* pp.318-330, February 1, 1993), they observed a nearly threefold higher prevalence of depressive symptoms among people living near an overhead transmission line than among controls. They characterized the association as "moderately strong."

In contrast, researchers led by Dr. Shari McMahan of the University of California, Irvine, did not find more depressive symptoms among women living adjacent to high voltage transmission lines than among those a block away (see *MWN,* J/A92). The study, which used the same depression scale as Poole (Savitz used a different one), was published in the *AJE (139,* pp.58-63, January 1, 1994).

All the researchers expressed some dissatisfaction with the exposure assessment for the studies. The Savitz group noted that the study's use of job title as proxy for EMF exposure might not be adequate. Poole and colleagues wrote that their estimate of proximity to the transmission line was "extremely crude" and the "major limitation" of the work. And McMahan's team, which relied primarily on distance to power lines, expressed doubts that the supplementary EMDEX measures they used in the study were "necessarily representative" of EMF exposure.

School EMFs Alarm Parents and Teachers Across the Northeast

Reacting to high EMF levels at schools, parents and teachers in several states have followed the example of California activists at the Slater School in Fresno and at the Montague Elementary School in Santa Clara by demanding that affected classrooms be moved. Here is an update:

Classrooms Closed in New Jersey

At Elementary School No.14 in Clifton, children have been moved out of the four classrooms closest to a substation at the urging of parents and teachers. After indoor measurements indicated magnetic field levels ranging from 5.5 mG to 10.8 mG, Superintendent of Schools William Liess transferred the children from three classrooms to another wing, where the magnetic fields are below 3 mG; a fourth class was moved to another school. John Groh, president of the Clifton Teachers' Association, told *Microwave News* that he is relieved because, "We don't want to find out down the line that people have paid a price because of negligence."

Liess made the measurements after a statewide survey, conducted by utilities, of magnetic fields at all schools within 100 feet of transmission lines 69 kV or higher revealed that EMFs at the school were the second highest in the state. In February, the New Jersey Board of Regulatory Commissioners (BRC), which directed the survey, reported that statewide, fields ranged from 0.2-47.3 mG on the property of the schools—no indoor measurements were taken by the utilities, however.

EMF levels on the grounds of the Clifton school were found to reach 41.6 mG by Public Service Electric & Gas (PSE&G), one of four utilities that participated in the survey. The Clifton school is adjacent to a right-of-way for two 138 kV and two 230 kV transmission lines. The Timothy Christian School in Piscataway had the highest readings in the state, according to *The Record,* a newspaper based in Bergen County.

Liess found out about the Clifton school's standing from the newspaper, he said in an interview, adding that he has a "big problem" with that. "We've been floundering around by ourselves," with no guidance from the state or the utility about what the numbers mean, he said.

Neither PSE&G nor the BRC plans to reduce the magnetic fields at any of the schools. The levels found in the survey "are not unusual or unique," Robert McCourt, PSE&G's EMF issue manager, told *Microwave News.* "I don't see any reason for concern," he said. In an interview, BRC's Carmen Armenti, who ordered the survey, said it is difficult to plan a course of action until there is scientific consensus on the issue.

Dr. Daniel Wartenberg, an epidemiologist at the Environmental and Occupational Health Science Institute in Piscataway, favors "a more comprehensive survey" that includes indoor measurements. Wartenberg, chair of the Committee on Non-Ionizing Radiation of the New Jersey Commission on Radiation Protection, said he had recommended such an approach to the BRC prior to the survey.

A classroom was also closed at the Grenloch Terrace School in Washington Township because of high EMF levels. The fields were associated with lighting fixtures in the room and not with a nearby power line, according to the *Star Ledger,* a Newark newspaper. Readings taken by Atlantic Electric Co. for the state survey ranged from 1.0 mG to 4.0 mG.

The results of the state survey were only made available for public inspection in BRC offices in Newark and Trenton. The BRC would not disclose the EMF readings at individual schools over the phone—because such information could be "misinterpreted," according to Sharon Shulman in the BRC press office. Copies of the entire report may be purchased for $90.00 each from: BRC, Electric Division, Two Gateway Center, Newark, NJ 07102, (201) 648-2466.

Kindergarten Abandoned in New York

In New York, a kindergarten classroom was closed in February at the Franklin Early Childhood Center in Hewlett on Long Island following the discovery of elevated magnetic fields, but power line EMFs were not thought to be at fault. There are no high-tension wires nearby.

School officials called in the Long Island Lighting Co. (LILCO) after worried parents pressured them to confirm a reading taken by a parent with a hand-held meter. LILCO found EMFs of over 90 mG in the room, according to Joanne Piluso, who had first measured the fields. The fields are strongest on the floor of the room but their source has not been identified. Superintendent of Schools Dr. Bert Nelson told *Microwave News* that the children were moved "to ease the minds of parents until we can have an expert tell us if there's anything to be concerned

TVA: No Lines Near Schools

"Whenever possible, the Tennessee Valley Authority (TVA) will not site transmission lines near schools and densely populated areas," according to the authority's EMF guidelines, which appear in the March 8 issue of *Inside TVA,* an internal newsletter.

The TVA has followed this policy for "quite some time," according to spokesman Frank Cason, as the public has become more and more involved in TVA's siting decisions. He said that the authority holds public meetings and invites comments on corridors for new transmission lines before deciding on an actual route. "We are a lot more willing now to take social factors into consideration" in locating a line, he added. The TVA is a power wholesaler for Tennessee and parts of six other southern states.

about."

The school district is already dealing with a power line EMF controversy at another school. School officials have been negotiating with LILCO over ways to lower magnetic fields at the Hewlett-Woodmere Middle School, which has a 69 kV transmission line on its property. The school was among those identified in a state survey, released last July, as having EMFs greater than 2 mG (see *MWN,* N/D92, M/A93, M/J93 and J/A93).

LILCO has taken the position that the Hewlett-Woodmere school district will have to pay for any mitigation—a spokeswoman said another Long Island school paid for reconfiguring a line—and proposed three "technically feasible" options to choose from: reconfiguring the line for $150,000; moving the line onto a nearby street for $400,000; or burying the line for $700,000. The utility calculates that the first option would cut EMFs to 1.5 mG or less and the second method to below 1.0 mG. The utility estimates that burying the line might provide the *least* mitigation—saying that under this alternative the fields could still be up to 2.0 mG.

The district came up with a fourth option—have LILCO build a new school farther away from the line. The LILCO spokeswoman, Suzi Halpin, argued that the district is "using the EMF issue to pursue desires for a new school and a new parking lot."

Nelson responded that this was a "distortion" and that he had offered LILCO the opportunity to "join hands in partnership" with the district and create a "model, energy-efficient school." He said he has no quarrel with their rejection of the proposal and that the new school is now a dead issue.

Nelson is still negotiating with LILCO over the cost of reconfiguring or burying the line. He said moving the line is not feasible because the school would have to obtain permission to build structures on private property. In a March 10 letter to Nelson, LILCO wrote that it was "willing to absorb $70,550 of the $161,971" cost of reconfiguring the line. The cost to the district would be $91,421. Nelson noted that the quoted cost had jumped from $150,000 to $161,971.

Nelson said the more expensive burial option is still on the table. Based on the breakdown of expenses provided to him by LILCO, Nelson believes the quote is "padded" and could be reduced. He added that the district has hired EMF consultant Dr. Luciano Zaffanella of Enertech Consultants in Lee, MA, to give advice on which option is better. Zaffanella will also measure magnetic fields inside all five district schools. The two options—reconfiguring or burying the line—will be voted on by the community in May school elections.

Meanwhile, parent Michelle Goldberg, who has been outspoken over the district's slowness to react to EMF concerns, has organized "a tower action committee." She said in an interview that EMFs became an issue at least two years before the state survey, when LILCO found elevated magnetic fields in the middle school music room. A music teacher died of breast cancer in 1992 and subsequently a transformer—thought to be the source of the fields—was removed from an adjacent utility room. Goldberg said she is as concerned about electrical wiring at the school as about nearby power lines.

At least one New York utility has been willing to pay for mitigation of magnetic fields in schools. Niagara Mohawk Power Corp., based in Syracuse, has paid for magnetic field mitigation at five different schools. "We've gotten heat from other utilities, but if it doesn't cost a lot of money to allay customers' concerns, it's worth it," Jack Toennius, Niagara Mohawk's director of environmental licensing and planning, said in a telephone interview. The utility lowered EMFs by reconfiguring or burying the lines (see *MWN,* M/A93 and M/J93).

No School Survey for Connecticut

The Connecticut Interagency EMF Task Force "is not recommending a school survey because there is no consensus as to how the numerical results would be interpreted," according to its January 1994 report. But Carolyn Dupuy of the Connecticut Department of Health Services (DHS) told *Microwave News* that the task force is still "gathering information" and that some type of survey remains a possibility. If a decision is made to go forward, she added, the task force would not want to "limit a survey to schools," but, rather, include any places children gather—day-care centers, homes, housing projects. The task force was set up in July 1991 and is chaired by Dr. Peter Galbraith of DHS (*MWN,* J/A91 and M/J93).

Connecticut 1994 Report on Task Force Activities To Evaluate Health Effects from Electric and Magnetic Fields may be obtained for free by contacting: DHS, Division of Environmental Epidemiology & Occupational Health, 150 Washington St., Hartford, CT 06106, (203) 566-8167.

Voluntary Survey Under Way in Maine

After legislation that would have required electrical utilities to measure EMFs at schools failed to pass, the state Committee on Education asked the utilities to offer schools free EMF surveys upon request and to provide them with background information. The Central Maine Power Co., Bangor Hydro-Electric Co. and Maine Public Service Co. agreed, and at least 37 schools have taken them up on their offer. The utilities plan to present a final report to the committee in September.

School Survey Bill Fails in Maryland

A bill to authorize the state Department of the Environment to "measure the level of [EMF] exposure at any public school or state office building located within 100 feet of high tension lines" will not emerge from the House of Delegates' environmental committee. Delegate Joan Pitkin, who introduced the bill, said in an interview that after the Department of the Environment withdrew support, citing lack of funds, the bill didn't stand a chance. Pitkin has not given up. "I won't go away," she said, and asked, "Do we really want to martyr our children and not protect them more?"

Clippings from All Over

I don't think [EMFs are] a proven health risk. The only thing that power lines do for certain is lower the value of your house.

— Dr. Clark Heath of the American Cancer Society, quoted in *The Record* (NJ), March 29, 1994

The most important study demonstrating health effects from non-ionizing radiation from nonthermal exposures is one recently published [M. Feychting and A. Ahlbom, *American Journal of Epidemiology (AJE), 138,* pp.467-481, 1993]. In this study long-term exposure to ELF radiation from power lines was associated with an increased risk of childhood leukemia. The study is important because it settled the debate of whether or not a non-ionizing type of radiation like ELF can cause cancer. It can. A similar study [S. London et al., *AJE, 134,* pp.923-937, 1991] also found an association between ELF radiation and childhood leukemia....[I]n light of the Feychting study it would be difficult to reject the probability that the association was due to ELF radiation associated with the Denver Wertheimer–Leeper wiring configuration.

—Affidavit of Dr. Richard Scribner, University of Southern California School of Medicine, in support of plaintiffs' case opposing the siting of a WSR-88D, NEXRAD Doppler weather radar in Ojai, CA, January 6, 1994

Utility industry representatives in the U.S. and Canada said the failure of the [Thériault] study to show a "definitive association" between magnetic fields and cancer was welcome. "Frankly, it's a sigh of relief," said Mark Warnquist, partner at LeBoeuf Lamb Greene & MacRae, a Denver law firm that represents utilities in EMF court cases.

—*Wall Street Journal,* March 31, 1994

An increase in the myc transcript has been measured by several investigators in cells exposed to various electric and/or EM fields. ...These findings are important to determining a mechanistic pattern for the effects of EM fields on cells since regulation of the c-*myc* gene plays an important role in initiation and continuance of normal cell proliferation, as well as in the inception of cancer....One conclusion is that a critical sequence responsive to the 60 Hz field lies within [an] approximately 900 [base pair] region....

—Hana Lin, Reba Goodman and Ann Shirley-Henderson, "Specific Region of the c-*myc* Promoter Is Responsive to Electric and Magnetic Fields," *Journal of Cellular Biochemistry, 54,* pp.286-287, 1994

According to Dr. Leonard Sagan, senior health specialist at the Electric Power Research Institute, epidemiologists generally do not consider odds ratios of lower than 2.0 to be statistically significant.

—*EMF News,* a publication of the Edison Electric Institute, p.4, February 7, 1994

Another tumor with rising mortality is primary cancer of the brain and nervous system. The increase has occurred in both sexes and is most pronounced in the 70-74 age group, in whom rates rose more than sixfold between 1950 and 1989. Similar trends have been observed in the United States, Japan, France, Italy, and West Germany. During the past 20 years there have been important developments in techniques for investigating intracranial disease....These changes may have led to better recognition of primary brain tumors that previously would have been diagnosed as stroke or metastatic disease. However, such artifacts of diagnosis are unlikely to provide a complete explanation for the trend, which began at least as early as 1950. Very little is known about the causes of brain cancer....[C]hanges in the overall exposure of the general population to ionizing radiation are insufficient to have had a major impact on brain cancer incidence. More recently, brain cancer has been linked with exposure to magnetic fields from electrical equipment. However, the evidence for a relation is far from convincing. In particular, it is not clear how magnetic fields would influence the biochemistry of cells in such a way as to initiate or promote cancer formation. As yet, therefore, the trends in brain cancer mortality are not satisfactorily explained.

—David Coggon and Hazel Inskip, "Is There an Epidemic of Cancer?" *British Medical Journal, 308,* pp.707-708, March 12, 1994

Many utility industry executives favor the first course: do nothing. They are concerned, apparently, that even minor adjustments in the way they do business might lend credibility to a theory they consider absurd, and might therefore lead to greater panic than currently exists. This view may be sincerely held. It is not, however, sensible. If some connection between EMF and cancer is shown—and the possibility, however remote, does exist—the industry would be vilified in the media and punished in the courts with enormous severity.

—*Inside PR,* "The Magazine of Reputation Management," p.18, January 1994

In many instances, risk assessment has become a code word for those who want to weaken our efforts to protect public health and the environment.

— EPA Administrator Carol Browner, quoted in the *Washington Post,* March 8, 1994

In 1991 we set up a working party to review continuously all the published available evidence [for a link between EMFs from power installations and certain types of cancer], both epidemiological and laboratory-based. The overall conclusion is that there is no proven evidence for the existence of the effects which have been suggested. If any such effects do exist then their incidence within the population, taken as a whole, must be exceptionally small.

—John Williams, Secretary and Chief Executive, The Institution of Electrical Engineers, letter to the *Times* (U.K.), March 24, 1994

Focused research is needed to discover the mechanisms, if they exist, whereby EMFs may promote cancer. Research is also needed on practical ways to reduce exposures to EMFs through mitigation measures and possible behavior modifications. Funding for this research should be provided in such a manner that it does not yield the perception of vested interests in the outcome....All involved parties should understand and, where possible, practice 'prudent avoidance' techniques, and should employ enlightened ways to minimize people's exposure to EMFs in the event that further research confirms a possible connection between exposure and cancer. Public information programs, particularly about the nature of EMFs, the current status of bioeffects knowledge, and overviews of research programs are an important part of this public process.

—William Hendee and John Boteler, "The Question of Health Effects from Exposure to Electromagnetic Fields" (Review Paper), *Health Physics, 66,* pp.133-134, February 1994

EPA Revives NIER Program; Plans To Develop RF/MW Rules

The Environmental Protection Agency (EPA) has reversed its course and will reestablish its non-ionizing electromagnetic radiation (NIER) program, agency officials report. After revealing last summer that it planned to all but eliminate its NIER program (see *MWN,* J/A93), the agency faced pressure from many quarters not to abandon its electromagnetic field (EMF) and radiofrequency and microwave (RF/MW) radiation work.

(Indeed, a request for action on EMFs has come from the President of the United States, see below.)

"We have decided to return to the issue of non-ionizing radiation," Margo Oge, director of EPA's Office of Radiation and Indoor Air (ORIA), told *Microwave News*. In its original budget for fiscal year 1995, which begins next October, the agency had cut its NIER staff from five full-time employees to one. The program will now go back to a staff of five. EPA Administrator Carol Browner "has given her tacit approval," said Dennis O'Connor, a special assistant in ORIA.

A new, comprehensive strategy for the agency's work on EMFs and RF/MW radiation is being developed, Oge said, "because we were not happy with the program we had." Oge explained that she had recently briefed Mary Nichols, EPA's assistant administrator for air and radiation, and that Nichols had generally approved the new strategy. In recent years, ORIA's EMF staff has done literature reviews and published reports and informational brochures, among other activities.

Oge said ORIA will now return to the development of RF/MW public exposure guidelines. The agency may also examine how exposures to EMFs can be reduced voluntarily.

After trying for more than a decade to develop RF/MW rules—and actually circulating draft guidelines for comment—EPA dropped this effort in 1988; the agency has done no work in this area since then, despite a recommendation in 1991 from its Science Advisory Board (SAB) that it complete the limits (see *MWN,* S/O88 and J/A91).

EPA is dissatisfied with the current version of the ANSI/IEEE C95.1 exposure guidelines. In comments submitted late last year in response to the FCC proposal to adopt C95.1, EPA noted "serious flaws" in the guidelines (see *MWN,* J/F94).

Meanwhile, EPA's planned summary of the current scientific evidence on the potential carcinogenicity of EMFs is taking longer than expected to complete. The roughly 30-page

The President Asks EPA for New Report on EMFs and Cancer

President Bill Clinton, fielding a question on EMFs from a child with leukemia, announced on March 19 that he had asked the head of EPA to prepare a report on the possible cancer link. He also noted that he is "somewhat impressed" by the actions of the Swedish government. The comments came during an ABC News special, *Answering Children's Questions,* in which he discussed a variety of issues with schoolchildren at the White House. The producers had arranged to have Kevin Larm of Omaha, NE, who has leukemia, ask a question about EMFs. But Kevin was in the hospital when the session took place, so his brother Patrick asked his question instead.

Kevin did appear in a short videotaped segment, in which he talked about other children in his neighborhood who have developed cancer and about his belief that EMFs were the cause. "The power company says there's nothing to electromagnetic fields, EMFs. I just think it's a big cover-up," he said. The tape showed an electrical substation near his school and a transformer in the Larms' backyard. Peter Jennings hosted the program:

> *Jennings:* Patrick, do you want to talk to the President?
> *Patrick Larm:* I want to ask you his question. I have heard that recent studies have linked EMFs to childhood cancers. Other countries, such as Sweden, are passing laws to set standards. As our President, can you help lower EMFs so hopefully some childhood cancers can be prevented?
> *President Clinton:* That's something we can do something about. We had a study in 1990 which was inconclusive about it. But, you're right, Sweden has concluded that EMFs do lead to higher rates of cancer. So I have asked the person who runs the Environmental Protection Agency for our government to do a review of this and to make a report to me in the near future to try to make a decision about what we should do.
> I think we've got to see what the best available evidence is. But I, frankly, was somewhat impressed with the arguments made by the Swedes. We just have to look into it and see whether there's honestly evidence there; and if there is, then we have to take action. And we're looking into it. And you tell your brother to hang in there.

The following week, on March 25, the President met at the White House with Kevin, Patrick and their mother, Julie Larm, and two Nebraska Democrats, Sen. James Exon and Rep. Peter Hoagland. EMFs were again the topic of conversation, according to Hoagland's press secretary, Russ Rader.

Julie Larm told *Microwave News* that she asked the President to issue an executive order prohibiting the construction of new homes, schools and hospitals within 5,000 feet of existing power lines, substations and pollution sources such as oil refineries—and vice versa. She asked the President to sign the order on Earth Day, April 22. Larm helped found Omaha Parents for Prevention of Cancer last year, after finding many cases of childhood cancer near where Kevin attends school. Within a one-mile radius of the substation near the school, at least 11 children have developed cancer within the last five years, she said.

A White House spokesman said that the session with the President was a private meeting and that no public statement was issued. EPA is preparing a response to the President (see p.10). Last summer, Vice President Al Gore also fielded a question about EMFs and childhood cancer, when he appeared on a C-SPAN call-in show (see *MWN,* J/A93).

document, which is being prepared in lieu of a full revision of the agency's 1990 EMF–cancer report (see *MWN,* N/D90, J/A91 and J/A93), had been promised by early 1994. It is now likely to take until September, according to Dr. Robert McGaughy of EPA's Office of Health and Environmental Assessment, who is the principal author.

The President's comments, broadcast in an ABC News special on March 19, came after EPA officials had decided that the five-person program should be revived. But Oge and O'Connor both said that the comments will likely focus new attention on the agency's NIER work. O'Connor said a response to the President is being prepared. It is expected that it will include McGaughy's report. But one staffer, who declined to be named, said, "Clearly we're going to have to do something more. As far as I know, this is the first time any U.S. President has mentioned anything about EMFs."

After plans to eliminate EPA's NIER program became known last year, Sen. Joseph Lieberman (D-CT) wrote to the agency, arguing that the elimination of the EMF program "would be inconsistent with the agency's responsibility to provide full protection of public health and the environment" (see *MWN,* N/D93). He also urged EPA to complete the RF/MW guidelines.

Dr. Genevieve Matanoski of the Johns Hopkins University School of Hygiene and Public Health in Baltimore, who recently became the chair of the executive committee of the SAB (see *MWN,* N/D93), also urged EPA to remain an active player on NIER issues. "Mary Nichols was impressed with the comments we received from Sen. Lieberman and Dr. Matanoski," Oge said.

The existence of the national EMF research and communications program (NERP)—Oge is EPA's representative on the program's interagency committee—may also have motivated the agency's return to the NIER issue. But the effect of the NERP was minor, "compared to the change of management at EPA," Oge said. Both Browner and Nichols were appointed by Clinton.

Any new effort to draft RF/MW guidelines would essentially begin from scratch, Oge said, due to changes in the scientific data. As early as 1984, EPA was ready to base exposure limits on a thermal threshold of 1W/Kg (see *MWN,* J/F84). Plans to propose a 100 $\propto$W/cm^2 general population limit were scrapped, however, just before the guidelines were to be published (see *MWN,* J/A84). In 1986, EPA formally proposed four options: exposure guidelines based on 0.04 W/Kg, 0.08 W/Kg or 0.4 W/Kg, or no action (see *MWN,* J/A86).

NCRP Report on Human Exposures to RF/MW Radiation

After ten years of work, the National Council on Radiation Protection and Measurements (NCRP) has released a guide to radiofrequency and microwave (RF/MW) radiation exposures. The 233-page report provides comprehensive information on various radiation sources and a "how-to" guide for estimating human exposures.

"The report will be useful for evaluating RF/MW hazards," Richard Tell, a Las Vegas-based consultant, who chaired the committee that wrote the report, told *Microwave News*. The report features procedures for evaluating the potential hazards associated with various types of radar, medical devices, communications systems and heating equipment. In addition, it covers broadband and narrowband survey meters and techniques.

A copy of *A Practical Guide to the Determination of Human Exposure to Radiofrequency Fields* (Report No.119), is available for $25.00 from: NCRP, 7910 Woodmont Ave., Bethesda, MD 20814, (800) 229-2652 or (301) 657-2652. (For more on the work of the NCRP, see *MWN,* J/F86 and M/J92. A list of members of the committee that wrote the report appears in *MWN,* N/D92.)

Opposition to Weather Radar in California Stirs Controversy

Homeowners near a new NEXRAD Doppler weather radar in Ojai, CA, are trying to persuade the National Weather Service (NWS) to move the facility. A lawsuit to force the government to reopen the environmental review process has failed, but in the process, the opponents have stirred controversy over possible health risks from powerful radars.

NEXRAD, or next-generation radars, have been built at, or are planned for, more than 150 locations nationwide. Of these, 116 will be operated by the NWS, 14 by the Federal Aviation Administration (FAA) and 26-30 by the U.S. Air Force, according to Lori Arguelles, a spokeswoman for the National Oceanic and Atmospheric Administration (NOAA), the parent agency of the NWS, in Washington. The radars are being built by Unisys, and design and construction are being coordinated by a Joint System Program Office (JSPO) at NOAA's Washington offices. So far, about 60 of the radars are operating, Arguelles said.

Led by actor Larry Hagman, whose home is about 300 yards from the Ojai installation, the radar's opponents have enlisted broad support since construction began last November. California's two Democratic senators, Barbara Boxer and Dianne Feinstein, have each written to the Department of Commerce—which includes NOAA—asking for a new environmental assessment. Rep. Elton Gallegly, a Republican, whose district includes Ojai, has introduced a bill (H.R.3850) that would require a study by the National Academy of Sciences of health risks from facilities such as the Ojai radar and that would prohibit its operation until the study is completed. And on March 3, Hagman, the former star of the television program *Dallas,* appeared on the *Montel Williams Show,* a nationally syndicated television talk show, to discuss the health risks from the radar. (The producer of the show also lives in Ojai.)

Ojai is in Ventura County, about 50 miles northwest of Los Angeles, and both the city and the county have passed resolutions which say that the radar violates local zoning rules.

The lawsuit, filed in federal court in Los Angeles, alleged that the federal government failed to meet the requirements of the National Environmental Policy Act (NEPA) with the Programmatic Environmental Impact Statement that the JSPO re-

leased in 1984 and the Supplemental Environmental Assessment that was completed in the fall of 1992 (see *MWN,* J/A92).

At a hearing in early February, attorneys for the radar opponents asserted that a temporary restraining order should be granted to prevent operation of the radar, because the JSPO had ignored "significant risks that the project may cause cancer, heart disease and increased incidence of congenital [birth] defects." The opponents introduced an affidavit from Dr. Richard Scribner, an epidemiologist at the University of Southern California in Los Angeles, who also lives in the area. He wrote that recent studies—of ELF EMFs, in particular—establish that non-ionizing radiation can cause cancer. (For an excerpt from Scribner's affidavit, see p.8.) District Court Judge Terry Hatter rejected this reasoning and denied the restraining order.

At a subsequent hearing on a motion from the government to dismiss the lawsuit in its entirety, the radar's opponents focused on procedural violations related to the Ojai site, trying to establish that local officials had been misled by the NWS, explained their attorney, Dale Givner of Oxnard, CA. This approach also failed, and Hatter dismissed the suit on April 4.

Givner told *Microwave News* that Hatter had appeared reluctant to consider the health issues, since this would have meant reopening the environmental review process and could have jeopardized the construction and operation of NEXRAD facilities nationwide. "That's a big ball of wax," he said. An appeal is being considered, Givner said, but he added that, "We have come to the conclusion that the likelihood of winning this in court is remote."

"The science shows us that these radars are safe to use," NOAA's Arguelles told *Microwave News.* Asked whether JSPO's environmental review was adequate, she said: "Judge Hatter thinks so. I would stand by that opinion."

With legal avenues all but exhausted, the radar's opponents are pursuing other solutions. Jim Maiella, Rep. Gallegly's press secretary, said that the head of the NWS, Dr. Elbert Friday Jr., told the congressman in early March that the Ojai NEXRAD radar could be moved if someone could be found to foot the bill—about $500,000. "We were encouraged," said Maiella, noting that area residents, including Hagman, were interested in this option. But when a local paper reported this development, Friday wrote to Gallegly that their conversation had been misrepresented and that "the NWS has no intention or plan to move the [Ojai] Doppler weather radar."

Meanwhile, controversy over the Ojai site is prompting questions in Melbourne, FL, where another NEXRAD facility has been in use since 1991. A March 31 report by Marilyn Meyer in a local newspaper, *Florida Today,* cited residents' concerns over the NWS radar and an older FAA radar in the same region that has come under suspicion as a possible cause of clusters of non-Hodgkin's lymphoma and Lou Gehrig's disease (see *MWN,* J/F92, M/J93 and S/O93).

NEXRAD or WSR-88D radars—which operate at 2.7-3.0 GHz, with 750 kW peak output power—have been controversial in other areas as well. In New York, opposition to a proposed site in Sayville prompted public hearings and a 50-page report from the Assembly's Environmental Conservation Committee, examining possible health risks (see *MWN,* M/A92). The NWS dropped its plans for the Sayville site.

European Research Center in Spain Awaits Funding

The European Bioelectromagnetics Association (EBEA) is proposing a $15 million research center in Spain for laboratory studies on the biological effects of non-ionizing electromagnetic radiation (NIER). The proposed European Bioelectromagnetics Center (EBC), which will possibly be sited in Madrid, would also develop medical applications for NIER, explore possible interaction mechanisms, support epidemiological studies and examine electromagnetic compatibility problems.

Three Spanish government ministries have given their support for the EBC, according to Dr. Jocelyne Leal, founder and former president of EBEA and chair of the project. Leal will now present the proposal to the European Community (EC) for support and funding.

The EC will be asked to provide a construction budget of 1.57 billion pesetas (about $11.5 million) and an equipment budget of 560 million pesetas (about $4 million). Under the plan, the EBC would have a staff of eight scientists, eight tech-

Health Concerns Raised Over Russian Radar in Latvia

The health and environmental effects of four high-power radars installed by the Russian military in Skrunda, Latvia, will be the focus of a conference June 17-21.

The radars were installed 25 years ago as part of an early-warning nuclear defense system. They are at the center of a dispute between Latvian authorities, who want them removed by the end of this year, and the Russian military, which wants to keep them functioning until alternative radars can be installed outside the Baltic states. A compromise calling for their removal in four years has been reached, pending ratification by the Latvian Parliament.

Latvian researchers have suggested that possible adverse health and environmental effects have been caused by the radars. Small-scale epidemiological studies of adults and children showed unspecified complaints. Scientists suspect that the radiofrequency radiation could act to worsen the course of existing diseases. Also, trees near the radar were found to grow more slowly.

The Latvian Academy of Medicine in Riga, 78 miles east of Skrunda, sees the next four years as an opportunity for more studies with animals and among local residents.

The four-day conference, *The Effect of Radiofrequency Electromagnetic Radiation on Organisms,* is being organized by scientists from the University of Latvia in Riga. Papers will address existing and ongoing studies and make recommendations for further work.

Conference participants will arrive in Riga and be taken to the Skrunda area for lectures and a field trip. For more information, contact: Dr. Imants Detlavs, Faculty of Biology, University of Latvia, Kronvalda str. 4, LV1842 Riga, Latvia, (371+2) 325656, Fax: (371+2) 225039.

nicians and 13 support personnel. A site for the center has been donated by the University of Alcalá de Henares in Madrid; the Spanish government, the national phone company and a private foundation funded development of EBC's master plan.

"This will be a one of a kind research center," said Dr. Thomas Rozzell of the U.S. National Academy of Sciences in Washington, who is scientific adviser for the EBC project. The main purpose of the center is to provide a carefully controlled laboratory setting for *in vitro* and *in vivo* experiments. The facilities will be adequate to support 10-12 experiments running simultaneously. Rozzell and others noted that the integrity of laboratory exposure systems has often been questioned, and that the center would provide an opportunity to control and characterize the EMF environment rigorously.

The center could help "save huge amounts of money," Leal told *Microwave News,* "because all the facilities, equipment and technical and supporting staff necessary for up-to-date studies will be in one place." Leal said she could not yet predict how soon construction of the center might begin. In 1982, Leal and Dr. Jose Delgado, both of the Hospital Ramón y Cajal in Madrid, published the results of the first studies to show that weak, pulsed, low frequency magnetic fields can affect the development of chick embryos (see *MWN,* Mar83).

The master plan for the EBC, which was published last year, includes a 130-page discussion of the state of the science. A second edition of the plan is being prepared. For more information, contact: Dr. Jocelyne Leal, Dept. Investigación, Hospital Ramón y Cajal, Carretera de Colmenar Km. 9, 28034 Madrid, Spain, Fax: (34+1) 358-1275.

RFI from Ham Radio Prompts Health Worries and Lawsuit

A dispute over radiofrequency interference (RFI) caused by an amateur radio transmitter in Little Egg, NJ—and concern that the radio signals may cause health problems—has escalated into a lawsuit alleging "electronic trespass."

Marlene and Michael Morris and Robert Schnabel complain that their telephones and televisions and an electronic doorbell pick up signals from the transmitter operated by Anthony and Sharon Marino, whose home is between the Morris and Schnabel residences. In their suit, they contend that the RFI has caused emotional distress and loss of property value. They do not allege that the RF radiation has caused health problems, but Marlene Morris said the case is motivated by health concerns.

"I'm doing this because I fear for what I'm going to find out in ten years," Morris told *Microwave News*. "When someone can tell me for sure that this radiation doesn't cause cancer, I'll be satisfied." She explained that the interference "is just an indication that the signals are there."

The Marinos' attorney, Judith Schneider of the Marlton firm of Rawle & Henderson, told *Microwave News* that, "We have tried to resolve this amicably." She said that it is the affected equipment that is faulty, not the Marinos' radio. The Federal Communications Commission (FCC) has inspected the Marinos' home and determined that they are operating legally, Schneider added. The Marinos have tried unsuccessfully to shield the devices in their neighbors' homes.

Schneider said she will argue in court that, "Interference claims such as these are the exclusive jurisdiction of the FCC." The court has agreed to allow the American Radio Relay League (ARRL)—the leading amateur radio organization, based in Newington, CT—to file an amicus brief on behalf of the Marinos.

"This case should never have gone this far," said Christopher Imlay of the Washington firm of Booth, Freret & Imlay, who represents the ARRL. He told *Microwave News* that the New Jersey courts—and all other state and federal courts—"clearly have no jurisdiction" to hear cases like this one. The ARRL brief has not yet been filed.

The case was filed in state Superior Court for Ocean County, in Toms River, in 1991. It was close to being tried last fall, when the lawyer representing the Morrises and Schnabel backed out of the case in a dispute over payment of his fees. The plaintiffs are now represented by Joseph Quinn, who is with the firm of Pringle & Quinn in Belmar.

Thériault Abstract

To determine whether occupational exposure to magnetic fields of 50/60 Hz was associated with cancer among electric utility workers, the authors used a case–control design nested within three cohorts of workers at electric utilities: Electricité de France-Gaz de France, 170,000 men; Ontario Hydro, 31,543 men; and Hydro-Québec, 21,749 men. During the observation period, 1970-1989, 4,151 new cases of cancer occurred. Each participant's cumulative exposure to magnetic fields was estimated based on measurements of current exposure of 2,066 workers performing tasks similar to those in the cohorts using personal dosimetry. Estimates were also made of past exposure based on knowledge of current loading, work practices, and usage. Workers who had more than the median cumulative exposure to magnetic fields (3.1 microtesla (∝T)-years) had a higher risk for acute nonlymphoid leukemia (odds ratio (OR) = 2.41, 95% confidence interval (CI) 1.07-5.44). The same observation holds for acute myeloid leukemia (OR = 3.15, 95% CI 1.20-8.27). There was also an elevated risk for mean exposure above 0.2 ∝T (acute nonlymphoid leukemia, OR = 2.36, 95% CI 1.00-5.58; acute myeloid leukemia, OR = 2.25, 95% CI 0.79-6.46). However, there were no clear dose–response trends with increasing exposure and no consistency among the three utilities. Men whose cumulative exposure to magnetic fields was above the 90th percentile (15.7 ∝T-years) had an elevated risk for brain cancer (OR = 1.95, 95% CI 0.76-5.00) that was not statistically significant. No association with magnetic fields was observed for any of the other 29 types of cancer studied, including skin melanoma, male breast cancer, and prostate cancer. Controlling for potential confounding factors did not change the results. G. Thériault, M. Goldberg, A. B. Miller, B. Armstrong, P. Guénel, J. Deadman, E. Imbernon, T. To, A. Chevalier, D. Cyr and C. Wall, "Cancer Risks Associated with Occupational Exposure to Magnetic Fields Among Electric Utility Workers in Ontario and Quebec, Canada, and France: 1970-1989," *American Journal of Epidemiology, 139*, pp.550-572, 1994. (Reprinted with permission.)

McGill University, who led the research effort, told *Microwave News*. "Unfortunately," he added, "the analysis shows a lack of dose–response and a heterogeneity among the three utilities."

Dr. Anthony Miller of the University of Toronto, who collaborated with Thériault, agreed: "We are now closer to regarding this as a real association." In an interview, he said that the study was an important effort because of the large number of workers surveyed, the detailed assessment of exposures and the investigation of possible confounders. Dr. Marcel Goldberg of INSERM, the French national health research institute in Paris, was the third principal investigator.

"The results support the link I first identified in 1982 among EMF-exposed workers and later found among amateur radio operators," Dr. Samuel Milham Jr., a consulting epidemiologist based in Olympia, WA, told *Microwave News*. "This is not a chance finding" (see *MWN,* J/A82, N/D87 and J/F89).

"The methods were excellent, but the results are murky," Dr. David Savitz said in a telephone interview. Even so, Savitz observed that the Thériault study "increases the evidence that magnetic fields are linked to cancer." Savitz, an epidemiologist at the University of North Carolina School of Public Health, Chapel Hill, is completing his own major study of cancer among utility workers for the Electric Power Research Institute. He said that he has drafted a paper and plans to submit it for publication soon.

Thériault and coworkers found no connection between magnetic field exposure and male breast cancer, prostate cancer or skin melanoma, three cancers which have also been linked to EMFs in previous studies. Nor did they see a link between EMFs and all cancers combined. There was no cancer risk associated with exposure to electric fields, but Thériault noted that he was planning a further analysis of the electric field data.

The investigators controlled for workers' exposures to known and possible carcinogens—including ionizing radiation and chemicals such as benzene. There was little change in the observed risks when these agents were taken into account. They also controlled for socioeconomic status (SES). For astrocytomas, the team found that by analyzing data according to a "white-collar/blue-collar variable," instead of SES, the risk was reduced from 12 to 1.5 times the expected rate.

The study included 4,151 new cases of cancer from 1970 to 1989 among 170,000 employees from EDF, 31,543 from OH and 21,749 from HQ. Among these were 140 cases of leukemia (47 AML) and 108 cases of brain tumors (41 astrocytomas).

Large Variation Among Utilities

The leukemia risk varied widely among the three utilities. The OH employees appeared to be at a significantly greater risk—those with a greater than median cumulative magnetic field exposure had 38 times the chance of developing AML and a sixfold greater risk of ANLL compared to less-exposed workers. When the data from the three utilities were pooled, the risks fell to three times the expected rate for AML and two-and-a-half times for ANLL. EDF employees faced less than a twofold increased risk of either type of leukemia. For HQ employees, the numbers were too small to allow a statistical analysis.

The researchers noted that for all leukemia there was, in general, a pattern for "an association in OH, a weaker one in EDF and no association in HQ." They added that, "Given this lack of consistency, the combined odds ratios should be interpreted cautiously."

One possible explanation for the interutility variation is that the EDF cohort did not include retirees. Both Thériault and Miller pointed out that much of the leukemia observed in Canada was among older subjects. "By not following French retirees," Thériault said, "We have lost important cases. That could explain the difference."

Miller, the chairman of the Department of Preventive Medicine and Biostatistics at the University of Toronto medical school, said that, taking into account the variation in the follow-up period, "It's not clear there is a big difference among

EPRI on Thériault Study

Reprinted below are excerpts from the Electric Power Research Institute's (EPRI) comments on the Thériault study. They were released on March 31.

Based on the limited information presented, it appears that mean and cumulative magnetic field exposures at EDF were notably lower [than] at the other two utilities. In addition, the job definitions and the exposures within jobs varied significantly among the three companies....

This large and comprehensive study adds substantial new data on occupational exposures in the utility industry and to the consideration of an association between occupational exposure to EMF and cancer.

Among the many strengths of the study are its large sample size, extensive measurements, development of a specific *a priori* hypothesis, detailed assessment of potential confounding by other occupational exposures, and an experienced team of investigators. Also, all analyses were well conceived and implemented, including the choice of cut-points based on the overall exposure distribution.

Several issues in the study design and analysis are problematic. In terms of study design, cases and controls were drawn from three cohorts that were defined and followed up quite differently....

Differences in the cohort definitions and in the levels of exposure make interpretation of the combined results problematic....

In summary, despite many methodological improvements, the results of the Canada–France study are not clear-cut. While the study provides some evidence for the hypothesis of an EMF association with leukemia (in particular AML) and, to a lesser extent, with brain cancer, the authors conclude that "Despite the attempts made in this study to achieve adequate power, definitive evidence of an association between exposure to magnetic fields and leukemia and brain cancer has not been obtained." The lack of an exposure–response relationship and inconsistencies in results among utility cohorts underscore our limited understanding of the risks of exposure to EMF among utility workers and suggest the need for further analyses and additional studies.

Utilities Plan No Change in Policies for EMF Exposures

The three utilities that sponsored the Canadian–French occupational study have no plans to change their policies for workplace or public EMF exposures in light of the study's findings.

"Our recommendation to senior management is that we don't have enough scientific evidence to justify changes in daily working practices—that is, to limit duration or intensity of exposures," Dr. Michel Plante, a Hydro-Québec medical adviser and the Montreal-based utility's liaison to the Thériault study, told *Microwave News*. "Nor is there evidence to change the general exposure levels for the public from Hydro-Québec equipment at this time," he added. Plante cited the lack of "definitive evidence" of a cancer link, but stressed that, "We have the responsibility to do more research."

Ruth Greey, the senior EMF consultant at Ontario Hydro, said in an interview that the Toronto-based utility plans "no changes to what we are doing now." But, she noted, the policy would be reviewed "if a causal relationship between EMFs and cancer is found." She pointed out that the utility had already taken "a precautionary approach" to power line siting.

In a published statement, Electricité de France stated that EMF mitigation strategies are not "justified" by the new results. Although the study lends a "plausibility" to the link between magnetic fields and leukemia and brain tumors, "The problem of the carcinogenicity of EMFs remains a research problem," according to Electricité de France.

the utilities."

Nevertheless, Milham questioned whether the data for the three utilities should have been combined. "It helped overcome the problem of small numbers, but it glosses over the large variations in exposures and case follow-up in the three groups," he said. "I hope they will release a detailed, separate analysis for each utility."

The Canadian–French study features the most detailed estimates of worker exposures ever attempted for the utility industry. For each job category, a time-weighted average exposure was estimated by having a sample of workers—2,000 in all—wear Positron personal meters for a full five-day work week. A worker's cumulative exposure was estimated by combining the exposure data with time spent doing specific jobs.

Relative risks were calculated for those workers with higher than the median cumulative exposures compared to those in the lower half. In addition, the cancer risks were estimated for the 10% of workers most exposed.

Mean magnetic field exposures were generally less than 10 mG, though there were some exceptions. For example, OH hydroelectric operators had mean exposures of 54 mG.

The exposure assessments were not identical for the three utilities. But Thériault maintained that, "There was not enough of a difference in exposure assessment to explain the variation in results." He said that he thinks they may be able to explain the differences with further analysis.

Thériault noted that the measurement data made clear to him that job title was not sufficient to define exposure for a category of workers. "The job site is also important," he said. "Linemen in one part of the country have different exposures from those in other parts." He also cited the variation in exposures at different power stations.

Compatible with Previous Studies

The Thériault group argued that its results are "compatible" with those of the two previous studies for which extensive EMF measurements were also carried out.

Jack Sahl of Southern California Edison in Rosemead and coworkers did not find an association between occupational EMF exposure and leukemia, brain cancer or lymphoma (see *MWN,* M/A93 and J/A93). But the Canadian and French researchers wrote that this apparent inconsistency could be explained by the fact that Sahl had not looked at the risk by leukemia subtype. "Had we limited our analysis to all leukemia, we would have observed a somewhat elevated but not statistically significant odds ratio for the group with exposure above the median level...and, therefore, our conclusions would have been similar to those of Sahl et al."

In an earlier study, Dr. Birgitta Floderus and colleagues at the National Institute of Occupational Health in Sweden found an elevated risk of chronic lymphoid leukemia (CLL) (see *MWN,* S/O92). Thériault and coworkers speculated that the absence of an association between EMFs and CLL in their study might have resulted from the lack of follow-up of older, retired workers at EDF. "This...diminished our ability to observe an association with [CLL] if it did exist," they wrote.

When asked what should be done next, Savitz argued that epidemiological research still has an important role to play, but he cautioned that, "I don't think we are going to learn more from the kind of epidemiology Thériault and I have done, because these methods have not produced clarity so far. We need to do either different epidemiology or additional lab work."

Thériault pointed to the need to control for exposures outside the workplace in occupational studies. More generally, he advised: "Increase and accelerate the research. We may be dealing with a small risk, but in the future non-ionizing radiation is bound to be used a lot more and it is important to know whether there are health impacts."

Detailed Report Available Soon

A technical report by the Canadian–French research team, with more details than are published in the *American Journal of Epidemiology,* will be available the week of May 9 or soon thereafter, Ruth Greey, the senior EMF consultant for Ontario Hydro, told *Microwave News*. The report, which is more than 200 pages long, will contain both electric and magnetic field data, according to Dr. Michel Plante, a medical adviser at Hydro-Québec.

The report will cost about $75 (Canadian). To order, contact: Ruth Greey, Ontario Hydro, 5775 Yonge St., Toronto, ONT M2M 4J7, Canada, (416) 590-2424.

of McGill's Department of Occupational Health in Montreal told *Microwave News*. Héroux designed the Positron EMF exposure meter used in the Canadian–French study.

In addition to measuring electric and magnetic fields, the Positron meter and its prototype (the IREQ meter) also monitor high frequency transients by sampling signals in the 5-20 MHz frequency range. "Such transients are similar to the sparks on synthetic fabrics in dry air," Héroux explained.

Dr. Ben Armstrong, a biostatistician at McGill's Department of Occupational Health, who is leading the analysis of the transient data, declined to disclose any of the results. But one source, who asked not to be identified, said that the relative risks associated with transient exposures are higher than those associated with 50/60 Hz magnetic field levels. Armstrong said that the transient results have been submitted for publication.

In an effort to explain why his study on 50/60 Hz fields did not provide clear-cut results, McGill's Thériault speculated that, "The right EMF exposure parameter may not have been measured." The transient results suggest that high frequency EMFs may be another important index of exposure—though Thériault cautioned not to overinterpret them because, "It is difficult to understand what we are measuring."

As Dr. Richard Lovely, a senior research scientist at Battelle Pacific Northwest Labs in Seattle, pointed out in an interview, "Measures of magnetic field transients may be more important than the time-weighted average, since transients can affect important biological endpoints such as melatonin" (see *MWN,* M/J93).

A new paper by a team from Sweden's National Institute of Occupational Health (NIOH) and from the M.D. Anderson Cancer Center in Smithville, TX, underlines the potential importance of transients. The Swedish–American team found that chemically treated mice exposed to *intermittent* 50 Hz magnetic fields had significantly more skin tumors than those exposed to *continuous* 50 Hz fields and that the tumors appeared more quickly than in mice treated with the chemical carcinogen only. There also appeared to be a dose–response relationship in terms of tumors per affected animal. The findings corroborated results by the same team published last year in *Carcinogenesis* showing that *continuous* 50 Hz magnetic fields had essentially no effect on the development of skin tumors in a different strain of mice.

The results on intermittent exposures were first presented at last fall's Department of Energy (DOE) review of EMF research in Savannah, GA, by two NIOH researchers, Dr. Bo Holmberg, based in Solna, and Dr. Kjell Hansson Mild, based in Umeå. Mild explained that turning the fields on and off every 15 seconds generates complex EMFs, including high frequency transients. "It's not clear what the [biologically important] exposure is: Is it the intermittency of the field or is it the transient field or is it both?" Mild asked. "We have to dig deeper into this."

In Savannah, Holmberg told *Microwave News* that he could not explain his results but said, "My first bet would be the transients." The new results appear in the February 1994 issue of *Carcinogenesis*. They were deemed important enough by the editors of the journal to be published as an "accelerated paper."

A second report presented at the DOE meeting also highlighted the need to study transients. Dr. Jeffrey Guttman of Enertech Consultants in Campbell, CA, said that he had found preliminary indications that houses classified as "very high current configurations" (VHCC) under the Wertheimer–Leeper coding scheme "had a greater number of externally generated transients" than other houses—though he warned that this finding was based on a small number of observations. VHCC homes are those which have been most associated with childhood cancer in a number of different epidemiological studies.

In a 1990 paper, Armstrong, Thériault and Jan Deadman, also of McGill, reported that a series of measurements with the Positron and IREQ meters indicated that there was a very poor correlation between measures of exposures to power frequency magnetic fields and to high frequency transients. This finding suggests that the relative risks for exposures to 50/60 Hz fields and transients could be quite different.

In an earlier measurement survey with the Positron and IREQ meters, Deadman and a team of McGill and Hydro-Québec researchers reported that "utility workers' exposures were significantly higher than background levels...by a factor of 171 for high frequency transient electric fields."

Armstrong noted that the analysis of the transients was not part of the joint utility study, and only Hydro-Québec and Electricité de France had collected the data.

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UPDATES

CELLULAR PHONE LITIGATION

Motorola Seeks Dismissal...A motion to dismiss the cellular telephone lawsuit brought by Motorola employee Robert Kane will be argued before Illinois Circuit Court Judge Joseph Casciato this spring. Kane alleges that exposure to RF radiation while testing a prototype cellular phone antenna caused his brain tumor (see *MWN,* J/F94). Motorola's attorneys contend that Kane's complaint fails to make a plausible case that the company, or the employees who are also named as defendants, were aware that the tests "posed a high probability of serious harm." Court papers filed in support of Motorola's motion also argue that the case should be dismissed because the Illinois workers' compensation act provides exclusive remedy for on-the-job injuries: "The act clearly prohibits common law or statutory actions against an employer." In their legal papers, Kane's attorneys, led by Gina Fietsam of the Chicago firm of Holstein, Mack & Klein, repeat the allegation that Kane's supervisor, Thomas Hull, asked Kane whether he felt heat while using the prototype antenna. This, and research on RF radiation deposition in the human head that was published by Motorola's Dr. Quirino Balzano, "unquestionably demonstrate Motorola's recognition of the potential for dangerous effects from electromagnetic radiation," states the memorandum they filed opposing dismissal. Motorola's brief also argues that Kane's complaint never states "that his testing of the prototype phone actually caused his brain tumor. This failure to allege causation in and of itself dooms plaintiffs' entire complaint." Kane's attorneys respond: "Plaintiffs have alleged all essential elements of each cause of action. Defendants' knee-jerk motion to dismiss should be denied in its entirety." Motorola is represented by Jeffrey Cashdan of the Chicago firm of Kirkland & Ellis.

COMPATIBILITY & INTERFERENCE

Assessing EMI Risks for Fly-by-Wire... Tests by the U.S. military indicate that "long-standing concerns that fly-by-wire flight control systems are inherently vulnerable to microwave radiation are unfounded," Bruce Nordwall reports in *Aviation Week and Space Technology* (February 14, 1994). Fly-by-wire systems, which use electronics to operate critical aircraft control systems, have become common in newer military and commercial airplanes, heightening EMI worries (see *MWN,* J/F89). The Radio Technical Commission for Aeronautics (RTCA) in Washington is currently studying the EMI risks that portable electronic devices such as laptop computers and CD players could pose to all avionics, including fly-by-wire systems (see *MWN,* M/J93). The military, on the other hand, is examining possible EMI from high-intensity radiation, which could include radars or EMP generators. In one phase of the tests, a digital flight control computer was exposed to microwaves at strengths from 1.4 kV/m to more than 39 kV/m, over a range of RF frequencies. The systems tested were only susceptible "at very high power levels, well above those produced by commercial radar installations," according to the magazine. The study, a collaborative effort among researchers at the Naval Air Warfare Center in Warminster, PA, the Air Force's Phillips Lab in Albuquerque, NM, and the Ar-

my Research Lab in Adelphi, MD, included low-power tests designed to find weaknesses in the EMI shielding. Nordwall also notes that a fiber-optic data bus—generally considered "EMI proof"—was disrupted, "because the optoelectronics were not shielded."

EPIDEMIOLOGY

Research Summaries...A new loose-leaf report from the Electric Power Research Institute (EPRI) aims to provide a quick, easy reference to the results of dozens of major EMF epidemiological studies. So far, the binder includes 27 summaries, covering research up to 1990; another installment, which will make the collection at least as current as the 1992 Swedish residential and occupational studies (see *MWN,* S/O 92), should be available late this year, said Robert Banks of Robert S. Banks Associates Inc. in Minneapolis, which prepared the report for EPRI. After that, updates are planned for about once a year. "The idea was to provide an easy-to-read, comprehensive introduction to the science," said Banks. The summaries run two to five pages, and most include charts with odds ratios or other key results. The introduction to the report notes that, "Each summary was submitted to the primary author for review and all comments received have been incorporated." *EMF Epidemiologic Summaries* (Report No. TR103040) is available for $200; prices for the updates are not yet set. Two additional booklets, *Fundamentals of Epidemiology: Parts 1 and 2* (BR103324 and BR103325), are included as an appendix. These provide an overview of the science of epidemiology and a primer on the statistical methods that are used. They are also available separately; single copies are complimentary. Contact: EPRI Distribution Center, 207 Coggins Dr., Pleasant Hill, CA 94523, (510) 934-4212.

EXPOSURE ASSESSMENT

EMFs from Incubators... Researchers in both the U.S. and Sweden have found high EMFs in incubators commonly used in hospital nurseries for premature babies. Drs. Charles Polk of the University of Rhode Island in Kingston and Shakikant Mehta of Roger Williams Hospital in Providence, RI, measured maximum magnetic fields of 107-289 mG three-quarters of an inch above the bed surface in three different types of incubators. The fields were highest at one end and lowest at the other in all of the incubators (the infants can be placed with their heads at either end). Dr. Gert Anger of the Swedish Radiation Protection Institute in Stockholm, Sweden, tested four different types of incubators from the Karolinska Hospital's neonatal division. In three, the fields were 10-20 mG in a small region of the bed and slowly dropped off to 2-3 mG away from that area. In the fourth, the fields reached 48 mG in one location and exceeded 10 mG over the whole bed. Anger told *Microwave News* that there may be several reasons for the difference between his and Polk's readings: His measurements were taken at two inches above the bed surface because his meter had a larger coil than Polk's, and Sweden uses 230 V, compared with 110 V in the U.S., thereby requiring less current for the same power. In both studies, the researchers were unable to determine the source of the fields because the incu-

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bators were only available temporarily. Polk suspects that the high levels are caused by the blower motor, since the space above the bed is heated by hot air circulation and the fields are distributed unevenly. If this is correct, "it should not be particularly difficult to reduce field levels by using different fan motors, by magnetic shielding or by motor relocation," Polk concluded. Anger concurred, explaining that it should be possible to reduce exposure by increasing the distance between the bed and the source of the fields. "These fields are much higher than in the average home away from appliances," Polk noted in a presentation at the *DOE Annual Review of Research on Biological Effects of EMFs,* held October 31-November 4, 1993, in Savannah, GA. Polk and coworkers are preparing a paper for publication. Anger presented his findings at the *3rd Nordic Workshop on Biological Effects of Low Frequency Electromagnetic Fields,* held March 14-15, 1994, in Umeå, Sweden. A paper will be published by the Radiation Protection Institute in mid-April, he said.

MEASUREMENTS

P-1140 Protocol Approved... The U.S. measurement protocol for video display terminal (VDT) emissions received final approval from the IEEE Standards Board on March 17. Known as P-1140, it is largely the same as the Swedish MPRII rules—except that it does not include limits. MPRII, which was completed in 1990, has an appendix with technically achievable guidelines, and these have become the *de facto* international EMF emissions standard for computer manufacturers. Several times during the development of the U.S. protocol, emissions limits were added and then dropped. The P-1140 working group decided that any limits would be beyond its scope, according to Dheena Moongilan of AT&T Bell Labs in Holmdel, NJ, who chaired the panel. Among the other differences between the two protocols, the most significant is that P-1140 requires fewer measurement points. For a time, the working group, which was set up in 1987, attempted to write a measurement protocol for EMFs from *all* types of electronic equipment, but this effort was ultimately abandoned. (For more on the development of P-1140, see *MWN,* J/A87, M/A88, M/J89 and S/O90.) Copies of *P-1140—Standard Procedures for the Measurement of Electric and Magnetic Fields from VDTs from 5 Hz to 400 kHz* are available for $27.00 (plus $4.00 handling) from: IEEE, 445 Hoes Lane, Piscataway, NJ 08855, (800) 678-4333.

New ELF/VLF and RF/MW Meters... Holaday Industries Inc. has introduced an ELF/VLF electric field meter that is "specifically designed to meet the MPRII VDT measurement protocol," according to the company's Dave Baron. The HI-3638, covering 5 Hz to 400 kHz, features fiber optics to isolate the sensor; it can be used with an optional interface for computerized or automated testing. The HI-3638 sells for $2,395, which includes a digital readout. Holaday has also introduced an updated RF/MW measurement system, designated the HI-4000. The system includes two isotropic probes: the HI-4422 ($4,500), which covers 10 kHz to 1 GHz, and the HI-4450 ($9,500), which covers 80 MHz to 40 GHz; both can be

used with the same digital readout or computer interface as the HI-3638. An upgrade of the company's 3000 series, the 4000 system also features fiber-optic isolation of the probes. "The ability of probe connections to perturb the field that is being measured has long been a subject of debate," Baron pointed out, "and this technology should remedy the problem." For more information, contact: Holaday Industries, 14825 Martin Dr., Eden Prairie, MN 55344, (612) 934-4920.

MEETINGS

EBEA Papers... Abstracts of the 148 papers presented at the *2nd Congress of the European Bioelectromagnetics Association* (EBEA), which met December 9-11, 1993, in Bled, Slovenia, are now available. The proceedings, however, will not be published until later this year. The abstracts can be ordered from: Secretariat, EBEA Congress, University of Ljubljana, Faculty of Electrical and Computer Engineering, Trzaska 25, 61000 Ljubljana, Slovenia. The cost is 20 German marks (approximately $12.00 U.S.).

BEMS Special Sessions... The program for the Bioelectromagnetics Society (BEMS) meeting in Copenhagen, Denmark, includes a "Symposium on Epidemiological Studies of Power Fields in North Europe" on June 16 and a "Workshop on the Safety of Mobile Communications" on June 17. For more information, contact: BEMS, 120 W. Church St., Frederick, MD 21701, (301) 663-4252.

VDTs

Pregnancy Studies Reexamined... Nearly all of the occupational epidemiological studies conducted to date have been flawed by the lack of "a clear definition of exposure," according to Dr. Vincent Delpizzo of the Australian Radiation Laboratory in Yallambie. In a review of 21 studies, to be published next fall in the *American Journal of Industrial Medicine,* Delpizzo writes that the "most likely" cause of the adverse pregnancy outcomes observed was ELF EMFs. He bases this view on the 1992 Finnish study (see *MWN,* M/A92, M/J92 and J/F94), and on studies that have found an association between reproductive problems and magnetic fields from sources other than VDTs. These include studies by Dr. Nancy Wertheimer and Ed Leeper on electric blankets and ceiling cable electric heating systems (see *MWN,* M/J86 and N/D88) and by Dr. Jukka Juutilainen on residential exposure to power line magnetic fields (see *MWN,* M/A92). Delpizzo does not recommend further VDT epidemiological studies, however, because VDT emissions have been reduced in recent years. He concludes that studies of the effects on pregnancy of exposure to higher levels of ELF EMFs are needed....Italian researchers led by Fabio Parazzini at the Mario-Negri Institute of Pharmacological Research in Milan have a somewhat different point of view. Writing in the *Journal of Epidemiology and Community Health (47,* pp.265-268, 1993), they conclude on the basis of a meta-analysis of nine case–control studies, that VDTs pose no major risk to pregnant women. They agree with Delpizzo in cautioning that other sources of magnetic fields may be more important than VDTs.

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Suit Blames Texas Utility for 11 Cases of Childhood Cancer

EPRI Charged with Misleading the Public

In the largest electromagnetic field (EMF) lawsuit ever filed, 11 Texas families allege that magnetic fields from power lines and building wiring caused their children's cancers. Eight of the children were diagnosed with acute lymphocytic leukemia (ALL). The families claim that Houston Lighting & Power Co. (HL&P) was aware that magnetic fields can cause childhood cancer, but failed to take preventive action.

The suit, which was filed in December in the District Court of Harris County, TX, also charges that the Electric Power Research Institute (EPRI) conspired with the utility to discredit research linking EMFs to cancer, manipulate public opinion on EMF health risks and prevent government regulation of EMFs. The case is not expected to go to trial for at least two years.

The families are being represented by Joseph Jamail, one of the most successful—and richest—trial lawyers in America (see below). Janet Evans, an attorney with Jamail's firm, Jamail & Kolius in Houston, explained that Jamail will handle the case with John Tyler of Tyler & Das, also in Houston. Neither Jamail nor Tyler responded to repeated requests for interviews. One plaintiff contacted by phone said he would be happy to talk about the case but that his lawyers had advised his family not to comment at this time.

HL&P and its corporate parent, Houston Industries Inc., are represented by the Houston firm of Baker & Botts. Irv Terrell, an attorney with the firm, said in an interview that he had filed a response denying the complaint's

(continued on p.13)

Attorney Joe Jamail: A String of Record-Breaking Victories

The *American Lawyer* magazine described Joe Jamail as a "giant-killer." *Forbes* cited him as "the nation's highest-paid plaintiffs' lawyer," in a cover story on "Corporate America's Most Powerful People." The *National Law Journal* named him as one of the most influential attorneys in the U.S.

Jamail's suit against HL&P and EPRI marks the first time an attorney of his stature and resources has taken on a case linking EMFs to cancer.

Jamail won what the *Guinness Book of World Records* says is the largest civil damages award in history: an $11.12 billion verdict against Texaco in 1985 (later settled out of court for $3 billion). Estimates of his fee in the case ranged from $300 million to well over $400 million.

This is the Houston lawyer's second listing in *Guinness*. His first world record was set in a 1978 case against Remington Arms, which resulted in what was then the largest-ever individual cash settlement, $7 million, and the recall of 200,000 rifles with faulty safety catches. "A lot of my cases

(continued on p.13)

« Power Line Talk »

The completion of **EPA**'s revised **EMF–cancer report** is still months away, but the Washington-based National Electrical Manufacturers Association (NEMA) is already arguing that it should never be released. "We should not have individual agencies popping up and giving their own risk assessments," said NEMA's **Douglas Bannerman**, an environmental consultant who believes that only the DOE and the NIEHS, the two agencies coordinating the RAPID program, should set policy on EMF health risks. "The government should be speaking with one voice and we want DOE and NIEHS to have that one voice," he said. Bannerman made his concerns public on March 15 at the National EMF Advisory Committee (NEMFAC) meeting in Washington, but the EPA appears unmoved. "We're not going to change our plans. We see no reason to do so," said EPA's Dr. **Robert McGaughy**, who is in charge of the report. Five years ago, a draft of the report caused a stir due to its conclusion that EMFs are a probable or possible human carcinogen (see *MWN,* M/J90 and N/D90). The rewrite will probably also make waves because the EPA does not seem to be backing away from the view that there is an EMF–cancer link (see *MWN,* S/O94). However, the strength of EPA's commitment to this finding remains to be seen. The report is now in the midst of its second round of peer review—this time by a group of epidemiologists. An interagency review is the next step. The report is scheduled for public release in September, according to McGaughy. And EPA's EMF assessment is not the only one nearing completion. An NAS-NRC committee is drafting its own views of the cancer risk (see pp.6-7).

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The NIEHS and the DOE are moving to sponsor studies to validate and extend Dr. **Wolfgang Löscher**'s work on **breast cancer** (see *MWN,* J/A93 and J/F95). The two agencies have been following Löscher's work, and last year NIEHS' Dr. **Gary Boorman** and DOE's **Paul Gailey**, the manager of the EMF program at the Oak Ridge National Lab, TN, visited his lab at the School of Veterinary Medicine in Hannover, Germany. Boorman, who is already in the midst of a number of large animal studies on reproductive and cancer risks (see *MWN,* S/O 90), is drafting a protocol to repeat Löscher's animal studies in the U.S. In a presentation to NEMFAC on March 14, Boorman said that he will keep costs down by seeking a contractor who already has an animal facility in place, in order to avoid the expense of building a new one from scratch. Nevertheless, he warned that the study will still cost "several million dollars." As we reported in our last issue, ever since Löscher's results began to appear in print, he has found it almost impossible to raise research funds in Germany. The DOE has stepped in with an offer to help. At the agency's request, Löscher has submitted a proposal, which is now under review. "We feel that Löscher's findings have a direct bearing on the goals of the U.S. research program and we want to make sure that his studies are continued and repeated. It's important to keep Löscher's lab open while others are trying to repeat his work," Gailey said in an interview. Boorman has tentatively arranged a collaboration with Dr. **Bo Holmberg** of Sweden's National Institute of Occupational Health, who is also interested in pursuing Löscher's findings. Boorman told the committee that if he can secure the money to repeat Löscher's experiment with continuous 50 Hz and 60 Hz magnetic fields, Holmberg will run the same experiment with intermittent fields. Last year, Holmberg's group reported that mice treated with a chemical carcinogen and an intermittent 50 Hz magnetic field had more skin tumors than mice only exposed to the chemical (see *MWN,* M/A94). In contrast, Holmberg found no synergistic action with a continuous 50 Hz field. NEMFAC tentatively endorsed Boorman's project and gave him the green light to draft a request for proposals.

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It appears that the **DOE biological mechanisms research program** will continue—at least for now. Last year, its fate was thrown into doubt when a Senate committee ordered that it be folded into the **NIEHS RAPID** health effects program, and specifically asked the two agencies to formulate an agreement on how the consolidation would be effected (see *MWN,* M/A94 and S/O94). Because both the House and the conference committees were silent on the issue, no one knew how the Senate language would be interpreted. The DOE and the NIEHS have concluded that the two programs should both move forward. Their rationale is that the two efforts are "complementary and independent" and that the two agencies will make sure that "there is no unnecessary duplication." Under their agreement (which has been signed by the NIEHS but not yet by the DOE), the DOE program will only be absorbed by the RAPID program if specifically required by law. The Senate committee report was interpreted as "advice," said DOE's **Robert Brewer**, albeit "advice that we take very seriously." NIEHS' **Dan Vandermeer** reiterated his position that, "We have no interest in taking over the management of the DOE program." When the Clinton Administration's proposed fiscal year 1996 (FY96) budget was recently announced, it became clear that not only will the DOE program survive, but it will snag more government funds than the RAPID program. The Clinton budget asks for $6 million for DOE's studies on mechanisms and $4 million for the RAPID effort. (Of course, these figures could change—as they did last year—when the appropriations bills move through Congress.) The government's RAPID budget for FY95 is $8 million, all of which must be matched by industry—and no money can be spent until industry comes up with at least half of its share. By early March, industry had given the DOE $3.5 million, with more than $800,000 promised for the near future—so some new research funds should be available soon. This still leaves approximately $3.7 million to be raised by the close of FY95 at the end of September. In FY94, industry had to contribute only $4 million, but ended up $50,000 short of that goal. The electric utility industry continues to support the $65 million RAPID program, according to Shirley Linde, the chair of NEMFAC, but she said on March 14 at the committee meeting that she had

heard that some East Coast utilities are quietly lobbying against the program.

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The EPA, DOE and American Public Health Association's EMF ***Workshop for Decision Makers*** will be held May 15-16 in Annapolis, MD. Attendance will be limited to 40-50 participants and will be by invitation only. State and local government officials, as well as representatives of utilities and citizens groups, will discuss lessons learned, research and policy needs and ways of facilitating the dissemination of information. Contact EPA's Dennis O'Connor at (202) 233-9486.

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The **California EMF Program** has issued its first request for proposals (RFP), for an analysis of policy issues related to possible EMF health effects in public schools and day-care centers. The winning bidder will be asked to devise guidelines for local school districts, city and county planning departments and various government regulatory agencies. The guidelines must cover all contingencies—for instance: (1) that future research will prove conclusively that EMFs are health hazards; (2) that it will clear EMFs of causing any health risks; or (3) that some amount of uncertainty will remain. In a March 23 letter, Dr. **Vincent Delpizzo**, the program's research director, cautioned that the principal investigators must "neither appear to have prejudged, or in fact have prejudged, the best course of action." Persons with a "definite point of view" can still participate, as long as "the overall composition of the team is balanced." A peer-review panel has been named to decide on the proposals and to oversee the study. The members are: Dr. Dick Ball, DOE, Washington; Elinor Blake, Contra Costa County Health Services, Martinez, CA; Shan Cretin, Shan Cretin & Associates, Santa Monica, CA; Paul Locke, director, Center for Public Health and Law, Washington; and Dennis O'Connor, EPA Office of Radiation and Indoor Air, Washington. Proposals are due by May 30. An RFP for school exposure assessment will be available at the end of April.

DOE–EPRI Review in Palm Springs

The 1995 annual review of EMF bioeffects research, sponsored by the DOE and EPRI, will be held November 11-18 at the Hilton Hotel in Palm Springs, CA. For reservations, call (800) 445-8667 or (619) 320-6868.

A call for abstracts will be issued in June. For more information, contact: W/L Associates, 7519 Ridge Rd., Frederick, MD 21702, (301) 663-1915, Fax: (301) 371-8955.

California Cancerphobia–Property Value Case Dismissed as New Brain Tumor and Lymphoma Suits Are Filed

A state appeals court ruled that the California Public Utilities Commission (PUC) has exclusive jurisdiction over all power line EMF safety questions, and for that reason has ordered a lower court to dismiss a property devaluation suit against San Diego Gas & Electric Co. (SDG&E).

"The decision, if left undisturbed, could end EMF litigation in California," said Greg Barnes, assistant general counsel for SDG&E, who believes that PUC jurisdiction will make it impossible for plaintiffs' lawyers to earn large contingency fees in EMF suits. While some plaintiffs' lawyers dissent from this view, all agree that the decision is already affecting other cases (see below and box, p.4).

The February 28 ruling stemmed from a lawsuit brought by Martin and Joyce Covalt of San Clemente, CA, in December 1993. SDG&E petitioned the Court of Appeal in Santa Ana to order the case dismissed, contending that EMF health and safety issues can only be brought before the PUC (see *MWN,* N/D94).

According to the appellate ruling, "The superior court would have to come to conclusions contrary to those reached by the PUC in considering the same issue" in order to award damages. The PUC has ruled that there is insufficient evidence to conclude that EMFs threaten public health. The appellate court concluded that EMF regulation "is best left to the PUC which can assure uniformity...throughout the state, rather than to courts acting on an ad hoc basis."

"This decision has dealt a serious blow to the fundamental constitutional rights of all property owners in the state of California," Michael Withey, the Covalts' attorney, stated in a press release. The ruling will be appealed, according to the statement, released by Withey's firm, Schroeter, Goldmark & Bender in Seattle. Withey did not return repeated telephone calls for comment.

The state Supreme Court will announce within the next couple of months whether it will hear the appeal. If it accepts the case, a final decision may not come for another year or two.

Statewide attention focused on the jurisdictional issue, but the Court of Appeal also ruled on the specifics of the Covalts' lawsuit. It found that the Covalts' fear of cancer was not compensable because it was not backed up by reliable medical and scientific opinion. The ruling cited *Potter v. Firestone Tire & Rubber,* a recent California decision which concluded that fear of cancer following exposure to a toxic substance is unreasonable unless plaintiffs can prove that they will "more likely than not" develop cancer as a result.

As summarized in the decision, the Covalts had alleged that their fear of "contracting cancer in the future is their [personal] injury," and that public fear of EMFs, "regardless of the reasonableness of that fear," decreased the value of their property. But the ruling stated that the Covalts' lawyers conceded in oral argument that their clients no longer claimed damages resulting from their fear of cancer. They still sought damages for medical monitoring for that disease.

The Covalts' suit had not yet gone to trial in Superior Court, and the Court of Appeal noted that it is rare for a higher court to intervene before final judgment at a lower level. In explain-

ing its decision to grant "extraordinary relief," the appeals panel cited the jurisdictional issue and the "widespread interest" in the outcome, as well as the fact that SDG&E had successfully defended itself in two similar lawsuits. "Many more litigants are waiting in the wings to test out the same theories" of an EMF–cancer link, according to the decision. By granting the dismissal, the court held that "needless and expensive trials" have been prevented.

The PUC's general counsel had written to the Court of Appeal on July 19, 1994, in support of SDG&E's position, asking the panel to confirm the PUC's "exclusive jurisdiction" over EMF safety issues.

Although the PUC lacks authority to award damages (except in utility bill disputes), the court asserted that its decision on jurisdiction does not leave the Covalts without recourse: They may petition the PUC to "have unsafe utility equipment moved or altered....If the Covalts are unsatisfied with the PUC's handling of their complaint, they must seek review before the [state] Supreme Court."

The Covalts' case is similar to one brought by their neighbors, Mark and Cheryl McCartin and two other couples. A California Superior Court judge dismissed the McCartin complaint in 1994 (see *MWN,* M/J94). The previous year, a jury rejected a claim by Michelle and Ted Zuidema that EMFs from SDG&E power lines caused their daughter to develop a rare kidney cancer (see *MWN,* M/J93).

PG&E Charged in Phone Worker's Brain Cancer

The Pacific Gas and Electric Co. (PG&E) is the target of a lawsuit filed on February 3 by the family of telephone line worker Mark Callan, who died in February 1994 from a brain tumor. The suit claims that EMFs from PG&E power lines and transformers caused Callan's cancer, and that PG&E "knew or should have known" about the danger but failed to warn workers or reduce or monitor their EMF exposures.

Lawyers for both sides said they expect the first issue in the case to be the relevance of the recent Covalt decision to personal injury claims (see box below).

During Callan's 14 years in the telephone industry, he worked for Pacific Bell, AT&T and two other firms, both indoors and outdoors. "Line workers often do their jobs within ten feet of high-voltage power lines and transformers, day in and day out," said attorney Ron Herron, a member of the San Francisco firm of Herron & Herron, which is one of two representing Callan's widow, Cynthia Ford, and their three children. He cited a Johns Hopkins University epidemiological study of telephone line workers, which found significantly elevated cancer rates among cable splicers, a subgroup of line workers (see *MWN,* N/D89 and M/A93).

Roger Rizzo, an attorney on the case for PG&E, said, "The

Is Power Line EMF Litigation Over in California?

Attorneys for both sides in *Covalt v. SDG&E* have said that a dismissal would put an end to power line EMF litigation in California. Now that the case has been dismissed, will this prediction prove correct?

Lawyers for California utilities answer yes, if the ruling that the PUC has exclusive jurisdiction is not overturned by the state Supreme Court. "We expect to argue that the Covalt case applies to the Muir case, and will ask for a dismissal," said John Tinker, defense attorney in *Muir v. SCE*. Roger Rizzo plans to make the same argument for the defense in *Ford v. PG&E*. SDG&E lawyer Greg Barnes said that plaintiffs' lawyers "have been promoting junk science in the courts of California. This Covalt case killed that business."

Plaintiffs' attorneys question whether the implications are quite so sweeping. They contend that even if the Covalt ruling is sustained, its significance may be limited to the property devaluation issues that were at the heart of the Covalt family's legal action.

"The Covalt ruling may not affect personal injury or wrongful death claims," said Ron Herron, the plaintiffs' lawyer in the Ford brain tumor case. "As an example, electrocution claims have traditionally been heard in superior or municipal court, not by the PUC."

The Covalt decision involved property devaluation and a fear of developing cancer, not a current illness. But SCE's Tinker feels the ruling "is broad enough to apply to personal injury cases."

According to Barnes, the decision's "rationale is that you can't maintain any damage action where the outcome of the trial might conflict with the findings of the PUC on power line safety issues. And the PUC does not link EMF with cancer." Rizzo observed that "this rationale applies with equal if not greater force to a personal injury claim."

Herron plans to pursue his case either way. "Even if it's determined that the PUC has jurisdiction—well, for every wrong there has to be a remedy. If the PUC wants to create a forum where it adjudicates the claims of people hurt or killed by EMFs and decides on damage awards, then so be it." If Herron is right, jurisdiction over personal injury cases would put the PUC in a difficult position, because it currently has no authority to award damages (except in disputes over utility bills).

Rizzo said that such questions would likely be explored as soon as the PUC's jurisdiction is confirmed. But he said there is no doubt that "if the courts apply the same reasoning as in the Covalt decision, personal injury cases will have to go to the PUC."

The question of personal injury claims received little explicit attention in the Covalt ruling, since there was no attempt to prove physical injury or to show clear scientific evidence that EMFs cause cancer. In cases where plaintiffs seek to prove either point, the courts will have to address the question more directly. The answer will determine whether there is still any financial incentive for lawyers to bring this type of lawsuit.

Whatever the final result, every EMF claim in the state is now faced with the hurdle of *Covalt*.

company sympathizes with the family, and brain cancer is certainly a terrible disease. But we don't believe this case has any merit." He noted that two previous brain cancer–EMF lawsuits against PG&E had been dismissed. Both cases were defended by Rizzo's firm, Sedgwick, Detert, Moran and Arnold, also of San Francisco.

"This is a novel case," said Rizzo, "because other than workers' comp, I'm not aware of any civil cases that are occupational." In April 1994, Washington state denied an EMF-related workers' compensation claim by the widow of utility worker Robert Pilisuk (see *MWN,* M/J94). The workers' compensation system in each state almost always has sole authority over health and safety claims against employers. But since Mark Callan was never employed by PG&E, his widow was free to sue the company in Superior Court.

"The scientific and medical community really doesn't know what causes brain cancer," contended Rizzo. "There's no strong argument for singling out EMFs."

Herron disagreed, noting, "This case comes at a time when the electric power industry has just studied 140,000 death certificates and found a statistically significant link between EMFs and brain cancer," referring to the recent work of Drs. David Savitz and Dana Loomis (see *MWN,* J/F95). "Other studies have been showing a link to cancer for 15 years. Our suit is just the tip of an iceberg. Thousands of telecommunications workers have high exposures to EMFs from power lines and equipment—not just on poles but also in commercial buildings."

"The problem with epidemiological studies," Rizzo responded, "is that they don't prove cause and effect. There's a high association between a rooster crowing and the sun rising, but that doesn't prove that the rooster makes the sun come up." He argued that the Savitz–Loomis results are different from those of other investigators, including Dr. Gilles Thériault of McGill University and Jack Sahl of Southern California Edison (see *MWN,* M/A93, J/A93 and M/A94). "The Sahl study showed absolutely no link at all. So there's no consistency, and there's also no laboratory studies that would make the link biologically plausible."

The case is expected to go to trial sometime after the fall of 1996.

SCE Sued Over Non-Hodgkin's Lymphoma

Southern California Edison Co. (SCE) is being sued by a Newport Beach resident who has developed non-Hodgkin's lymphoma. The plaintiff, Douglas Muir, claims that his disease resulted from exposure to power line EMFs.

Muir's complaint, filed in Superior Court on December 13, 1994, charges SCE with product liability and negligence. The charges relate to three 4 kV SCE distribution lines, which, the complaint states, were directly outside Muir's bedroom window. The magnetic fields inside Muir's apartment ranged as high as 6.6 mG, according to SCE's own measurements in March 1994, cited in the complaint. Muir was diagnosed in February 1994, about 13 years after he first leased the apartment.

SCE lawyer John Tinker said that he "absolutely" will ask for a dismissal on the basis of the recent Covalt decision. Muir's attorney, Annee Della Donna of the Santa Ana firm of Wylie Aitken, disagreed on the relevance of *Covalt* to personal injury.

Muir also contends in his complaint that SCE violated the requirements of both the National Electric Code and the PUC Code General Order 95, which mandate a 12-foot distance between a roof and power lines. SCE has since raised the lines to the required level, the complaint states. Tinker said that the distance requirement applied to hazards such as electrocution, not to EMFs.

Lymphoma in Dogs Linked to Residential EMF Exposures

Dogs that lived in high-current-configuration houses were 80% more likely to get lymphoma than dogs that lived in low-current houses, according to a team of Colorado researchers. The cancer risk for dogs that lived in very-high-current houses was almost seven times that of dogs that lived in houses near buried power lines. The association between measured fields and lymphoma was not significant, although dogs that lived in houses where outdoor magnetic fields were, on average, over 2 mG had an up to 90% greater risk of lymphoma than dogs that lived where the fields were lower.

Since the study is the only one of its kind, the results must be interpreted cautiously, lead investigator Dr. John Reif of the Colorado State University College of Veterinary Medicine in Fort Collins told *Microwave News.* But he said that there is "some consistency" with what has been reported in studies of childhood leukemia. And, he added, the results are "supportive of the notion that exposure to EMFs as measured by wire codes is associated with lymphoma."

Studies by Dr. David Savitz of the University of North Carolina School of Public Health, Chapel Hill, and by Dr. John Peters of the University of Southern California in Los Angeles found significant associations between wire codes and leukemia (see *MWN,* N/D86 and M/A91). Reif, like Savitz and Peters, used versions of the wire codes developed by Dr. Nancy Wertheimer and Ed Leeper for their 1979 landmark study of residential EMF exposure and childhood cancer.

Reif commented that dogs make good subjects because

Selected New Papers

Joseph Bowman et al., "Hypothesis: The Risk of Childhood Leukemia Is Related to Combinations of Power Frequency and Static Magnetic Fields," *Bioelectromagnetics, 16,* pp.48-59, 1995 (see *MWN,* M/A92).

Donald Haes Jr. and Michelle Fitzgerald, "Video Display Terminal Very Low Frequency Measurements: The Need for Protocols in Assessing VDT User 'Dose,'" *Health Physics, 68,* pp.572-578, April 1995.

James Randa et al., "Catalogue of Electromagnetic Environment Measurements, 30-300 Hz," *IEEE Transactions on Electromagnetic Compatibility, 37,* pp.26-33, February 1995.

S. Tofani et al., "Evidence for Genotoxic Effects of Resonant ELF Magnetic Fields," *Bioelectrochemistry and Bioenergetics, 36*, pp.9-13, 1995.

"you know where they are all the time." As he and his coworkers explained in the February 15, 1995, *American Journal of Epidemiology (141,* pp.352-359), dogs' shorter life spans and the fact that they, in general, spend more time than human subjects in and around their homes "may reduce the misclassification of environmental exposures that often plagues studies in humans" (see *MWN,* J/F95). In addition, lymphoma in dogs is similar to human leukemia and has been used as a model to study the effects of other pollutants, such as herbicides.

The researchers used dogs with other types of cancer as the controls. They pointed out that this could have caused them to underestimate the association between EMFs and lymphoma if EMFs do promote cancer in general, as some investigators claim. Reif is planning another analysis with a different control group.

NCI Disputes Loomis Findings on Female Breast Cancer Risk

Researchers at the National Cancer Institute (NCI) in Bethesda, MD, have found no overall association between occupational EMF exposures in women and breast cancer deaths. These results contrast with those of Dr. Dana Loomis's earlier study using the same data. Loomis found a 40% higher breast cancer mortality among female electrical workers (see *MWN,* N/D93).

"I don't think that you can say from our data that there is or there is not a risk," Dr. Kenneth Cantor, who led the NCI study, told *Microwave News*. He said that the point of his letter in the *Journal of the National Cancer Institute (JNCI) (87,* pp.227-228, February 1, 1995) "was to show how imprecise this method and approach is."

In his letter and in telephone interviews, Cantor emphasized the limitations of studies such as his and Loomis's—both relied on death certificates for occupational data. He explained that these types of studies can suggest possible breast cancer risk factors, but cannot test hypotheses: "They provide a crude first approximation and should only be used to make the most general statements." He noted that the media had overinterpreted the Loomis report.

Cantor and colleagues used a different study design than did Loomis: They assigned EMF exposure levels and probabilities of exposure based on job titles. The exposure assessment was carried out by NCI industrial hygienist Dr. Mustafa Dosemeci. In contrast, Loomis, who is at the University of North Carolina School of Public Health, Chapel Hill, categorized jobs more simply, as exposed or unexposed.

In an interview, Loomis conceded that his own report was "preliminary." He said that he was not surprised that the NCI researchers had found different results given their different approach. "It's a challenging proposition to assign exposures to these jobs. For the majority of jobs, we know nothing about exposure," he said.

The NCI researchers concluded that, "The primary contribution of the work of Loomis et al. (and this analysis) has been to rule out the possibility of [a] very high breast cancer risk associated with exposure to extremely low frequency fields. The possibility of a modest elevation of risk that is causal cannot be addressed by these data."

They did find a significant, but "modest," increase—approximately 30%—in breast cancer among black women who had a "medium" or "high" probability of EMF exposure.

Cantor and his associates have been attempting to identify potential occupational risk factors for breast cancer. In a separate analysis, published in the March 1995 issue of the *Journal of Occupational and Environmental Medicine (37,* pp.336-348), they reported an association between breast cancer risk and exposure to radiofrequency (RF) radiation. While significant for both white and black women, the risk for black women was double that of white women (29% and 14% excess, respectively).

In their letter to *JNCI,* Cantor and coworkers argued that RF exposure is not an important risk factor for breast cancer because of an absence of a dose–response relationship and other factors.

New EMF Booklets

Two new booklets, from the U.S. and from the U.K., provide overviews of EMF health risks.

Questions and Answers About EMF: Electric and Magnetic Fields Associated with the Use of Electric Power was prepared under the direction of the NIEHS and the DOE for the EMF RAPID Program. The 67-page booklet reviews potential health effects, outlines recent research and discusses what the government is doing to address public concerns. Tables listing average EMF levels from appliances are also included.

Single copies are available for free from the EMF Infoline at (800) 363-2383. To purchase bulk quantities, contact: Alicia Hilary, U.S. Government Printing Office, Washington, DC 20402, (202) 512-1708. A Spanish edition will be released soon.

Living with Electricity: EMFields Information Booklet No.1, by Alasdair Philips with Neil Mayhew and Tim Williams, a team of U.K. activists, provides basic information on topics ranging from how EMFs are generated to the official British government position to military uses.

The 57-page booklet is available for £9 (approximately $14.50) in the U.K. and £12 (approximately $19.20) elsewhere from: Alasdair Philips, 2 Tower Rd., Sutton, Ely, Cambridgeshire CB6 2QA, U.K., (44+638) 742922, Fax: (44+638) 743155. Payment must be in pounds.

NAS Appoints Panel To Assess RAPID Program

The National Academy of Sciences (NAS) has appointed a seven-member committee to assess work sponsored under the EMF Research and Public Information Dissemination program (RAPID). The committee, mandated by the Energy Policy Act of 1992, will review the implementation of the $65 million national program, administered jointly by the National Institute of Environmental Health Sciences (NIEHS) and the Department of Energy (DOE) (see p.2 and *MWN,* N/D92).

RAPID Engineering and Biomedical Research Grants

On March 8, DOE's EMF Research and Public Information Dissemination (RAPID) Program announced five grants for engineering studies. These were chosen from 41 proposals from 17 institutions. This summer, the DOE will issue a second request for proposals. For more information, contact: DOE RAPID Program Manager Lynne Gillette, (202) 586-1495, Fax: (202) 586-0784. On March 14, NIEHS' Dr. Michael Galvin announced two new biomedical grants. (For a list of prior awards, see *MWN,* S/O94.)

Engineering*

Investigator(s)/Institution	Award	Project
Dr. Dan Bracken T. Dan Bracken Inc. Portland, OR	$111,399	Recommend guidelines for personal exposure measurements. These will include sampling strategies, methods of analysis and the selection of specific field parameters, instrumentation and measurement protocols. Carry out pilot studies to test recommendations.
Dr. Dan Bracken T. Dan Bracken Inc. Portland, OR	$99,889	Establish standards for an EMF measurement database, part of the EMF Clearinghouse being developed by the NIEHS with the DOE. Review existing data, develop a standardized format to allow the inclusion of both past and future EMF measurement data in an easily accessible database.
Fred Dietrich and **Bill Gish** Electric Research and Management Inc. Pittsburgh, PA	$120,552	Recommend guidelines for measuring fields associated with specific types of sources. Includes developing candidate field parameters and testing the practicality of measuring them. Measurements will be made for a wide range of sources.
Pamela Long Magnetic Measurements San Francisco, CA	$122,804	Recommend and evaluate guidelines for field measurement in a variety of typical environments. Focus on the environment as a whole and the field levels people might experience within it, given their patterns of activity.
Dr. Luciano Zaffanella Enertech Consultants Lee, MA	$227,591	Survey EMFs and determine the contributions of specific sources. Examine both typical environments and some with intense or unusual field sources.

Biomedical

Dr. Theodore Litovitz† Catholic University of America Washington, DC	$693,606	Investigate and characterize the mechanisms by which cells detect and respond to weak 60 Hz sinusoidal magnetic fields.
Dr. Fatih Uckun‡ University of Minnesota Minneapolis, MN	$462,938	Elucidate the molecular mechanisms by which low-energy EMFs initiate a cascade of cytoplasmic and nuclear signaling events in human lymphocyte precursor cells.

*Each grant was selected by a subset of the following reviewers: Dr. Joseph Bowman, NIOSH; Lynne Gillette, DOE; Dr. Imre Gyuk, DOE; Norbert Hankin, EPA; Dr. Gregory Lotz, NIOSH; Edwin Mantiply, EPA; Dr. Mark Methner, NIOSH; Dr. Martin Misakian, NIST; Jack Sahl, Southern California Edison; Dr. Thurman Wenzel, NIOSH.

†The members of the NIH peer-review panel were: Drs. Joseph Roti Roti (chair), Washington University School of Medicine, St. Louis; Joan Bull, University of Texas Medical School, Houston; Peter Corry, William Beaumont Hospital, Royal Oak, MI; Deborah Cory-Slechta, University of Rochester School of Medicine, NY; David Grdina, Argonne National Laboratory, Argonne, IL; Fred Hetzel, Presbyterian/St. Luke's Hospital, Denver; Richard Luben, University of California, Riverside; Kenneth McLeod, State University of New York School of Medicine, Stony Brook; Martin Misakian, NIST, Gaithersburg, MD; John Moulder, Medical College of Wisconsin, Milwaukee; Russell Reiter, University of Texas, San Antonio; Jeffrey Saffer, Battelle Pacific Northwest Labs, Richland, WA; Thaddeus Samulski, Duke University School of Medicine, Durham, NC; Peter Valberg, Gradient Corp., Cambridge, MA; Jerry Williams, Johns Hopkins Oncology Center, Baltimore.

‡The members of the NIH peer-review panel were: Drs. James Lin (chair), University of Illinois, Chicago; Erik Cheever, Swarthmore College, Swarthmore, PA; Graham Jamieson, American Red Cross, Rockville, MD; Donald McRae, Georgetown University, Rockville, MD; Antonio Sastre, AS Consulting and Research Inc., Suffern, NY; Maria Stuchly, University of Victoria, BC, Canada; Ronald Wakai, University of Wisconsin, Madison.

The committee is chaired by Dr. Charles Bean, an academy member and professor of science at Rensselaer Polytechnic Institute in Troy, NY. Two others on the committee are also members of the academy: Dr. Maurice Fox, professor of molecular biology at Massachusetts Institute of Technology in Cambridge, and Dr. Peter Marler of the Animal Communication Laboratory at the University of California, Davis. The four other members of the committee work on EMF issues: Fred Dietrich, an engineer with Electric Research & Management Inc. in Pittsburgh; Dr. Walter Rogers, manager of the biosciences section at the Southwest Research Institute in San Antonio; Dr. Jan Stolwijk, professor of epidemiology and public health at the Yale University School of Medicine in New Haven, CT; and Dr. Jerry Williams, the director of the Radiobiology Lab at the Johns Hopkins Oncology Center in Baltimore.

Stolwijk and Williams are also on the NAS-National Research Council's (NRC) committee that is reviewing potential health risks from EMF exposures (see *MWN,* S/O91 and M/J93). The work of this committee has been delayed by a temporary lack of funds, according to Dr. Larry Toburen, the NAS-NRC staff director for both review committees.

The RAPID committee met for the first time on March 13 in Washington, but its purpose was primarily organizational, Toburen said.

Swedish VDT Emissions Standard Goes International

A committee of European experts is putting the final touches on a draft revision and expansion of MPR2—Sweden's measurement and emissions guidelines for video display terminal (VDT) EMFs (see *MWN,* S/O90). While MPR2 now functions as the *de facto* international VDT standard, the new version, known as MPR3, is designed to make it official.

MPR3 is significantly different from MPR2: It includes four separate emissions categories (see table below), a simplified protocol for laboratory measurements and directions for workplace surveys. The new standard requires far fewer measurements for magnetic fields—half as many as MPR2. In addition, MPR3—designated SS4361490 (1995)—is designed for all types of displays, not just standard cathode ray tube monitors.

The draft proposal, which will be released this spring, incorporates key elements from guidelines developed in the U.S., Europe and Japan. "We looked at the existing standards, and we tried to take the best things from each of them," said Gert Anger of the Swedish Institute for Radiation Protection in Stockholm, who is on the expert panel. Other members include representatives from Swedish government agencies and large computer manufacturers, such as Apple, Hewlett-Packard, IBM and ICL.

"Market pressures are leading to the development of disparate guidelines around the world and there is a danger of this leading to confusion," Dave Sawdon of IBM U.K. said in an interview from his lab in Winchester, England. "The purpose of the standard is to harmonize measurement methods and to predefine some performance criteria so that VDT emissions can be compared among products," he explained. Sawdon is serving as the editor of the MPR3 document.

The panel—chaired by Hjalmar Bondestam of Combinova, a Swedish manufacturer of EMF meters—is working under the aegis of the Swedish Electrical Commission, known as SEK. The European Committee for Electrotechnical Standardization, called CENELEC, has officially recognized the expert panel. If approved by CENELEC, MPR3 would become a European standard and could then be submitted to the International Electrotechnical Commission for possible adoption as a worldwide standard.

"VDT technology has developed to the point that MPR2 needed updating and clarifying to remove the loopholes that have become apparent since it was first introduced," said Sawdon, who oversees IBM's Hursley EMC Laboratory, one of two accredited for MPR2 measurements. As an example, Sawdon explained that manufacturers of multimode monitors, which feature various levels of resolution, can claim their products meet the limits, even if they only do so at lower resolutions.

Under MPR3, a VDT would have a label identifying its compliance with a given category. If a product has higher levels than those specified in categories A, B or C, or meets even lower levels, a manufacturer could choose to have it labeled as category X.

Having different categories is "worth trying," said Kjell Fransson, a representative from the Swedish white-collar union TCO, who serves on the panel. But he had doubts about category X, calling it "a joker."

John Chubb of Apple's imaging products division in Santa Clara, CA, is less sanguine: "Having four different levels of compliance is probably not going to catch on," he said. While Apple will probably continue to meet MPR2 and the strict guidelines developed by TCO, it is unlikely to loosen internal standards to meet the less stringent category C or the manufacturer-specified category X: "I can't see why we would go

Emissions Guidelines for Computer Displays

Proposed MPR3 Categories	ELF § (Band I: 5 Hz - 2 kHz) E-Field	ELF § (Band I: 5 Hz - 2 kHz) H-Field	VLF § (Band II: 2 kHz - 400 kHz) E-Field	VLF § (Band II: 2 kHz - 400 kHz) H-Field	Electrostatic Field ∞
A	≤10 V/m•	≤2 mG◊	≤1.0 V/m◊	≤0.25 mG#	≤±5 kV/m@
B	≤25 V/m*	≤2 mG#	≤2.5 V/m#	≤0.25 mG#	≤±5 kV/m@
C	≤50 V/m*	≤2 mG#	≤10 V/m#	≤0.25 mG#	≤±5 kV/m@
X	Manufacturer Specified Emissions Levels				
Existing Guidelines					
TCO	≤10 V/m•	≤2 mG◊	≤1.0 V/m◊	≤0.25 mG#	≤±500 V
MPR2	≤25 V/m*	≤2.5 mG#	≤2.5 V/m#	≤0.25 mG#	≤±500 V
JEIDA+ (& P-1140‡)	≤50 V/m†* ≤250 V/m¶*	≤2.5 mG#	≤10 V/m†¶#	≤0.25 mG#	N/A

Footnotes

§ ELF: extremely low frequency; VLF: very low frequency; E-Field: electric field, measured in volts per meter (V/m); H-Field: magnetic field, measured in milligauss (mG). 1 mG = 100 nanotesla.
∞ Measured at 10 cm from the VDT.
@ This is equivalent to ±500 V.
• Measured at 30 cm in front of the VDT.
* Measured at 50 cm in front of the VDT.
◊ Measured at 50 cm around the VDT and at 30 cm in front of the VDT (single point).
Measured at 50 cm around the VDT.
+ Japan Electronics Industry Development Association.
‡ Electric and magnetic emissions limits were proposed in February 1991 but were never adopted (see *MWN,* M/A94).
† International Electrotechnical Commission (IEC) Class I equipment.
¶ IEC Class II equipment.

backwards since MPR2 is so widely known," Chubb said.

The most significant variation among the categories is that the electric field limits are significantly higher in category C than in categories A and B. The ELF magnetic field limit in categories B and C is somewhat stricter than the one specified by MPR2: 2 mG at 50 cm around the VDT rather than 2.5 mG. This is an acknowledgment that new display technology can inherently achieve this level, Sawdon said. But category A, which is based on TCO's guidelines, has the strictest limits—2 mG at 30 cm from the front of the VDT and at 50 cm from the back and sides.

Chubb noted that the MPR3 protocol for *in situ* measurements will make it easier to compare survey results. Paul Snayd, manager of IBM's VDT project office in Somers, NY, pointed out, "A protocol for field measurements would better help customers who are concerned about the issue."

"The fact that they are reducing the number of test points for laboratory measurements is great," said Chubb, who helped develop the MPR2 guidelines and the IEEE P-1140 measurement protocol. He is pleased that the measurement method will now be closer to that specified by P-1140 (see *MWN,* M/A94). But P-1140 Chairman Dheena Moongilan of AT&T Bell Labs in Holmdel, NJ, wondered, "Why not adopt P-1140?"

Chubb does not think that this is an option because P-1140 does not include emissions limits: "Who's going to say, 'I measured by P-1140, but I meet MPR2?'"

Moongilan questioned having EMF limits at all, maintaining that "achievable limits don't make sense, since they imply greater safety."

CIRRPC Charter Not Renewed

The White House Office of Science and Technology Policy (OSTP) is not renewing the charter for the Committee on Interagency Radiation Research and Policy Coordination (CIRRPC). The 11-year-old committee will cease operating this September 30, the end of the current fiscal year.

A key factor in the decision was the formation last year of the National Science and Technology Council, according to a February 10, 1995, letter to Dr. Alvin Young, the chairman of CIRRPC, from Dr. John Gibbons, President Clinton's science adviser and the head of the OSTP. A new subcommittee of the council's Committee on Health, Safety and Food will take over CIRRPC's responsibilities.

In 1992, a CIRRPC-commissioned report concluded there was "no convincing evidence in the published literature" to support the possibility that EMFs present a health hazard (see *MWN,* N/D92). The report was designed to balance the 1990 Environmental Protection Agency (EPA) draft report which concluded that EMFs are a possible human carcinogen (see *MWN,* M/J90 and S/O94).

Dr. Robert McGaughy, a senior scientist in EPA's Office of Health and Environmental Assessment, who was in charge of the 1990 draft report and who is currently working on its revision (see p.2), serves as chairman of CIRRPC's subpanel on EMF health effects.

Others are concerned that MPR2 and MPR3 may offer consumers a false sense of security, because the guidelines fail to characterize what may be key aspects of VDT fields. Clas Tegenfeldt, an electrical engineer at Linköping University in Linköping, Sweden, points to variations over time, modulations and transients. "There is no guarantee whatsoever that an MPR2-approved VDT does not affect the user's health," he notes in a paper to be presented at the *2nd Copenhagen Conference on Electromagnetic Hypersensitivity,* May 22-23 (see *MWN,* N/D94).

IBM's Sawdon emphasized that MPR3, like MPR2, is based on what is technically achievable, not on health research.

Ferromagnetic Contamination: Does It Vitiate in Vitro *Studies?*

The validity of *all* laboratory studies on the effects of nonionizing radiation has been thrown into question because of possible contamination by ferromagnetic particles. In a letter that appeared in the March 9 issue of *Nature,* Dr. Michael Nesson of Oregon State University, Corvallis, and Drs. Atusko Kobayashi and Joseph Kirschvink, both of the California Institute of Technology in Pasadena, caution that such particles "may provide a simple mechanism to account for links between EMF exposure and *in vitro* biological effects."

Kirschvink stressed in an interview that he believes high-frequency studies are also suspect: "Microwave—250 MHz to 10 GHz—*in vitro* studies are just as confounded."

Nesson told *Microwave News* that he and his colleagues had decided to notify the general scientific community because funding of *in vitro* EMF studies was continuing, especially under the RAPID program, after the problem of contamination had been announced.

"We feel very strongly that this essentially invalidates all *in vitro* work," Nesson explained. "It's a totally uncontrolled factor." And Kirschvink said: "You cannot use the *in vitro* work to say anything about the public health question." Asked his opinion of the health risk, Kirschvink replied, "The epidemiological work makes me pause to think."

"We are not spoilers of the idea that there may be biological effects of EMFs," said Nesson, "but we are certainly spoilers of the current body of data, all lacking in controls." In 1992, Kirschvink and colleagues reported having isolated microscopic particles of naturally occurring magnetite from human brain tissue (see *MWN,* M/J92). They suggested that, if in fact there are any EMF health risks, these particles could play a role. Nesson noted that, "Calculations suggest that 1-10 mG are sufficient for biogenic magnetite to have an effect."

In their letter to *Nature,* the researchers point to "ferromagnetic particulates present not only in the dust in the air, but also adsorbed onto the surfaces of laboratory equipment, present within glass and plastics and even in reagent-grade laboratory chemicals and water." Kirschvink told *Microwave News* that scientists "should avoid any disposable plastic labware like the plague and all glassware should be boiled with aqua regia, a mixture of nitric and hydrochloric acid."

« Cellular Phone Notes »

The Cellular Telecommunications Industry Association's (**CTIA**) Scientific Advisory Group on Wireless Technology (**SAG**) has decided to defer a repeat of the **Lai–Singh** experiment which showed that 2.45 GHz radiation can cause single-strand DNA breaks in the brains of rats (see *MWN,* N/D94) until a SAG-approved exposure system is available. The decision was based at least in part on a review by the **Harvard Center for Risk Analysis**' cellular telephone advisory committee. However, the SAG appears to be ambivalent about whether to wait until a head-only exposure system is developed or until an international validation study of the comet assay used by Drs. Henry Lai and N.P. Singh is completed. In a February 8 letter to the SAG's Dr. George Carlo, the center's Dr. Susan Putnam wrote that, "The majority of the peer reviewers stated that the repetition of the [Lai–Singh study] should be deferred until an appropriate *in vivo* exposure system is developed. There was some concern expressed, however, that this would delay the program and that there was no reason to wait before beginning the replication process of the [Lai–Singh] study....The majority of the reviewers again stated that it would be prudent to wait until the international validation [was] completed before repeating the initial study. There were also several comments in disagreement with this, however. There was some concern over whether the international validation would be contributory to the issue and also concern that waiting would provide unnecessary delays to the program with little added benefit." Putnam told *Microwave News* that only six of the 11 members of the committee—Drs. Larry Anderson, Carl Durney, Saxon Graham, Asher Sheppard, Peter Valberg and Gary Williams—had responded to her request for comment, but she would not say what each had recommended. The four epidemiologists on the panel had not expressed opinions; neither had the committee's final member, Dr. Don Justesen. Since the panel was first announced last year (see *MWN,* J/A94), Dr. Philip Cole has resigned; very recently EPA's Dr. Joe Elder joined the group. The Harvard center would not release its report without Carlo's permission, and Carlo kept it confidential for six weeks. On March 23, Carlo released it as an attachment to a letter to FDA's Dr. Elizabeth Jacobson, in which he stated that, although the SAG would delay *in vivo* studies, it would release a request for proposals "within the next couple of weeks" for *in vitro* studies in "multiple laboratories." Carlo announced that, "Our goal is to have the initial *in vitro* work completed within the second quarter of this year." Mike Volpe, SAG's spokesperson, said that three labs will do the *in vitro* work: that of Dr. Martin Meltz of the University of Texas Health Sciences Center in San Antonio and two others to be selected from proposals received in response to the upcoming request. Volpe confirmed that the SAG expects to have experimental data in hand by the end of June. Carlo noted in his letter that the international validation study " may take several years" and that the *in vivo* work will begin " when the SAG's exposure system is available." In contrast to the SAG, Motorola has already initiated a repeat of the Lai–Singh *in vivo* study (see *MWN,* J/F95).

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The **Los Angeles Cellular Telephone Co.** (LACT) is paying the **California Public Utilities Commission** (PUC) $4.37 million to settle alleged violations of cellular tower siting rules. The PUC concluded that, "LACT knowingly and intentionally misled the commission by filing incorrect information," but felt that the intent behind the company's actions would be difficult to prove, according to a joint PUC–LACT statement. The settlement was also prompted by the fact that the investigation—which involved 150 LACT cell sites—would have required more than a year to litigate. The February 28 agreement gives LACT two years to bring its sites into compliance. The cellular phone company has also concluded an inquiry into an additional three sites for alleged "misrepresentation[s] to the PUC, premature construction and permitting deficiencies," with a settlement of approximately $725,000, according to Ira Alderson, an attorney with PUC's safety and enforcement division. Both settlements stem from a PUC investigation begun in 1992 to determine whether cellular companies had had the necessary state and local permits before beginning construction. "We suspected that there was a widespread practice of not following the steps required by the PUC," said Alderson. The first phase of the probe focused on LACT, the Bay Area Cellular Telephone Co. (BACT) and GTE Mobilnet of California. GTE Mobilnet was fined $343,000 for working on a site without permission and BACT was fined $2,000 for not submitting required permits to the PUC. GTE Mobilnet has appealed the decision. In the second phase, the PUC required all California cellular carriers to file detailed information regarding their compliance with siting rules. The commission is approximately halfway through this portion of the inquiry, Alderson said. Some companies, including McCaw Cellular Communications, now a subsidiary of AT&T, and Mountain Cellular, have already settled with the commission, he added. "I think that because of the investigations, cellular companies are trying to comply more," Alderson noted.

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In the latest in a series of progress reports, Dr. **George Carlo** and other members of the **CTIA's SAG** research effort briefed representatives of federal agencies at FDA's Center for Devices and Radiological Health on March 17 in Rockville, MD. After the meeting, one attendee said: "The epi work seems to be progressing, but the other studies are moving very slowly." Another commented that, "It's not only a question of speed, we don't know where they are going," adding that after the meeting, "We decided that the federal agencies needed to coordinate better." And a third attendee expressed concern that, "There isn't enough emphasis on cancer promotion studies." All those who offered their views asked for anonymity.

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U.K. defense experts have now ruled out **EMI** from a cellular phone as a potential cause of a **helicopter crash** that killed 24 top intelligence officers in Scotland last June, according to the February 5 edition of the U.K.'s *Sunday Express* (see

MWN, S/O94). Investigators are now looking into the possibility that the Chinook helicopter was sabotaged.

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In March, Dr. **Donald McRee** joined **CTIA's SAG** as the director of extramural research upon his retirement as chief of the National Institute of Environmental Health Sciences' Environmental Health Resources Branch. McRee is a former president of the Bioelectromagnetics Society (1982-83). He was later appointed as the editor of the society's journal, *Bioelectromagnetics,* but was forced to step down when neither the institute nor the society provided him with administrative support (see *MWN,* M/A88). McRee did research on microwave bioeffects for nearly 20 years before taking on administrative duties. In one of his dosimetry studies, he reported that local specific absorption rates (SARs) in the brains of rat cadavers were two to three times higher than the whole-body SARs (see *Health Physics, 46,* pp.315-320, 1984, and *MWN,* My84).

Cell Phone Company Manager with Brain Tumor Sues Motorola; CTIA and Carlo Charged with Conspiracy To Deceive Public

Debbra Wright, an Arizona-based manager for Bell Atlantic Mobile, has filed suit against Motorola Inc., charging that its portable cellular phones caused or aggravated her brain tumor. Motorola is also accused of failing to test the phones for safety or to warn users of health risks, and of conspiring with other parties to deceive the public about the health risks posed by cellular phones.

Others named in the conspiracy charge are the Cellular Telecommunications Industry Association (CTIA); Dr. George Carlo of CTIA's Scientific Advisory Group on Wireless Technology (SAG); Ron Nessen, CTIA vice president for public affairs and communications; and Carlo's consulting company, Health and Environmental Sciences Group Ltd.

Nationwide, there are now eight lawsuits pending that seek to link cellular phones to brain cancer, but this is the first by an employee of a service provider. It is also the first such case to name the CTIA, Nessen or Carlo as defendants. The suit, filed in an Illinois state court on March 2 in Chicago, is not expected to go to trial until 1998 or 1999.

"This case uncovers the methods the industry has used to avoid telling the truth to the public. It was decades before this happened in the tobacco industry, before their propaganda machine was exposed," said Wright's attorney, Robert Holstein of Holstein, Mack & Klein in Chicago. He said that Wright learned of her cancer in December 1993, on the same day CBS News announced Motorola engineer Robert Kane's lawsuit over his own brain tumor (see *MWN,* J/F94). Holstein's firm represents Kane and three other plaintiffs in similar cases, in addition to Wright.

Wright has worked in the cellular industry since 1988, first for US West Cellular and then for Bell Atlantic Mobile. "I used *only* Motorola's portable cellular phones," she said in an interview from her home in Gilbert, AZ, where she is recovering from her second round of brain surgery. "And I was a heavy user." She added that her tumor is located "exactly where I'd been holding the phone ever since I was in the business."

The defendants have issued strong denials. "We sympathize with the individual in question," said a press release from Motorola. "However, we have seen these same opportunistic lawyers before. They are dealing in junk science and baseless theories to pressure Motorola into out-of-court settlements."

"This case is not about safety or the scientific process," CTIA spokesperson Mike Houghton asserted in an interview. "It's about greedy tort lawyers."

In a written statement, Carlo said, "I am unable to comment on any specific aspects of the lawsuit." But he insisted that, "The SAG's work is an open book."

The suit has drawn attention to a CTIA workshop held last December in San Diego, at which Carlo and Nessen were the main speakers (see box, p.12).

As an example of what it calls "the CTIA's deceptive and false pronouncements," the complaint cites a 1993 statement to the *Wall Street Journal:* "There have been thousands of studies that have shown these phones are safe."

When asked if the CTIA still stands by that statement, Houghton said, "Back in 1993 we said there had been thousands of studies that were either around, near or at the cellular range. As we've gone forward, as the SAG has been established, it has become apparent that more specific studies are needed....The statement I'd make today is that there is no evidence that would lead us to suspect any biological reason why they might cause any harm."

Last November, Wright asked Bell Atlantic Mobile for any information they had on research showing that portable cellular phones are safe. "You know what they gave me a week later?" she recalled. "This little CTIA brochure folded in thirds. My manager said, 'This is all we have.' The truth is, there *is* no research proving safety. It's not there."

The brochure in question was printed in January 1993, according to Houghton. Titled *Safe Cellular Phones,* its first paragraph contains this sentence in bold: "The research has shown overwhelmingly that the radio transmissions from cellular telephones pose no health risk."

Asked whether the CTIA would say that today, Houghton answered, "It's not a yes or a no question. At that point in time, that is what was known." He added, "We take comfort in the fact that every day they *don't* find something is more evidence in support of our original proposition."

Wright insisted that, "You're not talking to a disgruntled, nonperforming employee." When she worked in phone sales for US West, Wright says, she was twice named salesperson of the year for the Southwest region. Just days before her suit was filed, she was promoted from assistant manager to manager of Bell Atlantic Mobile's real estate division in the Southwest.

"I've sold a lot of phones," said Wright, breaking into tears. "I might have jeopardized a lot of people's lives." But Wright

San Diego CTIA Meeting Sparks Conspiracy Lawsuit

Debbra Wright decided to sue the CTIA and Dr. George Carlo only after attending a CTIA workshop held last December in San Diego.

"Originally I was just going to sue Motorola," said Wright, "but that's when I decided that I had to sue the CTIA, too. They are hiding the truth." The complaint alleges that at CTIA seminars and workshops, "industry personnel are instructed on how to deceive and misrepresent the safety of the cellular portable telephones."

"It's absolute nonsense," countered CTIA spokesperson Mike Houghton. "That's a greedy lawyer trying to make a routine meeting into something nefarious. It's not anything we're ashamed of." Wright's attorneys have obtained a court order to protect records of the meeting.

Wright said she met with her supervisor on November 28, 1994, and told him she was preparing to sue Motorola. "To be fair to Bell Atlantic Mobile, I thought I should let them know." A week later, "He told me that the CTIA was having this seminar in San Diego, 'and I want you to go.'"

Wright attended the December 13 workshop with several other Bell Atlantic Mobile employees. "It was an eye-opening meeting," she recalled. "Most of it was about how to control the media."

"I had assumed that since the CTIA was supposed to have all this research, the science was what was going to be discussed," she explained. "I was really surprised when I found out that the whole purpose of the CTIA was to keep the public from knowing that the studies hadn't been done, to keep their attention away from the scientific process."

Houghton, who also attended the meeting, described it differently: "The seminar was talking about cellular tower siting and electromagnetic compatibility [EMC] issues. A lot of it was about how to deal with reporters who may have been led astray by litigation cases, who may not know the facts."

Also at the meeting was Robert Kane, the Motorola engineer with brain cancer who has filed his own suit against the company. "One of the strong focuses of the material they handed out was the portable cellular telephone issue," Kane said, "and how industry people should respond to media questions about safety." Kane registered for the meeting but was thrown out before it began. He refused CTIA demands that he give back his seminar materials.

According to Wright, CTIA speakers at the seminar expressed concern that if the industry came under more government regulation and failed to control its image in the media, it could suffer the same fate as the nuclear power industry.

Carlo was a featured speaker, with two long presentations. Reading from her notes, Wright quoted Carlo as saying, "We need to avoid having the Food and Drug Administration get involved in regulating us. This is bad news for us."

During a discussion of how to divert media attention away from research on safety issues, according to Wright, Carlo made these comments: "Scientists are very dangerous. If you turn it over to the scientists, they will usually come back with more questions than answers....It is dangerous to allow reporters to report on studies."

Asked about these alleged remarks, Carlo issued a statement: "I'd like to respond to that, but my lawyers have advised me not to comment on matters in litigation."

Wright said that several speakers feared possible media attention to the EMC issue, as it concerns cardiac pacemakers (see *MWN,* J/A94). Wright told *Microwave News* that she had never before heard that this might be a problem, and that she asked who would warn the public. She said that Liz Maxfield, CTIA vice president for industry affairs, stated that it was up to the physicians who had installed the pacemakers, since they had lists of their patients. According to Wright, Maxfield said it was not the industry's responsibility.

"That's when I said enough's enough," said Wright. "There's no way you can excuse that kind of disregard for people's lives."

Maxfield and Houghton both denied that Maxfield had said this. Houghton said Maxfield mentioned that cellular phone manufacturers were considering common language for user manuals to urge those concerned to consult pacemaker manufacturers or their physicians to learn if their devices are adequately shielded. "But we did not say that if there's a problem, we have no responsibility."

Houghton pointed out that telecommunications companies are sponsoring research on EMC at the University of Oklahoma (see *MWN,* J/A94), and said, "The industry, as an industry, is going to wait and see whether there is an actual problem. We're waiting for results from these studies."

Kane registered for the meeting by fax, and was seated without incident. "But then Mike Altschul, CTIA's general counsel, sat down next to me and said I had to leave," according to Kane. "He said they'd called Motorola and that I wasn't authorized to represent the company. I said I'd never claimed that I was."

After arguing with Altschul, Kane said that, "I could see they just weren't going to start until I left. So I picked up my handouts and was herded towards the door. Altschul demanded the papers back. I said no, I'd already paid for them. So he popped out his wallet to give me cash, but I declined." Kane added that a few days later the CTIA "FedExed me a nasty letter," again demanding return of the workshop materials.

On March 31, Wright's attorneys were granted a court order protecting documents related to her suit. CTIA's Houghton said, "We'll comply fully with any order, because we have nothing to hide."

The motion specifically called for protection of a videotape of the San Diego seminar. However, Houghton said that the only part of the meeting that had been taped was "for media training. But that's always destroyed immediately afterwards. That's standard operating procedure for media training, because it can be embarrassing....[Sometimes] it's not the kind of thing you'd want your boss to see."

added that she takes comfort from the attitude of others who work in the cellular phone business. "I can't tell you the number of people in the industry who've called me giving support. They're saying that the truth has got to come out."

Carlo's attorney said that his legal expenses will be paid by the escrow fund established by the CTIA to finance the SAG's research effort. "Legal representation and liability coverage are normal operating expenses of the scientific research program," James Baller of the Washington law firm of Baller Hammett explained in a statement. Carlo and his consulting company are named as defendants in the lawsuit, but the SAG itself is not.

Suit Blames Texas Utility *(continued from p.1)*

allegations. He asserted that, "There is no scientific evidence that shows cause and effect between EMFs and leukemia."

EPRI spokesperson Barbara Klein in Palo Alto, CA, said that the institute's attorneys have also filed a response denying the charges. She added that, "It is our long-standing policy not to comment on pending litigation." EPRI has retained the law firms of Cooley, Godward in Palo Alto, CA, and Fulbright & Jaworski in Houston, whose Otway Denny, past president of the Houston Bar Association, will be working on the case.

Only one case dealing with EMFs and childhood cancer has ever gone to trial. In 1993, Michelle and Ted Zuidema lost a lawsuit charging that San Diego Gas & Electric power lines had caused their daughter Mallory to develop a rare kidney cancer known as Wilms' tumor (see *MWN,* M/J93). Several epidemiological studies have indicated a link between EMFs and both childhood leukemia and brain tumors; no such association has ever been shown for Wilms' tumors.

The Texas case " absolutely has the attention of the utility industry," attorney Mark Warnquist of the Denver office of LeBoeuf, Lamb told the *Houston Business Journal* (March 31). " You've got Jamail, 11 kids with cancer, a conspiracy claim and a Harris County jury....Harris County is not the worst in the country for jury verdicts. But it ranks up there."

One of the plaintiffs, the Fewell family, lived next to seven sets of transmission lines. Their son Kyle was diagnosed with ALL in mid-1994 and is now undergoing chemotherapy. Kyle Fewell's school is also near high-voltage power lines. Another party to the suit is the Hickey family, whose son is also being treated for ALL. According to the complaint, the Hickeys' backyard bordered on eight sets of high-voltage transmission lines.

Other families lived over buried power cables or near transformers, distribution lines or electric meters. The suit charges that "the magnetic fields secretly and silently invading" their homes from these facilities were "well in excess of the level proven to cause childhood cancers."

ALL is a cancer that occurs predominantly in children, with an annual incidence of about 4 cases per 100,000 in American children two to ten. According to the Leukemia Society of America, it is cured about 65% of the time. Three of the children involved in the lawsuit have died; two had ALL.

The complaint alleges that HL&P conspired with EPRI "to hide the effects of their wrongful conduct and to conceal their wrongful actions... [and] to falsely persuade plaintiffs, the public at large and the responsible governmental entities that magnetic fields present no cancer danger or any other form of danger."

The suit describes the conduct of HL&P and Houston Industries in the following terms:

> Every death and cancer...could easily have been prevented by the defendants [who] have long had the knowledge and technology available to completely insulate the public from the dangers of magnetic field exposures. They have knowingly chosen to conduct their operations, however, in a reckless and unsafe manner for the purpose of avoiding the extra expenses associated with safely conducting their operations. In sum, the deaths and cancers inflicted on the innocent children and their families in this case were allowed to occur by the HL&P defendants in this case so that [they] could maximize their profits.

The lead plaintiff is Joyce Bicki; the lead defendant is Houston Industries.

This is not the first time HL&P has been involved in an EMF lawsuit. In a judgment handed down in 1985, the company was ordered to pay more than $25 million in punitive damages to a school district for siting a 345 kV power line on school property in "reckless disregard" of children's health. The award was later reversed, but not before the utility had moved the line off school property (see *MWN*, N/D85, N/D 87, J/A88 and M/J89).

Attorney Joe Jamail *(continued from p.1)*

have social ramifications like those recalls," Jamail later told Donald Vinson, author of *America's Top Trial Lawyers*. "I take a lot of pride in something like that."

This past January, Jamail won a settlement reported at over $100 million in a suit accusing a Bryan, TX, chemical plant of causing infant deaths and birth defects by polluting the air and water with arsenic. Among his other big victories was the MiniScribe case, a 1992 securities fraud lawsuit in which the jury awarded $568 million in damages.

Jamail, 69, is the sole owner of his law firm, which employs eight attorneys. The firm's winning record has made Joe Jamail one of the ten richest people in the state of Texas, with an estimated wealth of $700 million.

What's the secret of Jamail's success? "He is the master of creating a morality play of right and wrong," according to a defense lawyer who has followed his career closely. During one trial, defense counsel kept emphasizing the size of the fee that Jamail stood to gain if he won the case. Jamail later recalled to Vinson: "Finally the other lawyer asked, 'What do you think Mr. Jamail's going to do with that money?' Well, that invited me: ' Your Honor, he's now invited me to tell you and this jury what I'm going to do with my fee. Most of it I am going to give to Galveston charities for underprivileged children,' and I sat down. My client won."

Jamail has been criticized for his high fees, but he feels he's earned them. "If I didn't win," he told *Forbes,* "I wouldn't get paid."

Jamail did not respond to *Microwave News'* requests for an interview about the Texas EMF lawsuit.

FROM THE FIELD

Paul Brodeur on Nebraska Childhood and Worker Cancer Clusters

Reprinted below are excerpts from Paul Brodeur's testimony before the Nebraska state legislature's Natural Resources Committee on February 8, 1995, in Lincoln. In his testimony, Brodeur refers to a cluster of 17 cases of childhood cancer in west-central Omaha, zip code 68144. The school attended by Kevin Larm, who has leukemia, is in zip code 68144. Kevin Larm and his family met with President Bill Clinton last March and urged him to issue an executive order to reduce EMF exposures from power lines and substations (see MWN, *M/A94 and N/D94). A paperback edition of Brodeur's book,* The Great Power Line Cover-Up: How the Utilities and the Government Are Trying To Hide the Cancer Hazards Posed by Electromagnetic Fields, *was published in February by Back Bay Books, an imprint of Little Brown & Co.*

I have been asked by the group called People Organized for Wise Energy Representation to present to you today the medical and scientific evidence regarding the cancer hazard posed by exposure to [EMFs] given off by high-voltage and high-current power lines....

The evidence that power line [EMFs] can either cause cancer or promote its development is not at all inconclusive, as you have been led to believe by previous witnesses, but is very powerful. The evidence is, in fact, so powerful that I believe it will persuade you to support the resolution before you, which calls upon the Nebraska Public Power District [NPPD] to delay construction of the 96-mile-long, 345 kV Pauline-Moore transmission line until November 1995 or later....

I will start out by telling you that a majority of the medical and scientific studies published in the peer-reviewed medical literature show that children living in homes near high-voltage or high-current power lines, as well as workers exposed to [EMFs] on the job, are developing cancer at significantly higher rates than children and workers who are not exposed, or who are less exposed.

I offer as documentary proof of this statement an 11-page summary of the findings of the epidemiological studies of the cancer-producing effects of [EMFs] as compiled by the National Library of Medicine [NLM] in Bethesda, MD. I wish to emphasize that this list of epidemiological studies and their findings comes from the medical database of the [NLM]. It includes the childhood residential studies and the adult occupational studies with original data that have been published in the peer-reviewed medical literature....

...[M]ost of the so-called "negative" studies that have been cited by previous witnesses and by electric utility officials as finding no cancer hazard associated with [EMFs] are not, in fact, peer-reviewed studies of cancer in human beings. Most of these negative studies do not contain any original data, nor have they been subjected to peer review. Most of them simply contain the undocumented opinions and assertions of members of ad hoc committees, who are often paid consultants of the electric utility industry....

Keeping in mind that...11 studies comprise the total number of childhood cancer EMF studies in the peer-reviewed medical literature, please note that eight out of the 11 show that children living in homes near high-voltage or high-current power lines suffer a statistically significant increased risk of developing cancer—mostly leukemia, brain cancer and lymphoma—when compared to children who do not live in such homes.

Thus, an overwhelming majority of the childhood residential studies published in the peer-reviewed medical literature and compiled by the [NLM] show positive findings for cancer....So much for the claim of the electric utility industry that this is "junk science."...

I have carefully reviewed the testimony given by Dr. Thomas J. Safranek, the epidemiologist employed by the state of Nebraska Department of Health [NDOH], who appeared before you on December 17, 1994. I find no mention whatsoever in his testimony of the childhood residential studies....

[Y]ou will see that a clear majority of the occupational studies show that workers exposed to [EMFs] on the job are developing brain cancer, leukemia and lymphoma far more readily than other workers or less exposed workers....

To summarize: There are 30 occupational studies on the [NLM] list before you....24 out of the 30 show a statistically significant increased risk of cancer among workers exposed to [EMFs] on the job. 22 of the 30 studies show excess brain cancer among workers exposed to [EMFs].

Incidentally, two very recent occupational studies have not been included on the list before you. One of them is a study conducted by researchers at McGill University in Montréal of 223,000 electric utility workers in France and Canada [which] found that workers with heavy exposure to EMFs had two-and-a-half times the incidence of leukemia as workers with less exposure. Another occupational study was published just last month...by Drs. [David] Savitz and [Dana] Loomis of the University of North Carolina [which] found that those men with heavy exposure to EMFs were dying of brain cancer more than two-and-a-half times as often as less-exposed workers....

I would like now to turn to a different subject—the record of the [NPPD] with regard to forthright disclosure about the medical studies showing the cancer threat posed by exposure to [EMFs].

On July 7, 1994, Mr. R.G. Oswald, the project manager for the [NPPD's] proposed Pauline-Moore high-voltage transmission line, wrote to Senator Robert Kerrey and told the senator that, "Out of 20 epidemiology studies compiled over the past 15 years, only three show an association between cancer and [EMFs]."

How can that statement possibly be true...?

This same [NPPD] official wrote letters to Senator Kerrey on January 7, 1994, and on July 7, 1994. Each of these letters contains the following sentence: "It seems that for every study that shows a possible relationship [between cancer and exposure to EMF] there is an equally respected study which shows no relationship."

Members of the committee, the [NPPD] has blatantly misrepresented the medical findings about the cancer hazard posed by exposure to [EMFs] to the U.S. senator from the state of Nebraska....

...[Y]ou will remember that when Dr. Safranek testified before you on December 17, he mentioned an investigation that he and some colleagues in the [NDOH] had conducted regarding a cluster of childhood cancer that had occurred among children living in four adjoining zip code areas in the west-central section of Omaha. He told you that 38 cancers had developed among these children during the five-year period between 1987 and 1991. He and his colleagues acknowledged that this was 22 more cancers than should have occurred among these children during that period of time.

In their report, which is dated January 25, 1994, Dr. Safranek and his colleagues in the [NDOH] declared that because the types of cancer that afflicted the children in the four-zip-code area were "quite diverse," no causal agent could be identified. They concluded by saying that, "For this reason, the [NDOH] has decided not to initiate any further study of this cluster, although as a precautionary measure, the NDOH will continue to monitor the incidence of cancer in this area."

This decision is somewhat puzzling, because a list of the 38 childhood cancers...[in] the report shows that 17 of them are cancers known to be associated with exposure to [EMFs]. They include six malignant brain tumors, three leukemias, three cases of non-Hodgkin's lymphoma, three melanomas of the skin, one case of Hodgkin's disease and one additional cancer of the blood-forming system....

In the concluding section of their report, Dr. Safranek and his col-

leagues declared that, "There is little environmental information to suspect that this particular section of the city [the four-zip-code area] harbors a unique risk to children for developing cancer." Elsewhere, however, they acknowledged that in one of the four zip codes—68144—17 children had developed cancer, whereas only 6.4 cancer cases were expected, and that the American Telephone & Telegraph Company (AT&T) operates a large manufacturing plant on the southern boundary of this zip code....

During the past three years, a major workmen's compensation action has been making its way through the Nebraska state courts. The plaintiffs in the case are the survivors of seven men who died of malignant brain tumors during the five-year period from 1989 to 1994. The workmen's compensation action alleges that the seven dead workers developed brain cancer as a result of occupational exposure to [EMFs].

All seven men worked at the AT&T plant. Not only did all of them work at the plant, they all worked in Building 30 at the plant. Not only did they all work in Building 30, they all worked in the southern portion of Building 30. The southern part of Building 30 is the site of an extensive electroplating operation, many welding assembly lines and a carbon-block operation.

Large rectifiers are used to convert alternating current to direct current in the electrolytic process of the electroplating operation. These rectifiers produce immensely powerful [EMFs]. So powerful are these fields that some men working near the rectifiers report that their hair stands on end, and that they have to remove their wristwatches, because the strong magnetic fields make the watches go "haywire."...

Radiofrequency [RF] energy is used in the carbon-block operation. So powerful is the [RF] radiation given off by the heat sealers on the south side of Building 30 that during the 1980s it interfered with the communications of planes flying into and out of the Strategic Air Command (SAC) center at Offutt Air Force Base. It also interfered with the communications of amateur radio operators in the Omaha area. The problem was solved by building a Faraday cage around the workers in the carbon-block operation to keep the radiation inside the plant.

The seven deaths from the brain cancer among men working in Building 30 is considered to be extraordinary by all of the medical researchers and neurological scientists with whom I spoke last week. Indeed, it is 10 to 12 times the number of brain cancer deaths that should have occurred during that five-year period among the men who worked in Building 30.

During the past 20 years, a total of 13 brain cancer deaths are known to have occurred among men working in the south portion of Building 30. However, the medical researchers I spoke with caution that because of turnover in the work force, and the fact that many former workers in Building 30 have undoubtedly left the Omaha area, the incidence of brain cancer among these workers is bound to be much higher. In addition, unconfirmed reports indicate that an unusually large number of men who worked in Building 30 have died of leukemia and lymphoma.

Obviously, the cancer hazard in Building 30 should be the subject of an immediate investigation by the National Institute for Occupational Safety and Health.

Meanwhile, a potential connection between the cancer tragedy among the men who worked in Building 30 and the cancer tragedy occurring among children living in the zip code areas to the north is not hard to make. The huge AT&T plant in west-central Omaha uses huge amounts of electrical energy. This electrical power is supplied to a substation near the plant by two high-voltage transmission lines that run along separate corridors through residential neighborhoods in two of the zip codes where children are developing excess cancer. These two lines pass within 40 to 50 feet of many homes and office buildings. A 345 kV transmission line—the same type as the proposed Pauline-Moore line—runs through three of the zip code areas where children are developing excess cancer. It passes within 100 feet of some homes.

Anyone driving through these areas, as I did yesterday, will be struck not only by how close the high-voltage transmission lines are to homes, but also by the large number of electrical substations that are present in these neighborhoods, and by the large number of high-current feeder lines that emanate from these substations. These high-current feeder lines give off very strong magnetic fields and they are dangerously close to hundreds of homes. Anyone who measures the strength of the power-frequency magnetic fields at the doorways of such homes, as I did yesterday, will find that these fields are often many times stronger than the fields associated with cancer in the peer-reviewed childhood and occupational studies compiled by the [NLM].

Yet [NDOH] officials never took a single [EMF] measurement when they investigated the cluster of 38 cancers among the children living in the four contiguous zip codes. Nor did they bother to investigate whether the childhood cancer victims lived near the high-voltage transmission lines feeding electricity to the AT&T plant. Or whether they lived near the many electrical substations and high-current feeder lines in these neighborhoods. Nor did the state health officials bother to look into the incredibly high rate of brain cancer deaths among men working in Building 30 at the AT&T plant. Or take into consideration the fact that the tragic situation there may be connected with the high cancer rate among the children in the four nearby zip codes.

Do the [NDOH] officials even know about the extraordinary brain cancer cluster among the men working in Building 30?

Instead of conducting a thorough investigation of the cancer cluster in the four contiguous zip code districts of west-central Omaha, the state health authorities declared that, "There is little environmental information to suspect that this particular section of the city harbors a unique risk to children for developing cancer," and announced that they had decided not to initiate any further study of the childhood cancer cluster.

Members of the Natural Resources Committee, allow me to suggest that when the citizens of Omaha and elsewhere in Nebraska learn, as I did last week, that the incidence of childhood cancer in the four zip code areas of west-central Omaha remained high for the sixth year in a row during 1992—the most recent year for which cancer statistics are available from the Nebraska Cancer Registry—they may well demand that their representatives in the state legislature take action to reduce the exposure of unsuspecting Nebraskans to [EMFs].

In closing, I hope that I have raised some questions in your minds about the potential cancer hazard that will result from exposure to [EMFs] given off by [NPPD's] proposed 345 kV Pauline-Moore transmission line. I thank you for allowing me to bring the important public health hazard posed by power line emissions to your attention. I trust that you will give it serious consideration.

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UPDATES

EXPOSURE ASSESSMENT

Sewing Machine Fields... The DOE's RAPID engineering program will characterize the EMFs from sewing machines (see also, p.7). The project was prompted by a U.S.–Finnish study showing consistently higher rates of Alzheimer's disease among EMF-exposed workers, especially dressmakers and sewers (see *MWN,* J/A94). Preliminary measurements by NIOSH's Dr. Joseph Bowman found that sewing machine operators' heads were exposed to 2-11 mG, and that the readings were as high as 200 mG at knee level. "We expect to ask the Battelle Pacific Northwest Lab in Richland, WA, to assess worker exposures from sewing machines in Finland and to characterize the fields from typical units," said Lynne Gillette, manager of the DOE EMF RAPID Program. The NIEHS is also exploring ways to further the work of Dr. Eugene Sobel of the University of Southern California School of Medicine in Los Angeles, according to NIEHS' Dan Vandermeer. Sobel, who announced the EMF–Alzheimer's link last year, is presently on sabbatical in Finland.

MEDICAL APPLICATIONS

Diathermy Study Challenged... Last year, Drs. Rita Ouellet-Hellstrom and Walter Stewart of the Johns Hopkins University (JHU) School of Public Health found a significantly elevated risk of miscarriage among physical therapists who administered microwave (MW) diathermy during or shortly before their first trimester of pregnancy. In contrast, shortwave (SW) diathermy therapists had no elevated risk (see *MWN,* J/F94). Now, Drs. Bruce Hocking and Ken Joyner of Telecom Australia in Melbourne are disputing those findings. Writing in the February 1 *American Journal of Epidemiology (141,* pp.273-274, 1995), they argue that since 27.12 MHz SW radiation penetrates more deeply than 2450 MHz microwaves, it should have the greater effect—assuming, of course, that there is an effect — in early pregnancy when the fetus is buried deeply within the mother's abdomen. The Australians conclude that the failure of the epidemiological results to conform to this model undermines the JHU team's claim of a MW effect. Ouellet-Hellstrom and Stewart disagree. The differences in penetration do not explain the association, they concede, but they contend that some other factor might. "The data are fixed, but the possible explanations are not!" they write, suggesting that, "One should examine the extent to which competing explanations are supported by data, not whether data are supported by competing explanations."

MEETINGS

Medical Device EMC... The FDA and the Association for the Advancement of Medical Instrumentation (AAMI) are jointly sponsoring a conference on *Electromagnetic Compatibility for Medical Devices: Issues and Solutions* in Anaheim, CA, May 24-25, to heighten awareness of potential EMI/EMC problems and to provide an "open (nonthreatening) forum" to discuss them. Among the speakers will be Howard Bassen, Dr. Elizabeth Jacobson and Jeffrey Silberberg, all of the FDA; Dr. Bernard Segal of the Jewish General Hospital in Montréal,

Canada, will speak on "The Potential Magnitude of the EMI Problem." A representative of Motorola is expected to review possible EMI from cellular phones. To register, contact: AAMI, 3330 Washington Blvd., Suite 400, Arlington, VA 22201, (800) 332-2264 or (703) 525-4890, ext.260, Fax: (703) 276-0793. (For more on this issue, see p.12 and *MWN,* J/A93, N/D93 and J/A94.)

Ultrawide Band Measurements...A symposium on *Current Issues in RF Radiation and Ultrawide Band Measurements* was held at the Armstrong Lab (see below), February 13-16. Thirty-five participants attended the by-invitation-only meeting, which was chaired by Richard Tell, a consultant based in Las Vegas.

MILITARY LABS

Brooks AFB May Close... On February 28, the Pentagon issued a list of bases that it proposes to close. Among the 33 large installations is Brooks Air Force Base (AFB) in San Antonio, home to the Armstrong Lab, where most of the U.S. research on the biological effects of RF/MW radiation is carried out—much of it cloaked in secrecy. This is ironic because the Air Force had spent years convincing the Pentagon to transfer the Army's and Navy's RF/MW research labs—then located in Bethesda, MD, and Pensacola, FL, respectively—to Brooks (see *MWN,* J/A92). The IEEE has started a lobbying campaign to keep the Armstrong Lab open. In a March 15 memo, Dr. Eleanor Adair of the John Pierce Foundation in New Haven, CT, wrote to members of the SCC28 subcommittee that wrote the 1992 ANSI/IEEE RF/MW exposure standard, urging them to contact their elected officials because, "There can be no doubt that many critical questions relating to human health effects of exposure to [RF/MW radiation] remain to be answered." Adair noted that it would cost an estimated $40 million to move the lab and that it could continue to operate autonomously even if Brooks closes down.

PEOPLE

Two members of the National EMF Advisory Committee have changed jobs. Dr. **James Melius** has left the New York State Department of Health in Albany to become the scientific and medical director of the Center to Protect Workers' Rights in Washington. The center is the research arm of the Building and Construction Trades Department of the AFL-CIO. And **John Coughlin**, an attorney who played a key role in setting up the RAPID program, has left the Wisconsin PSC to go into private practice as a mediator and arbitrator in Madison, WI. ...**Ramona Trovato** has taken over from **Margo Oge** as the director of EPA's Office of Radiation and Indoor Air. Another new member of the EPA EMF team is **Denise Settles**, an epidemiologist....**Martha McNeal** has left PG&E in San Francisco, where she was the EMF program director, to start a consulting firm in West Palm Beach, FL, to help utilities set up EMF programs....**Dan Bart** has been promoted to the position of vice president for standards and technology for the Electronic Industries Association and the Telecommunications Industry Association.

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POLICE RADAR LITIGATION

Medical Monitoring Suit Defeat... An Illinois judge has dismissed a class action suit seeking medical monitoring of police radar equipment users. On February 27, Cook County Circuit Court Judge Margaret Stanton McBride ruled in favor of a motion by attorneys for Kustom Signals Inc., MPH Industries Inc. and Decatur Electronics Inc., the manufacturers of radar guns being sued by Harold Blesy and five other police officers suffering from cancer. The decision to seek regular health exams and funding for related research, instead of personal injury damages, is a new legal strategy to link cancer and police radar. But the defense argued that even if it were shown that radar equipment could increase the plaintiffs' chances of developing cancer, this would not give them a basis to sue. Defense lawyers contended that state law requires proof of responsibility for a specific injury. "Illinois has a very strong injury-in-fact requirement," said attorney Patrick Morris of the Chicago firm of Johnson and Bell, who represents MPH Industries. Morris added that this requirement is less clear-cut in California, New York, Ohio, Pennsylvania and perhaps other states. Judge McBride accepted the motion to dismiss without issuing a written opinion or making any verbal comment. Plaintiffs' attorney Norman Rifkind of Biegel, Schy, Lasky, Rifkind, Goldberg and Fertik in Chicago said that the complaint had been dismissed without prejudice, and that his firm filed a motion for clarification on April 3.

RESOURCES

Collection of ELF and RF/MW Papers... The January/February 1995 issue of *Radio Science* features 11 articles on "Electromagnetics in Biology and Medicine." The special section was edited by Dr. Maria Stuchly of the University of Victoria, Canada. Among the papers are: Dr. V.F. Zolin's well-referenced review of "Bioelectromagnetics in Russia," Sweden's Drs. Bo Holmberg and Agneta Rannug on "Magnetic Fields and Cancer Development in Animal Models" and EPRI's Dr. Stan Sussman on exposure assessment in ELF studies and Dr. Om Gandhi on dosimetry at ELF and RF/MW frequencies.

Carpenter on Childhood Cancer Risk..."The association between residential exposure and childhood cancer is, in my judgment, strong, and growing stronger," concludes Dr. David Carpenter, dean of the School of Public Health at the State University of New York, Albany, in a review of six residential studies on the potential link between magnetic field exposure and childhood cancer. The review is followed by commentaries by 11 researchers—including Drs. Devra Lee Davis, Paul Héroux, Rosemonde Mandeville, Indira Nair and Nancy Wertheimer—most of whom agree with Carpenter's evaluation. *Epidemiological Evidence for an Association Between Exposure to 50 and 60 Hz Magnetic Fields and Cancer* (Paper No. 6, November 1994, 31 pp.) costs U.S.$4.25 (C$3.99 in Québec and C$3.75 elsewhere in Canada) and is part of the James Bay Publication Series on the environmental impact of hydroelectric development. Order from: North Wind Information Services Inc., C.P. 38, Succ. Place du Parc, Montréal, PQ H2W 2M9, Canada, Fax: (514) 287-7355.

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Industry Pressures FCC To Adopt ANSI RF/MW Exposure Standard

The Federal Communications Commission (FCC) is facing a massive lobbying campaign from the broadcast, communications and electronics industries as it prepares a new radiofrequency and microwave (RF/MW) exposure standard. Under the Telecommunications Act of 1996, which became law on February 8, the agency must adopt acceptable limits by August 5.

The new telecommunications law also bans state and local governments from restricting towers for cellular phones and other communications devices because of safety concerns—as long as the towers comply with the FCC's new RF/MW limits (see p.10).

At issue is whether the FCC should follow the 1992 American National Standards Institute/Institute of Electrical and Electronics Engineers (ANSI/IEEE) standard—as it first proposed in March 1993 (see *MWN,* M/A93)—or the limits recommended by the National Council on Radiation Protection and Measurements (NCRP) in 1986. The FCC could also select elements from each of them. Essentially all the corporate interests have lined up in favor of the ANSI standard—only the Environmental Protection Agency (EPA) is urging the commission to favor the NCRP guidelines.

"We interpret EPA's advice to mean that the best option would be to combine what are considered the best elements of the ANSI and NCRP standards," FCC's Dr. Robert Cleveland told *Microwave News.* Cleveland is coordinating the agency's effort to establish regulations by early August.

But industry representatives are adamant that only the ANSI standard

(continued on p.11)

Commentary

ANSI/IEEE v. NCRP: Battle for Control of RF/MW Standards

Who would have believed there would be such an intense lobbying effort over which RF/MW radiation standard the FCC should adopt? After all, the 1992 ANSI/IEEE and 1986 NCRP standards were largely based on the same studies and written by the same people.

Although the ANSI standard is more recent, it is not altogether based on better science. Instead, the current campaign reflects the preferences of a small clique of individuals who run IEEE's SCC28 committee that wrote this standard, and who have longtime connections to industry and the military.

At a critical SCC28 meeting held in Tucson, AZ, in 1989, in addition to the representatives from AT&T, GE, IBM, Lockheed, Motorola and Raytheon, approximately a quarter of those present were from the military.[1] Many of them showed up only to swing the vote on a number of key

(continued on p.12)

« Power Line Talk »

Dr. **De-Kun Li** of Kaiser Permanente in Oakland, CA, will run a three-year prospective epidemiological study of **spontaneous abortions** among 1,500 women, under a $1.2 million contract from the **California EMF Program**. Starting in July, Li's team will measure EMF exposures for a 24-hour period as soon as possible after a woman becomes pregnant. Enertech Consultants in Campbell, CA, will collect the exposure data, and T. Dan Bracken Inc. in Portland, OR, will analyze them. Li and his colleagues recently completed a study which found that use of electric blankets during pregnancy was associated with an elevated risk of birth defects among babies born to women with fertility problems (see *MWN,* S/O95). The award represents close to 30% of the program's $4.2 million, five-year external research budget. (The program's total budget is $7 million.) The announcement of this contract comes as a surprise to many who are still waiting for the results of an earlier study by the California Department of Health Services on EMF exposures and miscarriage risks among electric blanket users. Dr. **Gerri Lee** and Dr. **Raymond Neutra**—who heads the California EMF Program—collected prospective and retrospective data in the early 1990s, but the project has been delayed, ostensibly due to shortages in funding to finish the analysis. In 1992, Lee did report preliminary findings showing an up-to-fivefold increased miscarriage risk among women using electric blankets, at an invitation-only workshop sponsored by EPRI and the DOE (see *MWN,* J/A92 and N/D95). But Lee and Neutra have consistently refused to discuss their results in public. Dr. **Jack Sahl**, a senior research scientist at Southern California Edison in Rosemead, objects to proceeding with this new project because, he argues, Lee and Neutra should issue a report on the first study and have it peer-reviewed before considering the next project. "This would be the normal process," he said in an interview. Lee sees it differently: "The study doesn't have to be complete to know that we should proceed. We already have preliminary results that might not change once further work is done." And funding is available *now,* she told *Microwave News*. "Internally, we are finished, but a lot of work needs to be done on validation before it is published," which will take months, she explained. Lee said that she plans to present the first phase of the study, which looked at self-reported electric blanket use, at this June's Bioelectromagnetics Society (BEMS) meeting. And the rest of the study should be ready for publication by the end of the year. Dr. **Vincent Delpizzo**, the program's research director, stands behind proceeding with the new project. "This is a priority area for the California EMF Program," he said. "We hope that these prospective measurements may help clarify the concept of exposure," he explained, noting that Lee and Neutra's study indicated that measurements taken early in pregnancy did not correlate well with those taken later. "Reproductive health studies offer a unique opportunity to measure exposure at, or close to, the 'right' time," he said, adding that in most cancer studies exposure can only be measured long after the disease has been diagnosed. Neutra declined to be interviewed.

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EPA's Dr. **Carl Blackman** has replicated a key **melatonin** experiment first reported by Dr. **Robert Liburdy** of the Lawrence Berkeley National Laboratory in Berkeley, CA. Four years ago, Liburdy announced that weak magnetic fields could inhibit melatonin's ability to slow the growth of human breast cancer cells, known as MCF-7 (see *MWN,* J/A92). In June, Blackman's team will tell the BEMS annual meeting in Victoria, Canada, that "a 12 mG, 60 Hz magnetic field can completely block [melatonin's] oncostatic action." The results are significant on two levels. First, it is another factor in favor of the "melatonin hypothesis," the leading theory to explain the EMF–cancer link. But equally important, at a time when EMF research is looked at skeptically, Blackman has done what few have done before: achieve an exact replication of a key EMF biological experiment. "It's a robust effect," Blackman said in an interview. Liburdy is delighted. "This *in vitro* effect now stands as an interaction whose important experimental parameters have been identified and can be studied in other labs," he told *Microwave News*. Further tests of Liburdy's results are planned at the Battelle labs in Richland, WA—one of the four sites dedicated to replicating EMF experiments under the RAPID program.

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EPRI has developed a new, cost-effective way to reduce EMFs from ground currents substantially. Past EPRI research identified such ground currents as a principal source of magnetic fields in the home, and a recent analysis by Dr. Nancy Wertheimer, Dr. David Savitz and Ed Leeper found that the presence of ground currents was linked to higher risks of cancer (see *MWN,* S/O95). Ground currents are created when some of the return current in a house escapes through conductive plumbing—which is often used to ground the electrical system—instead of flowing back through the neutral conductor in the service cable. EPRI's new net current control (NCC) device ensures that the neutral conductor acts as the path of least resistance, causing return current to flow through the service cable instead of the pipes. This virtually eliminates ground currents—and when current flow in the cable is approximately the same in both directions, the magnetic fields from the house wiring cancel each other out. **Rochester Gas & Electric Co.** (RG&E) recently tested an NCC device in response to a family's request that magnetic fields in its home be reduced, especially in the child's bedroom. The device cut peak magnetic fields from 12 mG to 4.5 mG, while average fields were reduced by half, to 2.0 mG. These remaining fields were almost entirely due to ground currents from neighbors' homes. If NCC devices were installed for those homes as well, RG&E engineers estimated, the fields in the first house would fall to near zero. Richard Lordan, manager of EPRI's magnetic field management program, told *Microwave News* that the NCC device can be a low-cost alternative to other mitigation methods. The device itself—a ferromagnetic core through which the service cable is looped—is expensive, costing as much as $2,000. But it is easily installed on the service pole, which often makes it cheaper

than other approaches. "Tracking down the exact sources of ground currents and fields inside the home can be time-consuming and expensive," Lordan explained. Inserting an inexpensive plastic coupler between two sections of water pipe is another way to reduce ground currents—but the expense of digging up water pipes can make this option cost more than the NCC device.

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Enertech Consultants, based in Campbell, CA, has created a magnetic field calculation program called **B-Fast** and has made it available for public use through its home page on the World Wide Web <http://www.etc-inc.com>. Since it is written in Sun Microsystems' Java programming language, users do not need specialized software of their own. Instead, they simply input a few parameters—e.g., the current on the line—and the program does the rest. B-Fast is accessible on the Internet to anyone with a Web browser that can take advantage of Java (such as Netscape Navigator 2.0). "Our test version of B-Fast produces the same results as the BPA and SCE-FIELDS programs," Enertech's **Michael Silva** told *Microwave News,* referring to software from the Bonneville Power Administration and Southern California Edison. "It's not full-blown, but it is fine for most applications," he added. Silva says Enertech will add new features to the program in the coming months—but it already plays background music.

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San Diego Gas & Electric (SDG&E) announced in late March that "three of the nation's top scientists" have joined a friend-of-the-court brief in support of the utility in the *Covalt* property devaluation suit. The brief, which argues that there is no scientific reason for concern about an EMF–cancer link, was originally filed in September by the **Atlantic Legal Foundation** on behalf of 14 scientists, including six Nobel laureates (see *MWN,* N/D95). The new signers are Dr. **Patricia Buffler**, an epidemiologist and the dean of the School of Public Health at the University of California, Berkeley; Dr. **Dimitrios Trichopoulos**, chair of the Department of Epidemiology at the Harvard School of Public Health in Boston; and Dr. **Leonard Hamilton**, retired head of the Biomedical and Environmental Assessment Group at the Brookhaven National Laboratory in Upton, NY. Buffler and Trichopoulos have both been employed as expert witnesses on behalf of utilities, with Buffler having testified for SDG&E in two earlier lawsuits over EMFs.

Electric Fields Concentrate Radon Daughters; U.K. Researchers See Answer to EMF–Cancer "Enigma"

A team of British scientists has found that the decay products of radon—a naturally occurring radioactive gas—are attracted to such common sources of EMFs as power lines and electrical appliances. The researchers, led by Dr. Denis Henshaw of the University of Bristol, argue that this finding may help explain the link between EMF exposure and cancer.

"The observations show that EM fields can concentrate in their vicinity a cocktail of radon daughter nuclei, a known carcinogen, and presumably other potentially harmful agents," they concluded in a paper that appeared in the January 1996 *International Journal of Radiation Biology (69,* pp.25-38). "We have crossed a major conceptual barrier," declared Henshaw, explaining that the results could reveal a mechanism by which EMFs cause cancer.

Henshaw and his coworkers found up to 18 times higher levels of radon daughters in the vicinity of power lines and appliances than in other areas. (Radon daughters result from the decay of radon and include isotopes of polonium, which emit alpha particles that can damage DNA.)

The Bristol team outlined a number of different mechanisms by which electric fields may affect radon daughter aerosols, leading to their deposition on nearby surfaces. "A clear implication of the experimental results is that a person situated near a source of [EMFs] would receive a higher skin dose," which is likely to be significant, the researchers noted. They argued that the presence of electric fields potentially could result in higher levels of radon daughters and other contaminants being deposited in the lungs of those close to the field source. Organs other than the lungs could then be affected by the movement of the particles within the body.

"Henshaw may be onto something, but it is not necessarily just electric fields that can move radon daughters around; AC magnetic fields can do so, too. Henshaw has not really checked that yet," Ed Leeper, a physicist based in Boulder, CO, told *Microwave News.*

But other members of the scientific community interpret the study more skeptically. The U.K.'s National Radiological Protection Board (NRPB) called the group's theory "implausible" and "purely speculative." The NRPB, based in Chilton, contends that when radon is deposited on surfaces, fewer are then available to be breathed. "Electric fields have in the past been suggested as a way of reducing radon exposure," the NRPB argued in a February 14 press statement. "The attachment of radon daughters to particles present in room air will also tend to reduce doses to the sensitive cells in the airways of the lung because these particles will deposit less effectively than the unattached daughters."

While the Bristol study has received little attention in the U.S., the British media covered it extensively—some even rushed the story into print, breaking a press embargo. The findings appear to have hit a raw nerve among a U.K. public that is increasingly concerned about cancer clusters and low property values near power lines (see *MWN,* J/F96).

On the same day that the study was published, *Dispatches,* a television program on the U.K.'s Channel Four, featured "Electricity and Cancer," on the Bristol radon findings and on

several towns where citizens attribute increased rates of cancer to high EMF levels.

On February 8, even before the program aired, the *Times* prophesied that the study "could open the way to scores of legal actions against electricity companies and suppliers." Martyn Day, an attorney whose London firm, Leigh, Day & Co., is pursuing a dozen EMF–childhood leukemia cases, noted in the February 14 *Financial Times* that, "Judges are likely to be most persuaded by the human data, but the Bristol theory does plug a gap by offering a plausible mechanism."

Indeed, Henshaw and his colleagues concluded that, "We believe that the observations may have implications for the apparent enigma that there is no persuasive biological evidence to show that power frequency [EMFs] can influence any of the accepted stages in carcinogenesis."

The February 17 *Daily Telegraph* reported that the Bristol study will add weight to the arguments of those who are fighting the construction of new power lines. And the February 18 *Sunday Telegraph* noted that the study has "given rise to questions about whether developers should continue to build houses near pylons," and that "the renewed publicity is certain to feed the paranoia within the housing market."

Yet an item in the February 15 issue of *Nature* argued that publicity surrounding the study greatly overstated the significance of the results. And a review of the *Dispatches* program, in the February 24 *British Medical Journal,* suggested that the show presented an unbalanced view of Henshaw's work and needlessly worried parents over the risk to their children.

Dr. James McLaughlin of the Radon Research Group at University College in Dublin, Ireland, wrote in the *Irish Times* (February 21) that he agreed with the NRPB that electric fields "help to deposit radon decay products onto surfaces, thereby reducing the probability of inhaling these substances," but nevertheless he recommended prudent avoidance in the siting of future power lines.

Henshaw responded in a March 4 letter to the *Irish Times* that, "Using the experimental measurements in our paper, it is possible to show that there is no significant reduction in radon decay product concentrations in room air from 50 [Hz] electric fields, in contradiction to Dr. McLaughlin's assertions." The evidence suggesting that electric fields may increase human exposure to radon is too strong to ignore, he concluded.

McLaughlin also noted that while radon is believed to be linked to lung cancer, it is premature to suggest that radon causes leukemia—a disease that epidemiological studies have more commonly linked to EMFs. Henshaw and his coworkers contended in their paper, however, that evidence is emerging that may establish an association between radon and leukemia, brain tumors and kidney cancer, especially in children.

While there are few studies tying lung cancer to EMFs, Dr. Gilles Thériault and his coworkers at McGill University in Montreal, Canada, found a strong association between transient EMFs and lung cancer among utility workers (see *MWN,* N/D94). Dr. Genevieve Matanoski of the Johns Hopkins University School of Hygiene and Public Health in Baltimore was the first to observe an EMF link to lung cancer (see *MWN,* N/D89).

Virginia Power Granted Appeal of $1 Million Property Award

On January 12, the Virginia Supreme Court, in Richmond, allowed Virginia Electric & Power Co. (VEPCO) to appeal a $967,000 award in a power line property devaluation suit. John and Janet Dolzer had won their case, arguing that the public's fear of EMFs played a large role in driving down their property's value. The Supreme Court's four-member majority based its order for a new trial on legal issues separate from EMF questions.

The Dolzers contend that VEPCO's two 230 kV transmission lines on their property significantly depreciated the overall value of their 140-acre farm. The utility, based in Richmond, had been granted a seven-acre easement by eminent domain in July 1993. Ten months later, at the Circuit Court in Louisa County, a jury valued the easement at $254,000 and assessed damages to the remaining property at $713,000.

At the Circuit Court, the Dolzers presented testimony from three experts—a broker and two real estate appraisers—who valued the farm at more than $1.5 million. The appraisers cited examples in which property values had depreciated by 50% or more due to concerns about EMFs from power lines, and they estimated the Dolzers' loss at over $650,000.

A real estate appraiser for VEPCO testified that the Dolzers should receive $15,000 for the easement, but no compensation for alleged devaluation to the remaining property.

The Supreme Court ruled that the Circuit Court had wrongly denied a motion in which VEPCO offered to offset the impact on the Dolzers' land values by limiting its access to the easement and by allowing railroad construction on it. Four judges favored a new trial without considering VEPCO's contention that the claim of public fear of EMFs is speculative.

In an unpublished opinion, the three dissenting judges agreed with the Dolzers' assertion that EMFs had devalued their property: "[T]he Dolzers' experts supplied the necessary quantification of damage to the market value of their remaining property caused by prospective purchasers' fear of EMF[s]."

VEPCO's attorney, Joseph Spivey of Hunton & Williams in Richmond, told *Microwave News* that he expects the new trial to begin early this summer. The attorney for the Dolzers, Charles Purcell of Purcell & Purcell in Louisa, did not respond to calls for comment.

In an article that appeared in the January 1996 *Appraisal Journal,* attorney Michael Rikon wrote: "It is entirely possible to conclude, after an EMF market study, that most parcels of EMF-affected property will have a restricted resale value."

Finnish Animal Study Suggests EMFs May Promote Tumors

Magnetic fields may indeed promote cancer in mice, according to a new study from Finland. In a paper presented at the *3rd International Congress of the European Bioelectromagnetics Association* in Nancy, France, on March 1, Dr. Jukka Juutilainen of the University of Kuopio reported that 50 Hz magnetic fields can accelerate the development of skin tumors induced by ultraviolet (UV) radiation.

"Magnetic fields seemed to increase the rate at which skin tumors appeared, although the total number of animals with malignant tumors was similar in all of the groups exposed to UV radiation," Juutilainen, who led the study, told *Microwave News*. But he cautioned that, "This is just one experiment that has not been replicated here or elsewhere."

Nevertheless, there is further support for the hypothesis that EMFs act as tumor copromoters in related, unpublished work by Drs. Craig Byus of the University of California, Riverside, and Maria Stuchly of the University of Victoria in British Columbia, Canada. In a study funded by the U.S. National Institute of Environmental Health Sciences (NIEHS), Byus and Stuchly saw a significant increase in skin tumors among mice that had been treated with DMBA, a known chemical carcinogen, and then exposed to 60 Hz magnetic fields and TPA, a known chemical promoter.

"We found more total tumors and a higher percentage of animals with tumors among the EMF-exposed mice," Byus said in a March interview, adding that he is preparing his results for publication. These findings were first reported at last June's Bioelectromagnetics Society annual meeting in Boston (see *MWN,* J/A95).

In addition, Dr. Wolfgang Löscher has observed a dose–response relationship between 50 Hz magnetic field exposure and the development of breast cancer among rats exposed to DMBA (see story on right).

The Finnish team used female mice genetically engineered to have multiple copies of a human gene that regulates the production of ornithine decarboxylase (ODC), a naturally occurring enzyme. ODC plays a key role in cell growth and differentiation.

The Finnish team used UV radiation to initiate tumors in both ODC-transgenic and normal mice. Three groups of 44 mice, each consisting of equal numbers of transgenic and normal mice, were exposed to a constant 1 G field, an intermittent field varying from 12.6 mG to 1.26 G for one hour (followed by two-hour breaks) or to UV radiation alone. A fourth group served as controls.

Juutilainen and coworkers found that by the end of the experiment, the number of mice with malignant tumors was similar in all UV-exposed groups. But "skin tumors appeared slightly sooner in the magnetic-field-exposed compared to the UV-only-exposed groups," Juutilainen said.

There was no significant difference between the groups exposed to a constant field and those exposed to an intermittent field, he noted.

In the exposed and control groups, the ODC-transgenic mice developed tumors more quickly than did the normal mice, Juutilainen said. But the results among the two types of mice were qualitatively similar. The strain of ODC-transgenic mice used in the experiment was established by Dr. Juhani Jänne and his group at the University of Kuopio. Jänne has an international reputation for his work in developing transgenic animals.

"ODC-transgenic mice have a greater susceptibility to cancer promoters," pointed out Byus. In 1987, Byus and Dr. Ross Adey of the VA hospital in Loma Linda, CA, reported that

Battelle Gets $1.5 Million To Repeat German Breast Cancer Study

Dr. Larry Anderson of the Battelle Pacific Northwest Labs in Richland, WA, has won a $1.5 million contract from the NIEHS to repeat Dr. Wolfgang Löscher's breast cancer study. Löscher and his associate Dr. Meike Mevissen, both of the School of Veterinary Medicine in Hannover, Germany, found that magnetic fields can promote the action of the carcinogen DMBA, increasing the rate of breast cancer among rats (see *MWN,* J/A93, J/F95, M/A95 and J/A95).

"We have had a number of conversations with Löscher and we plan to replicate his study as closely as possible," Anderson said in an interview.

Löscher told *Microwave News* that he is satisfied with Battelle's study design. "The statistical power of the replication study gives a 75% chance of replicating our findings," he said.

Beginning in July, Anderson's team will run a series of studies using a total of 1,300 rats. A set of three-month exposures will include an *exact* replication of Löscher's experiment, in which rats were given four 5 mg doses of DMBA over four weeks and were continuously (18.5 hrs/day) exposed to 1 G, 50 Hz magnetic fields. Anderson will conduct two other similar experiments, using 60 Hz magnetic fields at 1 G and at 10 G.

In a set of six-month studies, rats will be treated with a single 10 mg dose of DMBA before being subjected to one of the same three magnetic field exposures. Dr. Gary Boorman of the NIEHS favors using such a "standard" protocol—longer exposures and less total DMBA—because of its greater sensitivity to weak cancer promoters.

In each experiment, Anderson will measure melatonin levels, which Löscher found to be lower among EMF-exposed rats. The controls will be exposed to fields of less than 1 mG.

The Department of Energy also has a strong interest in Löscher's work and is funding him directly to confirm and extend his results. Löscher has been unable to secure financial support for his work in Germany since his results were published.

Dr. Bo Holmberg of Sweden's National Institute for Working Life in Solna is also trying to repeat Löscher's experiments (see *MWN,* M/A94).

EMF exposure stimulated transient increases in ODC activity *in vitro* (see *MWN,* N/D87).

The Finnish researchers used the experiment to test the hypothesis that increased ODC activity might explain why magnetic fields promote cancer. But the data did not support this. On the contrary, the team found that the effects of long-term magnetic field exposure were independent of those of high ODC activity.

Epidemiology Roundup

RF Exposure and Brain Tumors in U.S. Air Force

U.S. Air Force personnel exposed to RF/MW radiation had a 39% elevated risk of brain tumors, according to a study by Dr. J. Kevin Grayson of the Armstrong Laboratory at Brooks Air Force Base, TX. Grayson also found that exposure to low-frequency EMFs was linked to an increased brain cancer risk of 28%. Both results are of borderline statistical significance.

"This result could easily be explained in terms of bias," Grayson said in an interview. "This study is just a baby step—but you've got to start somewhere."

Grayson's research, published in the March 1, 1996, *American Journal of Epidemiology,* was carried out in response to concern among Air Force personnel about the relationship between cancer and RF/MW radiation from various kinds of electronic equipment, as well as EMFs from power lines and VDTs. He noted that, although there have been many occupational studies of EMFs and brain cancer, "Few epidemiologists have attempted to examine the association between exposure to [RF/MW] fields and brain tumor risk."

On-the-job exposure to low levels of ionizing radiation was not associated with an increased likelihood of brain cancer. Possible interactions between different types of fields were analyzed, but no increase in risk was found. Grayson concluded that the latter result "calls into question the role of extremely-low-frequency EMFs as a tumor promoter."

The study examined 230 cases of brain cancer from hospital records for 880,000 active-duty Air Force personnel. The data were from military records only; Grayson did not attempt any follow-ups on those who had left the service.

Exposure assessment was based on a job-exposure matrix, which drew on various sources. Overall, Grayson described exposure estimation as one of his study's main limitations. "The only recommendation I could make from here is that we do a prospective study and measure actual exposures," he said. "That's extremely expensive, but we're not going to have the answers until we do that."

A strong relationship was found between senior military rank and the chance of brain cancer. Grayson did not offer any explanation for this result, other than citing previous findings of an increase in risk at higher levels of socioeconomic status.

In a related paper in the February 1996 *Aviation, Space and Environmental Medicine,* Grayson and Dr. Terence Lyons, also of the Armstrong Lab, reported a higher incidence of certain cancers among flying than among nonflying officers in the U.S. Air Force. This study did not examine possible effects of EMFs and RF/MW radiation.

No EMF Effect on Overall Mortality

In a study of 22,000 utility workers at Hydro-Québec, researchers at McGill University in Montreal, Canada, found no increase in overall mortality among those with relatively high EMF exposures. But they cautioned that "small numbers and approximate exposure assessments preclude the denial of any risk, in particular if it were to affect a rare cause of death."

Writing in the January 1996 issue of *Occupational and Environmental Medicine,* Drs. Dalsu Baris, Ben Armstrong, Jan Deadman and Gilles Thériault explained that they conducted this study because, "Nearly all epidemiological studies have focused on cancer, with no attention given to other causes of death." They analyzed data from a cohort of Hydro-Québec employees that was used in their earlier Canadian–French study of occupational EMF exposure and cancer risk (see *MWN,* M/A94 and N/D94).

They did find a significant doubling of risk of death by accident or violence among workers with higher EMF exposures, part of which was attributable to electrocutions. In addition, Baris and coworkers saw some nonsignificant associations between EMF exposure and leukemia, brain cancer and suicide, and between pulsed EMFs and lung cancer.

Comparisons of utility workers with the general population—using standardized mortality ratios (SMRs)—showed that utility employees had generally *lower* death rates than the population as a whole. The research team attributed this finding to the "healthy worker effect"—the fact that those who hold a regular job are healthier, on average, than those who do not. Drs. David Savitz and Dana Loomis drew similar conclusions about SMR comparisons in their study of 139,000 American utility workers, which found an EMF–brain cancer connection (see *MWN,* J/F95).

Baris and his coworkers cautioned that the weak associations they observed may have been understated, due to potential biases in their study. But despite this uncertainty, they concluded, "These results are broadly reassuring that major causes of death are not strongly associated with exposure to electric and magnetic fields."

EMF–Suicide Link Not Strong

Baris's team at McGill also analyzed the relationship between death by suicide and EMF exposure, using data from the same cohort of Hydro-Québec utility workers.

Several earlier studies of residential exposure to power line EMFs had found an association with increases in suicides and/or symptoms of depression, although one other residential and two occupational studies found no such link (see *MWN,* M/J88, J/A92 and M/A94, and Baris's companion article in the January 1996 *Occupational and Environmental Medicine).*

The McGill researchers explained what might cause such a connection:

> EMFs have been found to reduce the production of melatonin hormone by the pineal gland and disturb its circadian rhythm. There is substantial evidence that disruption in the normal circadian rhythm of pineal melatonin secretion is associated with depression.

After examining the Hydro-Québec data, Baris's group found "mostly small, nonsignificant increases" among workers with higher-than-normal cumulative EMF exposure. One out of ten indices of EMF exposure did show a significant rise in the suicide rate, and this did not seem to be explained by confounding factors such as alcohol use and marital status. But the team did not put much weight on this finding, noting that this index had not been identified in advance as being more relevant than the others, and there was no evidence of a dose–response relationship. The researchers also noted that there were

many weaknesses in their ability to control for confounders.

"Thus," they concluded, "the evidence from this study for a causal association...is weak."

EPRI Study of Childhood Leukemia Survival

The Electric Power Research Institute (EPRI) is funding a $1,724,000 study on whether EMFs are related to survival or relapse among children with acute lymphocytic leukemia (ALL). The study will examine whether EMF exposure is associated with specific biological predictors of survival at the time of diagnosis, and will prospectively measure whether it is related to survival.

Researchers will measure EMF exposures of 610 children with ALL at three times over a three-year period, each measurement to be taken in a different season of the year. The children will be monitored by an EMDEX-Lite meter 24 hours a day over a several-day period. A pilot study conducted in 1991 at Children's Hospital at Stanford in Palo Alto, CA, determined that bedroom monitoring was "not...an adequate surrogate for personal monitoring."

"Since everybody pretty much agrees that EMFs don't initiate cancer, the question is whether they might be involved in other stages of the disease," Dr. Leeka Kheifets, head of EPRI's EMF health effects research, told *Microwave News*. "This is an innovative way to look at whether EMFs might influence late stages of carcinogenesis, in terms of promotion or progression."

The study is being led by the Western Consortium for Health, a nonprofit consulting group based in Berkeley, CA, which is affiliated with several Schools of Public Health in the University of California system. Also participating are the Pediatric Oncology Group, a health network that includes Children's Hospital at Stanford, and Enertech Consultants in Campbell, CA. The principal investigator is Dr. Donna Foliart of the Consortium's Moraga, CA, office.

Brain Cancer Among IBM Computer Programmers

Computer programmers at IBM Corp. with more than ten years on the job had three times as many brain tumors as other employees, according to a company-sponsored study. But the University of Alabama, Birmingham, researchers who did the study believe that the statistically significant finding "may be due to chance," because, as Dr. Colleen Beall explained, "There were too many inconsistencies in the data."

Writing in the March 1996 issue of *Epidemiology,* Beall and Dr. Elizabeth Delzell, Dr. Philip Cole and Ilene Brill reported that the higher risks for programmers were "unanticipated." Their research had focused on workers in "VDT development"—defined as jobs that involve "work on cathode ray tube displays...with the power on and the metal or plastic covers removed."

IBM originally commissioned the study after an unpublished epidemiological survey found "a cluster of three brain tumors" at a British IBM plant engaged in the development of VDTs and other products. The University of Alabama team examined 10,331 records

No Power Line Connection to Childhood Brain Tumors Seen

Two recent studies of childhood brain tumors did not find any clear-cut association between the disease and power lines.

Dr. Susan Preston-Martin of the University of Southern California School of Medicine in Los Angeles analyzed 298 children with brain cancer in Los Angeles County, while Dr. James Gurney, working at the Fred Hutchinson Cancer Research Center in Seattle, studied 133 children with brain tumors in western Washington state. Their papers were both published in the January 15, 1996, *American Journal of Epidemiology,* together with an invited commentary by Dr. Charles Poole of the Boston University School of Public Health and replies from the authors of the two papers.

Preston-Martin and colleagues measured EMF exposures directly and also used wire codes devised by Dr. Nancy Wertheimer and Ed Leeper in Denver. Higher-current wire codes correlated with higher measured EMFs, but the field levels within each wire code were much lower than for the same category in Denver. "Very-high-current configuration" homes in Los Angeles had fields only half as high as such homes in Denver, Preston-Martin reported.

Preston-Martin told *Microwave News* that in Los Angeles, 3 mG is "an exceptionally high field." Analyzing only the homes with fields this high gave results that were "consistent with the hypothesis of elevated risk," but the numbers involved were too small for a clear result. "It could be that Los Angeles is not a good place" for such a study, Preston-Martin said. She does not plan to do another case-control EMF study but disagrees with those who call EMF research "junk science": "There is something going on and it would be good to get to the bottom of it."

Preliminary results from the Preston-Martin study had indicated a *higher* cancer risk for homes with *underground* service cables, a finding that she had described as "perplexing" (see *MWN,* N/D 94). She and her team have now concluded that this was "an artifact attributable to bias in the control selection process." Poole noted that while random-digit dialing and nonconcurrent control selection are popular because they are quick and inexpensive, the experience of Preston-Martin's team "should make others think twice" about the possible pitfalls of these practices.

"My work does not indicate that there is a relation between childhood brain tumors and wire codes," Gurney said in an interview. "My opinion is that we are not going to resolve the magnetic field issue with any more wire code studies," he added. The study by Gurney and coworkers did not directly measure field levels, but used wire codes only. Gurney is now at the Wayne State University School of Medicine in Detroit.

Drs. David Savitz of the University of North Carolina, Chapel Hill, and Bill Kaune of EM Factors in Richland, WA, both told *Microwave News* that field levels in Seattle-area homes are more similar to those in Denver than to those in Los Angeles. But Wertheimer contended that, "It's tricky to apply our wire codes to mixed neighborhoods on the West Coast."

"These studies reduce the likelihood that magnetic fields from power lines are related to childhood brain cancer," commented Savitz.

Poole wrote that these negative findings on brain tumors are independent of previous findings on childhood leukemia. Nonetheless, he added, they "might weaken" the EMF–leukemia link. To argue otherwise, he wrote, "one would be obliged to conclude that both [Wertheimer's and Savitz's] earlier studies were 'false positives' for brain cancer but 'true positives' for leukemia."

Poole also argued that "publication lies much closer to the beginning than to the end of peer review." In highlighting what he called "the postpublication phase" of the peer-review process, Poole urged investigators "to view publication not as a claim to knowledge, but simply as an open invitation to inspect one's results." Wertheimer concurred, and said, "We need to study *why* different studies have produced different results if we are to avoid regressing to an argument of 'Is not!' versus 'Is too!'"

in IBM's U.S. mortality file, all for employees who had worked for the company after 1967, and analyzed 149 cases of brain cancer. They write that they found that there was "no meaningful association between VDT development work and brain tumor mortality." They did find somewhat higher brain cancer rates in the broader category of "engineering/technical workers," but this increase was less than that found among programmers.

For programmers, the chance of brain cancer rose along with the number of years spent on the job. Those with five to nine years' experience had a risk that was twice as large as for other workers, and for ten or more years, the risk tripled. The likelihood of gliomas, a specific type of brain tumor, also rose as the length of time spent in programming increased.

Beall and her coworkers doubt that this reflects a real job-related health risk or that VDTs might have been to blame. They noted that programmers in different departments faced varying levels of risk, and that before 1975, programs were usually written and corrected on paper, not on computer display screens.

Beall, who is now at the University of Alabama's Tuscaloosa campus, told *Microwave News,* "I personally don't think it's too likely" that the IBM programmers' increased risk could have been related to EMF exposure. Does the question deserve more research? "If it were up to me," she answered, "I wouldn't put a lot of resources into that. I think our findings are more likely to have been a result of chance." Cole, one of Beall's Birmingham colleagues, has been a frequent expert witness for utilities, testifying that EMFs pose no cancer risk.

A number of recent studies have focused on the relationship between brain tumors and EMFs (see p.7 and *MWN,* M/A90 and J/F 96). An Australian study in 1992 found that women working at VDTs developed gliomas at almost five times the normal rate (see *MWN,* J/A92). Half of the subjects in that study were computer programmers. But no increased risk was found among men in that study, while among IBM programmers there was no increased risk for women.

HIGHLIGHTS

Mobile Phone Health Standards: ICNIRP Follows European Proposal, Looser than ANSI and NCRP

The International Commission on Non-Ionizing Radiation Protection (ICNIRP) has issued limits for human exposures to cellular phones that are similar to those proposed in 1994 by the European Committee for Electrotechnical Standardization, known as CENELEC. The ICNIRP guidelines are weaker than those adopted by both ANSI/IEEE and the NCRP.

In a statement published in the April issue of *Health Physics (70,* pp.587-593), the ICNIRP recommends maximum localized specific absorption rates (SARs) of 2 W/Kg for the public and 10 W/Kg for workers—the same levels under review by CENELEC. The 1992 ANSI and the 1986 NCRP guidelines prescribe two sets of stricter partial-body SARs—1.6 W/Kg and 8 W/Kg.

The ICNIRP also follows the European guidelines in that SARs are averaged over any 10 g of tissue in the head, as compared to any 1 g of tissue, as recommended by ANSI and the NCRP. In general, as the averaging volume gets larger, compliance becomes easier.

In 1992, the International Non-Ionizing Radiation Committee of the International Radiation Protection Association (IRPA/INIRC)—ICNIRP's predecessor—proposed rejecting the 7 W exclusion clause that the committee had included in its 1988 RF/MW exposure guidelines (see *MWN,* M/J92). But in its final, published statement, the ICNIRP did not explicitly abandon the exclusion clause; rather it specified the 10 W/Kg localized SAR for workers that had been recommended in 1988. The 1988 standard did not include a partial-body recommendation for the general public.

"The ICNIRP definitely does not support any exclusion that violates the basic SAR limits," Rüdiger Matthes, scientific secretary at the ICNIRP, told *Microwave News*.

Reprinted below are ICNIRP's conclusions in the statement, "Health Issues Related to the Use of Hand-Held Radiotelephones and Base Transmitters."

1. The results of published epidemiological studies do not form a basis for health hazard assessments of exposure to RF fields, and neither can they be used for setting quantitative restrictions on human exposure. They do not provide a basis for hazard assessments in relation to the use of hand-held radiotelephones and base transmitters.

2. Data from laboratory studies relevant to cancer do not provide a basis for limiting exposure to the fields associated with the use of hand-held radiotelephones and base transmitters.

3. Limits for human exposure to the fields associated with the use of hand-held radiotelephones and base transmitters should be those of the INIRC (IRPA/INIRC-1988 [see *MWN,* J/F88]) for whole-body average SAR[s] and those of ICNIRP for localized SAR[s] set out in this document.

4. There is no substantive evidence that adverse health effects, including cancer, can occur in people exposed to levels at or below the limits on whole-body average SAR[s] recommended by INIRC (IRPA/INIRC-1988) or at or below the ICNIRP limits for localized SAR[s] set out in this document.

5. At the frequencies and power levels involved in the use of hand-held radiotelephones, there will be no concern about shocks and burns.

6. The localized SARs in the head associated with the use of hand-held radiotelephones must be assessed for each frequency and configuration used.

7. For hand-held radiotelephones used in occupational situations, ICNIRP recommends that the localized SAR in the head be limited to 10 W/Kg averaged over any 10 g mass of tissue in the head (0.1 W absorbed in any 10 g mass of tissue in the head).

8. For hand-held radiotelephones used by the general public, ICNIRP recommends that the localized SAR in the head be limited to 2 W/Kg averaged over any 10 g mass of tissue in the head (0.02 W absorbed in any 10 g mass of tissue in the head).

9. The use of radiotelephones should be restricted to areas where

interference effects are unlikely to occur (for example, well away from hospital intensive care departments and similar locations). Manufacturers of electrical equipment are encouraged to design and manufacture equipment that is insensitive to RF interference.

The ICNIRP members that drafted the statement are: Drs. Anders Ahlbom, Karolinska Institute, Stockholm, Sweden; Ulf Bergqvist, National Institute for Working Life, Solna, Sweden; Jürgen Bernhardt, Institute for Radiation Hygiene (IRH), Neuherberg, Germany; Jean-Pierre Césarini, Fondation Rothschild, Paris, France; Louis Court, Center for Military Health Research, La Tronche, France; Martino Grandolfo (vice chairman), National Institute of Health, Rome, Italy; Henri Jammet (chairman emeritus), Paris, France; Rüdiger Matthes (scientific secretary), IRH, Germany; Alastair McKinlay, NRPB, Chilton, U.K.; Michael Repacholi (chairman), Royal Adelaide Hospital, Adelaide, Australia; David Sliney, U.S. Army Center for Health Promotion and Preventive Medicine, Aberdeen Proving Ground, MD, U.S.; Jan Stolwijk, Yale University, New Haven, CT, U.S.; Mays Swicord, Motorola, Plantation, FL, U.S. (formerly FDA, Rockville, MD); Laszlo Szabo, National Research Institute for Radiobiology and Radiation Hygiene, Budapest, Hungary; and Thomas Tenforde, Battelle Pacific Northwest Labs, Richland, WA, U.S.

FCC–EPA on RF & EMF Levels at Amateur Radio Stations

A survey of nine amateur radio stations by the FCC and the EPA found that most meet current RF/MW guidelines for human exposures in accessible areas.

Typical readings in accessible areas near antennas and equipment were 1-20 V/m for RF electric fields and less than 50 mA/m for RF magnetic fields, concluded authors Dr. Robert Cleveland of FCC's Office of Engineering and Technology (OET) in Washington and Edwin Mantiply of EPA's National Air and Radiation Environmental Lab in Montgomery, AL.

The highest readings were near vehicle-mounted antennas and wire antennas mounted just above a roof or a yard—some of these levels exceeded the ANSI/IEEE guidelines. Levels in inaccessible areas close to the installations reached 237 V/m and 1,350 mA/m. The measurements were taken under conditions Cleveland and Mantiply believe would result in "worst-case" exposures.

The operating power of the antennas ranged from 100 watts to as much as 1,400 watts at frequencies between 1.8 MHz and 250 GHz.

Although published earlier this year, the report is based on measurements originally made in 1990 at stations in Southern California that used a wide variety of equipment. There are currently more than 500,000 licensed amateur radio operators in the U.S.

Measurements of 60 Hz magnetic fields were also taken at the operators' locations. The levels were as high as 14 mG but were generally less than 4 mG, according to the report. Unlike the RF surveys, however, no attempt was made to find the maximum EMF levels, Cleveland told *Microwave News.*

While the FCC currently excludes amateur operators from being routinely evaluated for compliance with RF guidelines, this policy is being reevaluated (see p.1). "Data obtained as a result of this study will assist the FCC in determining how to ensure compliance with new RF guidelines that may be adopted in the near future," wrote Cleveland and Mantiply.

The 55-page report, *Measurements of Environmental Electromagnetic Fields at Amateur Radio Stations* (FCC/OET ASD-9601), is available for $23.50 from: The National Technical Information Service, Springfield, VA 22161, (800) 553-6847; Order No. PB 96-145016. It can also be ordered from the International Transcription Service Inc. at (202) 857-3800. For further information, call the OET RF Safety Program at (202) 418-2464.

Millimeter-Wave Eye Research Funded by Hewlett-Packard

Hewlett-Packard Co. (HP) is funding research into the effects of millimeter waves on the eye. The company is supporting a study on safety issues for a new class of short-range computer communications devices that would operate at 59-64 GHz. "We don't want to have products that cause any harm," HP's Cynthia Johnson said in an interview.

At the same time, HP is intensively lobbying the FCC to choose the less stringent of two proposed exposure standards for this part of the spectrum (see p.11). The company has told the FCC that a 5 mW/cm^2 limit could make its new technology "impractical," and is unnecessary because "scientific data simply does not exist for health effects of power levels at these frequencies."

"Millimeter waves don't penetrate beyond four-tenths of a millimeter into the skin," said Johnson, HP's government affairs manager, in Washington. She explained that for this reason, "The only place there could be any reason for worry is in the eye."

HP has given a total of $96,000 to Henry Kues of the Johns Hopkins University's Applied Physics Laboratory in Laurel, MD, to study the effects of 60 GHz continuous-wave exposure on the eyes of rabbits. Previous work in Kues's lab has shown damage to the eyes of monkeys at microwave frequencies of between 1.2 and 2.85 GHz (see *MWN,* J/A83, S/O86, J/A87, J/A88 and S/O91). Pulsed microwaves caused much more damage at the same power levels than did continuous waves. Drugs used for treatment of glaucoma also led to effects at lower power levels.

"Ours is one of the few, if not the only, study that I know of at 60 GHz," Kues said of his new research for HP. Because these higher-frequency waves do not penetrate as deeply as the microwaves he has studied previously, Kues will look at possible damage to the cornea and the iris, but not the retina, which is at the rear of the eye. In an interview with *Microwave News,* he said that he may report some initial results at the Bioelectromagnetics Society meeting in June.

Damage to the corneas of rabbits exposed to 35 GHz millimeter waves was found by Dr. John Trevithick of the University of Western Ontario in London, Canada, in the late 1980s, in work that has been recently submitted for publication. In a 1995 report to the U.S. Army Medical Research and Materiel Command, which funded the research, Trevithick stated that damage was found with pulsed signals as low as

30 mW/cm^2 (see also *MWN,* S/O86).

In research done under contract for Bell Labs in the mid-1970s, Saul Rosenthal and colleagues at what is now Polytechnic University in Brooklyn, NY, found damage to rabbit corneas after both 35 and 107 GHz continuous-wave exposures at estimated power levels down to 26 mW/cm^2. They also found transitory effects below 10 mW/cm^2.

In more recent studies, Drs. Werner Grundler and Friedemann Kaiser in Germany have found effects at millimeter-wave frequencies on the growth of yeast cells.

The FCC must soon adopt regulations covering the millimeter wave part of the spectrum, and it is considering both the NCRP standard of 5 mW/cm^2 and the ANSI/IEEE standard of 10 mW/cm^2. A March 4 letter from HP's Johnson to the FCC blasted the NCRP standard, stating that it "cannot be considered to be the product of scientific method." Johnson told *Microwave News* that, "It would make us cut our power to such a point that millimeter-wave applications wouldn't make sense,"

Wireless local area networks for computers and point-to-point links between buildings are some of the products that HP is planning for the millimeter-wave band. In the 59-64 GHz frequencies that HP wants to use, millimeter waves are absorbed by oxygen molecules—which means that the strength of the signal falls off rapidly with distance.

"This oxygen-absorption band is especially suited for short-range communication, so you need more power to boost your range," Johnson explained. HP intends to develop what Johnson called "hot spot" applications—communications and data links in localized settings such as airports, campuses and shopping malls.

RF/MW Safety Standards and the New Telecom Law

New Law Helps Pacific Bell Beat Tower Opponents

The new telecommunications law has already had an impact on antenna siting decisions in three California cities. Federal preemption of safety issues (see box on right) helped Pacific Bell win approval for antenna construction in San Diego, San Francisco and San Jose—part of the $1.7 billion personal communications services (PCS) system it is building in California and Nevada.

In San Francisco, residents concerned about possible health effects from rooftop towers organized a petition drive and demonstration. They cited the California Public Utilities Commission's recent recommendation that cellular phone towers be kept away from schools and hospitals (see *MWN,* N/D95). But on March 7 the San Francisco Planning Commission voted 5-1 to give Pacific Bell the go-ahead.

"We've been preempted by the feds on the health concerns," Commissioner Kelly Hayden explained to the *San Francisco Chronicle*. While commission members had expressed sympathy with opponents' health worries, they were told by the city's legal department that the city could not set its own emissions standard under the new federal law.

One of the anti-tower petitions had been signed by Nobel Prize-winning physicist Dr. Martin Perl of Stanford University in Stanford, CA. Perl told *Microwave News* he had no further comment on the controversy.

In San Diego, opposition to Pacific Bell's towers focused more on potential interference from digital PCS phones to hearing aids and pacemakers (see *MWN,* J/A94, M/J95 and J/F96). San Diego's City Council voted 8-1 on February 13 to delay its decision for a month, responding to protests from a coalition of advocates for the hearing-impaired, senior citizens and investors in a rival type of digital technology. But on March 19 the council voted 5-3 in favor of Pacific Bell.

Bill Hart of the Personal Communications Industry Association (PCIA) in Alexandria, VA, said in an interview that FCC Chair Reed Hundt had intervened in San Diego by notifying the City Council that it could block Pacific Bell only if the antennas would violate specific zoning regulations. "That was something that we at PCIA helped to get in the language of the law," said Hart.

San Jose's planning commission gave its approval to Pacific Bell on March 27, ending a city-imposed delay. According to Pacific Bell's Lou Saviano in San Francisco, federal preemption of safety issues played a role in San Jose as well.

What the Telecom Law Says

Under the Telecommunications Act of 1996, which President Bill Clinton signed into law on February 8, state and local governments will retain general authority in "placement, construction and modification of personal wireless service facilities," but can no longer deny permits based on RF/MW levels.

The FCC will be responsible for RF/MW guidelines and must adopt an exposure standard before August 5, 1996. By the same date, President Clinton must present a plan by which federal agencies will make government property available for cellular facilities.

Specifically, the law states that state and local governments:

- Cannot set RF/MW standards that are stricter than those specified by the FCC in the siting of "personal wireless service facilities";
- Cannot "unreasonably discriminate" among cellular providers but can favor some applicants on the basis of aesthetic, visual or safety concerns;
- Cannot ban cellular facilities entirely—siting decisions must be made on a case-by-case basis;
- Must handle siting requests within a "reasonable period of time";
- And must have a written record of any decision denying the placement, construction or modification of cellular facilities.

The new law also enables anyone adversely affected by state or local government decisions to pursue court action or petition the FCC for relief in cases that are inconsistent with RF/MW regulations.

is acceptable. They argue that the ANSI standard is more recent, better reflects the consensus of the RF/MW community and is the product of a more open process.

On March 11, 1996, Dr. Eleanor Adair of the John Pierce Laboratory, Dr. C.K. Chou of the City of Hope National Medical Center, Dr. John Osepchuk, formerly of Raytheon Co., and Ron Petersen of AT&T Bell Labs, as well as representatives from the Cellular Telecommunications Industry Association (CTIA), met with senior FCC staff members to urge the adoption of the ANSI limits.

It would be a "serious mistake" for the FCC to adopt the NCRP guidelines, Adair wrote in a March 14 letter distributed to FCC staff by the CTIA. She warned that "utter confusion" would result from the FCC's reliance on the NCRP's 1986 report (see comments on right). Dr. Arthur (Bill) Guy, a professor emeritus at the University of Washington, Seattle, and Chou also submitted their own letters.

Adair, Chou and Guy were intimately involved in developing both the ANSI and NCRP standards. Chou and Guy are currently working on the CTIA's research program investigating the safety of cellular phones.

The strongest criticism of the NCRP report came in a March 4 letter from Hewlett-Packard Co. to FCC Chairman Reed Hundt. "The NCRP guidelines are seriously flawed" and "arbitrarily set limits that lack scientific basis," wrote the company's Cynthia Johnson. "The NCRP report has not even been subject to true peer review," she stressed.

Arthur Varanelli of Raytheon used e-mail to register a similar point: "There are aspects of the NCRP document that lend credibility to the unsubstantiated claims of nonthermal effects and modulation, and likewise encourage 'prudent avoidance' philosophies."

In a February 23 statement, the National Association of Broadcasters (NAB) argued that the ANSI standard is "the only rational choice."

Motorola is one of the few companies on the sidelines. Spokesperson Norman Sandler said that Motorola does not have a strong preference between the two standards. "They are essentially the same with respect to specific absorption rates," he said in an interview from his office in Schaumburg, IL. He added that Motorola wants the matter resolved soon. "Our position is that the public interest is best served by bringing this proceeding to a close."

The EPA appears to stand alone. In comments filed with the FCC in November 1993, the EPA called the ANSI standard "seriously flawed." The EPA disputes the ANSI high-frequency exposure limit of 10 mW/cm^2, its imprecise distinction between "controlled" and "uncontrolled" environments, the absence of special precautions for high-risk individuals (for instance, those with heart conditions) and the fact that the limit is based only on thermal effects (see *MWN,* J/F94).

The Electromagnetic Energy Association (EEA), a trade group based in Washington, has tried to convince the EPA to support the ANSI standard instead of setting its own RF/MW exposure guidelines. The EEA argued its case in a series of letters sent to EPA's Office of Radiation and Indoor Air (ORIA) last spring and at a June 1995 meeting with Ramona Trovato,

ANSI Is Better than NCRP Because...

Below are excerpts of comments sent to the FCC urging the adoption of the 1992 ANSI/IEEE RF/MW exposure guidelines.

Were the commission...to reject the overwhelming majority of the comments in this proceeding and focus solely on brief comments of the staff of the [EPA]—an agency which largely has discontinued its RF radiation regulatory and research program—we would have the classic case of the government listening only to the government.

—National Association of Broadcasters, February 23, 1996

No reasons are presented in the NCRP report to explain or justify the recommendations and conclusions. Therefore, these recommendations cannot be considered to be the product of scientific method. As is apparent from even a cursory review of the report, not a single peer-reviewed paper on millimeter waves was referenced....Indeed, as a purely academic matter, the NCRP report has not even been subject to true peer review. The NCRP report was, in fact, subject to a much more casual review than any ordinary scientific paper would undergo. According to NCRP staff, the recommendations simply were reviewed by unnamed NCRP council members who may or may not be experts in this field. In short, the NCRP report does not even constitute a conclusive academic study of the problem at this stage and, therefore, it should not be used to guide an industry.

—Cynthia Johnson, Hewlett-Packard, March 4, 1996

Adoption or incorporation of NCRP Report No. 86 will result in increased nuisance litigation for persons and companies involved with [RF] radiation. As we have seen with the global reaction to the "leaked" NCRP pseudoscience report on 60 Hz, where fear and suspicion about home appliances has been inflamed, the use of anything but a legitimate consensus standard, such as ANSI/IEEE C95.1-1992, will entice people to consider as legitimate the "standard" promulgated by the FCC. The resulting conflict will increase litigation concerning products, services and installations previously "approved" by the FCC.

—Frank Kendall, Raytheon, March 11, 1996

The differences between the ANSI/IEEE and NCRP guidelines emphasized by EPA do not involve significant public health concerns but rather reflect the preferences of the EPA technical staff. In fact, the ANSI/IEEE standard arguably provides a *higher* level of protection than the NCRP standard.

—Cellular Telecommunications Industry Association, March 11, 1996

I am greatly disturbed by news that the FCC intends to adopt all or part of the 1986 NCRP report...instead of the ANSI/IEEE C95.1-1992 standard....I currently serve on the newly formed NCRP Scientific Committee 89-5, charged with revision of the 1986 report, and can already assure you that this revision will in no way resemble its 1986 predecessor. The exposure criteria will, in fact, closely reflect the more up-to-date ANSI/IEEE C95.1-1992 standard developed by IEEE SCC28, subcommittee 4, of which I served as cochairman until late 1995.

—Dr. Eleanor Adair, John Pierce Laboratory, March 14, 1996

I believe that it would be a mistake for the FCC to adopt the older 1986 NCRP standard at this time, considering the fact that newer and more advanced standards have been developed since the publication of the NCRP standard....

—Dr. Arthur Guy, University of Washington, Seattle, March 14, 1996

the director of ORIA. Sources told *Microwave News* that the EEA's intense—and sometimes heavy-handed—lobbying deterred the EPA from proposing its own RF/MW guidelines. AT&T Bell Labs, the CTIA, the NAB and Raytheon are all members of the EEA.

The FCC has not indicated what direction it will take, but has previously maintained that it will defer to government health agencies in its decision.

On March 26, however, at the CTIA convention in Dallas, FCC Commissioner Rachelle Chong, who will have a say in the final decision, told attendees that she is "comfortable" with the ANSI standard.

Commentary: ANSI/IEEE v. NCRP *(continued from p.1)*

decisions. Dr. Mays Swicord, formerly with the FDA and now at Motorola, was so incensed that he threatened to stop at a local bar on his way to the next subcommittee meeting to pick up a few sots to vote his way.

"I am not happy with the process," complained Dr. Elliot Postow sometime later. Postow, a former Navy man now with the National Institutes of Health, had identified 17 of the 31 members of the IEEE committee as being associated with the Department of Defense (DOD). Even Dr. Om Gandhi of the University of Utah in Salt Lake City, the cochair of the subcommittee that wrote the standard, warned that this "is not going to sit well with the public."[2] An investigation was promised but was soon abandoned.

Similar complaints had been lodged years earlier. In 1984, Dr. Nicholas Steneck, a professor of history at the University of Michigan and the author of a book on how the ANSI RF/MW radiation standards were set, put the ANSI leadership on notice: "It is irresponsible and possibly immoral to continue with the status quo," he wrote.[3]

Not long afterwards, EPA's Dr. Carl Blackman and a number of others became so concerned over what they perceived as improprieties in the subcommittee's work—for instance, deciding on proposed limits before the scientific data had been reviewed—that they refused to vote, stalling progress on the standard.[4] The impasse was finally cleared when the IEEE stepped in and indemnified all those working on the standard against future liability.

Any suggestion that the ANSI exposure standard was based on the best available science is insupportable. Take, for example, the decision to double the high frequency limit to 10 mW/cm^2—one of the EPA's principal objections against the ANSI standard. The move to abandon the NCRP limit of 5 mW/cm^2 above 3 GHz was proposed as early as 1986, the year the NCRP guidelines were released. It was as contentious then as it is today.

This proposal was not driven by any sudden breakthroughs. The only rationale was to make the RF/MW limit consistent with a laser standard above 300 GHz[5]—a strange argument which prompts people to scratch their heads and ask why a standard should be changed below 3 GHz to meet an unrelated standard in a different part of the spectrum. In 1989, it was still a sore point. If the limit were doubled, "We would look like yo-yos," cautioned Dr. Quirino Balzano of Motorola.[6] But those in control had already made up their minds in favor of the 10 mW/cm^2 limit.

Or consider the cancer question. The ANSI/IEEE document is totally silent about it. Indeed, there is no indication that the IEEE ever discussed it—an inexplicable lapse, since Dr. Bill Guy, one of the architects of the standard, ran a $5 million animal exposure study at 2450 MHz that many observers are convinced showed a cancer risk.[7]

The NCRP committee, under the chairmanship of Guy himself, had essentially completed its report when his cancer results emerged. But the council realized that it could not release the report without addressing the Guy study. In contrast, the IEEE committee, with Guy as its vice chairman and years to grapple with the data, simply ignored the issue.

Nor is cancer the only omission. The IEEE committee paid little, if any, attention to experiments showing effects on the eye, on the blood-brain barrier and on the nervous system—all at specific absorption rates well below the ANSI and NCRP threshold for ill effects of 4 W/Kg.

The EPA and NIOSH, two health agencies that have studied the RF/MW health data for decades, have each advocated pegging the threshold to 1 W/Kg for the public and to 2 W/Kg for workers, respectively.

Ironically, whether the FCC elects to follow ANSI or the NCRP will not make any difference in the siting of cellular phone towers—the principal reason for the congressional mandate to set standards. Nor will it make much difference to the broadcasters. So why are the CTIA and the NAB fighting so hard to promote the IEEE and ANSI at the expense of the NCRP? And why are so many engineers and physicists lobbying against a standard that they helped write and are now in the process of revising?

The answer is that if the FCC favors the NCRP guidelines, it will diminish the influence of the IEEE's SCC28 committee, which industry and the military effectively dominate. AT&T, the CTIA, Raytheon and the DOD know a good thing when they have it and are fighting to retain control.

The NCRP is a conservative organization, but since it is a congressionally chartered body there is a degree of public oversight. It was this measure of accountability that forced a discussion of the Guy cancer results in 1986.

This also helps explain why so many people involved in writing the NCRP standard are now attacking it. They are comfortable working hand in glove with the military and with industry. But they are uncomfortable with public accountability, even in very small doses.

The FCC is supposed to base its decisions on the public interest. It has long maintained that it would defer to the federal health agencies on RF/MW standards. If so, it has no choice but to listen to the EPA and favor the NCRP guidelines.

1. See *MWN*, S/O89.
2. See *MWN*, J/A90.
3. See *MWN*, O84.
4. See *MWN*, J/A86.
5. See *MWN*, J/A86.
6. See *MWN*, S/O89.
7. See *MWN*, J/A84, Mr85 and N/D86.

RECENT BOOKS

P. Baraton and B. Hutzler, ***Magnetically Induced Currents in the Human Body,*** Geneva, Switzerland: International Electrotechnical Commission (IEC), 1995, 45 pp., 105 SwF (approximately $88.25), including postage. Contact: IEC Central Office, 3 rue de Varembé, PO Box 131, 1211 Geneva 20, Switzerland, (41+22) 919-0211, Fax: (41+22) 919-0300.
Describes a method for calculating the relationship between external magnetic fields and induced electric fields and currents in the human body. The authors, both of Electricité de France, the national utility, conclude that "overhead lines and domestic appliances do not pose any field problem for the general public," but add that occupations with high exposures "merit a deeper analysis."

David Bates, ***Environmental Health Risks and Public Policy: Decision-Making in Free Societies,*** Seattle: University of Washington Press, 1994, 117 pp., $12.95 (paperback). Contact: University of Washington Press, PO Box 50096, Seattle, WA 98145, (206) 543-4050, Fax: (206) 543-3932.
Bates, professor emeritus at the University of British Columbia in Vancouver, discusses how public policy has evolved around five environmental health risks—air pollution, asbestos, cigarette smoking, EMFs and lead poisoning. "Public involvement in these five hazards has varied from intense, in the case of cigarettes and [EMFs], to episodic in the case of air pollution, to surprisingly almost absent in relation to lead," Bates writes.

Martin Blank, ed., ***Electromagnetic Fields: Biological Interactions and Mechanisms,*** Washington: American Chemical Society, 1995, 497 pp., $129.95. Contact: American Chemical Society, PO Box 57136, Washington, DC 20037, (202) 872-4363, Fax: (202) 872-6067.
Includes 26 papers on the characteristics of EMFs, cellular effects, health risks, endogenous fields, biophysics and medical applications. "All of these papers were peer-reviewed," Blank, of Columbia University in New York, told *Microwave News.*

Jean-Marie Danze et al., ***Pourquoi et Comment: Mesurer Les Champs Electriques et Magnetiques 50/60 Hz,*** Paris, France: Encre, 1994, 151 pp., 120 FF (approximately $24.50). Contact: Encre/Sté ARYS, 8 rue Darwin, 75018 Paris, France.
A French–Belgian team assembled this how-to book on measuring EMFs. Much of the equipment described is manufactured in the U.S.

R. Timothy Hitchcock and Robert Patterson, ***Radiofrequency and ELF Electromagnetic Energies: A Handbook for Health Professionals,*** New York: Van Nostrand Reinhold, 1995, 542 pp., $84.95. Contact: Van Nostrand Reinhold, 115 Fifth Ave., New York, NY 10003, (800) 842-3636, Fax: (606) 525-7778.
Hitchcock, an industrial hygienist at IBM, and Patterson, a professor of environmental health engineering at Temple University in Philadelphia, have assembled a great deal of data—with hundreds upon hundreds of references. Unfortunately, they have made little effort to help the reader distinguish the strong from the weak studies. The chapter on power frequency EMFs is particularly weak and appears to have been added as an afterthought. (They fail even to mention the Swedish, Danish and Finnish childhood epidemiological studies that have been the focus of international attention.) Transients are also ignored. These omissions are surprising, given that Patterson used to work at EPRI.

B. Blake Levitt, ***Electromagnetic Fields: A Consumer's Guide to the Issues and How to Protect Ourselves,*** San Diego: Harcourt Brace & Co., 1995, 432 pp., $15.00. Contact: Harcourt Brace & Co., 525 B St., San Diego, CA 92101, (800) 543-1918, Fax: (800) 235-0256.
This lengthy discussion of the EMF debate by Levitt, a science writer based in Warren, CT, is intended for the lay audience. "The non-ionizing band of the electromagnetic spectrum will probably turn out to be far more significant than anyone heretofore imagined," she concludes.

Michael Milburn and Maren Oelbermann, ***Electromagnetic Fields and Your Health: What You Need To Know About the Hidden Hazards of Electricity—And How You Can Protect Yourself,*** Vancouver, Canada: New Star Books, 1994, 207 pp., C$16.00 (US$12.00). Contact: New Star Books, 2504 York Ave., Vancouver, BC V6K 1E3, Canada, (604) 738-9429, Fax: (604) 738-9332.
While the title implies that this is another self-help book, Milburn and Oelbermann, both EMF consultants in Waterloo, Ontario, provide a compelling discussion of the scientific debates regarding EMFs: "As biological effects from weak [EMFs] are not supposed to exist at all, a scientific battle royal is under way as the different personalities within scientific circles conflict. This is a side of science not often seen by the public." The book, which was released without fanfare in Canada a few years ago, has not received much attention in the U.S.

Charles Polk and Elliot Postow, eds., ***Handbook of Biological Effects of Electromagnetic Fields,*** Second Edition, Boca Raton, FL: CRC Press Inc., 1996, 618 pp., $125.00. Contact: CRC Press, 2000 Corporate Blvd., NW, Boca Raton, FL 33431, (800) 272-7737, Fax: (800) 374-3401.
This is a revised and updated overview of what is currently known about the biological effects of non-ionizing radiation. Topics treated briefly or omitted in the 1986 edition are now covered, including evaluations of recent epidemiological studies (see *MWN,* J/F96); the interaction of short-duration, high-intensity pulses with cells; and the use of low-frequency, pulsed EMFs in bone and soft-tissue repair. The chapters on the effects of static magnetic fields, ELF magnetic fields and unmodulated microwave radiation have been changed significantly, as have those on field computations and "window" effects, according to the editors. Polk is at the University of Rhode Island in Kingston and Postow is with the National Institutes of Health in Bethesda, MD. They note in their foreword that the contributors, who include many well-known researchers in the field, "have tried to differentiate between what is clearly established, what is suggested by available evidence without being convincingly proven

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and what is conjecture at the present time." CRC Press called the first edition, which sold 2,500 copies, a "best-seller," Polk told *Microwave News*.

Robert Proctor, ***Cancer Wars: How Politics Shapes What We Know and Don't Know About Cancer,*** New York: Basic Books, 1995, 368 pp., $25.00. Contact: Basic Books, 10 East 53rd St., New York, NY 10022, (212) 207-7057, Fax: (212) 207-7203.

Proctor traces the history of research on cancer and examines its political and social dimensions. "Such knowledge as we have of causes ...has done surprisingly little to aid us in our search for solutions," argues Proctor, a professor of history of science at Pennsylvania State University. While he cites the debate over the health effects of EMFs as one example of the many politically charged controversies surrounding cancer research, he does not discuss the subject in detail. Instead, he focuses on asbestos, natural carcinogens, radon and smoking. In a brief submitted in the *Covalt* case (see p.3 and *MWN,* M/J95 and N/D95), the plaintiffs' attorneys cite *Cancer Wars,* comparing Proctor's description of tobacco industry-sponsored research to the work done by utilities.

Russel Reiter and Jo Robinson, ***Melatonin: Your Body's Natural Wonder Drug,*** New York: Bantam Books, 1995, 290 pp., $22.95. Contact: Bantam Books, 1540 Broadway, New York, NY 10036, (800) 323-9872.

From soup to nuts on melatonin. A chapter on EMFs is included (see *MWN,* N/D95). Reiter is a professor of neuroendocrinology at the University of Texas Health Sciences Center in San Antonio, and Robinson is a medical writer in Portland, OR.

FROM THE FIELD

Clippings from All Over

You've probably heard all about it. A friend, a coworker or even your doctor has raved about it—melatonin. If you haven't tried the most exciting natural health discovery of the century, now is the time. The evidence is in, and it's overwhelming—melatonin can add up to 20 years to your life and make every one of them more vigorous and fulfilling than you ever dreamed possible. The all-natural hormone can: boost the immune system, beat arthritis, ease insomnia, prevent cancer, zap stress, help prevent heart attack and stroke, lower cholesterol, control high blood pressure and rev up your sex life. It's a fact, say doctors Walter Pierpaoli and William Regelson.

—John Latta, "Melatonin Miracle," *National Examiner,* p.22, February 20, 1996

"There's probably nothing on earth, or in the universe, that we understand as well as electromagnetic fields and the interaction of electromagnetic fields with matter, including biological matter."

—Dr. Robert Adair, Yale University, New Haven, CT, quoted by John Palfreman in "Apocalypse Not," *Technology Review,* p.26, April 1996

[T]he very fact that the APS made a statement dealing with epidemiology and leukemia is strange. The APS Council has as much competence in such areas as proctologists have in quantum theory.

Dr. A.R. Liboff, Oakland University, Rochester, MI, "Power Line Magnetic Fields Are Likely Related to Leukemia in Children (Despite the Opinion of the American Physical Society)," p.47

Improved epidemiological studies, in which exposure to 60 Hz magnetic fields is accurately determined, demonstrate a negligible risk. Relax. Make friends with your toaster. Save your candles for a blackout.

Dr. Robert Park, University of Maryland, College Park, and American Physical Society, "The Great Power Line Scare," p.49

—Both appearing in "Point/Counterpoint," *Alternative Therapies,* March 1996

"This is all for the benefit of those twerps who have these beastly [mobile] telephones. We don't need them. No one who uses one ever has anything useful to say."

—Quinlan Terry, an architect, on the proposed construction of three mobile phone towers in a picturesque valley northeast of London, quoted by Michael Horsnell in "Phone Masts Loom Over Constable Country," *The Times* (U.K.), February 19, 1996

Employers and owners of commercial facilities and offices would do well to keep informed on EMF issues and the outcome of related lawsuits. EMFs are pervasive—they are everywhere. We are all exposed to them and it may be only a matter of time before you or your business is the defendant in an EMF lawsuit. Moreover, there are questions about whether standard commercial liability insurance will afford coverage against such claims.

—James Otto and Alan Stazer of the Los Angeles law firm of Cummins & White in an article, *EMFs—Sources and Liabilities,* distributed by the Pollack PR Marketing Group, also in Los Angeles, with a March 14, 1996, letter to prospective magazine editors, offering "some solid advice from someone who knows what EMFs are all about."

"I trust the [cellular telephone] industry's studies as much as I trust Philip Morris' studies on tobacco."

—Robert Gardner, a Washington Township, OH, resident living near a proposed tower site, quoted by Ron Nissimov in "Praying for Deliverance," *Mansfield News Journal* (OH), p.1A, March 24, 1996

The introduction and widespread use of cellular telephones are very recent phenomena, and no epidemiologic studies have addressed the question of whether microwaves in the operating range of cellular telephones (800 to 900 MHz) might be related to cancer. Only if cellular phones influence a late stage in carcinogenesis would it be likely that epidemiologic studies could detect an effect at this time.

—Drs. Peter Inskip, Martha Linet and Ellen Heineman, "Etiology of Brain Tumors in Adults," *Epidemiologic Reviews, 17,* p.392, 1995

"The big challenge for policymakers will be deciding when to pull the plug on scientific research into the EMF–human health hypotheses. We are not there yet, but, in my opinion, we are getting close."

—John Graham, Harvard Center for Risk Analysis in Boston, quoted in "Graham: EMF Funds Can Be Better Spent," *EMF News,* p.2, March 25, 1996

[I]t may be time to consider the use of melatonin in specific clinical trials where free radical damage is a component of the disease process being studied.

—Dr. Russel Reiter, "Functional Diversity of the Pineal Hormone Melatonin: Its Role as an Antioxidant," *Endocrinology & Diabetes, 104,* p.15, 1996

Dr. Clark Heath of the American Cancer Society on EMF Epidemiology, Past and Future

Dr. Clark Heath, the vice president of epidemiology and surveillance research at the American Cancer Society in Atlanta, is skeptical about possible cancer risks from EMFs. His analysis, "EMF Exposure and Cancer: A Review of Epidemiologic Evidence," appears in the January/February issue of the society's journal, CA—A Cancer Journal for Clinicians. Microwave News *interviewed Heath in mid-March.*

Q: You describe the epidemiological findings of an EMF–cancer connection as "weak, inconsistent and inconclusive." Could you elaborate?
A: The epidemiological studies are weak because, except in some of the initial studies, the observed elevated risks are not very high. And there are no consistent dose–response relationships.

In epidemiology, a relative risk of two or less is not unlikely to reflect effects of confounding or study design problems. This is the level at which statistical noise starts to interfere with discerning real findings. So when you have low relative risks like that, you're very dependent on finding consistent results across many studies that are done in different ways. There's a lot of strength to that—having different methodologies yielding the same results. But I don't see that kind of pattern in the epidemiological work on EMFs.

In fact, the EMF data are inconsistent. For any one cancer or cancer hypothesis, some studies suggest one thing and others the opposite.

In addition, there's not an underlying foundation of basic biological research in other realms pointing in the same direction. Where cancer risk factors in humans have proved to be not just associations, but cause-and-effect associations, almost all of them involve this kind of coherence with biological data from other disciplines. These are conspicuously absent here.

Q: Do you think demonstrating a biological mechanism is necessary before drawing a conclusion on carcinogenesis?
A: No, I don't think it is absolutely necessary—when the studies are consistent, the risk levels are high and there is a dose–response relationship. If those things are present in epidemiological work, they can quickly lead to a strong belief in cause-and-effect. But none of those things are present so far in the mass of data on EMFs.

Q: What would convince you that EMFs increase the risk of cancer?
A: At this point, what would convince me fastest would be some reproducible biological research demonstrating a plausible mechanism.

Q: The Electric Power Research Institute's recent meta-analysis of occupational studies found "some support" for a small increase in brain tumor risk. What's your assessment of this paper?
A: I don't think it changes the picture very much. But the question of cause-and-effect is by no means closed, and I wouldn't deny that there's room for more research. Future epidemiological studies in this field are going to have to be a good bit more rigorous. They'll have to use methodological approaches that are very difficult to carry out—like being *prospective* rather than *retrospective,* and measuring actual exposures to fields instead of using surrogates. A lot of the literature in EMF epidemiology is devoted to this problem of exposure—whether you use wiring configurations, field measurements inside homes, reconstructed field levels from electrical current records, etc.

As far as summing up past research, I relied perhaps the most on the 1992 review by the British National Radiological Protection Board. I think they did a comprehensive job.

Q: You mentioned the reconstruction of past field levels. The Swedish study by Drs. Maria Feychting and Anders Ahlbom calculated historical field levels and found a link to leukemia. What do you think of their findings?
A: Well, this gained some objectivity by using records that existed before all of this controversy occurred—as opposed to having the idea in your mind when you stand outside a home, trying to make some judgment about the wires. I would feel more convinced by those findings if they were stronger, of course, and if they were coupled with individual measurements of exposure. Of course, that's impossible with those studies, because you can't turn back the clock. That's where prospective studies, where possible, would be useful.

Q: It has been proposed that EMFs may not initiate cancer but only encourage its growth once it exists, and that this may account for some of the inconsistency between studies. What's your opinion?
A: This might make sense if there were some supporting evidence from basic studies at the experimental level—if you had results from biomarker studies that might relate to promotion rather than initiation. But with the present data, I don't think this idea makes the cancer hypothesis any more provocative.

Q: There are various hypotheses about what might be the biologically relevant aspect of EMF exposure. How do you see this issue?
A: You can postulate lots of things about radiation. But any idea about the biological effects of EMFs would gain a lot of strength if you first asked the physicists whether *they* thought it made any sense. When the physicists look at radiation, they look to see whether it causes cell damage. When you get below ultraviolet radiation, it doesn't—other than when you use it for cooking.

Q: Do you think there's much evidence for nonthermal bioeffects?
A: Well, I think that there are some hypotheses that are intriguing, but they're no more than that without some basic evidence from laboratory experiments. That's not the area in which I'm an expert, nor did I try to review that literature. But as far as I'm aware, they haven't gotten to that stage yet.

Q: Some argue that if EMFs increased the rate of cancer, rising use of electric power would have created a cancer epidemic. You seem to reject this argument.
A: I don't believe that argument is as easily made as it seems on the surface. At the time I put the article together, I concluded that this was not a strong point on which to build a negative case. The arguments for why it was weak are well stated by [Dr. David] Savitz in his second methodological review. The trouble with arguing from these ecological studies, in which you make a population-specific observation, is that you still have to see how it correlates with individual people. By itself, it's very weak evidence, and its absence doesn't tell you much.

Q: Because there are so many other factors at work in that population?
A: It's a much more complicated scene—similar to questions about diet differences between Oriental countries and the West and the frequency of breast cancer. Those correlations seem very strong on the surface: low-fat diet, low breast cancer rates; high-fat diet, high breast cancer rates. But when you start looking at studies of individuals, asking people about their diet, the associations are not strong. Which do you believe? I prefer the individual-based studies.

Q: In your review, you note with concern that, "Considerable research funding is being devoted to the study of potential [EMF–cancer] links." Do you think too much money is currently going into EMF–cancer research?

A: I don't think so—to date. It's a hard thing to judge. This is a very important issue, if only because electrical power is so essential to our society and is so widespread. But in the face of repeatedly in-

consistent results, particularly in the face of the lack of coherent basic biological findings, one wonders where you draw the line. Funding such studies indiscriminately, without a lot of care in their design and direction, becomes more and more of a problem.

Q: Should we hold off on more epidemiological studies until there are clearer results on possible biological mechanisms?
A: For my part, I'd be inclined that way. I would be much more interested in this field if there were exciting biological findings at the basic research level—animal, molecular, what have you. I don't see that, and in the face of the weakness and fragility of the epidemiological findings, I don't think you're going to get anything stronger until there are clearer basic biological results.

Q: If you had $100 million to spend on cancer research, how much of it would you allocate to research on EMFs?
A: Not very much. What I would allocate would be towards very specific basic research by biologists—especially on the genetics of cell systems, on promotional agents and on interactions with the cell membrane. And I would pay a lot of attention to the physicists. I probably would *not* be inclined to spend much of that money on epidemiological studies.

Q: EMF effects on melatonin production have been cited as a potential mechanism by which EMFs might act to promote breast cancer. Do you think the idea of a link between breast cancer and EMFs is worth particular attention?
A: I haven't heard of any basic data that really support the idea. It's an intriguing idea. I think you could write a science-fiction novel about it. But I don't see the data to support it. The epidemiological data don't, and I haven't seen any basic biological work that's carried it much beyond the statement of a hypothesis.

Q: Are you familiar with Löscher's animal studies and the attempts to replicate them that are being funded by the NIEHS?
A: No, I'm not. Again, the article is a review of what has been published in the epidemiological literature.

Q: What's your opinion of "prudent avoidance"—taking low-cost measures to reduce the public's EMF exposures?
A: Avoidance of *what,* if no risk has been proven? I think that if there is a risk here, it's a very low risk. I haven't drawn a conclusion myself, but I tell people I don't think that the evidence supports that conclusion. There are a lot of situations in which hypothesized risks are suggested. You'd live in a cocoon, isolated from everything, if you paid attention to all of them.

Q: What do you think of specific policies, such as phasing power lines so that the surrounding EMFs are lower, or placing a child's bed on the opposite side of the room from the power service?
A: The science that's the basis for those decisions isn't sound at all. The one effect that has come out of this that may be *very* real is the increase in property-value litigation. And I suppose some measures to reduce EMFs, if they allay public concern, might have some cost savings on the litigation side that would make them moderately attractive. But I don't think that people should delude themselves into thinking that by taking such measures, they are avoiding a proven biological hazard.

When people call and ask me if they should buy a house near a power line, I say there's no good scientific evidence suggesting that that's a hazard. However, there's good evidence, scientific and otherwise, that it can have an effect on your pocketbook. It's like trying to sell houses near the Love Canal a decade ago. In fact, it's quite the same.

Q: Could you elaborate?
A: Well, at the time of the Love Canal controversy, there was concern about increased cancer and various other health risks. Clearly, there were toxic materials present in the canal, which it's known would cause harm if you were directly exposed at high doses. In that sense, Love Canal is *not* the same as the EMF issue. But despite the proximity of toxic materials to the homes, no firm evidence was ever found to show scientifically that they *had* actually harmed health. Nevertheless, the property values fell.

Q: Would you have bought a home there, leaving aside the financial risk?
A: It's not just the financial side. At that time—I don't know how it is now—there was a lot of community anxiety and concern, which really would shape the living environment in which you'd be buying a house. It's complicated.

Q: How likely is it that EMFs are just a phantom risk?
A: You mean, not a risk at all. Well, you're up against the old bugaboo—you can't prove a negative. You try to establish the existence of a negative by ruling out the positives, but you'll never have a pure negative finding. You just have to draw a conclusion about how the evidence looks as a whole.

After 10 or 15 years of EMF research, the existence of *any* hazard is still speculative. But I wasn't inclined in this review to overstate my conclusions and declare that the case is closed. It's obviously a very complicated issue, and not just a scientific one.

"MICROWAVE NEWS" FLASHBACK

Years 15 Ago

• In a letter to the *New England Journal of Medicine,* Dr. Hylar Friedman of the Army Medical Center in El Paso, TX, reports a link between microwave exposure and polycythemia, a rare blood disorder that entails an increased risk of leukemia.

• A workers'compensation board upholds a claim that Sam Yannon died from overexposure to RF/MW radiation on top of the Empire State Building while working for New York Telephone.

• The U.S. Secretary of the Navy recommends to the Secretary of Defense that the Navy ELF communications system be scrapped.

Years 10 Ago

• Rats chronically exposed to 60 Hz magnetic fields have a greater risk of birth defects and lower birth weights, according to a study by the Battelle Pacific Northwest Labs in Richland, WA.

• Sweden's Karolinska Institute in Stockholm announces that mouse fetuses exposed to pulsed magnetic fields like those from VDTs have five times the rate of malformations as unexposed controls.

• The NAB petitions the FCC to preempt state and local rules for RF/MW radiation and to adopt the 1982 ANSI standard.

Years 5 Ago

• A University of Southern California team in Los Angeles reports a significant link between wire codes and childhood leukemia.

• A police officer in San Francisco sues Kustom Signals contending that microwaves from traffic radar caused his melanoma.

• NIOSH finds no increased risk of miscarriage for telephone operators using VDTs, compared to those using other displays.

• A Seattle widow sues Seattle City Light, claiming that her husband, Robert Pilisuk, died of leukemia from exposure to EMFs.

MELATONIN

From Wonder Drug to Snake Oil... In retrospect, it was almost inevitable. New findings in melatonin research provoked a flurry of pop science books, with titles such as *Melatonin: Your Body's Natural Wonder Drug* (see p.14), *Stay Young the Melatonin Way* and even *The Melatonin Miracle*. The books led a *Newsweek* cover story last August 7 to declare, "Scientists say this hormone could reset the body's aging clock, turning back the ravages of time." Mainstream media enthusiasm spread to the supermarket tabloids: The *National Examiner* of February 20 called melatonin "the most exciting medicine of the century," and "an incredible cure-all that's set the medical world on fire" (see p.14). The paper breathlessly told its readers that "half of Hollywood is using it"—including the actor who plays Superman on TV. In the midst of this frenzy, several of the world's leading scientific journals did their best to set the record straight. In "Melatonin Madness," published in the December 29 issue of *Cell,* Drs. Steven Reppert and David Weaver of Harvard Medical School criticized an experiment conducted by the authors of *The Melatonin Miracle*. Drs. Walter Pierpaoli and William Regelson switched the pituitary glands of old and young mice and cited the results as proof that melatonin can reverse aging. But Reppert and Weaver had some news for the *Miracle* men: The strain of mice used in this experiment does not produce melatonin at all. The Harvard researchers discussed the fact that melatonin has "substantial biological effects" in humans beyond its role in sleep patterns, possibly including influences on the retina and on estrogen receptors. "This potential for interaction with other systems," they argued, "should raise concern about the indiscriminate, unregulated use of melatonin in humans." In the January 20 issue of *The Lancet,* contributing editor Dorothy Bonn noted dryly that, "Melatonin is freely available in the U.S.A., and apparently there has been no need for efficacy claims to be tested there....In the U.K., some other European countries and Canada, however, melatonin is now classified as a medicine and has been withdrawn from general sale." The title of a January 25 *Nature* article by well-known melatonin researcher Dr. Fred Turek of Northwestern University made his opinion clear: "Melatonin Hype Hard To Swallow." He wrote that in *The Melatonin Miracle,* "evidence contradictory to [the authors'] hypotheses is invariably ignored." For instance, the book touts melatonin's beneficial effects on sex drive, but Turek pointed out that "in many animals, treatment with melatonin is associated with gonadal atrophy." Turek called for more research and for large-scale clinical trials of the hormone's possible therapeutic effects. He warned that without such work, "unwitting customers of drug and health-food stores will be the test subjects for melatonin." The April *Journal of NIH Research* focused on this problem in an article, "Media Hype Helps Pill Marketers Cash In on 'Miracle' Melatonin." Reppert and Weaver's article in *Cell* concluded that, "The cure for melatonin madness is to ignore the hyperbole...and focus instead on hypothesis testing and sound science." The mass media have started to change their tune, though whether they can avoid hyperbole is another question. The February 5 *Time* magazine ran a photo of several books on melatonin over the caption "Snake Oil?"

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PEOPLE

It is now *Dr.* **Paul Gailey**. Gailey, who helps manage the NIEHS-DOE RAPID program at the Oak Ridge National Labs in Oak Ridge, TN, has received his doctorate from the University of Utah in Salt Lake City, working with Dr. **Om Gandhi**. His dissertation was on the theoretical minimum detection limits for human cells exposed to environmental magnetic fields. "The results indicate that magnetic field strengths of less than 100 mG can produce membrane potentials exceeding thermal noise in some cases," Gailey said, pointing out that his results are substantially different from the early predictions by Dr. **Robert Adair** and others....Dr. **Keith Florig** has left Resources for the Future in Washington to return to Carnegie Mellon University's (CMU) Department of Engineering and Public Policy in Pittsburgh as a research engineer. He is now working on the California EMF–School Policy Project (see *MWN,* J/F96), among other risk analysis issues. Florig received his doctorate from CMU in 1986; his thesis advisor was Dr. **Granger Morgan**....**Fred Dietrich** of Electric Research and Management in Pittsburgh has been elected a fellow of the IEEE for "contributions to the development of instrumentation and techniques for the measurement of EMFs."...AT&T is splitting up into three companies, and **Ron Petersen** has a new institutional home—if in name only. The systems and technology business units, including Bell Laboratories, are no longer part of AT&T and are now called Lucent Technologies Inc. "I will continue to do what I have been doing for the last 25 years," said Petersen. Lucent is headquartered in Murray Hill, NJ....Dr. **Thomas Budinger** of the Lawrence Berkeley National Laboratory in Berkeley, CA, has been elected to the National Academy of Engineering in Washington for "contributions in quantitative medical imaging and safety of space exploration and experimentation."...In the listing of recent EPRI reports in our last issue, **Kyle King** was identified as being with GE in Lenox, MA. In fact, King left GE in 1994 to join Enertech Consultants' Lee, MA, office.

POLICE RADAR

Officer Wins Settlement... The Virginia Workers' Compensation Commission has found that a police officer's testicular cancer was caused by his use of a hand-held traffic radar unit. The commission ruled last November 14 that Franklin Chappell of the Portsmouth, VA, police force had proven "to a reasonable degree of medical certainty" that his disease was caused by exposure to radar—but it rejected his claim on the grounds that it had been filed too late. However, rather than fight Chappell through the appeals process, the city agreed to pay the portion of his hospital bill not covered by insurance and to restore his used-up sick leave. Chappell was diagnosed with testicular cancer in January 1993. He underwent chemotherapy and had his right testicle removed. He has been in remission since 1994. His urologist and oncologist both testified that his cancer was a direct result of radar exposure, and even the city's doctor called his exposure "bothersome." Chappell told *Microwave News* that he routinely left the unit—which was always turned on—in his lap, because the bracket that was sup-

posed to hold it was defective. Chappell is back on the Portsmouth force and says, "The radar training is much better now. Back then, they just gave you the gun and said, 'Now you're a radar man.' Now you have to attend a two-day class, and they go into detail on the do's and don't's."

RAPID

Staff and Budget Changes...DOE's EMF program has a new boss and a new bureaucratic home—but if you don't know where to look, you will never find them on the agency's revised organizational chart. Lynne Gillette and Dr. Imre Gyuk, DOE's only two EMF staffers left in Washington, are now in the Office of Energy Outreach, whose acting director is Ronald Bowes. Bowes reports to Dr. Allan Hoffman, the acting head of the Office of Utility Technologies, who in turn answers to DOE Assistant Secretary Christine Ervin. Robert Brewer, who took over the EMF program from Marvin Gunn in 1994 (see *MWN,* N/D94), has been reassigned and now works with Hoffman on other policy issues. For the 1996 fiscal year, the NIEHS-DOE RAPID program's budget is less than half of that in the previous year: $3.39 million v. $7.7 million. The $3.39 million must still be matched with contributions from industry. In 1995, the utility and related industries fell short of their matching commitments by more than $1.5 million, a shortfall that meant less research spending. DOE's biological mechanisms program fared better and was only cut by about 10% in 1996—$5.06 million v. $5.5 million. President Clinton's 1997 budget, which is still subject to negotiation, would give each program $4 million before any across-the-agency cuts, which are currently estimated to be 5-10%. (In March, the DOE issued a progress report on the RAPID program (DOE/EE-0088); it is available from the Public Inquiries Center, DOE, 1000 Independence Ave., SW, Washington, DC 20585.)

RESOURCES

EMF Bioeffects Bibliography... From Adair and Adey to Wilson (Bary) and Zaffanella, over 800 listings are included in *Selected Bibliography: Electromagnetic Fields—Investigations into the Biological Activity of Low-Frequency EMFs,* assembled by the Human Ecology Action League (HEAL). Both epidemiological and laboratory studies are included, as well as a few papers each on therapeutic uses of EMFs and on public policy. The listings are not annotated, but the document is more inclusive than some earlier works, including three used by HEAL as a starting point: bibliographies compiled by Congress' Office of Technology Assessment (OTA) in 1989, by the EPA in 1990 and by DOE's Bonneville Power Administration in 1993. In fact, HEAL was surprised to find that these "three core sources did not overlap to any great extent, despite their proximity in time and similarity of purpose." The earlier bibliographies included 571 listings, but only 19 were mentioned in all three. Founded in 1977, HEAL describes its purpose as "to serve those whose health has been adversely affected by environmental exposures," especially to chemicals, and "to alert the general public about the potential dangers of chemicals." Available for $44.00 from: HEAL, PO Box 29629, Atlanta, GA 30359, (404) 248-1898, Fax: (404) 248-0162.

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MICRO WAVE NEWS

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MICRO WAVE NEWS

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Dropping the 'H' in WHO

Air Force Microwave–Cancer Study Shrouded in Mystery

Fifteen years ago, Dr. James Toler of the Georgia Institute of Technology sent the U.S. Air Force (USAF) a proposal for a study on the effects of long-term, low-level microwaves. The animal exposures began in 1989 and were completed the following year. But today, more than six years later, the results have yet to be released officially.

In June 1995, Toler was expected to present his findings at a special workshop organized by the USAF, which was held in Boston the day before the start of the Bioelectromagnetics Society's (BEMS) annual meeting. But he declined to do so.

"I went to the meeting expecting to see some conclusive data and I am still waiting," Dr. Asher Sheppard, a consultant based in Redlands, CA, said in a recent interview.

In his Boston talk, Toler said that at one point in 1990 he had observed more mice with tumors among the exposed group than among the controls—42 versus 35—but that by the end of the experiment there were no differences in the numbers of tumors or survival rates between the two groups. He would not be more specific, promising instead to present the data during the BEMS meeting. Later that day, Toler went home to Atlanta and the results remained a mystery.

In an interview a month after the BEMS meeting, Toler still would not talk about the tumor counts, but he remained firm about the study's findings: "We saw no effects and the biostatistician saw no effects."

James Merritt, Toler's project officer at the USAF's Armstrong Laboratory

(continued on p.13)

Physicists and Biologists Butt Heads at First NIEHS EMF Risk Workshop

Once again, it was the biologists versus the physicists. This time they met at a symposium on cellular studies convened by the National Institute of Environmental Health Sciences (NIEHS) to help the agency assess health risks from exposures to electromagnetic fields (EMFs).

At the opening session on March 24 in Durham, NC, Dr. James Weaver, a physicist at the Massachusetts Institute of Technology (MIT) in Cambridge, MA, presented a model showing that the thresholds for EMF interactions have to be above 1 G. "I have a hard time understanding the experimental data for levels below that," he told *Microwave News*.

But the biologists were not buying it. "There appears to be wide acceptance of the existence of *in vitro* biological effects down to 10-20 mG," countered Dr. Martin Blank of Columbia University's medical school in New York City, who spoke for many of those at the meeting.

(continued on p.7)

EMF NEWS

« Power Line Talk »

The **DOE** plans to stop all EMF research in September 1998—the end of fiscal year 1998. The news came in a March 7 letter from **Christine Ervin**, DOE assistant secretary, to Dr. **Ken Olden**, the director of the **NIEHS**. "We believe that the federal government should base the decision of whether to support any further research on the results of your agency's risk assessment, and that any research be managed by your agency," Ervin wrote. If the DOE follows through on this decision, it will mean the end of the DOE's core program, which began in 1978. DOE work on the EMF RAPID program would also come to a close, but Congress had originally designed RAPID to be a five-year effort. "If you are looking for public credibility on the EMF issue, the health agencies should be taking the lead on the research, risk assessment and communications," commented the DOE's **Bob Brewer**. **Lynne Gillette**, DOE RAPID research manager, stressed, "The DOE is clear that it wants to be out of the EMF research business. We are getting the message in many different ways." Ervin's letter sent shivers through the EMF community. "This is not the time for the DOE to say that the EMF issue has been finalized. All the questions have not been answered," said Dr. **Richard Luben** of the University of California, Riverside, the president of the Bioelectromagnetics Society. Much, therefore, depends on the NIEHS risk assessment (see p.1). "We agree with Christine Ervin that decisions on further research should be based on a review of the risk assessment process," said Dr. **Gary Boorman**, who heads the RAPID program at the NIEHS. Meanwhile, Ervin has announced that she will leave the DOE on May 1.

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Ervin's letter also brought word that the **EPA** will stop managing its **EMF hot line** (see *MWN,* M/J94) on June 15, 1997. "The EPA has decided that it no longer has the ability to run the EMF infoline because of significant budget cuts and as a result of the Senate language," said **Denise Settles**, EMF-ELF coordinator at the EPA in Washington. In 1995, the Senate Committee on Appropriations stated that it was cutting the EPA's budget by $350,000 because the "EPA should not engage in EMF activities" (see *MWN,* S/O95). The EPA's decision caught many observers by surprise because the RAPID program has been paying for the hot line. As one close observer, who asked not to be named, noted, "The EPA is the only agency that refuses money."

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A replication of a **breast cancer** study originally carried out in Dr. **Wolfgang Löscher**'s lab at the School of Veterinary Medicine in Hannover, Germany, has had to be repeated. Last year the U.S. NIEHS contracted with a team led by Dr. **Larry Anderson** at the **Battelle Pacific Northwest Labs** in Richland, WA, to test whether magnetic fields can promote the action of the carcinogen DMBA, as Löscher had previously reported (see *MWN,* M/A96). Löscher gave his rats four 5 mg doses of DMBA, which some toxicologists believe is so much that it masks the action of a cancer promoter. Indeed, when Anderson completed the 13-week magnetic field exposure study at the end of last year, the breast cancer tumor rates were above 80%, which are unlikely to allow any conclusion about EMF effects. The experiment is being repeated with four 2 mg doses of DMBA—this should cut the tumor rates in half, according to a dose–response study. (Battelle also ran a 26-week exposure study using a single 10 mg dose of DMBA.) Dr. **Gary Boorman**, who negotiated the contract for the NIEHS, stands by his original decision. "What we did was right even though the dose was too high, because people were asking for an *exact* replication," he told *Microwave News*. Results of both the Battelle breast cancer studies are expected to be announced at the DOE's EMF review next November in San Diego.

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In December 1995 Dr. **Patricia Buffler**, dean of the School of Public Health at the University of California, Berkeley, published a meta-analysis of studies of **brain tumor** risk and occupational EMF exposure. Buffler and her coauthors concluded that the studies showed a "small but significant" increase in the risk, that biases were "unlikely" to be the cause and that "this meta-analysis provides some evidence against the hypothesis of no association between occupational exposure to EMF[s] and the risk of cancer" (see *MWN,* J/F96). But now Buffler has gone to court in an occupational brain tumor case to argue that "concerns about EMF[s]" are "essentially without scientific foundation." In February Buffler and 11 other scientists intervened in the ***Ford*** EMF lawsuit in San Francisco, in a friend-of-the-court brief filed by the **Atlantic Legal Foundation** (ALF). Three of those signing the brief are Nobel Prize winners, but ALF general counsel **Martin Kaufman** told *Microwave News,* "The person we considered most significant was Pat Buffler, because she's an epidemiologist, she's in California and she's an author of one of the articles that the plaintiffs relied on"—the brain tumor meta-analysis. "I believe my position is consistent," Buffler told *Microwave News*. "The association noted in the meta-analysis...was with occupations or job titles presumably exposed to EMFs, not EMF exposures *per se*. In fact, in this publication, higher risk ratios were not observed for jobs with higher measured EMFs." The ALF brief mainly discusses residential studies, but it contends that, "The findings of those studies would also apply to persons working near 60 Hz electric power lines, such as those involved in this case." In fact, the bulk of the ALF's brief in *Ford* is identical to one that it filed in a residential property devaluation suit, the ***Covalt*** case (see *MWN,* N/D95 and M/A96). Kaufman said this was appropriate "because the issue is quite similar." The *Ford* lawsuit was filed in 1995 by the widow of a telephone line worker who died of a brain tumor; it charges that his cancer was due to EMF exposure from working next to power lines (see *MWN,* M/A95).

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Reports of **Doug Bannerman**'s retirement are greatly exaggerated—even though he was feted at two going-away parties. The National Electrical Manufacturers Association (**NEMA**), based in Rosslyn, VA, has asked him to continue to track the EMF issue. A 13-year NEMA veteran, Bannerman has agreed to stay on until at least the end of the year. He worked on various environmental issues in the past but will now focus only on EMFs.

Trying To Define the EMF–Melatonin Relationship: Data from Real-World and Lab Exposures Diverge

Recent studies of EMFs and melatonin continue to indicate that a relationship may exist—but provide little clarity about what it might be. Studies in the workplace have shown that EMF exposure is associated with a drop in melatonin levels, but this association has not always been supported by laboratory studies.

"Most natural observations appear to find melatonin changes, while controlled lab studies tend not to," commented Dr. John Reif of Colorado State University in Fort Collins. "In a general way, I'm concerned that the controlled lab trials may not mimic exposures in the real world."

Depressed Melatonin Levels in Garment Workers

A preliminary study of 60 workers at a Finnish garment factory found "a highly significant effect" of EMFs in reducing nocturnal melatonin levels, Dr. Jukka Juutilainen of Finland's University of Kuopio told *Microwave News*.

Eye-level measurements of magnetic fields were taken for the two different types of sewing machines used in this plant, and seamstresses were assigned to high- or low-exposure groups based on the type of machine they used, with average exposures either above or below 10 mG. Unexposed nonindustrial workers were used as controls.

Through questionnaires, information was gathered on other possible factors such as age, smoking, light exposure and use of alcohol, coffee, home appliances, mobile phones and certain medications. Multiple-regression analysis found strong effects of both magnetic field exposure and smoking on nighttime levels of melatonin. Melatonin levels were not measured during the day.

No difference was found between melatonin levels on Thursday nights and those on Sunday nights, indicating "that the possible suppression caused by magnetic field exposure is chronic, with little recovery during the weekend," according to the study. Juutilainen will present these results at the *5th Nordic Workshop on Biological Effects of Low Frequency EMFs,* to be held April 17-18 in Trondheim, Norway.

Daytime Melatonin Down in Utility Workers

In a study of 192 electric utility workers, Reif and Dr. James Burch, also of Colorado State University, found that some EMF exposures are associated with lower levels of melatonin. They presented their findings last November in San Antonio at the Department of Energy's (DOE) annual EMF research review.

Electricity generation and distribution workers and other utility employees who served as controls wore EMDEX meters adapted to measure ambient light as well as magnetic field intensity. Adjusting for light exposure and other factors that can influence melatonin levels, Burch and Reif found a significant association between magnetic field exposures and lower daytime melatonin levels on the second and third of three days of measurement.

Some studies have suggested that EMF effects on melatonin may depend on whether the field is continuous or intermittent. Burch and Reif found that magnetic fields in the home that were "temporally coherent" (that is, less intermittent) had a very significant association with lower melatonin levels at night. They concluded that, "The intensity and temporal characteristics of magnetic fields appear to be involved in melatonin suppression."

"The time of day during which exposure occurs may be important," Reif said in an interview. He suggested that future research examine this issue, as well as physical characteristics of EMFs such as transients and temporal coherence.

Continuous EMF Exposure Shows No Effect

A continuous 60 Hz, 200 mG magnetic field applied to people while they slept had no effect on nocturnal melatonin levels in an experiment conducted for the Electric Power Research Institute (EPRI) by Dr. Charles Graham and coworkers at their laboratory at the Midwest Research Institute (MRI) in Kansas City, MO. Blood was drawn every hour during an eight-hour period, but melatonin levels showed no difference for real and sham EMF exposures.

In a similar study published in 1994, Graham found no over-

New Book Surveys Melatonin, Breast Cancer and EMFs

This will be a hot year for the "melatonin hypothesis," the idea that EMFs may increase breast cancer risks by lowering levels of melatonin.

The results of efforts to replicate key animal and cellular breast cancer studies should be announced in the months ahead (see *MWN,* M/A96). On the epidemiology front, the Karolinska Institute in Stockholm, Sweden, and Seattle's Fred Hutchinson Cancer Research Center will report on the first two large studies to focus on EMFs and light at night.

A good source of current information on this debate is *The Melatonin Hypothesis: Breast Cancer and Use of Electric Power,* edited by Drs. Richard Stevens, Bary Wilson and Larry Anderson, all of the Battelle Pacific Northwest Labs in Richland, WA. The just-published volume includes contributions from the editors and almost all other key players in the field: Blackman, Blask, Graham, Haggren, Lerchl, Liburdy, Löscher, Matt, Reiter, Yellon and others. Among the authors are researchers from all of the much-anticipated ongoing studies, except for the Karolinska epidemiologists.

In an introductory chapter, the editors state, "The body of evidence is sufficient to bind electric power over for trial, but not nearly adequate to render a verdict." For those who would like to be informed jurors, this 776-page book is essential.

The Melatonin Hypothesis can be ordered for $87.50 (plus appropriate sales tax and $3.50 shipping within the U.S.; $12.50 for overseas airmail delivery) from: Battelle Press, 505 King Ave., Columbus, OH 43201, (800) 451-3543 or (614) 424-6393, Fax: (614) 424-3819, E-mail: <press@ battelle. org>.

all effect for intermittent EMF exposure. However, data from that study showed that men with preexisting low levels of melatonin had even lower levels when exposed to EMFs, suggesting that a person's prior melatonin level may be an important factor. A 1995 study by Graham, also using intermittent EMF exposure, did not support this hypothesis. The most recent experiment used continuous magnetic fields instead, and still found no effect.

However, Graham states that it would be premature to conclude that EMFs do not affect human melatonin. He points out that all of the subjects in the three studies were "healthy young men," and that the types of EMFs with which people come in contact in an industrialized society are much more varied than those created in the carefully controlled MRI exposure facility. Specifically, Graham points to the possible biological effects of high-frequency transients, which are common in many homes (see also *MWN,* S/O95 and J/A96).

MRI's Dr. Antonio Sastre told *Microwave News* that in these three experiments, transients from switching the fields on and off would have been "minuscule to nonexistent." He said that he and Graham are currently planning experiments to examine whether transients can influence human melatonin.

Details of Graham's study appear in his report to EPRI, *Melatonin Levels in Continuous Magnetic Fields* (TR-106178).

Rat Study Gives Mixed Results

Past experiments by Dr. Russel Reiter and colleagues showed a link between rapid changes in static magnetic field exposure and lowered nocturnal melatonin levels in rodents. Reiter suggested that induced electrical currents in the animals had caused a drop in melatonin production (see *MWN,* J/A90 and N/D93).

In a recent series of experiments conducted for EPRI, Reiter set out to verify these findings. Rats were subjected to the repeated rapid inversion of a strong DC magnetic field, ranging from 0.5 to 5 G, for various lengths of time. Reiter measured both pineal melatonin activity and melatonin levels in the blood.

In his report to EPRI, *Static Magnetic Field Perturbations and Pineal Melatonin Production* (TR-107238), Reiter states that magnetic field exposure produced a significant drop in serum melatonin in ten out of 23 rats. Pineal melatonin showed significant changes less often. Magnetic field strength did not show a dose–response relationship. Reiter notes one way in which these variable results were very consistent: "In the 17 cases where one of the [melatonin] parameters was modified by the magnetic field exposures, in every case a reduction was observed."

The fact that serum melatonin often went down while pineal melatonin was unaffected led Reiter to change his hypothesis about a possible mechanism of interaction: "It has been assumed that the fields...reduced the ability of the pineal gland to form melatonin." Instead, Reiter now proposes that melatonin is "more rapidly taken up into tissues during the exposure." He notes that others have suggested that EMFs may lead to higher levels of free radicals; if this is the case, an antioxidant like melatonin "would disappear from the blood more quickly than [is] normal because it would be required for the scavenging of free radicals."

VDT Work Seen To Lower Daytime Melatonin

Workers' circulating levels of melatonin decreased significantly over the course of a day of VDT work, report Swedish researchers Drs. Bengt Arnetz of the Karolinska Institute in Huddinge and Mats Berg of the Karolinska Hospital in Stockholm. No such change was observed during a day at the office without VDT use. "This suggests that there is direct impact from the electromagnetic environment of the [VDT] on levels of melatonin," Arnetz and Berg write in the November 1996 *Journal of Occupational and Environmental Medicine*. No measurements or estimates of EMF levels were attempted.

Levels of a different hormone, adrenocorticotropic hormone (ACTH), went up during the working day, and this showed a strong correlation with workers' subjective assessment of mental strain. Arnetz and Berg note that ACTH is "known as a classic stress hormone that reacts to mental strain." But, in contrast, "occupational strain did not correlate with melatonin levels."

About half of the 47 experimental subjects were people who had reported symptoms of electromagnetic sensitivity, while the others had not. Arnetz and Berg found no differences in hormone levels between these two groups (see also p.16).

The Taxing Problem of EMFs

A Canadian ruling that EMFs from an electrical substation devalued an adjacent property led to a tax cut for the property's owner. The city of Toronto agreed to the reduction in late February. The real estate at issue is a gas station next to a set of transformers operated by Toronto Hydro.

"You're going to see a lot more cases like this," predicted U.S. attorney Randy Airst of American Land Recycling Corp. in Exton, PA, who represented the company that owns the gas station, Ontario Ltd.

Airst asked for a reduction in the station's property tax assessment on several grounds, including suspected leaks from its own gasoline storage tanks and EMFs from the Toronto Hydro substation. In November 1995, a provincial review board rejected the concerns about the storage tanks, but accepted the EMF claim.

The Assessment Review Board cited "the environmental concerns created by possible adverse effects of EMFs and the stigma attached to adjacent properties," and concluded that "this has an adverse impact on the value of the property. Certain types of business would be unable to operate in such a location." For this and other reasons, the assessment was ordered reduced from $17,840 to $7,500, in Canadian dollars. The city of Toronto appealed, but on February 20 of this year it agreed to settle at $11,500.

Airst stressed that this will reduce the owner's tax bill by several thousand dollars for each and every year in the future. He also pointed out that a property tax case does not require showing any liability on the part of an electric utility. All that is needed, said Airst, is to show that public perceptions have affected the property's market value.

Airst is the author of *How To Avoid Environmental Liability: A Practical Guide for Real Estate Owners, Lenders, and Professionals,* which is published by Cahners in Des Plaines, IL.

No EMF–Skin Cancer Link in Canadian Mouse Studies

A set of experiments with mice do not support the idea that magnetic fields act as a cancer copromoter, according to a research team at Canada's Environmental Health Directorate in Ottawa.

Overall differences between mice exposed to magnetic fields and controls were minimal. In fact, taking all the experiments together, the incidence of skin tumors was slightly higher for the controls. The findings are described by Dr. Jack McLean and colleagues in the January 1997 issue of *Environmental Health Perspectives (105,* pp.94-96).

In 1991, McLean presented initial findings from the first of three experiments at the annual meeting of the Bioelectromagnetics Society (BEMS), in Salt Lake City, reporting a significantly higher incidence of tumors among magnetic field-exposed mice (see *MWN,* J/A91). McLean stressed that these data, from the first 17 weeks of exposure, were preliminary. And while the difference was still present after an additional six weeks of exposure, it was no longer statistically significant.

In an interview after the 1991 BEMS meeting, McLean said, "I'll breathe easier when our study is replicated." But when it was, the effect disappeared. In the second experiment, the number of mice with tumors was exactly the same in exposed and control groups. And in the third experiment, tumor incidence was significantly higher among controls. The principal reason for these differences in results, the researchers explain, is that tumor incidence in the control groups varied by a factor of two.

The strain of mouse that they used, the SENCAR mouse, was bred to be particularly susceptible to cancer. But skin tumor incidence among SENCAR mice in identical conditions can vary widely, and the paper cites one study that showed a sixfold variation. "This means there's too much noise in this model to pick out a weak effect," McLean told *Microwave News.* The paper states that using skin tumors in SENCAR mice as a model system thus "lacks the sensitivity to detect all but the most potent direct-acting carcinogens."

Dr. Maria Stuchly of the University of Victoria in British Columbia, Canada, agreed that this could be a problem: "The [EMF] effect is always on the border of detectability. The effect may be very subtle, or maybe it doesn't exist—it's an open question." Stuchly, who worked with McLean on the first of the three experiments, said in an interview that she was "not surprised" by the variability in the data, since this often occurs in skin tumor-promotion experiments with SENCAR mice.

A more recent copromotion experiment by Stuchly and Dr. Craig Byus of the University of California, Riverside, showed a statistically significant increase in tumor incidence among EMF-exposed SENCAR mice (see *MWN,* M/A96). In an interview this March, Byus said that the study has now been submitted for publication.

In McLean's three 23-week experiments, mice were treated on their skin with both the carcinogen DMBA and the tumor promoter TPA (also known as PMA) to test the idea that the action of the TPA might be enhanced by the application of a magnetic field. Half the mice were exposed to a continuous 60 Hz, 20 G field for six hours a day, five days a week—a time schedule designed to mimic human occupational exposures. The coils generating the magnetic field were shielded with thin copper tape to reduce electric field levels.

Byus noted that McLean had applied TPA to the animals only once a week, and commented, "The reason most people apply it twice a week is to get a more consistent response." He said that he knows of no other EMF study in which the TPA was applied only once a week.

McLean's findings are consistent with those of a study published in 1993 by Dr. Bo Holmberg and coworkers at the National Institute for Working Life in Solna, Sweden; it found that continuous 50 Hz magnetic fields did not promote the growth of skin tumors in SENCAR mice. However, a later study by the same group found that an *intermittent* 50 Hz field, switched on and off every 15 seconds, appeared to produce "a weak promotional effect" (see *MWN,* M/A94).

McLean's just-published experiments did not examine the effects of intermittent exposures, and he said he does not plan to do so.

McLean is now planning a new series of experiments with a different strain of mice in collaboration with Dr. Barry Glickman of the University of Victoria and others. "We're going back to take a look at this idea of mechanisms," he explained, "and whether there's any plausible connection between EMFs and the concentration of free radicals—not just in a test tube, but in a biological system."

Manual on Prudent Avoidance in New Schools Is Too Hot for DOE

The California EMF Program has released a 41-page report recommending no- and low-cost strategies for minimizing EMF exposures in new schools. The Department of Energy (DOE), however, has been told not to distribute the report—even though the DOE helped sponsor it.

At a March 18 meeting, the federal EMF Interagency Advisory Committee (IAC) decided that the report's support for prudent avoidance is too controversial. "The committee is worried that the report will be interpreted as advocating a *de facto* standard if it is issued by the federal government," the DOE's Lynne Gillette told *Microwave News.*

In fact, the report itself advises against establishing specific magnetic field-strength standards because they may "foment discord." Nor does the report recommend using a gaussmeter to measure EMF levels within a school—at least partially because "there is no scientific consensus" regarding what EMF levels are acceptable.

California officials were amazed by the IAC's decision. "Our stakeholders did not find this report controversial," said Dr. Raymond Neutra, the head of the California program. "We were very careful to structure the checklist so that it could be incorporated into existing practices of school design and construction."

Dr. Jack Sahl of Southern California Edison in Rosemead urged the DOE to distribute the report "in a timely manner." He noted that, "This type of precaution-based approach works in

EMFs, Risks and Cost-Benefit Analysis: U.K.'s NRPB Disputes Sweden's Quantification of Prudent Avoidance

Reprinted below is a commentary by Dr. John Stather, senior assistant director of the National Radiological Protection Board (NRPB) in the U.K., which first appeared in the February 1997 issue of Radiological Protection Bulletin, *the board's monthly report*. SSI News *is published by Sweden's Radiation Protection Institute (RPI). In late 1996 five Swedish national agencies, including the RPI, issued a pamphlet entitled* Low-Frequency Electric and Magnetic Fields: The Precautionary Principle for National Authorities, *which is very similar to what appeared in* SSI News. Microwave News *featured excerpts from the pamphlet in its November/December 1996 issue*.

National authorities in Sweden have recently recommended the application of the precautionary principle in relation to residential exposures to low-frequency electric and magnetic fields (EMFs) (*SSI News, 4,* No. 2, pp.1-4, 1996). The principle is advocated for decision making and planning for existing and new electrical facilities. It is proposed that when exposures from existing facilities deviate significantly from *normal,* measures to reduce exposure should be taken when they can be carried out at *reasonable* cost. For new facilities, their design and siting should be aimed at limiting exposures. The stated aim of these recommendations is "to reduce the risk of injury to human beings."

But what injury? And can the risk be quantified and the cost of avoidance justified? The current concern about effects of EMFs is largely the result of epidemiological studies. The Swedish authorities acknowledge that experimental studies have not so far yielded any results that clearly corroborate the epidemiological findings. Even the results of epidemiological studies are inconsistent, although the greatest concern relates to the possible risk of childhood leukemia.

Within Scandinavian countries the results of different studies have been quite variable and with considerable uncertainties. A study in Sweden suggested that children living close to transmission lines have a risk of developing leukemia some 2.7 times that in children living away from lines. Two studies from Denmark and Finland have suggested a 1.5-1.6-fold increase in the risk of childhood leukemia at higher exposures, but a more recent study in Norway has shown no increase in risk at all.

As described in the December issue of the *Bulletin,* a committee of the U.S. National Academy of Sciences has recently reported the results of a three-year study into the possible health effects of exposure to residential EMFs. It concluded, on the basis of reviews of experimental and epidemiological studies, that "the current body of evidence does not show that exposure to these fields presents a human-health hazard."

These conclusions are very similar to those by the NRPB Advisory Group on Non-Ionizing Radiation (*Documents of the NRPB, 5,* No. 2, 1994) which has said, "there is no persuasive biological evidence that ELF electromagnetic fields can influence any of the accepted stages in carcinogenesis. There is no clear basis from which to derive a meaningful assessment of risk, nor is there any indication of how any putative risk might vary with exposure."

This lack of evidence for harmful effects of EMFs contrasts with the information on ionizing radiation, where a range of epidemiological studies have unequivocally demonstrated a cancer risk. There is also very strong supporting evidence from studies with experimental animals, while cellular and molecular studies have shown direct effects of ionizing radiation on DNA and are now serving to elucidate the mechanisms involved in carcinogenesis.

Examples have been given by the Swedish authorities of the application of a rudimentary cost-benefit analysis for avoiding cases of childhood leukemia resulting from exposure to EMFs by changes in the design and siting of electrical facilities. Exposure reduction measures were estimated to cost between about two million and several hundred million Swedish kronor (£1≈12 SEK) per "statistical" case of childhood leukemia avoided on the basis of a relative risk of 2.7 (as found in the Swedish study). With lower risks the costs would of course be increased and if there were no risk at all, then the costs would be infinite, with no benefit.

The application of cost-benefit analysis to possible risks of cancer from power-frequency EMFs is fraught with difficulty in the absence of information on a dose–response relationship. In any analysis of this type, whether for ionizing or non-ionizing radiation, the uncertainties need to be properly recognized. Cost-benefit analysis can only inform decisions, it should not drive them.

Meanwhile, for EMFs, experimental and epidemiological studies continue to be kept under constant review by the NRPB. We are supporting the National Study of Childhood Cancer, which is examining a number of factors that might be implicated in childhood cancer, including EMFs. We maintain an active involvement in research in this country and abroad and will not hesitate to advise government if further information becomes available to suggest that a causal relationship between exposure to EMFs and cancer has been established.

California." Sahl has argued that prudent avoidance can be practiced in a way that is consistent with utility interests (see *MWN,* N/D96).

Written by Brooks Cavin III, a professor of architecture at California Polytechnic Institute in Pomona, the report offers simple guidelines based on four general principles for construction of school buildings:

- Maximize the distance between EMF sources and high-occupancy areas.
- Maximize the cancellation of magnetic fields by minimizing the distance between conductors in the circuit and by strictly adhering to the National Electric Code.
- Avoid "net current" conditions by adhering to established electric codes and by using sound engineering practices to keep circuits balanced.
- Reduce electrical current.

"The approach of using *no- and low-cost techniques* should not appreciably increase construction costs and should not create controversy," the report states. The report also does not advocate applying its recommendations to existing schools: "The expense and time required to retrofit all existing schools in a district to reduce magnetic fields would generally be high. The uncertain benefits of these more expensive actions should be weighed against other educational priorities."

A copy of *EMF Checklist for School Buildings and Grounds Construction* is available for $6.00 from: Copy Central, 5801 Christie Ave., Emeryville, CA 94608, (510) 547-7300. Copies of the report may be made if they are distributed at no charge. For more information, contact: M.A. Stevenson, California EMF Program, 5900 Hollis St., Emeryville, CA 94608, (510) 450-3818.

In fact, only a few have yet to take sides. "There are a lot of people who have made up their minds and who look for support for their particular point of view," observed Dr. Paul Gailey. "If you are in the middle, trying to be objective, it's a lonely place." Gailey, of the Oak Ridge National Lab in Oak Ridge, TN, maintains that there is no controversy about effects below 1 mG (there are none) and above 1 G (they clearly exist).

Dr. Robert Adair, a physicist at Yale University in New Haven, CT, endorsed Gailey's taxonomy—but reasserted his own well-known view: "I don't find effects above 500 mG impossible, but they are unlikely under 500 mG, with some extraordinary exceptions."

Dr. Charles Polk, who has degrees in electrical engineering and physics, urged everyone not to "lump all the physicists together, because many physicists believe it is quite possible to have low-level effects." Polk, an emeritus professor at the University of Rhode Island, Kingston, said that, "There is abundant evidence for biological effects down to 200 mG," and he does not reject the possibility of effects at even lower levels.

The NIEHS meeting on *in vitro* EMF research,* the first of at least three, is part of the risk analysis mandated by the U.S. Congress. At the end of next year, at the conclusion of the EMF RAPID research program, the NIEHS must offer its own opinion on possible EMF health hazards at environmental levels—that is, in Gailey's middle ground between 1 mG and 1 G.

"I am not at all convinced by the general assumptions that go into the physicists' models," said the NIEHS' Dr. Chris Portier, who is leading the risk assessment. "I continue to encourage the physicists to look at more complicated models that include a greater degree of biological detail," he said in an interview. As for the biological data, Portier said that he is not convinced, but is "sufficiently intrigued to spend a tremendous amount of effort to look at the 10-20 mG results." Portier is based in Research Triangle Park, NC.

At the heart of this dispute between two opposing camps is the adequacy of the theoretical models. MIT's Weaver limited his analysis to sinusoidal 60 Hz magnetic fields and two target systems, voltage-gated proteins and radical pair recombination.

Drs. Ross Adey of the VA Hospital in Loma Linda, CA, Richard Luben of the University of California, Riverside, and Indira Nair of Carnegie Mellon University in Pittsburgh all stressed the need to consider real-world exposures, which include intermittent exposures and complex waveforms such as transients.

"The problem is not with the physical theory but with the physicists' models," commented Dr. Imre Gyuk of the Department of Energy in Washington.

But perhaps the strongest criticism stemmed from some physicists' refusal to accept experimental data. "I am flabbergasted by the idea that if the data do not meet preconceived theories, the data must be wrong," said Dr. Eugene Sobel of the University of Southern California in Los Angeles.

Weaver stood firm. "More experiments will not do the job," he said at the closing session of the symposium. "We have tried hard to explain the effects and have failed."

* *EMF Science Review Symposium: Theoretical Mechanisms and* In Vitro *Research Findings,* Durham, NC, March 24-27, 1997.

The Power of Red Photons: What's the Mechanism?

Can low-level EMFs cause biological effects? Some physicists believe that there is no possible mechanism for EMF effects at the milligauss level. To believe otherwise, they say, is to ignore the laws of physics.

In one of the small-group discussions at the NIEHS symposium, Janie Blanchard of Bechtel Corp. argued that many physical mechanisms operate through surprising pathways. She got a skeptical response when she declared that low-energy photons could stop the motion of a two-ton mass traveling at 30 miles per hour.

"In fact," said Blanchard, "this effect can be reproduced consistently, even if the photon source is restricted to the lowest energy levels in the visible spectrum." The effect is so robust, she maintained, that even bright sunlight does not interfere with it.

"We have clear experimental confirmation of this phenomenon," said Blanchard. "All of us do—whenever we see a truck stop at a red traffic light."

Asked by *Microwave News* whether he finds the biological data convincing, Adair replied, "Not at all. A lot of people have done experiments that no one can replicate."

The physicists had their supporters. During an exchange on why it is difficult to find effects at environmental levels, Dr. James Wilson of Resources for the Future, an economics think tank in Washington, went to the microphone and said: "They are physically impossible, as Jim Weaver told us."

"Profound Health Implications"

The chasm between the physicists and biologists often appeared to be too wide to bridge. At one point, Adair called Dr. Carl Blackman and Janie Blanchard's ion parametric resonance model a "crackpot theory"—no different from creationism or mythology (see *MWN,* M/J94).

"You can't just say it's impossible," a frustrated Blanchard told Adair and Weaver at the end of a long panel discussion. "We need a dialogue," she said. Blanchard works at Bechtel Corp. in San Francisco and Blackman is with the Environmental Protection Agency in Research Triangle Park, NC.

Dr. Jack Sahl of Southern California Edison in Rosemead, CA, cautioned that, "If we cannot reach consensus soon, we will have lost an opportunity and undermine society's trust."

Dr. David Savitz of the University of North Carolina, Chapel Hill, pointed out how much is at stake in this debate: "If the physicists turn out to have been proven wrong, they will no longer be able to stop research grants from being funded." And even more importantly, Savitz said that, "The acceptance of the low-level *in vitro* work would have profound health importance, because it would affect the interpretation of the whole body of epidemiological literature."

The NIEHS has 18 months to issue its verdict. For the present, Portier will not offer his own opinion. "I refuse to get off the fence until the report is due," he said.

« Wireless Notes »

"CELL PHONES: DO YOU REALLY NEED ONE?" asked ***Consumer Reports*** on the cover of its February issue, promising to tell readers "HOW TO DECIDE." Apparently that decision does not require information on possible health risks, since the subject was not mentioned anywhere in the article. "Science really can't tell us anything yet," stated **Edward Groth**, technical policy director of **Consumers Union** (CU), which publishes the magazine. "There's no decent epidemiological evidence that there's a health impact from the kind of microwaves that you would see with cellular phones," Groth told *Microwave News*. He added that, "With levels that are thousands of times higher, such as with a microwave oven, there could be a heat impact"—but as for nonthermal effects, "the scientific community has been debating the effects of RF on health for 50 years." As to why that debate was not mentioned in the pages of *Consumer Reports,* CU spokesperson **Linda Wagner** explained that, "This particular story was focused on the contracts, what are the financial terms when consumers get a cell phone. They wouldn't include health questions in an article with this kind of focus." Wagner said that the magazine would run other articles on cell phones in the future, and that articles on cellular phone hardware would be more likely to deal with the health controversy. She added that the magazine's staff is "aware of the issue, and they're continuing to follow the science." An article in the January 1997 issue indicated that EMFs were not a reason to avoid the use of electric blankets—a change from the magazine's previous stance (see *MWN,* J/F97).

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Talking on a cellular phone has long been considered a potential **driving hazard**. And a study published in the February 13, 1997, issue of the prestigious *New England Journal of Medicine (336,* pp.453-458) found that, in fact, drivers face a fourfold increase in the risk of a collision when using a phone—"similar to the hazard associated with driving with a blood alcohol level at the legal limit." The researchers, Drs. Donald Redelmeier and Robert Tibshirani of the University of Toronto, Canada, looked at 699 drivers who owned cellular phones and were involved in accidents, comparing the times of the collisions with the times of incoming and outgoing calls. In light of the results, the authors recommend that unnecessary calls be avoided and that conversations be kept short, especially when driving in hazardous conditions. In a press statement, the **CTIA** voiced general agreement with these recommendations: "When you are behind the wheel, your most important responsibility is safe driving. Period." However, the industry group noted that the researchers did not "contend that phones were the cause of accidents." The results are similar to those of a 1996 study at the Rochester Institute of Technology in Rochester, NY, which looked at 100 drivers in New York who had been involved in accidents over a one-year period. They found that those drivers who used cell phones more than average stood a 5.5 times greater risk of having an accident. The CTIA had attacked that study as flawed and tried to deter the press from reporting it. The Canadian study featured an important new finding: Hands-free phones "offered no safety advantage over hand-held units." In an editorial on the Canadian study in the same issue of the journal, Drs. Malcolm Maclure of the Harvard School of Public Health and Murray Mittleman of Beth Israel Deaconess Medical Center, both in Boston, discount this finding because the study was "too small and had too little statistical power." Regardless, the CTIA has announced that it is working with automobile manufacturers to incorporate phones into audio systems. Maclure and Mittleman argue that laws prohibiting the use of cell phones while driving—which are already in place in Brazil, Israel and Switzerland—may be premature. But they add that the industry "now has an ethical obligation to include warnings and advice with their products and mailed bills; to support and assist in further engineering, ergonomic and epidemiologic research; and to provide easy-to-dial toll-free numbers for reporting road hazards and unsafe driving."

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IEEE SCC-34, the committee that develops performance standards for products that emit electromagnetic energy, has formed a new subcommittee to recommend how to certify that hand-held wireless phones meet the spatial peak specific absorption rates (SARs) mandated by the **FCC**. The FCC's limits are a combination of the ANSI/IEEE and NCRP standards (see *MWN,* J/A96). **Howard Bassen** of the FDA is the chair of both the new Subcommittee 2 and one of its two working groups—WG-1, which deals with experimental dosimetry. **Kwok Chan** of the FCC Labs in Columbia, MD, is leading WG-2's work on computational dosimetry. The basic objective of the two new groups is to develop protocols and models that will allow different labs to compare their results, according to **Ronald Petersen** of Lucent Technologies in Murray Hill, NJ, the chair of SCC-34. Petersen predicted that draft standards from both working groups will be ready by the year's end. "The long-term trend is towards using computational techniques, but there are still many uncertainties that have to be resolved," Petersen told *Microwave News*. A dosimetry workshop held at the FCC on February 4 (see *MWN,* J/F97) served as the first meeting of SCC-34's Subcommittee 2. The next meeting is scheduled for May 2. For more information, contact Petersen at (908) 582-6442 or by e-mail at <rcp@whwpy.wh.lucent.com>.

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Last December 3, the **CTIA**'s board of directors announced that it had "agreed to the outline of a contract" that would indemnify **WTR** and its researchers against the costs of any lawsuits (see *MWN,* N/D96). In early February, WTR's Dr. **George Carlo** told *Microwave News,* "We have an agreement." But as of the end of March, nothing had yet been signed. Asked why the indemnification issue was taking so long to resolve, Carlo responded, "WTR has and will continue to do everything in our power to reach an agreement that maintains the integrity of the research and the independence of WTR. Those are our only criteria." CTIA spokesperson **Tim Ayers** responded, "Those are our goals, too." Meanwhile, WTR's research contracts are still on hold.

FDA Workshop on Biological Effects of Wireless Radiation: Politics and Lack of Research Funds Stymie Progress

The most intriguing finding presented at the February Food and Drug Administration (FDA) workshop* on wireless radiation was 30 years old. In a talk on "Headaches from Cell Phones: Are They Real?" Dr. Allan Frey reported that in the 1960s, while he was studying microwave hearing, a number of his subjects complained about headaches. "I was sufficiently concerned about the headaches to stop research with humans," said Frey, who is credited with discovering microwave hearing.

To make his point, Frey, a researcher and consultant based in Potomac, MD, distributed a paper presented at an FDA symposium in 1969, in which he had written:

> ...I noticed that headaches appeared to be induced at some frequencies at low power levels. A limited amount of exploration leads me to believe that the headache effect is probably real, but it requires verification. Thus, it is mentioned here only as a hypothesis for research.†

So far, no one has tested Frey's hypothesis. But he remains convinced that cellular phones can cause headaches because, as he reminded the audience, "You get penetration into the head at those frequencies." And his concerns run deeper. "Headaches may only be the most obvious indicator of what is going on biologically," he warned. Frey believes that the headaches may stem from microwave-induced leakage through the blood-brain barrier.

The FDA workshop was held four years after the Cellular Telecommunications Industry Association (CTIA) launched its five-year research program designed to show that its products are safe (see *MWN,* J/F93).

Wireless Technology Research (WTR), created by the CTIA to run the program, has yet to sponsor a single biological experiment. The program is now at a standstill due to concerns over legal liability (see p.8 and *MWN,* M/J96). Some at the FDA workshop were openly skeptical that any biological studies would emerge from the industry effort.

"It is ultimately frustrating that no one wants to fund this research," complained Dr. Stephen Cleary of Virginia Commonwealth University in Richmond at the end of his talk on *in vitro,* nonthermal effects.

Cleary's concerns were echoed by another veteran microwave researcher, Dr. Henry Lai of the University of Washington, Seattle. Lai and his collaborator, Dr. N.P. Singh, have been unable to find support to continue their studies. Though long promised WTR research funds, they are still empty-handed. "I am disappointed," Lai told *Microwave News.* "We have been waiting for money for more than two years."

The FDA's own contribution has been minimal. The agency has opted to watch WTR's effort from the sidelines—with a few exceptions. Howard Bassen of the FDA's Center for Devices and Radiological Health (CDRH) has been evaluating probes to measure RF electric fields and methods of estimating energy deposition in the brain.

And the CDRH's Dr. Ewa Czerska is attempting to replicate Cleary's experiments showing that RF/MW radiation can enhance the proliferation of human brain tumor cells (see *MWN,* M/A90). In contrast to Cleary, who used 27 MHz and 2450 MHz radiation, Czerska is using 827 MHz radiation signals designed to mimic the emissions from a digital cellular phone. Czerska announced that she had at least partial confirmation of Cleary's results, observing greater proliferation at specific absorption rates of 1.6 W/Kg and 4.8 W/Kg. "The increase also appeared to be dose-dependent," she said. Czerska noted that this could not have been due solely to a thermal response, since conventional heating did not stimulate a similar level of proliferation.

Lai's latest results, first publicly announced at the FDA workshop, add a new twist to the microwave–DNA story. He reported that the previously observed increases in DNA single- and double-strand breaks are blocked by melatonin.

The political dimension of cellular phone research came into focus with the presentations by Drs. Ross Adey of the VA Hospital in Loma Linda, CA, and Joseph Roti Roti of Washington University in St. Louis.

Adey reviewed the results of his long-term exposure study for Motorola, which indicated that digital (TDMA) cellular phone signals had a protective effect against brain tumor development in rats (see *MWN,* J/A96). But Adey has yet to publicly disclose that a second, parallel exposure using continuous-wave, frequency-modulated (FM) microwaves had absolutely no effect (see p.13).

The biological impacts of FM and TDMA radiation are quite different, Adey said, adding that he could not elaborate further because, "I have been interdicted from talking about FM." The take-home lesson, said Adey, is that, "Every signal may have a different effect."

Roti Roti said that he had not observed the DNA breaks reported by Lai and Singh. But he noted that he had used a different type of microwave radiation and an *in vitro* assay rather than live rats.

At that point, a heated discussion ensued as to whether Roti Roti had used an appropriate signal. "I did not make the decision about the signal," an exasperated Roti Roti finally exclaimed. "I did not pick it. Talk to the lawyers who wrote the contract."

Motorola had a lawyer as well as a public relations consultant from Burson-Marsteller at the workshop. The lawyer, Charles Eger, who had also been in Victoria, Canada, for Adey's presentation of the Motorola TDMA rat study last June, would not say who had picked the experimental conditions for Roti Roti's study. "I'm not familiar with the contract," Eger told *Microwave News.* "I'm not a practicing lawyer; I'm a policy guy."

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* *Physical Characteristics and Possible Biological Effects of Microwaves as Applied to Wireless Communication,* held at the FDA, Rockville, MD, February 7, 1997. The abstracts of the talks are available at the *Microwave News* Web site, <www. microwavenews.com>.

† Allan Frey, "Effects of Microwave and Radiofrequency Energy on the Central Nervous System," *Biological Effects and Health Implications of Microwave Radiation: Symposium Proceedings,* Richmond, VA, September 17-19, 1969, pp.134-139.

EC Gets Wide-Ranging Proposal for Wireless Research; Industry Asked To Fund Independent $20 Million Effort

There are over 25 million wireless phone users in Europe today, but "definitive answers about health hazards...are unlikely to come about in the short term." That is one of the conclusions of the European Commission (EC) Expert Group on health effects of wireless telephones, which has recommended an extensive research program lasting five years or more. The program would be funded mainly by contributions from the telecommunications industry.

"The existing scientific literature...provides no convincing evidence that radiotelephones pose a long-term public health hazard," the expert group states in its report. But it notes that there is far less data on health effects of RF/MW radiation than on the effects of EMFs, and that "a comprehensive health hazard assessment requires such data."

The program would cost a total of 23.8 million European currency units, or ECUs—equivalent to over US$20 million. The plan, developed in response to an EC request in October 1995, was completed last September 30 and released to the public some months later (see *MWN,* J/F97). EC telecommunications specialist Leo Koolen, based in Brussels, Belgium, told *Microwave News* in mid-March that the commission would respond to the proposal "shortly, in a matter of months."

"We will be concentrating on nonthermal effects," Dr. Kjell Hansson Mild, one of ten members of the expert group, told a U.S. workshop on wireless radiation and health (see p.9). He said that the program would fund about 50 different projects, and would consider proposals from anywhere in the world. "The objective is not to promote research in Europe, but to answer a question," explained Mild, who is with the National Institute for Working Life in Umeå, Sweden.

The plan calls for spending 7.5 million ECUs on epidemiological research; 7.47 million on *in vivo* biological studies; 5.27 million on *in vitro* experiments; 1.44 million on research with human volunteers; and 1.44 million on biophysical interaction studies. It budgets 690,000 ECUs for overall project management.

Most studies would last between one and three years, with a fourth year expected for many live animal studies. A fifth year of funding is proposed for continuation of epidemiological work, and the report cautions that "by necessity, the epidemiological (cohort) program may extend beyond this period and further funding may be necessary."

The expert group calls for the telecommunications industry to provide funding for the research, and Koolen said that the European telecom industry had expressed "broad support" for the idea.

In a section titled "Firewall," the report stresses that industry "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." Funding awards should be made by a Proposals Assessment Panel "without consultation with industry or other funding bodies."

Information about the program's funding sources would, however, not necessarily be made public. The proposal provides that corporate and other contributors may remain anonymous: "Public acknowledgment of individual contributions for funding and materials in kind should be at the mutual agreement of the funding body and the EC."

The concept of a five-year, US$20 million research effort funded by industry, yet independent of its influence, is similar to the declared aims of the U.S.' Wireless Technology Research (WTR), which has been plagued by delays since its inception in 1993 (see p.9).

But while WTR has been entirely dependent on industry funding, the EC's Koolen told *Microwave News* that the EC project would include some government funds as well: "We expect the program to be cofinanced by the European Community and industry. This is a precondition for making sure that the program is, and is seen to be, independent, and that the industry money is well spent." While the details have yet to be worked out, Koolen stated that government money would make "a substantial contribution" towards the research effort.

Emphasis on Epidemiology

A significant emphasis is put on epidemiological research, which would receive over 30% of all funding. "Epidemiology is the only way to determine directly whether disease is caused in people," the expert group contends, while animal and i*n vitro* research provide "a very uncertain prediction of the human effects." Indeed, the group argues that wireless phone use is an especially good candidate for epidemiological research, citing the large number of users and the ability to use billing records to estimate exposures.

The expert group acknowledges that "epidemiological studies are not likely to give the 'first warning' of any ill effects," given that many carcinogens take as long as 15 to 40 years to cause disease. But the panel still assigns a relatively high priority to epidemiological work, pointing out that "a few years" is enough time to detect "many known instances of cancer causation, including certain effects of ionizing radiation." Besides brain cancer, the plan calls for "at least one study each" of acoustic neuroma, salivary gland tumors and adult leukemia.

The epidemiological work would not examine cancer risks

Not Quite on the Same Wavelength

The ten members of the EC's expert group on the health effects of wireless phones hold a wide range of opinions. This is often reflected in the language of the report, as in the following passage (with our emphasis):

> Investigations on different cell systems provide evidence for a lack of direct genotoxic and mutagenic effects of continuous and pulsed MW radiation at different power densities. *Yet* there have been a number of reports showing genetic damage in cells or organisms following RF exposure, *but* most often they could be ascribed to heating....*However,* when RF exposure precedes [exposure to a] mutagen, a synergistic effect is sometimes found.

among those living near cellular base stations. The expert group concluded that there was "neither dosimetric, biological or epidemiological justification for such studies," and that current epidemiological methods would be unlikely to provide clear results.

Cancer-related biological studies would focus on the possible role of RF/MW emissions as promoters or copromoters, as well as their possible impact on the immune system. Experiments on genetic effects would examine changes in the brains of animals exposed to RF/MW radiation, such as DNA damage.

Research on nervous system effects would not only examine such questions as headaches, the function of the inner ear and neurobehavioral issues, but also pineal melatonin secretion—with possible implications for both sleep patterns and carcinogenesis.

Working out possible mechanisms of interaction is also part of the proposed research effort, but is described as a lower priority. The same is true for human laboratory studies, which would examine headaches, sleep patterns and immune response.

Unlike the U.S. Food and Drug Administration (see below), the EC expert group does not call for any research on ocular effects. While a few past studies are briefly mentioned, this is not discussed as a possible area for further investigation. Nor does the research plan address electromagnetic interference (EMI) to medical devices. The report explains that, while EMI is important, it is "rather the responsibility of the EMI research and standards community."

Sharing and Controlling Information

The expert group suggests several ways in which research findings could be shared with the EC, funders and the general public. These include "annual open meetings," semiannual reports, a newsletter and a Web site on the Internet.

However, the report also calls for some restrictions on the sharing of information. While the expert group declares that results should be made public "without undue impediment," it adds that "some editorial control may be necessary" in order to maintain a high standard of quality. Accordingly, the plan states that preliminary or interim results "should not be presented at public or scientific meetings without the prior approval of the Research Monitoring Panel." Also, funding would be available only to researchers willing "to agree [to] mechanisms to prevent inappropriate preliminary publication."

Many members of the expert group have themselves been involved in cellular phone research. For example, Dr. Jørgen Bach Andersen of Aalborg University in Aalborg, Denmark, has developed a design for handset antennas that minimizes the amount of radiation absorbed by the user's head (see *MWN,* J/F95). Dr. Konstantin Hossman of the Max Planck Institute for Neurological Research in Köln, Germany, has conducted animal studies funded by Motorola (see *MWN,* J/A95). Mild is currently conducting an epidemiological study of cellular phones and headaches (see *MWN,* N/D96). Dr. Luc Verschaeve of the Flemish Technological Research Institute (VITO) in Brussels, Belgium, has found that close-range microwave exposure from a base station antenna can strengthen the effect of a chemical mutagen in human blood cells (see *MWN,* N/D96).

Three participants in the expert group are members of the International Commission on Non-Ionizing Radiation Protection (ICNIRP): Drs. Jürgen Bernhardt of the Institute for Radiation Hygiene in Neuherberg, Germany; Martino Grandolfo of the National Institute of Health in Rome, Italy; and the expert group's chair, Dr. Alastair McKinlay of the U.K.'s National Radiological Protection Board (see *MWN,* S/O96). The remaining mem-

FDA Tells CTIA's WTR Where To Focus

On March 13, Dr. Elizabeth Jacobson of the Food and Drug Administration (FDA) wrote to Dr. George Carlo, chair of Wireless Technology Research (WTR), to offer her agency's "suggestions for research priorities" on health effects of cellular phone radiation. "Since your resources are limited," she wrote, the FDA wanted to advise WTR "on how your program could be redirected...[to] answer the questions that the regulatory agencies believe are relevant to our concerns." Jacobson is deputy director for science at the FDA's Center for Devices and Radiological Health in Rockville, MD. Reprinted below are the FDA's recommendations. Jacobson wrote that she hoped WTR would find them useful "as you enter the implementation stage of your biological research." Established in 1993 by the Cellular Telecommunications Industry Association (CTIA), the WTR research program is at a standstill (see p.8).

- Chronic (lifetime) animal exposures should be given highest priority.
- Chronic animal exposures should be performed both with and without the application of chemical initiating agents to investigate tumor promotion in addition to tumorigenesis.
- Identification of potential risks should include end points other than brain cancer (e.g., ocular effects of RF radiation exposure).
- Replication of prior studies demonstrating positive biological effects work is needed. A careful replication of the Chou and Guy study (*Bioelectromagnetics, 13,* pp.469-496, 1992), which suggests that chronic exposure of rats to microwaves is associated with an increase in tumors, would contribute a great deal to the risk identification process for wireless communication products.
- Genetic toxicology studies should focus on single cell gel studies of DNA strand breakage and on induction of micronuclei. (These are the only direct genotoxic effects suggested at this time.) The need to replicate the Lai and Singh experiments used to demonstrate microwave-induced DNA strand breakage (*International Journal of Radiation Biology, 69,* pp.518-521, 1996) is strengthened by Dr. Lai's recent reports in scientific meetings that this effort is suppressed by melatonin exposure.
- Epidemiology studies focused on approaches optimized for hazard identification are warranted (e.g., case-control studies are well suited to studying rare diseases such as brain cancer).

Due to the latency of some of the health effects that have been suggested to be associated with exposure to non-ionizing radiation, long-term study is essential to test such associations. Indeed, we believe that continuing postmarketing surveillance is important in ensuring the safety of wireless technologies.

bers of the expert group are Drs. Anthony Swerdlow of the London School of Hygiene and Tropical Medicine in the U.K., Flora van Leeuwen of the Netherlands Cancer Institute in Amsterdam and Bernard Veyret of the University of Bordeaux in France.

The report includes descriptions of other RF/MW research programs around the world, sponsored by ICNIRP, the World Health Organization, WTR, the German telecommunications organization FGF and others. Several tables provide extensive listings of previously published papers in the field, and an appendix gives thumbnail sketches of research projects currently under way.

Copies of the EC expert group's report, *Possible Health Effects Related to the Use of Radiotelephones,* can be ordered by faxing Ms. Anja Jansen of the European Commission in Brussels at (32+2) 296-8395.

Australia in Uproar Over New Zealander's Proposal: Nanowatt-Level RF/MW Public Exposure Limits

Dr. Neil Cherry of Lincoln University in Canterbury, New Zealand, is advocating an RF/MW exposure standard below 1 $\propto W/cm^2$. His public comments on the need for stricter limits have created a firestorm of controversy in Australia, which has reached all the way to the Australian Parliament.

On February 28, Cherry issued a report arguing that recent studies point to exposure limits "at 0.1 $\propto W/cm^2$ if cancer risk is to be reduced and 0.01 $\propto W/cm^2$ if miscarriage risk, sleep disruption, children's performance impairment and chronic fatigue symptoms are to be reduced." Most national and international standards specify exposure limits between 200 and 1,000 $\propto W/cm^2$ for the general public.

Four days later, as a keynote speaker at a conference in Sydney, Cherry criticized the Australian government for not adequately addressing RF/MW health concerns. "I seriously wonder how many children and adults will have to die before we will adopt proper public health protection standards," he said.

The next day Senator Richard Alston, minister for communications and the arts, called Cherry "a shameless charlatan" and "a snake oil merchant" in Parliament. He added that Cherry "is a rabid populist and totally uninterested in any considered scientific debate. His remarks are highly inflammatory."

Alston also questioned Cherry's scientific credibility and accused him of supporting a "public scare campaign" about RF/MW radiation.

In particular, Alston bristled at accusations that the Australian government was unresponsive to health concerns. He pointed to the $3.5 million research project on wireless technology that was set up to advise the government on policy decisions (see *MWN,* N/D96).

Several senators rebuked Alston for the personal attack in Parliament, where he is immune to charges of libel. "Most of the remarks made by Senator Alston were highly defamatory....it would both be stupid and require more courage than he has to repeat those words outside this chamber," Senator Lyn Allison of Victoria said later that day in Parliament.

Because of the harsh nature of Alston's remarks, Cherry was granted a written right of reply to the Senate. "There is an immense amount of published scientific research showing many non-thermal effects of RF/MW radiation at the cellular level," he stated in the reply.

Cherry also noted that in 1996 a New Zealand planning tribunal—after hearing from Cherry and Israel's Drs. John Goldsmith of Ben Gurion University of the Negev in Beer Sheva and Richard Luben of the University of California, Riverside in the U.S.—allowed BellSouth to build a mobile-phone tower in Ilam, a suburb of Christchurch, under the condition that the power densities at nearby residences not exceed 2 $\propto W/cm^2$.

Alston claimed that Cherry had been discredited by the court since BellSouth had been permitted to go ahead with its plans. Cherry replied that the decision was "a major step forward" because it called for a limit far below the 200 $\propto W/cm^2$ advisory guideline New Zealand adopted in 1990.

Indeed, Cherry used the tribunal's decision as a basis for the proposed nanowatt standard in his February report, *Potential and Actual Adverse Effects of Radiofrequency and Microwave Radiation at Levels Near and Below 2 $\propto W/cm^2$.* Cherry stated that recent papers on shortwave radio transmitters in Schwarzenburg, Switzerland, on a radar system in Skrunda, Latvia, and on broadcast towers in Sydney, by Dr. Bruce Hocking, and in the U.K., by Dr. Helen Dolk (see *MWN,* N/D93, J/F96, S/O96 and J/F97), showed the need for even lower exposure limits.

In a 1995 report, Cherry had concluded that transmitters should be kept away from schools and residences "by such a distance that the intensity of the microwaves, when averaged over a year, does not exceed 0.1 $\propto W/cm^2$."

The situation in Australia has become especially tense because the telecommunications industry is preparing for deregulation in July. According to the March 12 *Australian Financial Review,* the process is expected to create a "$140 million-plus tidal wave of advertising, marketing and sponsorship," as new companies strive to compete with the current providers, Optus and Telstra.

At the same time, the Australian Local Government Association (ALGA) is seeking to disallow the 1996 telecommunications code, which was developed under the leadership of Senator Alston. According to ALGA President John Campbell, the code "largely ignores potential health impacts" and "perpetuates a system under which the carriers are their own judge and jury."

In his efforts at reform, Campbell has won the support of Senator Allison, telecommunications spokesperson for the Australian Democrats. "The government's response to Dr. Cherry's views is of concern to us," Allison said in a prepared statement. "It shows that the government has a closed mind about the health effects of EMR [electromagnetic radiation] and appears unwilling to listen to anything other than the 'industry line.'"

For information on obtaining a copy of the report, contact: Dr. Neil Cherry, Department of Natural Resources Engineering, Lincoln University, Canterbury, New Zealand, Fax: (64+3) 343-3693, E-mail: <cherry@kea.lincoln.ac.nz>.

Adey Finds No Effect, Detrimental or Protective, Among Rats Exposed to Analog Wireless Phone Radiation

Reprinted below is the abstract of a paper, "Brain Tumor Incidence in Rats Chronically Exposed to Frequency-Modulated (FM) Cellular Phone Fields," which will be presented by Dr. Ross Adey on June 9 at the 2nd World Congress for Electricity and Magnetism in Biology and Medicine *in Bologna, Italy (see p.18).*

Adey, who is with the VA Hospital in Loma Linda, CA, reported last summer that a similar experiment designed to mimic the signals from a TDMA digital mobile phone appeared to show a protective effect. That is, the animals exposed to pulsed radiation had fewer tumors than did controls (see MWN, *M/J96 and J/A96).*

Adey's more recent experiment used FM signals patterned after the radiation from an analog cellular phone. Both the FM and TDMA animal studies were sponsored by Motorola Corp.

One observer, who was aware of Adey's new results, commented that, "It's the low-frequency modulation that makes all the difference," referring to the 50 Hz modulation associated with the TDMA signals.

Frequency-modulated mobile phone systems have been the dominant technology for many years. Their continuing use worldwide appears certain in many applications, with typical RF carrier frequencies in the range from 0.1-1.5 GHz. Body tissues, specifically in the head and hand of the user, absorb up to 40% of the radiated signal. Portable FM phones, with average output powers of 0.6 W in the 800 MHz frequency band, induce field strengths in the most exposed tissues equivalent to 1 W/Kg±6db, depending on the device's position and design. Although occupational exposures of certain microwave workers to radar and other pulsed fields have been reported to carry an increased risk of brain tumors (e.g., Thomas et al., 1987), no comparable data have been reported for FM mobile phone users.

OBJECTIVE: Previous universal use of FM technology in mobile communication systems, as well as its continuing availability, suggest [the] need for assessment of possible human brain tumor risks in a suitable animal model; and to compare findings with our previous study in rats exposed to North American Digital Cellular (NADC) signals (Adey et al., *Proceedings of the Bioelectromagnetics Society,* 18th Annual Meeting, 1996). We have sought evidence for perturbation by FM phone fields of spontaneous brain tumor incidence, and in rats exposed to single doses of the short-lived carcinogen ENU *in utero,* and thereafter exposed intermittently to FM phone fields for 24 months (mean life span 26 months). Low ENU dosage was selected to give maximum sensitivity to possible tumor modulation by FM phone fields over the lifetime of the animal[s].

METHODS: We tested a frequency-modulated 836.55 MHz signal, with ±12.5 kHz maximum deviation. Modulation was by a recorded pattern of "balanced speech" that generated all major speech components in a 2-minute epoch that recycled continuously. Pregnant Fischer 344 rats were randomly assigned to 6 groups. They received either a single tail-vein injection of the carcinogen ethylnitrosourea (ENU, 4 mg/Kg) or inert buffer solution on gestational day 18. Far-field exposures (horn radiator, 836 MHz, circularly polarized) began on day 19 and continued after parturition until weaning at age 23 days. Offspring (n=540) of the 6 maternal groups then became treatment cohorts: Sham/Control (SC), n=90, 45M, 45F; ENU/Control (EC), n=90, 45M, 45F; Sham/Sham (SS), n=90, 45M, 45F; Sham/Field (SF), n=90, 45M, 45F; ENU/Sham (ES), n=90, 45M, 45F; ENU/Field (EF), n=90, 38M, 52F. Exposures simulating near-fields at a phone user's head began at 35 days, and continued for the next 23 months. Exposures were for 2 hours daily, antenna power 2.5 W, field-on 7.5 minutes, field-off 7.5 minutes. Far-field averaged SARs (modeled): pregnant dam (uterus) 1.0 W/Kg; fetus (brain) 0.9 W/Kg; isolated pup (brain) 0.1 W/Kg; young rat (brain) 0.4 W/Kg. Averaged near-field brain thermographic SARs: average males 2.3 W/Kg; average females 1.8 W/Kg. Survivors of the original 540 rats (n=372, 69%) were sacrificed at 730-733 days.

RESULTS: There were no effects on brain tumor incidence attributable to the FM fields in either the control or the ENU groups. There was the expected higher incidence of brain tumors in the ENU-exposed groups (EC, 15; ES, 17; EF, 15), in comparison with the low incidence of spontaneous brain tumors in the sham and control groups (SC, 2; SS, 1; SF, 3), $p < 0.001$. Comparing survival rates, lifetimes of ENU-exposed animals were significantly shorter than [those of] controls ($p < 0.0005$), but these differences were not influenced by FM field exposures.

DISCUSSION: The findings here are consistent with our previous study in rats exposed to NADC signals. The apparent "protective" effect in the NADC study, which did not gain statistical support, was not detected with FM fields. These effects have been modeled in the normal homeostatic balance between mechanisms regulating damage and repair in cell growth. They may indicate sensitivities to the 50/second pulsed characteristics of TDMA fields. Other packet frequencies in current use or proposed for cell phone use (GSM=217, iDEN=22, Iridium=11) may therefore merit specific study.

Air Force Microwave–Cancer Study Shrouded in Mystery *(continued from p.1)*

at Brooks Air Force Base in San Antonio, told *Microwave News* during the Boston BEMS meeting that Toler had never finished writing a final report and explained that Toler's abrupt departure was due to a lack of funds.

In fact, Toler had sent the USAF his final report a full year before the BEMS meeting.

For close to a year after the 1995 meeting, the USAF refused to release the report to *Microwave News* despite repeated requests under the Freedom of Information Act. When the USAF finally conceded, the report was stamped "DO NOT CITE OR QUOTE."

Those within the military have also been denied access to the results. "I was trying to get the article from [Toler] for over two years before I gave up," said Dr. Edward Elson. At the time, Elson was working on radiofrequency and microwave (RF/MW) bioeffects at the Walter Reed Army Institute for Research in Washington. He is now studying Gulf War illnesses for the Army.

Even members of the Armstrong Lab have been denied access to the Toler data—as Dr. Richard Albanese of the Occupational and Environmental Health Directorate found out when he asked to see the report.

The Guy Study

In 1984, Dr. Bill Guy released results from his long-term, low-level exposure study which showed that rats exposed to pulsed microwave radiation had a statistically significant increase in malignant tumors. The five-year, $5 million project, which was sponsored by the USAF, was the first long-term RF/MW study ever done in the U.S. (see *MWN,* J/A 84 and Mar85).

Guy exposed 100 male rats to 0.48 mW/cm^2, 2,450 MHz pulsed microwaves (10 microsecond pulses, 800 pulses per second) 21 hours per day for up to 25 months. The specific absorption rate, or SAR, was 0.4 W/Kg or less. A second set of 100 unexposed rats were used as controls. All the rats were housed in a pathogen-free environment.

Guy found a total of 18 malignancies among the exposed group and 5 among the controls. In particular, there were 9 endocrine tumors in the exposed group and 2 in the control group.

Although the study did not turn up an excess of benign tumors, there were 6 pheochromocytomas—benign adrenal tumors—all in the exposed rats.

Results from the study were first presented at the 1984 BEMS meeting in Atlanta. They were published eight years later in a special issue of *Bioelectromagnetics,* commemorating Guy's retirement from the University of Washington, Seattle (see *MWN,* J/F93).

"It's unfortunate that the data have not been released sooner, especially since it is a chronic exposure study. We should have had it a long while ago," said Dr. Stephen Cleary of Virginia Commonwealth University in Richmond.

Toler's $600,000 study is widely seen as a small-scale follow-up to Dr. Bill Guy's $5 million, long-term exposure study—also sponsored by the USAF and thought by many to show an elevated risk of cancer (see box above). As Dr. Samuel Milham, now a consultant based in Olympia, WA, commented more than ten years ago: "The findings are so suggestive of potential microwave effects that the portions of Dr. Guy's study dealing with immune status and neoplasia should, at a minimum, be replicated" (see *MWN,* N/D86).

Guy himself agrees. "I thought it should be repeated from the beginning," he told *Microwave News* in mid-March.

Dr. C.K. Chou, Guy's collaborator on the long-term exposure study, also favors more research. "The biological significance of these effects needs to be explored," he said at the 1995 USAF workshop. After leaving Guy's lab, Chou joined the City of Hope National Medical Center in Duarte, CA.

Guy's results continue to be cited as showing a positive effect. In a March 13 letter to Wireless Technology Research (WTR), Dr. Elizabeth Jacobson of the U.S. Food and Drug Administration (FDA) recommended that WTR perform a "careful replication of the Chou and Guy study which suggests that chronic exposure of rats to microwaves is associated with an increase in tumors" (see p.11).

The USAF, however, maintains that Guy's results do not point to adverse health effects. "His findings were that there were no effects of radiation—I mean, that's well known," Merritt said in an interview.

Toler's study differed from Guy's in several key respects. First, although Toler had initially set out to expose rats as Guy had done, the USAF amended the study design in 1987, stipulating instead the use of breast cancer-prone mice.

Also, Toler exposed 200 mice to radiation at 435 MHz rather than 100 rats at 2.45 GHz as Guy had done (see box below). According to Merritt, the lower frequency was designed to mimic the signal of a USAF early-warning radar system, PAVE PAWS.

Blood chemistry indices were monitored by Guy and were part of Toler's original study design. But they were later rejected by the USAF. When asked why, Toler responded, "As I recall, we could have done a whole lot more analyses. The primary interest was in mammary tumors."

In the report he wrote for the USAF, Toler did not give the final, overall tumor counts, but stated, "There was no evidence to suggest differences in tumor rates between sham-exposed and exposed animals." He stated that the final survival rates were the same for both groups.

Toler looked at a variety of tissues for cancer but did not examine the mice for leukemia. An appendix to the report with results of tissue analyses conducted by Pathology Associates Inc. (PAI) in Frederick, MD, appears to show that 178 of the exposed mice had cancer, as compared to 158 of the sham-exposed. There were also more total malignancies among the exposed mice (297) than among the sham-exposed mice (261). Some animals had more than one tumor. (These totals were added up by *Microwave News* from the data in the report by PAI.)

Liver cancer was the most prevalent type of malignant tumor, with 104 cases among the exposed mice and 98 among the controls. Toler did find a statistically significant increase ($p=0.033$) in hemangioma, a cancer of the blood vessels. But he dismissed the result as not significant because of "the absence of evidence of a difference between exposed and sham-exposed animals with

The Toler Study

Beginning in March 1989, Dr. James Toler exposed 200 female, mammary tumor-prone mice to 1 mW/cm^2, 435 MHz pulsed microwaves. The pulses had a width of 1 microsecond and a repetition rate of 1 kHz. The specific absorption rate, or SAR, was 0.32 W/Kg.

A second group of 200 mice served as controls. And an additional 25 mice were included among both the exposed mice and the controls to serve as "sentinels"—to be sacrificed in the course of the study to monitor the health of the entire colony.

The mice were exposed starting when they were approximately five weeks old for an average of 20 hours a day, seven days a week for 21 months. Once a week the animals were palpated for tumors and weighed.

In December 1990, the mice that were still alive were killed. Samples of 22 different tissues from all the animals were analyzed by Pathology Associates Inc. in Frederick, MD.

respect to combined hemangioma or hemangiosarcoma."

As expected, cases of mammary gland adenocarcinomas were high, but the exposed mice had only three more tumors than did the controls, 85 compared to 82. The median tumor onset time for these adenocarcinomas was nine days earlier for the exposed mice, though this finding was not statistically significant at the 0.05 level, according to Toler's report.

A year after the experiment began in March 1989, Toler indicated a consistent trend of a higher tumor incidence among exposed animals. By the end of May 1990, he had observed 42 exposed mice with tumors and 34 controls with tumors, a slightly different figure from what he reported in Boston in 1995.

In a July 20, 1990, memo to Merritt, Toler suggested extending the experiment by three months into December to avoid accusations of not exposing the mice for an adequate length of time. Merritt agreed with the proposal, scribbling in response at the bottom of the memo: "This has been a very well run study so far. It will become a landmark study in time."

At the end of that July, Toler reported finding 76 exposed mice with tumors and 67 sham-exposed mice with tumors. The following month, Toler reported to the USAF that the total number of animals with tumors, including possible tumors, was 109 for the exposed group and 87 for the sham-exposed group.

That September, when the experiment had originally been scheduled to end, Toler stopped reporting tumor counts to the USAF. He explained that he had "difficulty in assuring that observed abnormalities [were] actually tumors when the examinations [were] based solely on palpation."

Nonetheless, the health status updates for each animal continued to note, on the basis of palpation, those that appeared to have tumors. Based on these figures, the total of exposed animals with tumors at the end of September rose to 115, with 88 tumors among the controls.

The USAF recently submitted Toler's paper to *Radiation Research*. In an effort to explain the delay in publication, Toler said that the USAF had sent his paper to other journals before, but was told that the paper would have to be shortened. "At any rate, it was a sizable effort to trim it down to get it published," he said.

Merritt said that he would not comment on the results until they are published and was reluctant to say whether such research was worthy of further investigation. "You never close the door on studies. You'll always get complaints—you didn't do this, you didn't do that," he said in a recent interview. "I don't know whether this should be continued."

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"MICROWAVE NEWS" FLASHBACK

Years 15 Ago

• Two-way radios attached to workers' suits interfere with gas monitors, causing an eight and a half hour alert at the Three Mile Island nuclear plant in Middletown, PA.

• The Navy announces a $49.8 million plan to upgrade its ELF submarine communications system, with most of the money to be spent in Michigan and Wisconsin, and says it will monitor the ecological effects of the plan in Michigan but not in Wisconsin.

• Two legal secretaries in Rhode Island reach an undisclosed settlement with Amana Refrigeration Co., makers of the Radarange microwave oven, after only one day of testimony in the U.S. District Court in Providence. The two claimed to have developed cataracts after being exposed to radiation from a faulty oven in their lunchroom.

• Occupational Safety and Health Administration officials decide to stop citing companies for violating the RF/MW exposure standard, saying that the limits are meant only as an "advisory" guideline.

Years 10 Ago

• A committee assembled by the World Health Organization and the International Radiation Protection Association recommends magnetic field safety limits based on short-term health effects, not cancer risks.

• Two British researchers publish a paper in *Clinical Ecology* showing that weak EMFs can cause allergic reactions such as migraines and convulsions.

• A joint EPA–FCC study finds RF "hot spots," as much as ten times above the ANSI exposure limits, in public areas near some FM broadcast towers.

Years 5 Ago

• A Finnish study concludes that women exposed to ELF magnetic fields of more than 3 mG (rms) from video display terminals (VDTs) are more likely to have miscarriages, but does not find a link between the number of hours spent using VDTs and miscarriages.

• The U.K.'s Coordinating Committee for Cancer Research launches a £6 million study of the possible causes of childhood leukemia, including the role of EMFs.

• Traffic radar units are blamed in seven testicular cancer cases among police officers in Grand Rapids, MI, three times more than would be expected, according to a study by the University of Washington.

FROM THE FIELD

Clippings from All Over

Several committee members felt that the press release issued by the NRC in conjunction with the publication of the report did not reflect well the content of the report. These members solicited support from the rest of the committee to request that [the] NRC issue a new press release which, in their opinion, might be more reflective of the report. I declined to participate in this request, not because arguments could be constructed to place more or less emphasis on components of the report, but because I felt the original press release was a vehicle of the NRC, not of our committee. I always believed, during the duration of our deliberations, that the report, whatever its content, would be interpreted by different parties enjoined in EMF deliberations to reflect a particular viewpoint. I felt that the press release by the NRC was within the range of interpretations that a thoughtful individual or organization could infer from the report. I stand by the report completely. I believe it is an accurate description and analysis of current data on the possible health effects of EMF.

—Dr. Jerry Williams, Johns Hopkins Medical Institutions, Baltimore, "Is It Safe? A Discussion of the Report from the National Research Council (NRC) on Possible Health Effects of Exposure to Residential Electric and Magnetic Fields," presented at the *1997 EPRI EMF Seminar: New Research Horizons,* New Orleans, March 2-5, 1997 (see also *MWN,* J/F97)

"It's the conflict between the biological and epidemiological evidence and the difficulty of getting firm epidemiological evidence that makes [EMFs] so interesting. It would have a considerable impact on society if it were shown to produce a hazard—or if it didn't—because then we could stop worrying about it."

—Sir Richard Doll, chair of the UK's National Radiological Protection Board's (NRPB) Advisory Group on Non-Ionizing Radiation, quoted by Hilary Bower in "No Sign of Slowing Down" (a profile of Doll), *British Medical Journal,* p.700, March 8, 1997

Medical science has paid little attention to the health hazards of electromagnetic pollution, and it is difficult to establish causal connections between exposure and diseases that might not show up until years later. Scientific evidence here is scant and contradictory, making the whole topic "controversial"; still, I think it would be foolish to take no action while waiting for the evidence to be uncovered.

— Dr. Andrew Weil, *Eight Weeks to Optimum Health* (New York: Alfred Knopf, 1997), p.86

According to [Cellular Telecommunications Industry Association President Tom] Wheeler, the lawyers want to stop the research so there'll be less evidence to disprove claims of cellular phone-based ills. "They want to have a chilling effect," he observed.

—Edward Warner, "Cancer Research Heads Toward Main Event," *Wireless Week,* p.32, February 24, 1997

"In fact, the SAG and WTR have repeatedly made public statements which confirm the contention that existing data and studies do not rule out the possibility that cellular telephones cause ill health effects such as brain cancer."

—Michael Volpe, spokesperson for WTR, quoted by Jeffrey Silva in "Motorola Memo Raises Questions About WTR Research," *Radio Communications Report (RCR),* p.66, March 3, 1997

Many stations are looking to their towers to produce additional income streams. With cellular, PCS, SMR, two-way paging and a host of other new radio services, demand for tower space is exploding. Couple this with the public's general disdain for towers, and existing sites become very attractive to radio service providers. A broadcast tower that has room available can become a valuable piece of "vertical real estate."

—W.C. Alexander, "Make Money From Your Tower," *Radio World,* p.33, March 19, 1997

"This whole concept of electromagnetic warfare [needs to be] publicly debated."

—Dr. Richard Williams of the David Sarnoff Institute, Princeton, NJ

"I see this as a tremendous opportunity to educate the public about physics and auroral studies."

—Dr. Joseph Kan, University of Alaska, Fairbanks

Quoted by Lisa Busch in "Ionosphere Research Lab Sparks Fears in Alaska," on the HAARP Program, *Science*, p.1060, February 21, 1997

Most adults won't realize they're being affected by these new digital systems that are emitting microwave radiation. Me, I get nauseated and dizzy. My thyroid swells and my throat starts to close. My throat, neck, and ears ache. My insides feel scraped up and down.

—Pelda Levey of Bloomfield, CT, in an opinion column, "FCC Ignoring Health Effects of Cell Phone Antenna Towers," *Hartford Courant* (CT), p.A17, February 12, 1997

"I don't want to be a guinea pig."

—Chris Colonna, a telecommunications executive, on the use of the hormone melatonin to combat jet lag, quoted by Nancy Keats in "Sleepless in the Sky—Some New Tactics," *Wall Street Journal,* p.B4, March 14, 1997

UPDATES

ELECTROMAGNETIC SENSITIVITY

Linked to Flickering Light?... In Sweden and other countries around the world, a growing number of people have reported adverse reactions to VDTs, fluorescent light, household appliances and other devices that produce EMFs. The symptoms of such "electrical hypersensitivity" include itching or burning sensations in the skin of the face, eyes that feel dry or gritty and headache, dizziness or fatigue. Now a Swedish-Russian research team has found that people who have complained of this problem appear more sensitive to flickering light—at frequencies that overlap with the flicker produced by VDTs and fluorescent lighting. Writing in the January 1997 *Journal of Occupational and Environmental Medicine,* Monica Sandström and colleagues from the National Institute for Working Life in Umeå, Sweden, and from the Institute of the Human Brain in St. Petersburg, Russia, indicate that the difference between subjects and controls was consistent and statistically significant. But the difference was in the reactions of their brains, not their eyes: While the subjects' cortical responses to flickering light were stronger, their retinal responses were not. The researchers note that three previous studies of people reporting sensitivity to electromagnetic devices have tried to provoke the symptoms with controlled exposures to EMFs. Two studies could not, while the third did so only with a small minority of subjects. Thus, Sandström and her colleagues

suggest, other factors may well be involved. They stress that their research does not prove that sensitivity to flickering light is linked to the subjective symptoms; it does, however, indicate "that patients with perceived electrical hypersensitivity are hyperreactive in their nervous system." A member of Sandström's team, Dr. Kjell Hansson Mild, told *Microwave News* that they are planning follow-up studies, both with the same group of people and with 15-20 new subjects.

Linked to Nothing?...A skeptical perspective on electromagnetic sensitivity is advanced by Dr. Sture Lidén in a recent review article in *Allergy (51,* pp.519-524, 1996). Although " 'sensitivity to electricity' is a recent and ongoing epidemic in Sweden," Lidén writes, "the weight of evidence so far favors a psychosomatic explanation." He cites several provocation studies with a total of 140 participants, and asserts that "none of these subjects have been able to tell when the EMFs were turned on or off." A major part of Lidén's article is devoted to a history of psychosomatic disease, lumping together 19th-century diagnoses such as "pelvic madness," controversial modern diagnoses including chronic fatigue syndrome and occupational diseases such as "the so-called writer's cramp" of the early 1800s, "telegraphist's spasm" of the 1890s and repetition strain injury from computer use in the 1970s and 1980s. Lidén argues that all of these ailments are essentially psychosomatic.

EPIDEMIOLOGY

Occupational Leukemia Review..."There is some evidence for an association between occupational magnetic field exposure and leukemia, especially for chronic lymphocytic leukemia [CLL], but the inconsistencies between and within studies weaken the evidence," according to Dr. Maria Feychting. In a review paper published in the November 1996 issue of the *Journal of Radiation and Environmental Biophysics (35,* pp.237-242, 1996), Feychting, of the Karolinska Institute in Stockholm, Sweden, reported that, "Currently, no firm conclusions can be drawn regarding the association between occupational magnetic field exposure and adult leukemia." She reviewed 20 early "first generation" studies that used "crude" methods to assess EMF exposures (primarily job titles) and eight later efforts that included magnetic field measurements. Feychting summarized the results of these eight studies—"not an easy task": "For all leukemia diagnoses combined, half of the studies noted moderately elevated risk estimates, while the other half found no association. For leukemia subtypes the results are inconsistent, even if some trend can be seen for [CLL]." There "are no obvious explanations for the discrepancies among the results," she added. For future studies, she called for better exposure assessment, including magnetic field exposures for each subject as well as for possible exposures outside the workplace. Specifically, Feychting recommended that, "New studies should be designed to study [CLL], as well as other subtypes of leukemia."

MEETINGS

ICNIRP 1996 Workshop and 1997 Seminars... The International Commission on Non-Ionizing Radiation Protection (ICNIRP) has published a book of papers that were presented at its *3rd*

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New Scientist (U.K.), October 7, 1995

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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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International Non-Ionizing Radiation Workshop, held last April in Baden, Austria. The volume covers the electromagnetic spectrum from static and ELF fields to UV radiation and has an introduction by Dr. Michael Repacholi, a former chairman of ICNIRP and current director of the WHO's EMF project. Authors include Dr. Anders Ahlbom of the Karolinska Institute in Stockholm, Sweden, on "Cancer and Exposure to Weak ELF Magnetic Fields," Dr. R.D. Saunders of the NRPB in Oxfordshire, U.K., on "Biological Effects of RF Radiation" and Dr. Thomas Tenforde of the Battelle Pacific Northwest Labs in Richland, WA, on "Interaction of ELF EMFs with Living Systems." In addition, ICNIRP and WHO are together sponsoring two upcoming seminars: *Biological Effects of Static and ELF Electric and Magnetic Fields and Related Health Risks* on June 4-5 in Bologna, Italy (immediately before the *2nd World Congress for Electricity and Magnetism in Biology and Medicine),* and *Risk Perception, Risk Communication and Its Application to EMF Exposure* on October 22-23 in Vienna, Austria. To order *Non-Ionizing Radiation: Proceedings of the 3rd International Non-Ionizing Radiation Workshop,* send $60.00 plus shipping to: ICNIRP, c/o Roger Matthes, Institute of Radiation Hygiene, Federal Office for Radiation Protection, Ingolstädter Landstraße 1, D-85764 Oberschleißheim, Germany; for more information on the ICNIRP-WHO seminars, contact Matthes at (49+89) 3160-3288, Fax: (49+89) 3160-3289, E-mail: <matthes@bfs.de>.

World Congress Preview... There are a number of events planned in conjunction with the *2nd World Congress,* to be held June 8-13 in Bologna. On Sunday afternoon June 8, the U.S. DOE and NIEHS will present a progress report on the EMF RAPID research program. At the same time, the U.S. Air Force will host a workshop on thermal effects of RF/MW radiation. After the close of the congress, Italian officials will participate in a workshop and roundtable discussion on "Electromagnetic Risks and Public Concern"—simultaneous English-Italian translations will be provided. For more information, 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>.

POLICE RADAR

Workers' Comp Winner Drops Lawsuit... Franklin Chappell, a police officer in Portsmouth, VA, is no longer seeking damages from traffic radar manufacturer Kustom Signals Inc. In November 1995, the Virginia Workers' Compensation Commission found that Chappell's testicular cancer was caused by the radar unit he used on the job, and shortly afterwards Chappell reached a settlement with the city of Portsmouth (see *MWN,* M/A96). Chappell then sued Kustom, but the case was withdrawn this February 28. "Mr. Chappell and his attorney apparently decided that neither a trial judge nor a jury could be convinced that Mr. Chappell's testicular cancer was caused by his use of a traffic radar device," Kustom's attorney, Mark Oium of O'Connor, Cohn, Dillon & Barr in San Francisco, told *Microwave News.* But Chappell offered a different rationale. "The biggest reason was financial," he explained. "I'd have to take a chance on [legal costs of] about $200,000, and I just don't have that kind of money."

Dropping the "H" in WHO
The EC Must Not Delegate Wireless Health Research to WHO

The U.S. Air Force's handling of the Toler cancer study, as detailed on p.1, should stop anyone from ever looking to its Armstrong Lab for a fair appraisal of RF/MW health hazards.

Sadly, this is nothing new. Most veterans of the RF/MW scene have similar stories. The Armstrong Lab has long been known for its dogmatic denial of anything that could be construed as a nonthermal biological effect. Its real mission has *not* been to protect military personnel, but to protect the Pentagon's freedom to use its radars and communications systems.

Dr. Michael Repacholi, who runs the World Health Organization's (WHO) EMF Project in Geneva, Switzerland, does not see it that way. At a November seminar* on RF health risks held in Munich, Germany, Repacholi appointed three members of the Armstrong Laboratory to the working groups. A representative from the U.S. Army was also present. Absent was every U.S. government health agency knowledgeable about RF radiation: the EPA, FDA, NIEHS and NIOSH.

Of the seven other Americans participating in the seminar, two have publicly advocated ending all RF/MW research (see *MWN,* J/F88). Drs. Kenneth Foster and William Pickard have called RF/MW radiation "one of the most thoroughly studied of all potential environmental hazards." This conclusion runs counter to more recent reviews from Australia, the EC, New Zealand and even the U.S. cellular phone industry.

Amazingly, Repacholi appointed Pickard to chair the *in vivo* research panel. To analyze the animal studies, the WHO turned to a physicist who openly dismisses health risks and who has had scant training in biology.

Only two of the American participants actually do biological research. Repacholi sees no need to rely on biologists and physicians when it comes to health data.

The WHO does not allow industry representatives on its committees, so the gaggle of Motorola staffers who came to the Munich seminar sat on the sidelines while the military and other skeptics called the shots. If private corporations are thought to be too biased to take part, it is unclear how anyone can argue that the military is a disinterested seeker of truth. As the Toler study and countless other examples show, military institutions have their own vested interests in downplaying RF/MW health risks.

But Repacholi's only hope to raise funds for the WHO project in the U.S. lies with the military (see *MWN,* J/F97). So perhaps the selection of speakers reflects an old adage: "Money talks."

Repacholi is not new to controversy. To wit:

• He advocates loosening the Australian exposure standard at a time when the country is in the throes of an intense RF–health debate—even though Telstra and Optus, the country's leading telecom companies, favor the status quo. Asked why, Repacholi said that he wants the Australian standard to be consistent with the international limits adopted by ICNIRP. But the ICNIRP limits were shepherded to approval by Repacholi himself, when he chaired the commission.

• He told an Australian television news program: "The worst aspect of mobile phones is that they probably interrupt my meals in restaurants" (see *MWN,* J/A95).

• He advised an Australian Senate committee to ignore the U.S. National Council on Radiation Protection and Measurements' EMF report, drafted by an expert committee over a ten-year period, "because it is a nothing report" (see *MWN,* J/F96 and M/J96).

• Repacholi has been all too willing to serve as an expert witness for industry—for instance, he testified for BellSouth on cellular phone tower health risks in New Zealand.

• Earlier this year, Repacholi chaired an EMF conference sponsored by French and Belgian electrical utilities. Here again, Repacholi made no effort to present a balanced program, choosing instead to cater to the "no effect" views of his sponsors (see *MWN,* J/F97).

Then there is Repacholi's long-term animal study. In a late March interview, he refused to discuss his results, which, he said, are scheduled to appear in the May issue of *Radiation Research.* How could Repacholi fail to disclose RF/MW cancer data at his own seminar? He said that the contract with his sponsors, Australian telecom companies, barred him from revealing the results until three months after they were accepted for publication.

Given how few such studies have been done, Repacholi should have asked to be freed from his commitment for reasons of public health or delayed his seminar until the gag order had expired. Why should the telecom companies have advance notice of his results, and not those at the seminar? If he has found evidence of a cancer risk, Repacholi's secrecy would be scandalous.

Informed sources say that Repacholi is angling for a major role in the EC's RF/MW research program (see p.10). Indeed, Repacholi told *Microwave News* that his project will soon have "buckets of money." The EC should find another way.

The worldwide RF/MW controversy can only be resolved with a program that is perceived as fair and objective. The EC must not repeat the CTIA-WTR fiasco, with little to show after four years and $15 million but a fistful of frequent-flier miles.

* *Biological Effects of Nonthermal Pulsed and Amplitude-Modulated RF Electromagnetic Fields and Related Health Hazards,* November 20-21, 1996, Munich, Germany. The seminar was jointly sponsored by the WHO, the International Commission on Non-Ionizing Radiation Protection (ICNIRP) and the German and Austrian governments. When a conference summary was submitted to *Bioelectromagnetics* in March, the title had been changed to *Low-Level Exposure to Radiofrequency Fields: Health Effects and Research Needs*—omitting the words "nonthermal" and "hazards." Repacholi edited the text for publication.

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EMF Animal Studies: What's Going On?

CTIA's WTR: Five Years and Counting

"Equivocal" Cancer Finding in Two-Year EMF Animal Study

A two-year animal study has found a significant link between exposure to electromagnetic fields (EMFs) and thyroid cancer in male rats. But no such association was seen in mice or in female rats, and it is unclear whether the link represents a real biological effect.

A draft report from the National Toxicology Program (NTP) rates the thyroid result as "equivocal"—somewhere between "no evidence" and "some evidence" of an EMF–cancer connection. No increases were observed for brain tumors, breast cancer or leukemia in either rats or mice.

This study is the centerpiece of the NTP's multimillion-dollar effort on the health effects of EMFs (see *MWN,* S/O90), and is one of many recently completed studies that will be discussed at the National Institute of Environmental Health Sciences (NIEHS) review of *in vivo* research in Phoenix, April 6-9.

NTP scientists have had long discussions about whether EMF exposure caused the increase in thyroid cancer. "I don't think it did," said the NTP's Dr. Gary Boorman. "But it's a difficult issue. Almost every argument has two sides."

(continued on p.4)

Microwave News' EMF and EMR Internet Directory
Addresses for More than 250 Sites on the World Wide Web
See Special Section on pp.10-13

Dueling Data on Breast Cancer: U.S. and German Results Do Not Agree

Researchers at the Battelle Pacific Northwest Labs in Richland, WA, have been unable to confirm German experiments linking EMFs to breast cancer.

"Our results showed no increase in breast cancer in rats due to EMF exposure," Battelle's Dr. Larry Anderson told *Microwave News*. The work at Battelle was an attempt to reproduce the findings of Drs. Wolfgang Löscher and Meike Mevissen at the School of Veterinary Medicine in Hannover. The Battelle studies were sponsored by the RAPID research program (see *MWN,* M/A96).

Meanwhile, Löscher and Mevissen have a new 26-week study to support their earlier findings. As in five previous experiments, they found that EMFs promoted the development of breast cancer initiated with the chemical carcinogen DMBA. The incidence of tumors (based on macroscopic examination) was greater among animals exposed to a 1 G magnetic field than among controls, a difference they termed "highly significant." Löscher will present these results at the Bioelectromagnetics Society meeting in St. Petersburg, FL, this June.

"We now have three studies at Battelle, with a total of 1,300 animals, show-

(continued on p.5)

« Power Line Talk »

When **Paul Brodeur**'s book, *The Great Power-Line Cover-Up,* was published in 1993, jacket blurbs included this testimonial from fellow investigative reporter **Seymour Hersh**: "This book should be required reading for every parent in America, especially those with children in grade school. Paul Brodeur is as good a journalist as they come." Last December, Hersh was reminded of these words—and immediately disowned them. In a Washington bookstore where Hersh was promoting his JFK biography, *The Dark Side of Camelot,* a member of the audience complained that Brodeur had "cost the country a billion dollars a year and scared people to death" and asserted that the 1996 **National Academy of Sciences** (NAS) EMF report had proven Brodeur wrong. "So did you make a mistake?" the audience member asked. "Of course," Hersh answered, explaining his endorsement as "something for somebody I worked with at the *New Yorker."* This was just the way the publishing business works, he said, and "the bottom line is that if you believe everything you read on [a] jacket, I've got a bridge I wanna sell you." Hersh was obviously not expecting questions on magnetism or electricity—other than JFK's sexual kind—and he later admitted to New York City's *Village Voice* (February 17) that the query on EMFs left him "completely nonplussed." But when the exchange ended up on C-SPAN2, it did not leave Brodeur in a generous mood. In a January 30 letter, Brodeur told Hersh that his retreat "gives new meaning to the very concept of expediency." He wrote that, "If you had read [the NAS report], and not been so craven as to take what your interlocutor suggested about it as gospel, you might have known that the report did not exonerate power lines." Brodeur pointed out that the NAS panel called the data linking power lines and childhood leukemia "statistically reliable and robust." "Imagine having to point out to a smart truth sniffer like you that investigative journalists shouldn't always believe what they read in the newspapers!" commented Brodeur. He told Hersh that, "If you had not had your nose stuffed up Jack Kennedy's trousers for so long, you might have remembered how rigorously your and everyone else's manuscripts at the (old) *New Yorker* were scrutinized for factual accuracy." Brodeur concluded by saying, "As for me, I'm pleased to have cost the electric utility industry a billion dollars a year—a charge that sent you bravely scurrying for self-serving cover—and pleased to know that record numbers of Americans are refusing to buy homes near...high-current power lines." When Hersh spoke to the *Voice,* he insisted that the NAS report was "devastating" to Brodeur's viewpoint. But he is not about to get into a debate on the issue. "I consider it a crank letter," Hersh told the *Voice.* "I'm not going to respond to him."

«« »»

On February 23, the **U.S. Supreme Court** rejected a request from **Howard** and **Eve Reiss** to consider an appeal in their lawsuit against **Consolidated Edison**, the New York utility. Their action alleged that public fear of EMFs caused their home, near a Con Ed power line, to decline in value. The suit had been dismissed by a New York state court in December 1996 (see *MWN,* J/F97 and J/F98). An attorney for the Reisses, **Eric Bregman** of Sive, Paget & Riesel in New York City, said, "I'm convinced that we were right, but it's an area the courts just didn't want to wrestle with." Bregman told *Microwave News* that, "This appears to mean the end for EMF property litigation in New York state." The only exception, he said, would be when property is condemned by eminent domain, in which case New York's *Criscuola* decision still applies (see *MWN,* N/D93 and J/F94). The Reisses' claim was a test case for several similar EMF property lawsuits in New York (see *MWN,* J/A94), which are now likely to be withdrawn. Con Ed's Joseph Petta said in an interview that, "We're pleased with the U.S. Supreme Court's action. We feel that the New York courts were correct, and this action confirms that."

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A study of 32,000 Danish utility workers "does not support the hypothesis of an association between occupational exposure to EMFs and the risk of cancer," Drs. **Christoffer Johansen** and **Jørgen Olsen** of the **Danish Cancer Society** in Copenhagen report in the March 15 *American Journal of Epidemiology (147,* pp.548-555, 1998). A small but significant increase was seen in overall cancer risk, but much of this was due to asbestos-related lung cancer. There was no consistent association between EMF exposure and leukemia or breast or brain cancer.

EMF Review Scheduled for September in Tucson

There will be at least one more annual DOE review of EMF health research. But instead of being held in November, as in past years, the meeting will be in September, in Tucson, AZ.

The main reason for scheduling the review two months early is to allow for a review of the draft RAPID report. "We want to make sure that members of the EMF community give us their views and concerns," said NIEHS' Dr. Gary Boorman, who is in charge of completing the report by the end of October (see p.6).

The other reason is that federal agencies will likely have no EMF research budgets in fiscal year 1999, which begins on October 1, 1998. The review is being sponsored by the DOE, EPRI and the NIEHS.

"It's going to be a very different meeting this time," said Dr. Dan Driscoll of the New York State Department of Public Service in Albany. According to the proposed program, the draft RAPID report will be presented formally on Sunday, September 13, with Monday and Tuesday afternoons reserved for public discussion. Driscoll predicted that the meeting will probably end on Wednesday—one day earlier than in previous years—because fewer research papers will be submitted for presentation.

"I expect that this will be the last review," said Driscoll. Dr. William Wisecup, who is organizing the meeting, agrees. "I don't see any money coming down the pike," he said. For more details, see p.9.

New EMF Animal Research from Around the World

Australia: No Link to Lymphoma

Power frequency EMFs did not increase rates of lymphoma in mice, according to a new Australian study led by Drs. Antony Basten and Michael Repacholi.

In the March 1998 *Radiation Research,* they write that groups of about 100 transgenic mice were exposed to continuous 50 Hz EMFs at strengths of 10 mG, 1 G or 10 G for 20 hours a day for 18 months. An additional group was exposed to intermittent 10 G fields, switched on or off every 15 minutes. The incidence of lymphoma in the EMF-exposed groups ranged from 26% to 35%, with a 29% rate among unexposed controls. No association was found between EMFs and either an increased risk of cancer or a faster onset of the disease.

"There was no difference between animals exposed to magnetic fields and the controls—but it must be noted that there were no harmonics or high-frequency transients," Dr. Michael Repacholi told *Microwave News* (see p.19).

Basten and Repacholi used a strain of mouse that had been genetically altered to make it especially susceptible to lymphoma, so that detection of weak effects would be more likely. They calculated that this experiment had a 95% chance of detecting a doubling of the rate of lymphoma in the transgenic mice.

Many of the transgenic mice developed an unusual liver disease, which showed a significant increase in the 10 G continuous EMF exposure group. "This result is puzzling," the researchers write, especially since it did not occur with the intermittent 10 G exposures. "The biological significance of [this] result must remain in doubt" until it is repeated elsewhere, they conclude.

Basten is executive director of the Centenary Institute of Cancer Medicine and Cell Biology in Sydney. Repacholi was at Australia's Royal Adelaide Hospital before moving to Geneva, Switzerland, to head the World Health Organization's EMF project.

Finland: Mice Get Skin Cancer Faster

Mice regularly exposed to ultraviolet (UV) light developed skin cancer significantly faster if they were also exposed to power frequency EMFs, according to a study by Dr. Jukka Juutilainen of the University of Kuopio in Finland.

The EMF effect was not strong, reports Juutilainen, but "the consistency of the results suggests that the difference is a true [EMF] bioeffect rather than a chance finding." Preliminary results from this study were presented in 1996 (see *MWN,* M/A96), and final conclusions appear in the January issue of the *International Journal of Radiation Biology.*

This promotional effect can be seen in two ways: More animals had tumors, and there were more tumors per animal. But the effect is apparent only if both malignant and nonmalignant skin tumors are considered together. When malignant tumors are examined separately, the number is "low and similar" whether or not the mice were exposed to EMFs.

Three groups of about 44 mice each were exposed to UV light three times a week for 35 minutes at a time. Two of these groups were also exposed to EMFs, one with continuous exposure at 1 G and the other with exposures that were both intermittent and variable. The latter involved exposures of 20 minutes each at 13 mG, 130 mG and 1.3 G, followed by a two-hour pause, in an attempt to reflect the uneven character of actual human exposures.

Half the mice in Juutilainen's recent study were from a strain that over-expresses the gene for the enzyme ODC. Other researchers have shown that ODC is involved in cancer promotion, and that EMFs can have an effect on ODC (see *MWN,* N/D87 and J/F98). Juutilainen found that the ODC–transgenic mice did in fact have more skin cancer than normal mice, but that EMF exposure did not influence the levels of ODC. Thus, Juutilainen concludes, EMFs "may have cocarcinogenic effects that are not dependent on increased ODC activity."

"This study did not support the hypothesis that intermittent [and variable] magnetic fields would be biologically more active than continuous fields," Juutilainen reports. But he adds that the low statistical power of comparisons among the EMF-exposed animals means that such a difference cannot be ruled out. While the design of the exposure system reduced the occurrence of transients when the fields were switched on and off, some transients were still observed.

Sweden: No Promotion of Breast Cancer

A new Swedish study has found that EMFs did not promote the development of breast cancer in female rats.

Drs. Tomas Ekström, Kjell Hansson Mild and Bo Holmberg, of Sweden's National Institute for Working Life (NIWL), applied a single 7 mg dose of the chemical carcinogen DMBA to 180 Sprague-Dawley rats. Two groups of 60 rats each were then exposed to "an intermittent...transient-associated magnetic field," turned on or off every 15 seconds. Fifty Hz fields were used for both exposure groups, with one at 2.5 G and the other at 5 G. The third group served as a control.

Seventy percent of EMF-exposed rats developed breast cancer, as compared with 72% of controls. Writing in the January 16, 1998, *Cancer Letters,* the researchers report that, "The rate of tumor appearance in all groups was similar."

"This result may seem to be in contrast to Löscher and Mevissen," comments the Swedish team (see p.1). But they decline to draw such a firm conclusion, noting that "the magnetic field exposure scheme is different in our study."

In a 1994 study by Holmberg, Ekström, Mild and colleagues, intermittent EMF exposure appeared to promote the growth of DMBA-induced skin cancers in mice (see also p.19 and *MWN,* M/A94). The new EMF study marks the last by this research group. Mild, based at the NIWL in Umeå, told *Microwave News* that Holmberg has retired from his lab in Solna, and that Ekström is no longer working on EMFs.

A.W. Harris et al., "A Test of Lymphoma Induction by Long-Term Exposure of Eκ-*Pim1* Transgenic Mice to 50 Hz Magnetic Fields," *Radiation Research, 149,* pp.300-307, 1998.

T. Kumlin et al., "Effects of 50 Hz Magnetic Fields on UV-induced Skin Tumourigenesis in ODC–Transgenic and Non-Transgenic Mice," *International Journal of Radiation Biology, 73,* pp.113-121, 1998.

Tomas Ekström, Kjell Hansson Mild and Bo Holmberg, "Mammary Tumors in Sprague-Dawley Rats After Initiation with DMBA Followed by Exposure to 50 Hz EMFs in a Promotional Scheme," *Cancer Letters, 123,* pp.107-111, 1998.

For example, Boorman told *Microwave News,* the specific type of thyroid cancer that showed an increase is very rare. "We almost never see cancer in thyroid C-cells," he said, and to some this means the finding is probably just a fluke. "Others take the opposite view, that this means the finding of an increase is even more important." Boorman also heads the RAPID EMF research program at the NIEHS in Research Triangle Park, NC, and has written on the pathology of the thyroid gland in laboratory rats.

In a study with this many comparisons, some associations would likely appear by chance alone. But for thyroid C-cell cancers, male rats showed an increase in every EMF exposure group—and in two groups (20 mG and 2 G) the increase is very significant ($p<0.01$). "That's a more unusual event," Dr. Joseph Haseman, a biostatistician at the NIEHS, told *Microwave News.* "Having two groups at that level of significance, my guess would be that the odds of a chance finding are about 9% or 10%." In a third exposure group (10 G, continuous) the association was just short of statistical significance ($p=0.055$).

The NTP report downplays the likelihood that this finding represents a real biological effect. It cites the lack of either a dose-response relationship or increases in precancerous conditions, and points out that increased thyroid cancer has never been observed in epidemiological EMF studies. But the report also notes that EMFs can affect calcium flux *in vitro,* and that, "C-cells are sensitive to...changes in calcium concentrations."

"Is there a real risk?" asked Haseman. "I just don't know. It can't be dismissed." For this reason, Haseman said, he supports the conclusion that the evidence was "equivocal."

One of the report's peer reviewers, Dr. John Bailer of Miami University in Oxford, OH, suggested upgrading this finding to "some evidence" for an association. On the other hand, another reviewer, Dr. James Bus of Dow Chemical Co. in Midland, MI, urged that the report do more to emphasize that "the unexpected thyroid tumor finding seems unlikely to be attributable to [EMF] exposure." But when the peer reviewers met on March 11 in Research Triangle Park, there was unanimous support for the "equivocal" designation, according to Boorman.

Did the Experiment End Too Soon?

There is nothing equivocal about the letter that Drs. Cesare Maltoni and Morando Soffritti sent to the NTP on February 26: The two researchers question whether the experiment had been designed correctly in the first place. "It is our belief that the NTP bioassay was planned and conducted with a protocol that could only allow negative conclusions on 60 Hz [EMF] carcinogenicity," they write. Both are at the Ramazzini Foundation for Oncology and Environmental Science in Bologna, Italy.

"The results of the NTP experiments are far from conclusive," contend Maltoni and Soffritti. If this is not stressed, they warn, the negative findings for various cancers "could become an easy and dangerous alibi for all who wish to obscure and quickly conclude" the debate over EMFs and cancer.

Specifically, the Italian researchers state that, "The number of animals per group in the [NTP] experiment...may well be insufficient to expose the effects of a low-potency carcinogen." This problem is aggravated, they argue, by the decision to end the experiment after two years, when most of the animals were still alive: "Had we truncated our experiments on vinyl chloride after two years, we would never have exposed the carcinogenic effects of the compound at low doses, and the consequent regulations would not have taken place."

"In some ways Maltoni is right, but in others it's not quite so simple," responded Boorman. "It's true that [sometimes] you do not see an effect unless you do a lifetime study. On the other hand, the longer they live, the higher the incidence of cancer in the control animals, and that can cause problems for statistical power." He added that when an experiment runs longer, "There's more spontaneous death, and this may lead to loss of tissue. So you can say the study should go longer, but it's difficult to continue the work at the highest level of quality."

Maltoni is well known for his work linking vinyl chloride to cancer in the early 1970s. He plans to do his own rodent study on EMFs and cancer, which he outlines in the letter: "The size of our experimental groups will be much greater than those in the NTP study, the exposure will start during embryo life and will be continued for the whole life span, and the animals will be kept under observation until spontaneous death."

No Prenatal or Postnatal Exposures

In his written peer review, Dow Chemical's Bus noted that the NTP study "did not include pre- or early postnatal exposures. Thus, the findings of this study may not be particularly relevant to implications of human childhood leukemias." This point was raised by another reviewer, Dr. John Cullen of the College of Veterinary Medicine at North Carolina State University in Raleigh: "The period of greatest relative growth is completed by rats and mice by [age 6-8 weeks, when the EMF exposures began]....Human neonates may be more sensitive to exposure in their earliest weeks of life."

The NTP study was carried out at the IIT Research Institute (IITRI) in Chicago, under the direction of Dr. David McCormick. Groups of 100 male and 100 female F344 rats were exposed to 60 Hz EMFs for 18.5 hours a day for a two-year period. Three groups were exposed to continuous fields of 20 mG, 2 G or 10 G. Another group was exposed to a 10 G intermittent field, switched on or off every hour, while an additional group served as a control. The same procedure was followed with male and female $B6C3F_1$ mice. Great care was taken to avoid high-frequency transients in the EMF exposures, and to keep harmonic distortion to a minimum.

There were scattered significant findings for other cancers. For example, in female mice, the rate of malignant lymphoma was significantly lower among those exposed to the 10 G intermittent fields than among the controls. Other significant results included a positive trend for some skin cancer in male rats, and a negative association for some lung cancer in male and female mice. But none of these were as consistent as the thyroid finding in male rats.

Last year, NTP researchers reported on a smaller, eight-week experiment with a similar design, which found no evidence that EMFs increase the risk of cancer (see *MWN,* J/F98).

G.A. Boorman et al., *Toxicology and Carcinogenesis Studies of 60-Hz Magnetic Fields in F344/N Rats and B6C3F$_1$ Mice,* draft, NTP Technical Report No.488, NIH Publication No.98-3978, 160 pp., March 1998.

ing similar results," said NIEHS' Dr. Gary Boorman. "We think that's a significant body of data."

In an interview, Mevissen was critical of the Battelle work. "In two of their three experiments," she said, "the tumor rates in the controls were over 90%. Under these conditions, comparisons with the EMF-exposed groups are not very useful."

"I've been amazed at the differences between the Löscher and the Battelle studies," said Dr. Christopher Portier of the NIEHS in Research Triangle Park, NC, who is coordinating RAPID's EMF risk assessment (see p.6). "I have no good explanations," he added. "Like everyone else, I have only questions."

Both Boorman and Anderson said that the differing results in the Battelle and Hannover labs would be a major topic at the NIEHS symposium on *in vivo* studies in early April, and they hope the discussion will start to clarify the issue.

Differences in Genetics, Food and DMBA

Anderson said he has some "candidate ideas" on the reasons for the difference, "but right now no firm conclusions." He cited possible differences in the DMBA, the animals or the food used by each lab, or subtle differences in some aspect of the exposure environment.

"I think genetic differences between the Battelle rats and our rats are the most likely explanation for the differences in tumor and EMF outcomes," Löscher said in an interview. Sprague-Dawley rats "show marked genetic variability among different breeders," he explained, citing diet and the EMF exposure protocols as other possible factors.

Löscher noted that in every one of his experiments, "tumor incidence of the EMF-exposed group always stayed above the sham-exposed controls, although all studies were done blind." Löscher's six studies to date, with exposures from less than 10 mG to 1 G, have involved over 1,000 animals.

At Battelle, rats were exposed to EMFs for 18.5 hours a day, while in Löscher's lab, exposures went on around the clock. Dr. Susan Fischer of the MD Anderson Cancer Center at the University of Texas, Smithville, a peer reviewer of the Battelle draft report, urged that it address this disparity—and its possible effects. When *Microwave News* asked Löscher if the difference in exposure times could have changed the results, he answered, "I simply don't know." But he noted that his rats had 500 hours of additional exposure over the course of a 13-week study, or the equivalent of three extra weeks. Boorman responded that, "Certainly, in our 26-week study, the total exposures would exceed those in Löscher's 13-week studies."

Battelle did two 13-week studies and one that lasted 26 weeks. Each used exposure groups of 100 female Sprague-Dawley rats. In the first 13-week study, 20 mg of the carcinogen DMBA was applied to the rats in four weekly doses of 5 mg. Different groups were exposed to 1G 50Hz, 5G 50Hz or 1G 60Hz EMFs, while a control group was treated with DMBA only.

Both U.S. and German labs took great pains to avoid harmonics and transients in the animals' EMF exposures.

In Löscher's work, the breast tumor rate among controls was about 40%. But in Battelle's first 13-week study, the rate in the controls reached 92%, which left little possibility for contrast with the EMF-exposed animals (see *MWN,* M/A97).

"It would have been useful if they had done a preliminary experiment first, using small groups to assess the dose-dependent effects of DMBA in their strain of rats," said Mevissen, calling this a "fairly standard" approach. In the recent breast cancer study by Drs. Ekström, Mild and Holmberg (see p.3), a dose-finding experiment at the outset led them to use 7 mg—instead of 10 mg—of DMBA.

The high background tumor rate at Battelle "was not entirely unanticipated," according to the draft report on the study. "When we began," Boorman explained, "the people we consulted with who had used DMBA said that with 20 mg you'll get 90%-95% tumors with American rats. But we felt that if you're going to replicate a study, you can't choose to use a different dose."

The report states that "in light of [the] findings" of Battelle's first 13-week experiment, the Department of Energy (DOE) decided to sponsor a DMBA dose-response study. Based on these results, the Battelle group then carried out a second 13-week experiment with less DMBA: four weekly doses of 2 mg, for a total of 8 mg. This cut the breast cancer rate among controls to 43%. For EMF-exposed rats, the rates ranged from 38% to 48%.

Battelle's 26-week study, which was under way before the DOE dose-response study was done, used a DMBA dose of 10 mg in a single application. In this case, the cancer rate among controls was 96%. Among EMF-exposed animals, the rates ranged from 85% to 95%.

In all three Battelle experiments, "No promotional effect by magnetic fields was found on any of the tumor parameters," according to the report. To the extent that there was any trend, the EMF-exposed animals actually had fewer tumors. In the 26-week study, this gap was statistically significant for rats in the 1 G 50 Hz exposure group ($p<0.01$).

Although EMF-exposed animals at Battelle tended to have fewer mammary tumors, those tumors tended to be larger. But this trend was not significant, and Boorman noted that there was no increase in overall tumor mass per animal. An animal with fewer tumors might have larger ones "simply due to competition for nutrients," he observed.

Löscher has shown EMF-related changes in levels of the hormone melatonin and the growth enzyme ODC. While the Battelle team did not look at ODC activity, no consistent effect of EMFs on melatonin levels was found. Anderson's report notes, however, that the melatonin "data were highly variable within each [exposure] group," making interpretation difficult.

A recent paper by Löscher raises another important issue: a seasonal variation in the tumor burden of Sprague-Dawley rats. Löscher suggests that this may be due to known seasonal variations in melatonin production and immune function.

G.A. Boorman et al., *Studies of Magnetic Field Promotion in Sprague-Dawley Rats,* draft, NTP Technical Report No.489, NIH Publication No.98-3979, 168 pp., March 1998.

W. Löscher, M. Mevissen and M. Häußler, "Seasonal Influence on 7,12-DMBA-Induced Mammary Carcinogenesis in Sprague-Dawley Rats under Controlled Laboratory Conditions," *Pharmacology & Toxicology, 81,* pp.265-270, 1997. For more on Löscher and Mevissen's work, see *MWN,* J/A93, S/O94, J/F95 and J/A95.

W. Löscher, M. Mevissen and S. Thun-Battersby, "Magnetic Field Exposure for 26 Weeks Enhances Tumor Development and Growth in a Rat Breast Cancer Model," Abstract No.A-9-1, *20th Annual Meeting of the Bioelectromagnetics Society,* St. Petersburg, FL, June 7-11, 1998.

Taiwan Study Links Childhood Leukemia, Transmission Lines

An elevated risk of leukemia has been found among children living near high-voltage transmission lines in metropolitan Taipei, Taiwan. The study drew on data from Taiwan's National Cancer Registry for the years from 1987 to 1992.

Children living in areas within 100 meters of a transmission line had a leukemia rate 2.7 times higher than did children in the nation as a whole, a significant increase. Their cancer risk was 2.4 times higher than that of other children in the same neighborhoods, a finding just short of statistical significance.

Dr. Chung-Yi Li of the College of Medicine at Fu-Jen Catholic University, Taipei, and Drs. Wei-Chin Lee and Ruey Shiung Lin of National Taiwan University, Taipei, report these results in the February *Journal of Occupational and Environmental Medicine (40,* pp.144-147, 1998). Formerly with the Maryland Department of Health, Lin was the first epidemiologist to link brain cancer to occupational EMF exposure (see *MWN,* O84 and J/A85).

"I tend to think that EMFs are responsible for what we observed in the study," Li told *Microwave News*. But he added that

EMF RAPID Program Ending; Report Due in Late October

The National Institute of Environmental Health Sciences (NIEHS) is gearing up for the completion of the EMF Research and Public Information Dissemination Program, known as EMF RAPID.

The RAPID program has funded a variety of research projects (see *MWN,* S/O94, M/A95 and J/F97). The NIEHS will summarize the findings and put them into the context of the overall EMF health literature. In the Energy Policy Act of 1992, which mandated RAPID, Congress asked the NIEHS to determine whether exposure to EMFs produced by the generation, transmission and use of electricity affects human health.

A draft of the institute's final report is scheduled to be available by July 15.

Dr. Kenneth Olden, the director of the NIEHS, will send the report to Secretary of Health and Human Services Donna Shalala at the end of October. Shalala will then transmit the final report to Congress (see *MWN,* J/F98).

The NIEHS report will be the first evaluation of EMF health risks to be completed by a federal agency. The Environmental Protection Agency worked on such a review for more than ten years—and released a draft report in 1990—but has refused to publish a final version, which would have pointed to an EMF cancer risk (see *MWN,* M/J90 and J/F98).

Eleven chapters of the NIEHS report are currently under preparation (see table at right). They will be revised by a working group assembled by Drs. Christopher Portier and Mary Wolfe of the NIEHS in Research Triangle Park, NC. The report's summary chapter, with conclusions, will be written by the working group, which will meet in Minneapolis June 15-24.

"We hope to have the report written for the Minneapolis meeting," said Dr. Gary Boorman, who heads the RAPID effort at the institute. "It is an ambitious schedule."

The completed draft will be distributed to the public at no charge, Wolfe told *Microwave News.* Interested parties will have approximately six weeks to file comments.

The Energy Policy Act also set up the National EMF Advisory Committee and the EMF Interagency Committee to watch over the RAPID program. In September, both will review the draft report. The interagency committee, made up of representatives of federal agencies, must send its own report to Congress.

Congress had originally asked the NIEHS to complete its report by March 31, 1997, but granted an extension after the program got off to a slow start due to funding delays.

EMF RAPID Final Report: Chapter Authors and Working Group

Chapter	Author	Affiliation
In Vivo Cancer Studies	Dr. Larry Anderson	Battelle PNL, Richland, WA
Occcupational Epidemiology	Dr. Joseph Bowman	NIOSH, Cincinnati
Adult Residential Epi	Dr. Elisabeth Cardis	IARC Lyon, France
Clinical Human Lab Studies	Dr. Charles Graham	MRI, Kansas City, MO
In Vitro Studies	Dr. Richard Luben	University of California, Riverside
Molecular Biology	Dr. Mats-Olof Mattsson	Umeå University, Umeå, Sweden
In Vitro Cell Differentiation	Dr. Kenneth McLeod	State Univ. of New York, Stony Brook
Theoretical Mechanisms	Dr. Charles Polk	Univ. of Rhode Island, Kingston
In Vivo Non-Cancer Studies	Dr. Walter Rogers	Consultant, San Antonio
Childhood Residential Epi	Dr. Claire Sherman	University of California, Davis
Exposure Characterization	Dr. Michael Yost	University of Washington, Seattle

Attendees as of March 31: Drs. Arnold Brown, University of Wisconsin, Madison (emeritus); Mary Cook, Midwest Research Institute (MRI), Kansas City, MO; Sir Richard Doll, Oxford University, U.K.; Margarita Dubocovich, Northwestern University, Evanston, IL; James Felton, Lawrence Livermore National Lab, Livermore, CA; Maria Feychting, Karolinska Institute, Stockholm, Sweden; Paul Gailey, Oak Ridge National Lab, Oak Ridge, TN; Jean Harry, NIEHS, Research Triangle Park, NC; Leeka Kheifets, Electric Power Research Institute, Palo Alto, CA; Curtis Klaassen, University of Kansas, Lawrence; Genevieve Matanoski, Johns Hopkins University, Baltimore; Martin Misakian, National Institute of Standards and Technology, Gaithersburg, MD; Indira Nair, Carnegie-Mellon University, Pittsburgh; Louis Slesin, *Microwave News,* New York City; Richard Stevens, Battelle Pacific Northwest Labs, Richland, WA; Lorenzo Tomatis, Istituto per l'Infanzia, Trieste, Italy; Hiroshi Yamasaki, International Agency for Research on Cancer (IARC), Lyon, France; Paul Zweiacker, TU Services, Dallas.

Coordinator: Dr. Christopher Portier, NIEHS; Facilitator: Dr. Michael Gallo, University Medical and Dental New Jersey, Piscataway.

epidemiological methods could not do much more to clarify the EMF–cancer link. Li believes that epidemiologists should now turn their attention away from power lines and try to discover if there are any as-yet-unknown risk factors for leukemia. If a new one is found, researchers could then examine whether it is associated with power lines. "After all," he commented, "there must be something responsible for the association." If no other factors can be identified, it would strengthen the argument that EMFs are to blame.

The Taiwan team did not measure the distance of each house from the line. Instead, they based the study on areas where most of the land lies within 100 meters of a high-voltage transmission line. While acknowledging that this is a "crude" measure, they argue that any exposure misclassification would likely underestimate the risk.

A measurement study in the same part of Taiwan by Li, Lin and Dr. Gilles Thériault of McGill University in Montreal, Canada, found that high-voltage transmission lines produced fields of about 2 mG inside houses 100 meters away, with higher fields in houses that were closer. The same group also found a link between adult leukemia and calculated historical EMF levels in the home (see *MWN,* M/J97).

EMFs Alter Key Enzyme Activity

Dr. Fatih Uckun of the Wayne Hughes Institute in St. Paul, MN, has found new evidence that EMFs can alter the activity of protein kinases, enzymes that are involved in both normal cell function and cancer promotion.

Writing in the prestigious *Journal of Biological Chemistry (273,* pp.4,035-4,039, February 13, 1998), Uckun reports that EMFs can disrupt the "growth regulatory balance" in cancer cells. In a second paper, which will appear in the same journal this April, Uckun reports similar EMF-induced activity in a different, but related, enzyme system.

"This is another piece of evidence, which we first began to see in the 1980s, pointing to the importance of protein kinases as a key intracellular communication system that is sensitive to both ELF and modulated RF fields," Dr. Ross Adey of the University of California, Riverside, told *Microwave News.*

Uckun exposed lymphoma B cells to 60 Hz 1 G magnetic fields. His work was supported under a grant from the RAPID research program. Uckun did not respond to repeated requests for an interview (see also p.15).

HIGHLIGHTS

« Wireless Notes »

Dr. **Michael Repacholi**, who heads the EMF project at the **World Health Organization** (WHO), caused a stir last year when he reported elevated cancer rates among mice exposed to GSM digital cellular phone radiation (see *MWN,* M/J97). Now he has published a new study that he believes bolsters this finding. The second study had the same experimental design, but exposed the mice instead to 50 Hz EMFs and found no cancer risk (see p.3). Repacholi told *Microwave News* that the new data have implications for his cellular phone study: "The control groups for both our RF and 50 Hz field studies showed no statistical differences, which lessens the possibility that the RF study result was a chance event or due to errors in methodology."

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Dr. **Neil Cherry** toured the U.S. in March to address communities concerned about the proliferation of telecom towers. Cherry, of Lincoln University in Canterbury, **New Zealand**, has long advocated strict RF/MW exposure standards—0.1 ∝W/cm^2 for cancer risks and 10 nW/cm^2 to protect against miscarriages and neurological problems (see *MWN,* M/A97). He spoke at town meetings in California, Colorado and Massachusetts on possible health threats from broadcast, cellular and PCS radiation. The trip was arranged by **Christopher Beaver**, a filmmaker in San Francisco who last year successfully opposed a cell tower on a church steeple near his home; it was paid for by contributions from activists across the U.S. "I firmly believe that there is now sufficient evidence to establish that chronic exposure of large populations to extremely low levels of RF/MW radiation produces significant adverse health effects," Cherry said in an interview. "I am not an expert," he continued, "but I am a teacher, and as I look at the scientific papers, I can see a pattern. The mindset that keeps asking for more and more data before taking steps to protect public health is a fundamental part of the problem." While in San Francisco, Cherry debated former FCC Commissioner **Rochelle Chong** and Dr. **Martin Meltz** of the University of Texas Health Science Center in San Antonio on a local television station. Asked whether his trip was a success, Cherry answered, "People are thirsty for information, and I am able to confirm that their fears are based on science, not mere innuendo."

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In February, the Irish telecom firm **Eircell** released a glossy report declaring that families living near mobile telephone **base stations** have nothing to fear. There is "no evidence for any detrimental effect" of RF/MW radiation from wireless antennas, conclude the authors, Drs. **Maurice Hurley** of the Cork University Hospital, **Michael Maher** of Mater Private Hospital in Dublin, **Anthony Staines** of University College, Dublin, and **Philip Walton** of University College, Galway. At Eircell's request, the four had looked at a number of recent lab studies; they found none that "definitively demonstrated a 'cause and effect' relationship" between RF/MW exposure and cancer. They note, however, that no studies of the health effects of living near base stations are under way. Their conclusion that no health hazard exists is based on the fact that average power densities near Eircell's base stations are hundreds of times lower than both international limits and head exposure from a hand-held phone. The safety of wireless handsets is not addressed in the report: "We were asked to examine the masts [antennas] issue only," Maher told the *Irish Independent* (February 2). Some members of the public were

skeptical of the all clear. Dr. **Dawn Payne**, a physician who works for the **Irish Countrywomen's Association**, contended that "four experts were not enough" to reflect the diversity of scientific opinion on the subject, according to the February 4 *Irish Times*. Since the World Health Organization's program of cellular phone safety research is still under way, Payne asked, "Why not shelve the erection of masts until these results are published?"

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Thirty-one members of Congress have asked **FCC** Chairman **William Kennard** to "terminate all action" on his agency's proposals to preempt state and local rules on wireless telephone and digital television (**DTV**) antenna siting. Such proposals "violate both the language...and the Congressional intent" of the 1996 **Telecommunications Act**, emphasizes the group's January 30 letter to Kennard. Rep. **Robert Goodlatte** (R-VA), who assembled this group of legislators, helped write the act's federal preemption clause, so he can claim to know what Congress intended. Last summer, the FCC proposed to preempt all community tower moratoriums of unspecified length and any siting decisions influenced by concerns about RF safety (see *MWN,* S/O97). In response to a petition from the broadcasting industry, the FCC also asked whether it should apply a similar policy to community decisions on DTV transmitters (see below and *MWN,* S/O97). Since Kennard took over as head of the FCC from Reed Hundt, however, the agency appears to be more sympathetic to the lawmakers' and the public's concerns. According to the trade journal *RCR* (February 2), Kennard told reporters in Washington that federal preemption "shouldn't even be considered" until local officials and the wireless industry attempt to resolve their differences through negotiation (see p.15 and *MWN,* J/F98). On March 9, Kennard addressed a public meeting in Hardwick, VT, where Bell Atlantic Mobile's plan to place a 150-foot-tall wireless base station atop Buffalo Mountain, a local landmark, has angered many local residents. Kennard assured his audience that FCC intervention would be a "last resort," according to the March 11 *Hardwick Gazette*. While in the state, he also chatted with Rep. Bernie Sanders (D-VT) and Sens. Pat Leahy (D-VT) and James Jeffords (R-VT), who are sponsoring bills—H.R.3016 and S.1350—that would reverse the telecom law's restriction against local ordinances based on concerns about RF health effects and block preemption for DTV towers (see *MWN,* N/D97). Goodlatte approves of the substance of these bills, an aide told *Microwave News,* but the congressman feels that the letter is more likely to get results. If the FCC does not drop the proposed rules, the aide said, Goodlatte may press for legislation. As of the end of March, the FCC had not responded to the letter.

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The **National Audubon Society** in Washington also is objecting to federal preemption of state and local rules for siting **DTV** transmitters, and has called on the **FCC** to prepare an environmental impact statement (EIS) before adopting such a policy (see *MWN,* S/O97). On March 6, the FCC issued a public notice seeking comment on whether an EIS is required. The proposed rule is "environmentally unsound" and "overly broad," wrote Daniel Beard, the society's senior vice president for public policy, in a petition submitted last December 1. The national conservation group, which has more than 500,000 members, maintains that such an exemption is a "major federal action," for which federal law requires an EIS. The Audubon Society is concerned that poorly located television towers pose a threat to migratory birds: It notes that each year as many as one million birds are killed flying into broadcast towers in the U.S. If adopted, the society predicts, the exemption would lead to more siting mistakes and bird kills. The society is also worried about the precedent the rule would set as "an inappropriate blanket exemption from state and local laws for a single industry." It "could open the door to a host of similar proposals before other federal agencies," the group warns. Asked whether the Audubon Society will take the FCC to court if the agency does not draft an EIS, society spokesperson Perry Plumart told *Microwave News* that, "We want to keep our options open." Comments on the proposed rule must be submitted to the FCC by April 14.

In Texas, Digital TV Tests Interfere with Medical Devices

On February 27, Baylor University Medical Center in Dallas was confronted with the new era of digital television (DTV) "in a very rude way," according to Steven Juett, a senior clinical engineer at the hospital.

Tests of the new DTV technology by a local station caused widespread electromagnetic interference (EMI) with medical devices at Baylor. The interference "rendered the cardiac monitoring via radio telemetry useless," Juett told a biomedical engineering group on American Online. "This has caught us off guard."

Dallas' WFAA broadcast its first-ever DTV signals on that Friday at 2:00 p.m., the station's Dave Muscari told *Microwave News*. A second test occurred the next day. "It took Baylor a day and a half to figure it out," said Muscari. "They tracked the signal with a spectrum analyzer, and finally somebody remembered reading about our tests and put two and two together." WFAA's engineering staff got its first call from Baylor around 3:00 a.m. on Sunday, March 1.

Muscari reports that the month of March saw several incidents at other medical centers in the Dallas-Ft.Worth area. "Whenever the hospitals had a problem, we turned the signal off immediately," he emphasized. "It's an issue of public safety."

On March 25, the Federal Communications Commission (FCC) and the Food and Drug Administration (FDA) issued a joint statement explaining the cause: "Certain medical telemetry devices...are allowed to use TV broadcast channels that are unoccupied in their geographic area." DTV broadcasts are now taking over some of those previously unused channels. "Fortunately," the federal statement continues, "no patients were significantly affected" in any of these EMI cases.

The problem is not limited to medical equipment. An FCC engineer told the March 12 *Washington Post* that maritime radios, local cable TV systems, wireless microphones and apartment satellite antennas could also be affected.

One report blames DTV for an even more serious kind of

EMI. "After we did a DTV test a few months ago, a guy from the FAA called up frantic, wanting to know where the plane had crashed," a source at the UPN network told *Variety's* new daily New York City edition (March 16). The paper explained that, "The DTV test had emitted a signal identical to a jetliner's distress code, making officials think an aircraft had collided with the city's tallest building," the World Trade Center, which holds UPN's digital antennas. But Les Dorr, a Federal Aviation Administration spokesperson in Washington, told *Microwave News* he could not confirm that such an incident ever took place.

If DTV begins to use a frequency on which hospital equipment currently relies, the devices must either be replaced or retuned to a new frequency, usually by installing a different crystal oscillator. Baylor decided to move up the date of a planned upgrade of its equipment.

"We were not aware that this was a possible problem," said Muscari. Juett asserted that, "There was no coordination between FDA and FCC to prepare our medical center." The FCC had issued its own warning last October, according to the March 12 *New York Times,* but federal officials conceded that this had received little attention.

In mid-1996, the FDA urged the FCC to allocate frequencies "for the exclusive use of biomedical telemetry, as we understand is already the case in Europe." That June, the FDA's Dr. Elizabeth Jacobson warned that as long as medical devices were restricted to a secondary, unlicensed status, the FDA would remain "deeply concerned with the potential for injury to patients that might occur" in EMI cases. The FCC rejected the FDA's suggestion.

Finns Launch Research Program on Wireless Health Risks

Finland's Technology Development Center (TEKES), based in Helsinki, has begun a three-year research effort on possible health risks from cellular phone radiation.

Contributions from the government-run TEKES and from the Finnish wireless industry will amount to approximately 4.5 million marks ($800,000), about two-thirds of the program's cost. Dr. Jukka Juutilainen of the University of Kuopio, the program's coordinator, told *Microwave News* that the participating research institutes will cover the remaining expenses.

The program will include six projects:

• Development of exposure systems for animal and cell culture experiments, at the Center for Radiation and Nuclear Safety in Helsinki;

• Experiments on cocarcinogenic effects of wireless radiation, at the University of Kuopio;

• A feasibility study for an epidemiological study of cellular phone use and cancer, at the Institute of Occupational Health in Vantaa.

• A study of cellular phone radiation and electrosensitivity, at the Institute of Occupational Health;

• *In vitro* systems for studying RF/MW bioeffects, at the University of Kuopio and the Center for Radiation and Nuclear Safety;

• Computer models of exposure to wireless phone radiation, at the State Technical Research Center's (VTT) Information Technology lab in Espoo.

Several of the investigators, including Juutilainen, previously worked on studies of cellular phone safety led by the VTT. A VTT press release last May announced that this research had determined that mobile phones "pose no health threat to phone users," although some projects had not been completed at the time (see *MWN,* J/A97).

1998 Conference Calendar (Part III)

Parts I and II appeared in our last two issues.

April 25-26: **3rd COST 244bis Workshop on Biomedical Effects of EMFs: Intermediate Frequency Range (3 kHz-3 MHz),** Centre Universitaire Scientifique et Biomédical des Saints-Pères, Paris, France. Contact: Dr. René de Seze, Laboratoire de Biophysique Médicale, Faculté de Médecine, Av. Kennedy, F-30900 Nîmes, France (33+04) 66 68 32 44, Fax: (33+04) 66 23 55 38, E-mail: <biomed@zeus.sc.univ-montp1.fr>, Web: <www.radio.fer.hr/cost244/main/paris.htm>.

April 28-29: **RAPID EMF Engineering Review Symposium: Status and Summary of EMF Engineering Research,** Sheraton Hotel, Charleston, SC. Contact: W/L Associates, 7519 Ridge Road, Frederick, MD 21702, (301) 663-1915, Fax: (301) 371-8955, E-mail: <75230.1222@compuserve.com>.

July 19-24: **EMFs in Biology and Medicine: Sensory Perception, Self-Organization and Therapeutic Applications** (Gordon Research Conference on Bioelectrochemistry), New England College, Henniker, NH. Contact: Dr. Paul Gailey, Oak Ridge National Laboratory, PO Box 2008, MS 6070, Oak Ridge, TN 37831, (423) 574-0419, Fax: (423) 574-5227, E-mail: <pg7@stc06.ctd.ornl.gov>, Web: <www.ornl.gov/emf/gordon.htm>. See *Science,* February 27, 1998, p.1,374.

August 3-5: **International Symposium on Power Line to Microwave Radiation,** Montréal, Québec, Canada. Contact: Dr. A. Kumar, PO Box 240, 30 Rue Lippee, Les Coteaux, Québec J7X 1H5, Canada, (514) 620-3717, Fax: (514) 267-1144, E-mail: <kumar@colba.net>.

September 13-16: **DOE–EPRI Annual Review of Research on Biological Effects of Electric and Magnetic Fields from the Generation, Delivery and Use of Electricity,** Inn Suites, Tucson, AZ. Contact: W/L Associates, see April 28-29 above.

September 13-16: **International Symposium on Electromagnetic Fields in Biological Systems,** Prague, Czech Republic. Contact: Symposium EFBS, Institute of Radio Engineering and Electronics, Chaberská 57, 182 51 Prague 8–Kobylisy, Czech Republic, (42+02) 688-1804, Fax: (42+02) 688-0222, E-mail: <pokorny@ure.cas.cz>, Web: <www.ure.cas.cz>.

September 19-21: **4th COST 244bis Workshop on Biomedical Effects of EMFs: Health Risks of Prolonged EMF Exposure,** Graz, Austria. Contact: COST 244bis Secretariat, Unska 3, HR-10000 Zagreb, Croatia, (385+1) 6129-606, Fax: (385+1) 6129-717, E-mail: <cost244@fer.hr>, Web: <www.radio.fer.hr/cost244/main/meetings.htm#WORKSHOPSb>.

September 27-30: **3rd Congress of the International Association of Biologically Closed Electric Circuits in Biomedicine** and **2nd International Symposium on Electrochemical Treatment of Cancers,** Beijing, China. Contact: Dr. Xinchao Bao, China-Japan Friendship Hospital, Beijing 100029, China, (86+1) 064227535, Fax: (86+1) 064217749, E-mail: <gzliu@hns.cjfh.ac.cn>.

November 11-14: **18th Annual Meeting of the Society for Physical Regulation in Biology and Medicine,** The Queen Mary, Long Beach, CA. Contact: W/L Associates, see April 28-29 above.

November 19-21: **4th European Bioelectromagnetics Association (EBEA) Congress,** University of Zagreb, Croatia. Contact: EBEA Secretariat, Unska 3, HR-10000 Zagreb, Croatia, (385+1) 6129-606, Fax: (385+1) 6129-717, E-mail: <4thebea@fer.hr>, Web: <www.radio.fer.hr/cost244/4thebea>.

November 21-22: **5th COST 244bis Workshop on Biomedical Effects of EMFs: Biomedical Effects of Mobile Communications Equipment,** University of Zagreb, Croatia. Contact: COST 244bis Secretariat, see September 19-21 above.

Microwave News EMF–EMR World Wide Web Directory

All site addresses begin with: ***http://***

U.S. Government

For additional online regulatory information, see Health Physics, 73, *pp.310-311, August 1997.*

Congress

House of Representatives **<www.house.gov>**

Library of Congress **<www.loc.gov>**

Senate **<www.senate.gov>**

Federal Agencies

Department of Defense **<www.dtic.mil/lablink>**
(umbrella site for the military's research programs)

Department of Energy **<www.doe.gov>**
Office of Environment, Safety and Health **<www.eh.doe.gov>**

Environmental Protection Agency **<www.epa.gov>**
Office of Air & Radiation **<www.epa.gov/oar>**

Federal Communications Commission **<www.fcc.gov>**
Office of Engineering and Technology **<www.fcc.gov/oet>**
State and Local Focus **<www.fcc.gov/state&local>**
Wireless Telecommunications Bureau **<www.fcc.gov/wtb>**

Food and Drug Administration **<www.fda.gov>**
Center for Devices and Radiological Health
<www.fda.gov/cdrh>

National Institute for Occupational Safety and Health
<www.cdc.gov/niosh> (see p.13)

National Institute of Environmental Health Sciences
<www.niehs.nih.gov>
EMF RAPID **<www.niehs.nih.gov/emfrapid>** (see p.13)
Environmental Health Information Service **<ehis.niehs.nih.gov>**
National Toxicology Program **<ntp-server.niehs.nih.gov>**

National Library of Medicine **<www.nlm.nih.gov>**

National Technical Information Service **<www.fedworld.gov>**

National Telecommunications and Information Administration
<www.ntia.doc.gov>

Occupational Safety and Health Administration
<www.osha-slc.gov>

The White House **<www.whitehouse.gov>**

State and Local Agencies

California EMF Program
<www.dnai.com/~emf>

New Jersey Dept of Environmental Protection
Radiation Protection Program (page on non-ionizing radiation)
<www.state.nj.us/dep/rpp/ber/nrs/nrsindex.htm>

Quasi-Governmental Groups

National Academy of Sciences-National Research Council
<www.nas.edu>

National Council on Radiation Protection
and Measurements **<www.ncrp.com>**

Professional Societies & Trade Associations

American Industrial Hygiene Assn **<ww.aiha.org>**

American National Standards Institute **<www.ansi.org>**

American Public Power Assn **<www.appanet.org>**

Bakken Library and Museum **<www.bakkenmuseum.org>**

Bioelectromagnetics Society **<biomed.ucr.edu/bems.htm>**

Cellular Telecommunications Industry Assn (CTIA)
<www.wow-com.com>

Conference of Radiation Control Program Directors
<www.crcpd.org>

Edison Electric Institute **<www.eei.org>**

Electric Power Research Institute **<www.epri.com>**

Electromagnetic Energy Assn **<www.elecenergy.com>**

Electronic Industries Alliance **<www.eia.org>**

Health Physics Society **<www.hps.org>**

Institute of Electrical and Electronics Engineers **<www.ieee.org>**
Committee on Man and Radiation
<homepage.seas.upenn.edu/~kfoster/comar.htm>

National Assn of Broadcasters **<www.nab.org>**

National Assn of Regulatory Utility Commissioners
<www.erols.com/naruc>

National Assn of State Energy Officials **<www.naseo.org>**

National Assn of Telecom.Officers&Advisors **<www.natoa.org>**

National Assn of Tower Erectors **<daknet.com/nate>**

National Electrical Manufacturers Assn **<www.nema.org>**

National Electromagnetic Field Testing Assn
<www.theramp.net/nefta>

National Rural Electric Cooperative Assn **<www.nreca.org>**

Personal Communications Industry Assn **<www.pcia.com>**

Radiological Society of North America **<www.rsna.org>**

Telecommunications Industry Assn **<www.tiaonline.org>**

Western Electric Power Institute **<www.powerin.org>**

Outside U.S.

International

International Commission on Non-Ionizing
Radiation Protection **<www.sz.shuttle.de/dm1001/icnirp.htm>**

International Conference on Large High-Voltage Electric
Systems (CIGRE) **<www.worldnet.net/~cigre/HomePage.shtml>**

International Electrotechnical Commission **<www.iec.ch>**

International Mobile Telecommunications Assn
<www.imta.org>

World Health Organization International EMF Project
<www.who.ch/peh-emf>

Europe

European Bioelectromagnetics Assn
<bioem.ing.uniroma1.it/ebea/welcome.html>

European Committee for Electrotechnical Standardization
<server.cenelec.be>

European Cooperation on Scientific and Technical Research Program on Biomedical Effects of EMFs (COST 244 and 244bis)
<www.radio.fer.hr/cost244>

Australia

Australian Mobile Telecommunications Assn **<www.amta.org.au>**

Australian Radiation Lab: Non-Ionizing Radiation Section
<www.health.gov.au/hfs/arl/hm_nir.htm>

Electricity Supply Assn of Australia
<www.ozemail.com.au/~esaamelb/emf.htm>

Electromagnetic Radiation Alliance of Australia
<www.acay.com.au/~ssec/emraa.htm>

EMFacts Information Service (Don Maisch)
<www.tassie.net.au/emfacts>

Canada

Alberta Workers' Health Center
<www.web.net:80/~wrkrhlth/index.html>

Bridlewood Residents Hydro Line Committee
<www.ncf.carleton.ca/bridlewood-emfinfo>

Canadian Electricity Assn **<www.canelect.ca>**

Canadian Wireless Telecommunications Assn **<www.cwta.ca>**

Germany

Research Association for Radio Applications (FGF)
<www.fgf.de/links_e.html>

Italy

EMF-in-the-Web (Italian National Research Council)
<safeemf.iroe.fi.cnr.it/safeemf/emfref.htm>

Japan

Electronic Industries Assn of Japan
<www.eiaj.or.jp/english/index.htm>

Japan Electronic Industry Development Assn
<www.jeida.or.jp/index-e.html>

Sweden

National Institute for Working Life **<www.niwl.se/niwl.htm>**

Swedish Assn for the Electrosensitive (FEB) **<www.feb.se>**

Swedish Council for Work Life Research **<www.ralf.se>**

Electric Utilities

American Electric Power
<www.aep.com>

Arizona Public Service
<www.apsc.com>

Baltimore Gas & Electric
<www.bge.com>

Bonneville Power Administration
<www.bpa.gov>

Boston Edison
<www.bedison.com>

British Columbia Hydro
<ewu.bchydro.bc.ca>

Carolina Power & Light
<www.stockprofile.com/~hastings/cpl>

Central and South West
<www.csw.com>

Central Maine Power
<www.cmpco.com>

Cinergy
<www.cinergy.com>

Commonwealth Edison
<www.ucm.com/ucm/info/comed.htm>

Consolidated Edison
<www.coned.com>

Consumers Energy
<www.cpco.com>

Delmarva Power & Light
<www.delmarva.com>

Detroit Edison
<www.detroitedison.com>

Duke Energy
<www.duke-energy.com>

Duquesne Electric Power
<www.dqe.com>

Entergy
<www.entergy.com>

Florida Power
<www.fpc.com/flapower.htm>

GPU
<www.gpu.com>

Green Mountain Power
<www.gmpvt.com>

Hawaiian Electric Industries
<www.hei.com>

Houston Lighting & Power
<www.hlp.com>

Hydro Québec
<www.hydro.qc.ca>

Illinois Power
<www.illinova.com>

Indianapolis Power & Light
<www.ipalco.com>

Kansai Electric Power
<www.kepco.co.jp>

Kansas City Power & Light
<kcmo.com/kcpl>

LG&E Energy
<www.lgeenergy.com>

Long Island Lighting
<www.lilco.com>

Maine Public Service
<www.mainerec.com/mpsco.html>

Minnesota Power & Light
<www.mnpower.com>

Mississippi Power
<www.mspower.com>

Montana Power
<www.mtpower.com>

National Grid Co.
<www.ngc.co.uk>

New Century Energies
<www.psco.com/nce/index.htm>

New York Power Authority
<www.nypa.gov>

New York State Electric & Gas
<www.nyseg.com>

Niagara Mohawk
<www.nimo.com>

Northeast Utilities
<www.nu.com>

Northern States Power Company
<www.nspco.com>

Ohio Edison
<www.ohioedison.com>

Ontario Hydro
<www.hydro.on.ca>

Orange and Rockland Utilities
<www.oru.com>

Pacific Gas & Electric
<www.pge.com>

PacifiCorp
<www.upl.com>

PECO Energy
<www.peco.com>

Pennsylvania Power & Light
<www.papl.com>

San Diego Gas & Electric
<www.sdge.com>

EMF Litigation Home Page
<www.sdge.com/emf>

Southern California Edison
<www.sce.com>

Southern Company
<www.southernco.com>

Tampa Electric
<www.teco.net/TampaElectric.html>

Tennessee Valley Authority
<www.tva.com>

Texas Utilities
<www.tu.com>

Tokyo Electric Power
<www.tepco.co.jp/index-e.html>

TransAlta Utilities
<www.transalta.com>

Union Electric
<www.ue.com>

United Illuminating
<www.connix.com/~uil>

UtiliCorp United
<www.utilicorp.com>

Virginia Electric & Power
<www.vapower.com>

Wisconsin Public Service
<www.wpsc.wpsr.com/wpsr.html>

Swedish Mobile Telecommunications Assn <**www.mtl.se**>

Swedish Radiation Protection Institute (SSI) <**www.ssi.se**>

United Kingdom

Health and Safety Executive
<**www.open.gov.uk/hse/hsehome.htm**>

National Radiological Protection Board <**www.nrpb.org.uk**>

Powerwatch Network
<**www3.mailbox.co.uk/www.powerwatch.org.uk**>

Research Groups

Chalmers University of Technology (Sweden)
Bioelectromagnetics Group
<**www.nt.chalmers.se/BioEMgroup/BioElHomepage.html**>

Federal Institute of Technology (Switzerland)
Laboratory for EMF Theory and Microwave Electronics
<**www.ifh.ee.ethz.ch**>

University of Oklahoma
Center for the Study of Wireless EM Compatibility
<**www.ou.edu/engineering/emc**>

University of Victoria (Canada)
Industrial Research Chair in EMFs and Living Systems
<**www.bioelec.ece.uvic.ca/chair**>

University of Western Australia
Biomagnetics and Iron Biomineralization Group
<**www.pd.uwa.edu.au/BioPhys/Biophysics_Page_V.2.html**>

Wireless Technology Research (WTR) <**www.wtrllc.com**>

Consultants

Amuneal Manufacturing Corp. <**www.amuneal.com**>

Coghill Research Laboratories <**www.cogreslab.demon.co.uk**>

Enertech Consultants <**www.etc-inc.com**>

Ergonomics Inc. <**www.ergonomicsusa.com**>

Field Management Services Corp. <**www.fms-corp.com**>

Holistic Homes Design (low-EMF homes)
<**www.efn.org/~andrewm/HHD/HHD_main.html**>

Richard Tell Associates Inc. <**www.radhaz.com**>

VitaTech Engineering Inc. <**www.mnsinc.com/emf**>

Citizens and Interest Groups

Cellular Tower Coalition <**www.cellulartower.com**>

Cellular Towers, EMR and Health Effects
<**www.wwnet.com/~babbles**>

Communications Workers of America <**www.cwa-union.org**>

Electrical Sensitivity Network <**www.bslnet.com/esn**>

EMR Alliance <**www2.emralliance.com**>

Families Against Cell Towers at Schools (FACTS)
<**www.flipag.net/nopoles**>

Mind Control Forum <**www.mk.net/~mcf**>

West Virginia Power Line Fight
<**hill.concord.wvnet.edu/~noline**>

Personal Sites

Howard Bassen (FDA–CDRH)
<**www.networkkonnection.com/~hibem**>

Wireless Companies

AirTouch Communications
<**www.airtouch.com**>

Ameritech
<**www.ameritech.com**>

AT&T
<**www.att.com**>

AT&T Wireless Services
<**www.attws.com**>

BellSouth
<**www.bellsouth.com**>

British Telecom
<**www.bt.co.uk**>

Cellular One
<**www.cellularone.com**>

Deutsche Telekom
<**www/dtag.de**>

Deutsche Telekom Mobil
<**www.T-Mobil.de**>

Eircell
<**www.eircell.ie**>

Ericsson
<**www.ericsson.com**>

Esat Digifone
<**www.digifone.com**>

France Telecom
<**www.francetelecom.fr**>

GTE Mobilnet
<**www.mobilnet.gte.com**>

Hagenuk
<**www.hagenuk.de**>

Iridium
<**www.iridium.com**>

MCI Communications
<**www.mci.com**>

Motorola
<**www.mot.com**>

Nextel Communications
<**www.nextel.com**>

Nippon Telegraph & Telephone Corp.
<**www.ntt.com**>

Nokia
<**www.nokia.com**>

Omnipoint
<**www.omnipoint.com**>

Siemens
<**www.siemens.com**>

Sprint PCS
<**www.sprintpcs.com**>

Telecom New Zealand
<**www.telecom.co.nz**>

Teledesic
<**www.teledesic.com**>

Telstra
<**www.telstra.com**>

U.S. West
<**www.uswest.com**>

For additional wireless company web site addresses, see the directory at Wireless Week's *web site, listed at right.*

Robert Bedard (California EMF activist)
<**www.cruzio.com/~rbedard/waveguide**>

Stewart Fist (Australian journalist) <**www.electric-words.com**>

Andrew Marino (Louisiana State University Medical Center)
<**www.ortho.lsumc.edu/Faculty/Marino**>

Michael Milburn (author of *EMFs and Your Health*)
<**ourworld.compuserve.com/homepages/mpm_mo/homepage.htm**>

John Moulder (Medical College of Wisconsin)
<**www.mcw.edu/gcrc/cop.html**>

Valdemar Gisli Valdemarsson (EMF page in Icelandic)
<**www.isholf.is/vgv**>

Arthur Varanelli (Raytheon) <**pw1.netcom.com/~art16**>

Meters

EMC Test Systems <**www.emctest.com**>

Enertech Consultants <**www.etc-inc.com**>

EnviroMentor <**www.enviromentor.se**>

Ergonomics Inc. <**www.ergonomicsusa.com**>

F.W. Bell <**www.fwbell.com**>

Holaday Industries Inc. <**www.holadayinc.com**>

Narda Microwave <**www.nardamicrowave.com**>

Safe Technologies Corp. <**www.milligauss.com**>

TecHealth Corp. <**www.tec-health.com**>

Walker Scientific Inc. **<www.walkerscientific.com>**

Wandel & Goltermann **<www.wg.com>**

Other Products

Better Electromagnetic Environment
<www.bemi.se/index_e.html> (products for the electrosensitive)

BIOflex **<www.magnaflex.com>**

Magnetherapy **<www.das-mall.com/tectonic/index.htm>**

Magnetic Shield Corp. **<www.magnetic-shield.com>**

Microshield Industries **<www.microshield.co.uk>**

PhoneShield **<www.codem.com/phoneshield>**

Safe Technologies Corp. **<www.safelevel.com>**

Publications

American Journal of Public Health
<www.apha.org/news/publications/Journal/AJPH2.html>

Aviation Week **<www.aviationweek.com>**

Bioelectromagnetics **<journals.wiley.com/0197-8462>**

Cancer Causes & Control **<www.cancercauses.com/cc/cctext.htm>**

Compliance Engineering **<www.ce-mag.com>**

Conformity **<world.std.com/~csweb/conformity.html>**

Electromagnetics Forum **<www.tassie.net.au/emfacts>**

EMF Health and Safety Digest
<www.rsba.com/hsd/hsd_highlight_f.shtml>

Environmental Health Perspectives
<ehpnet1.niehs.nih.gov/docs/journals.html>

Epidemiology **<www.wwilkins.com/EDE>**

Health Physics **<www.wilkins.com/health_physics>**

International Journal of Radiation Biology
<www.tandf.co.uk/jnls/rab.htm>

Journal of the American Medical Association
<www.ama-assn.org/public/journals/jama>

The Lancet **<www.thelancet.com>**

Microwave Journal **<www.mwjournal.com/mwj.html>**

Microwave News **<www.microwavenews.com>**

Nature **<www.nature.com>**

New England Journal of Medicine **<www.nejm.org>**

Public Health **<www.stockton-press.co.uk/ph>**

Radiation Research **<www.cjp.com/radres>**

RCR (Radio Communications Report) **<www.rcrnews.com>**

Science **<www.sciencemag.org>**

Transmission & Distribution World **<www.tdworld.com>**

Wireless Week **<www.wirelessweek.com>**

Online Resources

Brooks Air Force Base (U.S. Air Force)

Compilation of the Dielectric Properties of Body Tissues at RF and Microwave Frequencies
<www.brooks.af.mil/HSC/AL/OE/OER/Title/Title.html>

Radiofrequency Radiation Dosimetry Handbook
<www.brooks.af.mil/HSC/AL/OE/OER/handbook/cover.htm>

EMF Bionet Newsgroup Archive
<www.bio.net/hypermail/EMF-BIO>

EMF Guru **<www.feb.se/EMF-L/EMF-L.html>**
(selected correspondence from Roy Beavers's dialogue group)

Microwave News ELF Gaussmeter Manufacturers List
<www.microwavenews.com/gaus.html>

National Academy of Sciences

EMF Research Activities Completed Under the Energy Policy Act of 1992: Interim Report, 1995
<www.nap.edu/readingroom/books/epact>

Evaluation of the U.S. Navy's ELF Communications System Ecological Monitoring Program
<www. 205.130.85.235/readingroom/books/elf>

October 31, 1996, press release announcing the NAS EMF report
<www2.nas.edu/whatsnew/25ba.html>

NIEHS EMF RAPID Program

Measurements Database **<www.emf-data.org>**

Progress Report December 1995
<www.niehs.nih.gov/emfrapid/RepToCongress/INT_RPT.html>

Research Information
<www.niehs.nih.gov/emfrapid/html/resinfo.htm>

Science Review Symposium: Theoretical Mechanisms and *In Vitro* Research Findings
<www.niehs.nih.gov/emfrapid/html/Symposium1.html>

Science Review Symposium: Epidemiological Research Findings
<www.niehs.nih.gov/emfrapid/html/Symposium2.html>

Science Review Symposium: *In Vivo* Laboratory Findings
<www.niehs.nih.gov/emfrapid/html/Symposium3.html>

NIOSH EMF Fact Sheet
<www.cdc.gov/niosh/emf2.html>

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FROM THE FIELD

Letter to the Editor

ELF Magnetic Fields from Spinning Steel-Belted Radial Tires: Implications for Epidemiological Studies

February 6, 1998

To the Editor:

A few months ago, one of us (SM) measured extremely low frequency (ELF) magnetic fields in his car, a 1993 Eagle Vision, using an F.W. Bell triaxial gaussmeter (model 4080). The fields were 3.0-4.0 mG (0.3-0.4 ∝T) at the driver's seat level and 6.0-20.0 mG on the rear seat, with higher fields measured laterally near the doors. Mysteriously, the fields were present only when the car was moving, and persisted when the car was coasting at 60 mph with the engine turned off.

Kjetil Vedholm and Dr. Yngve Hamnerius[1] recently explained that, "The metal cord in the tires is often permanently magnetized, which gives rise to an alternating magnetic field when the car is rolling." These Swedish researchers reported fields on the back seats of passenger vehicles as high as 50 mG (in the 5 Hz-2 kHz frequency range) when the car was traveling at 60 mph.

A visit to the two largest tire retailers in the Seattle area revealed that virtually all new radial tires contain steel belts and attract a compass needle. At the annual Department of Energy EMF review in San Diego last November, a number of colleagues suggested that SM's gaussmeter readings might have been motion-induced artifacts due to interaction with the Earth's static magnetic field. Hamnerius dismissed this idea, noting that an isolated tire spinning in his lab generated fields similar to those he had measured in moving cars.

A spinning wheel without a tire did not change the 0.2 mG field measured near the safety cover of the tire balancer, but a spinning steel-belted radial tire mounted on a wheel generated fields of about 6.8-7.0 mG in the same place.

Why had these fields not been discovered sooner, given the many hours of personal monitoring done with sophisticated recording gaussmeters in epidemiological studies of utility workers? Dr. William Kaune of EM Factors in Richland, WA, suggested that the fields were of such low frequency that they were filtered out by the meters.

Using the circumference of passenger car tires, Kaune and SM estimated that, at legal speeds, the tires would always spin at less than 20 revolutions/second (20 Hz). Nearly all the EMF epidemiologic studies published to date, both occupational and residential, have used versions of one of three meters to measure magnetic fields: the EMDEX and the AMEX, both made by Enertech Consultants in Campbell, CA, and the Positron, made by Positron Industries in Montreal, Canada. All of these units filter out frequencies below 35-40 Hz in order not to register effects of movement in Earth's static magnetic field.

Using the Bell 4080 meter and an EMDEX II meter, side-by-side measurements were made around appliances and under high-voltage transmission lines. The meters gave nearly identical readings. But in a moving car, the EMDEX usually gave substantially lower readings. At 60 mph, the EMDEX read 1.9 mG on the floor of the front seat, while the Bell meter read 7.9 mG in the same location. Similarly, on the back seat close to the doors, the EMDEX read 2.9-5.0 mG, while the Bell read 15.0-20.0 mG. More importantly, at a commercial tire-balancing machine, the EMDEX read 1.0 mG one foot from a spinning steel-belted radial tire, while the Bell read 6.0 mG and 6.4 mG in two trials with one tire, and 7.6 mG with another tire. Clearly, fields below 40 Hz are more effectively rejected by the EMDEX meter than by the Bell meter. (The Bell meter is designed to measure 60 Hz fields but filters the low frequencies somewhat less effectively than the EMDEX.)

Next, the static magnetic field associated with the tires in the store was corroborated with a fluxgate magnetometer (Walker FGM-301). We routinely detected static fields above the meter's maximum measurable level of 2.0 G at the tread surface of radial tires. In fact, we found some tires above the 5.0 G maximum measurable level of another magnetometer (R.B Annis Co.). The fields varied dramatically in both strength and polarity across the tread of the tire within very short distances (less than an inch), with many "hot spots." Some new tires had stronger fields than others, but all steel-belted radial tires—whether new, on cars or in a tire dump—showed similar fields. The fields dropped off quickly with distance from the tread surface, from over 2.0 G at the tread to about 100 mG at 3 inches from the tread.

The alternating magnetic fields generated by spinning tires were studied at a tire-balancing machine and in a moving car using the magnetometer connected to a portable oscilloscope (Tektronix 222 Digital Storage Oscilloscope) and a Toshiba portable computer (loaded with Metratek Waveform Manager, version 2, for Microsoft Windows 3.1). Magnetic flux density time-series data were acquired at different tire rotation rates and transformed into the frequency domain using a fast Fourier transform (FFT) algorithm in the computer.

We found that the frequency of the magnetic field was directly proportional to the speed of the automobile, 6 Hz at 30 mph and 12 Hz at 60 mph, while the intensity (rms) of the magnetic field remained fairly constant at 19 mG. (Note that care must be taken in interpreting magnetic field readings using common loop-type magnetic field probes, because field sensors will give the appearance of increasing magnetic flux density with increasing tire-rotation rate since the meters are more responsive to higher frequencies.) The waveform was roughly sinusoidal, but was distorted by high harmonic content. The magnitudes of the fundamental and harmonic components of the 30 mph magnetic waveform were 16 mG rms at 6 Hz, 10 mG at 12 Hz and 3 mG at 18 Hz.

Tires were easily degaussed using a hand-held magnetic tape degausser (Geneva Audio/Video Tape Eraser, Model PF211). With the car jacked up, the degausser was held near the tread of a tire—as it was spun by hand—and was gradually moved away over a 15-second period. Magnetic field measurements were taken after each tire was degaussed, and it became clear that each tire has its own sphere of magnetic influence inside the car. For instance, degaussing the right rear tire dropped the fields on the rear seat near the right door from 20 mG to 2.0 mG but had no effect on the fields on the rear seat near the left door.

Once the tires were degaussed, their magnetic fields stayed very low over a period of a few months.

Steel belts are made of very fine high-carbon wire (diameter = 0.0092 in). Each tire contains nearly one mile of wire. All iron wire products tested (nails, springs and paper clips) were magnetic, and the static field of a single strand of wire varied along its length in both polarity and intensity, suggesting that the wire manufacturing process may be the source of magnetism in tires. However, some specialty stainless steel wires are weakly magnetic, or not magnetic at all, and are difficult to magnetize.

Our observations suggest the need to reevaluate how exposures were assessed in previous residential and occupational epidemiological studies. If magnetic fields below 35 Hz are included, a child riding to and from school in the back seat of a car for one hour could receive as much magnetic field exposure on a time-weighted average basis as he could from spending 24 hours at home.

Similarly, electric utility line crews may spend as much time driving between jobs as they do climbing poles or towers—most of them

no doubt commute to work in cars. A rural area meter reader driving around in a car all day will have a significant magnetic field exposure below 35 Hz but relatively little exposure at power frequencies.

If magnetic field exposures below 35-40 Hz are biologically important, the use of meters that reject this part of the EMF spectrum could give a very distorted picture of ELF magnetic field exposure, thereby compromising epidemiological study results.

The focus on power frequency (50 and 60 Hz) magnetic fields was logical, since they are a pervasive concomitant of electricity use. However, the human nervous system operates at frequencies below 20 Hz as measured by brain waves, and magnetic fields sinusoidally modulated at 0.2 Hz were long ago shown to affect reaction time performance in humans.[2]

In view of our observations, we must wonder whether the outcomes of various EMF epidemiological studies would have been the same if the exposures had been assessed with meters that could measure magnetic fields below 35 Hz. Indeed, if cars are a major source of ELF fields, inclusion of exposures away from home should be considered in designing field measurement strategies for residential EMF studies.

It should not be technically difficult to build meters that can detect these ELF fields and isolate them from the effect of Earth's magnetic field. Also, it should not be very difficult to build field-free radial tires or to degauss existing tires.

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<rtell@radhaz.com>

1. K. Vedholm and Y.K. Hamnerius, "Personal Exposure from Low Frequency Electromagnetic Fields in Automobiles," *2nd World Congress for Electricity and Magnetism in Biology and Medicine,* Abstract No.F-9, Bologna, Italy, 1997.

2. H. Friedman, R.O. Becker and C.H. Bachman, "Effect of Magnetic Fields on Reaction Time Performance," *Nature, 213,* pp.949-950, 1967.

Clippings from All Over

"I have no intention of turning the FCC into a national zoning board."

—William Kennard, chairman, Federal Communications Commission, in a speech at CTIA's *Wireless '98,* Atlanta, GA, February 23, 1998

"I had thought it was voodoo."

—Dr. Fatih M. Uckun, pediatric oncologist, Wayne Hughes Institute, St. Paul, MN, on his earlier skepticism regarding a possible EMF–cancer link, quoted by Janet Raloff in "Electromagnetic Fields May Trigger Enzymes," *Science News,* p.119, February 21, 1998 (see p.7)

EMF Research Program Ending; Health Hazard Not Yet Found

—Headline of article on the impending conclusion of the EMF RAPID program, in *Electroindustry,* published by the National Electrical Manufacturers Association, Washington, DC, p.3, February 15, 1998

"...lowering per-minute costs will dramatically enlarge the market. The name of the game is to get people to talk more."

—Mario Gabelli, mutual fund manager, quoted by Susan Pulliam in "Bell Atlantic's Move May Spark a Price War in Cell Phone Service, Hurting Some Players," *Wall Street Journal,* p.C4, March 5, 1998

Home values can still be affected. Although the National Association of Realtors receives fewer inquiries on EMFs, real estate agents continue to contend with buyer anxieties, a problem also inextricably entangled with a dislike of the aesthetics of utility towers. Susan Coveny, president of RE/MAX Prestige, a realty agency in Long Grove, IL, says a home near a power line can sell for 20% less than a comparable house at some distance away. Coveny says she has commissioned tests of field strength in homes near power lines and has shown buyers literature about studies that have cast doubt on health effects. "It doesn't matter," she states. "Their reaction is, 'I know somebody near a power line who has brain cancer'."

—Gary Stix, "Closing the Book: Are Power Line Fields a Dead Issue?" *Scientific American,* p.33, March 1998

"Microwave News" Flashback

Years 15 Ago

• Drs. José Delgado and Jocelyne Leal of the Centro Ramon y Cajal Hospital in Madrid, Spain, report that 12 mG, 100 Hz PMFs caused "drastic" changes in developing chick embryos.

• In comments on EPA's announced intention to propose rules on RF/MW exposures, telecom lobbyists say it is vital that the EPA preempt stricter state and local ordinances. The FCC notes that it "lacks the necessary expertise" to write its own health and safety guidelines.

• Critics question a Sandia Labs conclusion that electromagnetic pulse (EMP) radiation from a high-altitude nuclear blast would not interfere with the safe shutdown of a nuclear power plant.

Years 10 Ago

• The New York Public Service Commission affirms its 1.6 kV/m limit for electric fields at the edge of power line rights-of-way and proposes a 100 mG companion limit for magnetic fields.

• An international team announces it has confirmed Delgado and Leal's finding that weak PMFs affect chick embryos.

• Resignations, legal worries and a dearth of funds bring the revision of ANSI's 1982 RF/MW standard to a halt. "The first order of business is to get some kind of liability insurance for the members," says Dr. Om Gandhi of the University of Utah in Salt Lake City.

Years 5 Ago

• Cancer clusters in three office buildings—in Washington, in San Jose, CA, and in Garden Grove, CA—continue to resist any explanation as investigators explore EMFs as a possible cause.

• In the Chrysler Building in New York City, magnetic fields greater than 2 G, generated by electrical equipment one floor below Klockner Chemical Co., force the firm to vacate its offices.

• Female paramedics worry that the Motorola 800 MHz two-way radios they use on the job may be the cause of their menstrual irregularities and their abnormal pap smears.

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UPDATES

ELECTROMAGNETIC INTERFERENCE

The Literati Tune In... The loss of 230 people aboard TWA Flight 800 may have been caused by EMI from military sources, argues Dr. Elaine Scarry in an 18-page supplement to the *New York Review of Books*' April 9, 1998, issue. The Boeing 747 went down in a fireball off the coast of Long Island, NY, on its way to Paris in July 1996. While there is general agreement that the fuel tank exploded, there is no consensus as to what sparked the explosion. Scarry teaches English literature at Harvard University in Cambridge, MA, where she is the Cabot Professor of Aesthetics and the General Theory of Value. In her heavily footnoted article—there are 106 in all—Scarry offers three scenarios: (1) A pulse of energy from outside the plane caused a spark that lit vapors in the fuel tank; (2) high-intensity RF radiation directly ignited the vapors coming out of a vent from the central fuel tank; and (3) a sudden pulse of energy "from a military jammer or countermeasures system" knocked the plane out of control. Scarry closes with three recommendations: First, that EMI be made part of the TWA 800 investigation (there are strong indications that it already was); second, that the Department of Defense reveal which radiation emitters aboard nearby planes and ships were in use at the time of the explosion; and third, that two long-classified Air Force reports on EMI be released to the public (see *MWN,* M/A89, as well as N/D87 and S/O88).

EMF REPRODUCTIVE EFFECTS

Offspring of Men at Work... Children whose fathers were exposed to power frequency EMFs on the job around the time of conception differ little from other children in the occurrence of birth defects or other health problems, according to a new Swedish study. Siv Törnqvist, a nurse at the National Institute for Working Life (NIWL) in Solna, found "no clear-cut effects" of paternal exposure to workplace EMFs, she reports in the February issue of the *Journal of Occupational and Environmental Medicine (40,* pp.111-117, 1998). Törnqvist analyzed birth and cancer registry data on two sets of "exposed" children and two control groups. Study I included 2,077 infants born from 1973 through 1986 whose fathers were power-industry electrical workers one year prior to their children's birth, according to census records. Study II included 178 children born from 1981 through 1994 to workers in electric utility jobs involving measured magnetic fields greater than 5.0 mG and electrical fields measuring above 30 V/m for a period of ten minutes or more over a six-hour work shift. In Study I, perinatal deaths were 30% more common among the exposed children than among the controls, but the difference was not statistically significant. Exposed children and controls differed only slightly in the incidence of low birth weight and of chromosomal anomalies. The two groups also differed little in the occurrence of birth defects, except for hypospadias, malformations of the urethral opening, which were more than twice as frequent in the exposed infants—but this excess was also not significant. And the two groups differed little in the overall incidence of cancers, with higher-than-normal morbidity rates in both. The exposure assessment method used in Study I is "relatively crude," Törnqvist writes, adding that the exposed group probably included infants whose fathers were not

exposed "at the crucial time." In Study II, Törnqvist reports a 59% excess of severe malformations in the high-exposure group, again noting that this is not statistically significant. As Törnqvist points out, however, the relatively small size of both the exposed and the control groups in Study II means that only major differences between them would be statistically significant. No cancers were identified among the Study II children. Törnqvist recently retired from the NIWL.

MEDICAL DEVICES

A Museum of Magnetic Frauds... Feeling stressed? If so, you may be interested in the Magnetic Resonance Belt that Torralvoma Research has been advertising lately in New York City's *Village Voice*. Besides preventing illness, the ads claim, the belt eliminates stress and "improves sexual power 200%." *Microwave News* called the contact number—(212) 673-1670—and spoke to Edgardo Torralvoma. He said that the belt holds quartz crystals magnetized at specific "resonances" for each of the seven chakras—yoga jargon for fields of spiritual energy. The magnetic fields energize the chakras, Torralvoma explained, and "as long as your chakras are charged, you don't get sick." When *Microwave News* told Robert McCoy about the belt, he said, "That's a new one." McCoy is the founder and director of the Museum of Questionable Medical Devices in Minneapolis, MN. The magnetic resonance belt is by no means the first medical device claimed to produce beneficial effects with magnetic fields. The museum has examples dating back to the 19th century. A 1911 ad in the *New York Medical Journal* touted the Bachelet magnetic wave generator as "promoting secretions and arresting the progress of degeneration." Another belt on exhibit is the I-ON-A-CO, whose makers claimed it would "improve the catalytic value" of iron in the blood, "thus enabling it to deliver an increased supply of oxygen to the system." Gaylord Wilshire, whose name lives on as a boulevard in Los Angeles, sold thousands of I-ON-A-COs in the 1920s. More recently, a farmer wishing to rid his crops of insect pests could place a dead bug in an Auto Sweep Resonator, along with a vial of pesticide and a photo of his field. The resonator, it was claimed, would ascertain the operative frequencies of these objects and, *voilà!*—no more pest problem. The resonator was seized by the Minnesota Attorney General in 1993 in connection with consumer fraud charges. McCoy got the idea for a museum of quackery after a friend offered him a collection of skull-measuring machines used in phrenology, a discipline popular until the 1930s in which inferences about intelligence and character were drawn from the shape of the head. For more information on the museum, contact: Museum of Questionable Medical Devices, 201 Main St., SE, Minneapolis, MN 55414, (612) 379-4046, E-mail: <quack@mtn.org>, Web: <www.mtn.org/quack>.

MELATONIN

Insomnia in Outer Space... One of the few documented benefits of melatonin supplements is their usefulness in overcoming jet lag. Soon "orbit lag" may be added to the list. " The space environment causes...sleeplessness in astronauts," according to the January 26, 1998, *Aviation Week & Space Technology,* and

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Sen. John Glenn (D-OH) will soon be part of an experiment designed to find out why. This October, NASA will study how life in zero G affects the circadian rhythms of Glenn and the rest of the crew of the space shuttle *Discovery.* Their melatonin levels and sleep patterns will be monitored, and before going to sleep, each of them will take either a melatonin pill or a placebo. A similar study was slated for a shuttle flight that began on April 2.

MICROWAVE COOKING

Depleting Vitamin B_{12}... When milk, beef or pork is cooked in a microwave oven, biologically active levels of vitamin B_{12} are diminished. A team of Japanese researchers found that after six minutes in a microwave oven operating at 2450 MHz, these foods lost 30%-40% of their available B_{12}, an essential nutrient that can protect against neurological problems and heart disease. Conventional cooking also depletes B_{12}, but not as quickly. Dr. Fumio Watanabe of the Kochi Women's University reports that, "The amount of B_{12} loss in the six-minute microwave-treated milk sample did not differ from that in the 30-minute boiled milk." Watanabe's paper appears in the January issue of the *Journal of Agricultural & Food Chemistry (46,* pp.206-210, 1998).

MICROWAVE WEAPONS

Information Warfare... The U.S. Air Force (USAF) has mounted high-power microwave generators on air-launched cruise missiles to test their usefulness in waging computer warfare, reports *Aviation Week* in its January 19, 1998, issue. The tests were somewhat successful, although "there were problems with range and focus," according to the magazine, which has excellent sources at the Pentagon. But the information wars of the future will involve more than just zapping computers. USAF General John Jumper predicts that the military will have the tools to make potential enemies see, hear and believe things that do not exist, according to a follow-up item in the March 9 issue. The same idea was contained in a 15-volume study by the USAF Scientific Advisory Board, issued in 1996, on how to maintain U.S. air and space superiority on the battlefields of the 21st century (see *MWN,* J/F97).

WIRELESS FICTION

Zoning Board Hearing... What is it like to be at a local zoning board hearing about a telecom tower? A short story ("Unapproved Minutes") by Tom Paine, who teaches creative writing at Middlebury College in Vermont, paints a vivid portrait in the April *Harper's* magazine. On the agenda of the Zoning Board of Adjustment of the fictional town of Carthage, VT, is the problem of a 50 kW radio station (WIKD) causing interference with the townspeople's appliances. For instance, some are picking up rock music (Led Zeppelin) on their electric toothbrushes. Paine clearly did some research: He refers to the classic 1962 Prausnitz-Susskind paper indicating a possible RF/MW–cancer connection and extrapolates from a Johns Hopkins study suggesting an RF/MW risk of Alzheimer's. The short story also includes a child with leukemia, a gaggle of industry lawyers and the telecom act's preemption of local RF/MW rules. It seems like the real thing.

VIEWS ON THE NEWS

Interpreting the EMF Animal Studies: What's Going On?

"Let's get to the bottom of this." Those were the words of Dr. Linda Chatman of Pfizer Inc. in her peer review of the Battelle labs' recent EMF–breast cancer study (see p.1). We couldn't agree more.

The Battelle results are at odds with a series of studies by Germany's Drs. Wolfgang Löscher and Meike Mevissen, and why the two labs differ is far from clear. But this—like the NTP's description of another recent study as "equivocal" (see p.1)—is symbolic of the entire field: There's too much evidence to ignore, but not enough to know what to think.

Ironically, things may be so murky in part because researchers have tried to make them too simple. Most EMF animal studies have used "pure" 50 or 60 Hz sine waves, without the high-frequency transients and harmonic distortions that are common features of electric power. But in the real world, the distribution of electricity is a messy thing.

"It might be cleaner and neater for engineers...to set up pure sine wave signals," Dr. Allan Frey of Randomline in Potomac, MD, comments in an Internet posting, "but that does not mean they are relevant to the biological organism."

As the WHO's Dr. Michael Repacholi told *Microwave News,* fields with transients and harmonics "are the ones to which people are actually exposed in our living and working environments." He pointed to "EPRI studies that indicate these fields produce signals that are above the noise level of cells and are thus detected by them" (see *MWN,* J/A95 and S/O95).

Another area that needs to be pursued is electric fields. In recent years, the research pendulum has swung so far towards magnetic fields that electric fields have been virtually ignored. Certainly, this has been true in EMF animal studies. But as another NTP peer reviewer of the Battelle study, Dr. Maria Stuchly of Canada's University of Victoria, observed, Dr. Anthony Miller's recent epidemiological study has implicated joint exposure to magnetic *and* electric fields (see *MWN,* J/A96).

There are other complexities, as scientists take up the difficult job of trying to model the real world inside the lab. At a February 6 workshop sponsored by the Bioelectromagnetics Society at the Catholic University of America in Washington, Finland's Dr. Jukka Juutilainen said that the results of animal studies so far suggest that, "EMFs potentiate the effects of known carcinogens only when both exposures are chronic, that is, when EMFs and the known carcinogen interact repeatedly during a long-term experiment." For example, in his own recent experiment with thrice-weekly exposures to UV light, EMFs promoted the development of skin tumors in mice (see p.3).

Juutilainen thinks that "the classical two-stage carcinogenesis experiments, with short-term initiator treatment followed by chronic exposure to EMFs as a potential promoter," may not be a good model for revealing EMF effects. Since EMFs may affect DNA repair or other processes that lead "to increased accumulation of mutations in critical genes," Juutilainen proposes that, "The more general concept of 'cocarcinogen' may be more appropriate than 'promoter' for describing the possible role of EMFs."

But it may be that none of these points explains one of the most important riddles—the contradictory results from the Löscher and Battelle labs. Both used sine waves, both used repeated applications of a chemical carcinogen. Löscher's studies form a coherent body of work and cannot be easily dismissed, especially given his supporting evidence on melatonin and ODC (see p.5). This is all the more true in light of the high cancer rates among controls that compromise two of the three Battelle experiments.

Understanding the EMF–cancer connection will not be an easy—or rapid—process. But it's important. As Pfizer's Chatman observed, "the strong epidemiological support for a potential association between [EMFs] and human malignancies" obliges us to "explore all reasonable possibilities" for an EMF–cancer mechanism. She's right.

We must get to the bottom of this.

Moving at the Speed of Light

It's 1993. Responding to public fears about brain cancer, the Cellular Telecommunications Industry Association (CTIA) announces a five-year, $25 million safety research plan. Set up in April, the program will become known as Wireless Technology Research (WTR). The U.S. has 12 million cellular phone users.

In 1994, program head Dr. George Carlo promises that the first biological studies will be under way, "with checks signed," by the end of the year. It doesn't happen.

In 1995, WTR calls itself "an unparalleled undertaking in the field of science—literally the largest independent research project of its kind in the world." In December, WTR pays for seven people to attend a conference in Waikiki, Hawaii. Not one test tube has gotten wet.

In 1996, almost half of the $25 million is gone. Lucent Technologies' Ron Petersen says, "We cannot really account for the money that WTR has spent." The cancer research program, he says, "is really nonexistent. There's nothing there." At year's end, the test tubes are all still dry.

In 1997, WTR announces that it will not do any chronic animal studies, once a key part of WTR's "research agenda," which took two years and countless meetings to produce. Carlo insists that WTR is "moving at the speed of light."

Today, after five years and $20 million, WTR does not have results from a single biological experiment. More than 55 million Americans now use cellular phones.

We have only one question: Has the CTIA's plan failed—or has it in fact succeeded?

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Precaution—From Principle to Practice
Positive Results or Probable Hype?

Swiss To Adopt Strict RF/MW Rules Based on Precautionary Principle

Swiss health and environmental officials have proposed strict rules for public exposures from new sources of radiofrequency and microwave (RF/MW) radiation. If the ordinance is adopted, which appears likely, Switzerland will have the most stringent exposure guidelines in the world—requiring power levels effectively a hundred times lower than those of the International Commission on Non-Ionizing Radiation Protection (ICNIRP) and the American National Standards Institute (ANSI).

"The rules are designed to be reasonable and pragmatic," Dr. Mirjana Moser told *Microwave News*. Moser is with the Radiation Protection Office of the Swiss Agency for Public Health in Bern. She attributed the tough new rules to public concern over possible health effects.

The guidelines are based on the precautionary principle, according to a commentary accompanying the proposed ordinance. Moser emphasized that "a very large population is being exposed to non-ionizing radiation, so very subtle effects can become very important from a public health standpoint."

"In all likelihood, the ordinance will be adopted with only minor changes," predicted Dr. Stefan Joss of the Non-Ionizing Radiation Unit at the Swiss Agency for Environment, Forests and Landscape, which is known as BUWAL.

BUWAL released its proposed ordinance, which covers exposures of the general population from both power frequency and RF/MW radiation, for public comment on February 16. After the comment period closes on May 15, BUWAL will circulate a revised draft among federal agencies. Once a consensus is reached,

(continued on p.4)

U.K. Study: Mobile Phones Can Make the Brain Work Faster

Cellular phone radiation can make the mind function more quickly, according to a new study by a British research team. Volunteers exposed to continuous and pulsed microwaves showed faster reaction times in tests of their attention. Memory was unchanged.

The effect "appears to be robust," according to Dr. Alan Preece of the Medical Physics Research Center at the U.K.'s University of Bristol. In a paper published in the *International Journal of Radiation Biology (75,* pp.447-456, 1999), Preece and colleagues note that although average reaction time decreased by only 14 milliseconds or less, the finding is statistically significant ($p=0.007$). "Although the change is within normal variation," Preece said in an interview, "the indication of any change at all is what is significant."

The study is Britain's first government-funded research on mobile phones and human health to be published. When it was made public on April 8, the

(continued on p.11)

« Power Line Talk »

The **German Research Foundation** has awarded Dr. **Wolfgang Löscher** a two-year grant of 300,000 DM (approximately US$170,000) for an animal study designed to investigate possible mechanisms by which EMFs could promote cancer. Löscher, of the School of Veterinary Medicine in Hannover, will study melatonin and polyamine levels and ornithine decarboxylase (ODC) activity in the mammary tissue of rats exposed to 50 Hz magnetic fields. In another experiment, Löscher will test whether exposure to 50 Hz EMFs affects mutation rates of oncogenes in rat breast tissue treated with the chemical carcinogen DMBA. Work is already under way, Löscher told *Microwave News*. Depending on the outcome of the studies, he added, the grant could be extended up to four more years. Known by its German abbreviation, DFG, the German Research Foundation is one of Germany's largest sources of research grants. Most of its budget comes from the government, but its decisions are independent. Grants are prestigious and highly competitive. Working with Dr. **Meike Mevissen**, now at the University of Bern in Switzerland, Löscher previously completed a series of experiments in which power frequency EMFs were found to increase mammary tumor growth in rodents (see *MWN,* J/A93 and J/F95). In the U.S., this research has been the focus of spirited debate. Last year, after researchers at the Battelle Pacific Northwest labs in Richland, WA, were unable to reproduce Löscher's results, his findings were challenged by Dr. Gary Boorman, the head of the EMF RAPID program at the NIEHS, among others. But Dr. Larry Anderson, who led the Battelle studies, pointed out that high tumor rates among the control animals in two of Anderson's three experiments left little room for contrast with the EMF-exposed rats (see *MWN,* M/A98, M/J98 and J/A98).

«« »»

Dr. **Eugene Sobel** of the **University of Southern California** in Los Angeles has received a $75,000 grant from the California Alzheimer's Program for a large-scale study of occupational EMF exposure and Alzheimer's disease. The study will draw on the 9,000-patient database of California's nine **Alzheimer's Disease Diagnosis and Treatment Centers** (ADDTC). Sobel examined 478 patients from one of these centers in a previous study, and found that those with no family history of Alzheimer's were more likely to get the disease if they had worked in jobs with significant EMF exposures (see *MWN,* J/F97). "Using data from the ADDTC centers is a big advantage," Sobel told *Microwave News*. He explained that other dementias are often misdiagnosed as Alzheimer's, but the ADDTC's rigorous protocols keep that problem to a minimum.

«« »»

EPRI canceled its biennial **EMF Science Seminar**, which had been scheduled for March 28-31 in Denver. **Robert Banks**, the publisher of the *EMF Health & Safety Digest,* who was organizing the meeting for EPRI, explained that the decision to cancel was made when it became clear that two of the star attractions would prove to be disappointing. Dr. **Kenneth Olden**, the director of the NIEHS, indicated that he would remain silent on his final report to Congress on the EMF RAPID program (see p.3). And Canada's **Mary McBride** decided not to reveal the results of her childhood cancer epidemiological study prior to its publication later this spring (see box above). "Frankly, it was our recommendation to cancel when the two big draws were not going to talk about what we had hoped," Banks said. Will there be a meeting next year? "It's up to EPRI," Banks replied. Jackie Turner, an EPRI spokesperson in Palo Alto, CA, said that plans for future seminars are "still under discussion." There is also a possibility that EPRI might take over the annual EMF research review, sponsored by the DOE each fall for many years. At the close of the final DOE review last year in Tucson, AZ, Dr. **Charles Rafferty** of EPRI's EMF program told the attendees that, "Our program is continuing. There is extraordinary value in the review and we would like to see it continue."

Canadian Childhood Cancer Epidemiological Study Due May 1

Mary McBride's epidemiological study of childhood leukemia and exposures to power frequency EMFs will be published in the May 1 issue of the *American Journal of Epidemiology.* McBride, of the British Columbia Cancer Agency in Vancouver, Canada, has declined to reveal her findings prior to their official release.

McBride and coworkers—including Dr. Gilles Thériault of McGill University in Montreal—enrolled 399 patients diagnosed with cancer between 1990 and 1995 and 399 controls, all from five Canadian provinces. EMF exposure assessment included 48-hour personal and residential measurements, as well as wire codes.

The paper was originally slated to appear in the June 15 issue of the journal, but the editors later agreed to expedite its publication.

«« »»

HealthGuard Inc., of Warwick, RI, has a new product that it claims can "alter the structure of EMFs and render them harmless" throughout the home. The **EMF Defender System 2000™** consists of a control box and two 3/4-inch diameter cables: one buried in the ground around the building and the other installed along the edges of the rafters. The theory behind the system, as HealthGuard explains, is that, "It is the *message* (60 Hz common household current), rather than the *energy* of the signal that determines if a biologic cell responds to an EMF." By generating random electromagnetic noise, the EMF Defender is supposed to "convert the EMFs into incoherent signals which cannot be detected by living tissue." This approach was developed by Dr. **Ted Litovitz** of the Catholic University of America in Washington, who was granted a patent on it in 1995 (see *MWN,* J/F 96). Litovitz licensed the concept to New York City-based **EMX**

Corp., which in turn sold HealthGuard the rights to use it for a home protection system. But some scientists question the idea of exposing consumers to an additional field (see *MWN,* J/F94; also J/A94). Others believe that EMF bioeffects may not even be caused by the basic sine-wave pattern of 60 Hz current, but by another aspect of exposure—for example, high frequency transients (see *MWN,* M/A98). In an interview, HealthGuard President **Harry Harootunian** responded that, "Dr. Litovitz's experiments have shown that it takes a coherent field to produce an effect." Harootunian estimated that the price of the EMF Defender System 2000 for a single-story, 2,000-square-foot building would be about $4,000. The EMF Defender is HealthGuard's only product; EMX has retained the rights to applications for specific appliances such as hair dryers and computer keyboards (see *MWN,* J/A93 and J/F94). Promotional materials for the EMF Defender prominently cite the **NIEHS EMF Working Group**'s conclusion that EMFs should be considered "a possible human carcinogen"—though that conclusion is incorrectly attributed to the **National Institutes of Health**. HealthGuard can be reached at (800) 556-0077, or (401) 781-7500.

RAPID Report Okayed by NIEHS, Release Expected in May

In late March, the National Institute of Environmental Health Sciences (NIEHS) completed its final report on the five-year EMF RAPID research program. The report must now be approved by Secretary Donna Shalala of the Department of Health and Human Services (HHS) before it can be sent to Congress and released to the public.

Dalton Paxman, a senior environmental advisor in the office of the secretary of HHS, told *Microwave News* that he expects the report to be sent to Congress in May. "It is under review, following the normal clearance process for all HHS documents," he said. "I don't see a problem with it."

Dr. Kenneth Olden, the director of the NIEHS, forwarded the report to his immediate superior, Dr. Harold Varmus, the head of the National Institutes of Health (NIH), on March 22. Varmus signed off on Olden's report on April 7 and passed it on to the office of Secretary Shalala, his bureaucratic superior.

NIEHS officials declined to reveal Olden's conclusions on EMF health risks. Dr. Sheila Newton, the director of NIEHS' Office of Program Planning and Evaluation in Research Triangle Park, NC, would only say that the report is 67 pages long, including 26 pages of references.

"The fact that Dr. Varmus had no scientific problems with the report would imply that the NIH does not disagree with our findings," Dr. Christopher Portier, chief of the NIEHS Laboratory of Computational Biology and Risk Analysis, said in an interview.

Last December, the NIEHS released a draft staff report on RAPID program research which indicated that the NIEHS was ready to discount EMF health risks (see *MWN,* J/F99). While this was a separate document from Olden's report to Congress, the board of directors of the Bioelectromagnetics Society (BEMS) wrote to Olden to express its concerns. "Many scientists working on the issues of EMF health effects question the impartiality and scientific judgment of the writers of the RAPID program report," warned BEMS President Dr. Betty Sisken of the University of Kentucky, Lexington, in the February 5 letter.

Sisken followed up with a second letter in early March. "I requested that Dr. Olden ensure that his final report to Congress be a fair assessment of EMF health risks, which includes all the relevant scientific studies," she told *Microwave News.*

The Energy Policy Act of 1992, which mandated the EMF RAPID program, requires two different final reports: one from NIEHS' Olden and one from an interagency advisory committee established under the law. Dr. Michael Marron of the Office of Naval Research in Arlington, VA, is leading the effort to write the committee report.

"We are waiting for the NIEHS report and will then file our own report with Congress," Marron said.

Reiter's New Hypothesis: EMFs May Deplete Melatonin

Dr. Russel Reiter has put forward a new variation on the melatonin hypothesis. He proposes that power frequency magnetic fields may reduce the level of melatonin in the bloodstream, rather than simply suppress the production of melatonin by the pineal gland (see *MWN,* M/J88).

Reiter advances this hypothesis in the November 1998 *Bioelectrochemistry and Bioenergetics (47,* pp.135-142) in a paper he first presented last May at a conference in Denmark.

While conceding that results are inconsistent, Reiter concludes that both human and animal studies provide some evidence linking EMFs to lower serum melatonin levels. But Reiter notes that data linking EMFs to reduced synthesis or secretion of the hormone "seem to be becoming progressively weaker overall."

Reiter, who is at the University of Texas Health Science Center in San Antonio and is editor in chief of the *Journal of Pineal Research,* offers two explanations for this apparent contradiction. As others have suggested, the pure sinusoidal waves used in lab studies may not have the same effect as real-world EMFs. Suppression of melatonin, Reiter states, "may require complex, 'dirty' fields," such as those produced by electric power in daily life.

Alternatively, the level of melatonin may fall "because it is being taken up by cells to defend against free radicals." The hormone is a powerful free radical scavenger, which promotes its depletion.

"Theoretically at least," Reiter explains, EMFs are "capable of prolonging the half-life of free radicals," leading to higher concentrations within cells. If this is true, more melatonin "will be required to neutralize the extra radicals" and the level of melatonin in the blood could fall "with no change in its production or its secretion from the pineal gland."

Reiter notes that in studies which found serum melatonin levels to be reduced, the changes were "not necessarily accom-

panied by any measurable reduction in melatonin synthesis."

Dr. Antonio Sastre of the Midwest Research Institute (MRI) in Kansas City, MO, shares Reiter's view that the clean 60 Hz fields used in lab studies "may be missing the mark." And Sastre agrees that EMFs could increase the lifetime of free radicals, although only at the high field strengths found in occupational settings.

(In a new paper, Dr. Robert Adair of Yale University in New Haven, CT, argues that magnetic fields of less than 50 mG will not increase the lifetime of free radicals; see p.14.)

But Sastre told *Microwave News* that the depletion hypothesis "doesn't help me reconcile what I see as a fairly consistent picture from human research," referring to studies with volunteers—including those by his MRI colleague Dr. Charles Graham—that have found no change in serum melatonin from EMF exposure. He also noted that melatonin is only one of several antioxidants that the body might use to neutralize free radicals.

Reiter concedes that, "The evidence for any one theory is weak," but he wants to see the issue resolved. More research is "imperative," he writes, to identify "the coupling mechanisms of the fields to the organism."

Richardson: DOE Not Interested in Doing More EMF Research

Secretary of Energy Bill Richardson has made it clear that the Department of Energy (DOE) does not intend to sponsor any more EMF research.

In a March 3 letter to Shirley Linde, the chair of the now disbanded National EMF Advisory Committee, Richardson stated that the National Institute of Environmental Health Sciences (NIEHS) is the appropriate federal agency to lead any future EMF research. Last year, Linde, among others, waged a campaign to change the DOE's decision to abandon its long-standing EMF program (see *MWN,* M/J98).

In his letter, Richardson wrote:

> Regarding the need for further EMF research, our position has been that specific research needs should be based on the results of the risk assessment performed by the NIEHS, and that further research should be directed by the NIEHS. In addition, the NIEHS is the appropriate federal agency to continue the public dissemination of information concerning EMF exposures and potential health effects.

Swiss Propose Strict RF/MW Exposure Rules *(continued from p.1)*

the proposal will go to the Swiss Cabinet for approval.

The environmental agency plans to adopt the ICNIRP limits—but with the added stipulation that levels are to be further reduced in "areas with sensitive uses," including homes, workplaces and playgrounds, where people could be subject to chronic exposures.

In essence, the BUWAL proposal is an attempt to draft exposure guidelines based on the precautionary principle, also known as prudent avoidance. Though it does not replace ICNIRP's numbers with a fully developed new standard, it does aim to give the public more protection against possible low-level effects.

Rather than specifying lower numerical limits on radiation exposure, BUWAL would establish minimum distances between new sources and sensitive locations. And for existing sources, BUWAL proposes to "minimize" exposures in sensitive areas.

The proposed ordinance does, however, allow regional officials some discretion to grant exceptions in cases where compliance with the minimum distance is not "technically or operationally feasible" or not achievable at "reasonable" cost.

For new sources of RF/MW radiation, the minimum distances must be sufficient to ensure that exposures do not exceed 10% of the ICNIRP electric and magnetic field limits. A tenfold tightening of the limit on these fields translates into a hundredfold lowering of the allowable power density. For example, since ICNIRP's power density limit in the 10-400 MHz frequency range is 200 $\propto W/cm^2$, the corresponding maximum exposure level under the Swiss ordinance would be 2 $\propto W/cm^2$. At 900 MHz, the Swiss guideline would be 4.5 $\propto W/cm^2$, and at 1800 MHz it would be 9 $\propto W/cm^2$.

The minimum distances are based on an antenna's maximum power output, not the six-minute averages used by ICNIRP, BUWAL's Joss pointed out. In actual practice, power densities would therefore be even less than 1% of the ICNIRP limits.

Mobile telephone base stations would be most immediately affected as the proliferation of wireless antennas continues. Moser estimated that, on average, the proposed ordinance would require a minimum distance of 17 meters (approximately 55 feet) between antennas and locations where people spend time.

Moser noted that wireless companies had voiced concerns over the new limits but that the industry now concedes that it could live with them. "For marketing reasons, the wireless carriers don't want to be seen as opposing precautionary measures," she said.

In a letter to regional environmental officials, Moritz Leuenberger, a member of the Swiss Cabinet, advised "caution" in issuing permits for new antennas so that the ordinance is not undermined before it takes effect.

The minimum distance provision also applies to new TV and radio transmitters, as well as radar. Moser believes these sources could comply with the new requirement: "I don't know of any cases where the rules would cause a problem." She noted that a large TV tower is being built near Bern, and said that, to her knowledge, this antenna would meet the proposed minimum distance requirements.

BUWAL would also establish minimum distances to protect against chronic EMF exposures. At these frequencies, however, BUWAL would use a more complex—and less restrictive—formula to calculate the exclusion zone.

The proposed regulations do not addresss exposures from hand-held mobile phones or from household electrical appliances.

The draft ordinance, *Verordnung über den Schutz vor nichtionisierender Strahlung,* and an accompanying commentary, *Erläuternder Bericht,* are posted in German and in French on the Internet at: <www.admin.ch/buwal/presse/aktuell.htm>.

HIGHLIGHTS

European Parliament Calls for Caution on EMF–EMR Exposure

On March 10, the European Parliament endorsed the idea of prudent avoidance of electromagnetic fields and radiation (EMF–EMR). In an advisory vote, it called for changes to a proposal from the European Commission (EC), which would establish a common standard for public exposure in the 15 member states of the European Union (EU).

The fate of the EC proposal will be decided by the EU's Council of Ministers when it meets in June.

The parliament backed all amendments passed by its Committee on the Environment, Public Health and Consumer Protection on February 18, including those supporting the "precautionary principle" and the "ALARA" approach to non-ionizing radiation—that exposure should be kept "as low as reasonably achievable" (see *MWN,* J/F99).

The amendments passed by the full parliament go beyond the environment committee's recommendations on one important point: They address the potential health risks associated with long-term, chronic exposures. The parliament noted that the EC's proposed safety standard was drafted "only with respect to the thresholds for acute effects." Declaring that the public must also be protected against "potentially harmful long-term effects," it urged the EC to "keep the matter...under review" and revise its standard by 2001.

Green Party representatives failed to win passage of a set of numerical limits far stricter than those put forward by the EC, whose proposal is based on the guidelines adopted by the International Commission on Non-Ionizing Radiation Protection (ICNIRP). The Greens' proposed limits had been defeated in the environment committee, and lost again in the full parliament by a vote of 443 to 82.

But Gianni Tamino, a member of the European Parliament (MEP) from Italy and vice chair of the parliament's Green group, said he was happy with the results. "Three Green amendments were approved," he told *Microwave News.* "Considering the whole situation, it is a success. This vote of the European Parliament helps to put pressure on the EC, member states and the Council of Ministers" before the council makes its decision in June.

Tamino said that there are indications that the council wants changes in the EC proposal. Even if the ICNIRP-based limits remain the same, Tamino said, he is hopeful that the proposal's language will be improved. In any case, the vote by the parliament means that, "We have opened up the debate," Tamino said. "Many members of parliament are now saying that we need more research, more information."

"Everything I have heard indicates that the EC will accept most of what Parliament has put forward," said Philip Whitehead, MEP from Staffordshire East and Derby, U.K., and a member of the Labor Party. "The most important thing is the principle of continuous review, since there is such disagreement at the moment about what a minimum safety standard should be." Rather than close off the discussion, Whitehead said in an interview, "We're trying to establish that full information about this issue should go to member states on a continuing basis."

Focusing on the issue of cellular phones, Whitehead argued that there has not been nearly enough research. "Countries like Finland, where mobile phones are extremely widespread, are

Warning Labels on European Cell Phones? Not Quite

When the European Parliament passed a resolution that mentioned putting labels on mobile phones, it caused a buzz on the Internet and in the world press.

Last November, British courts had dismissed a lawsuit demanding that all mobile phones bear labels warning of harmful health effects (see *MWN,* N/D98), and many observers seemed to think that the European Parliament was now backing the same requirement. But, in fact, the parliament's proposal was far milder, and its March 10 vote was only an advisory one.

The parliament urged that consumer products "capable of producing electromagnetic fields"—especially mobile phones—include information "on the fields generated...as a function of distance and the type of use." While this would be useful information for individuals who wish to practice prudent avoidance, no warning or cautionary language would be required.

In any case, the European Parliament's vote does not require anything of anybody: It is only a suggestion. Mandatory labeling would require action by national governments or by the EU's Council of Ministers.

But exaggerated reports soon rippled through the media. The U.K.'s Sunday *Observer* (March 14) claimed that the European Parliament wanted "all mobile phones in Europe to carry health warnings." The story spread to South Africa, where the *Cape Times* (March 22) incorrectly asserted that, "Cellular phone users in Europe will soon be faced with a warning message every time they dial." Inaccurate stories like these soon snowballed on the Internet. By April 13, *Wired* magazine's on-line edition (at <www.wired. com>) was quoting former *Dynasty* star Linda Evans in support of the European Parliament's supposed demand for "warning labels" on wireless phones.

When MEP Philip Whitehead spoke to *Microwave News,* he tried to set the record straight. "What we have not done, and do not have the power to do, is compel the manufacturers to put a notice on mobile phones saying that they will fry your brain," said Whitehead, who is from the U.K. "There's no legal basis to say that they are definitely harmful."

Personally, Whitehead said, he would favor labels that go a bit beyond anything that the European Parliament has endorsed—for example, "saying that if you want to be cautious, use an earpiece; or avoid using the phone in confined spaces [such as a car], where the level of waves will be higher."

Whitehead seems to practice what he preaches. He spoke with *Microwave News* on his cellular phone, but used an earphone to increase his distance from its antenna. "As wonderful as they are," he remarked, "I think people would be unwise to use these devices for too long a period."

engaged in a gigantic experiment," he argued. If evidence in the future shows "cause for concern," Whitehead said, then it would be appropriate to consider stronger measures.

In the past, the European Parliament has been largely an advisory body, but it has recently begun to assert itself and demand a greater share of the power presently vested in the EU's bureaucracy, the EC. This tension was made clear in the EMF–EMR vote, with the parliament demanding more accountability. For example, the EC proposed that future research on EMF–EMR exposure be evaluated by the EC with "guidance by competent international organizations such as ICNIRP"—with no mention of any parliamentary role. The parliament voted to remove this reference to ICNIRP, and replace it with a call for the EC to report to parliament on future findings about health effects. Other references to ICNIRP were also removed, though a few remained.

Some sections of European industry have criticized the EC's proposal from the opposite direction, arguing that the ICNIRP guidelines are too strict. The U.K.'s Electricity Association (EA) protested that the EC proposal would impose unnecessary burdens on power providers, particularly in rural areas with sparse populations (see *MWN,* J/F99). In a concession to the EA's complaints, the parliament urged that a European standard for public exposure should focus on areas where people "live and spend significant [amounts of] time."

« Wireless Notes »

Lloyd's of London, the leading **U.K. insurance** underwriter, is refusing to cover manufacturers of wireless phones against health risks to users of their phones, the *Guardian* and its sister publication, the Sunday *Observer,* both leading British newspapers, reported on April 10 and April 11, respectively. The announcement follows the release of the University of Bristol findings of changes in cognitive function following exposure to signals from a mobile phone (see p.1).

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Wireless carriers often use church steeples to conceal their cellular antennas (see *MWN,* S/O97 and J/A98). But in **Austria**, some officials of the **Roman Catholic Church** have moved to put religious structures out of the companies' reach. On January 15, Vienna's *Der Standard* reported that Bishop Alois Kothgasser of Innsbruck had prohibited cellular equipment on churches and chapels in his diocese. Kothgasser described the ban as appropriate "in view of the specific character of places of worship." The decree will also cover other buildings owned by the church, the diocese stated, "as long as the question of adverse health effects from radio antennas remains the subject of controversy." The archdiocese of Salzburg has also banned the placement of antennas on its property, according to *Der Standard,* citing possible exposure to lawsuits related to health effects.

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On April 10, tower opponents joined forces with breast cancer activists and environmentalists at a public forum on health concerns associated with wireless telecommunications in Tiburon, CA, near San Francisco. "Despite assurances from industry that these phones and towers are safe, the public remains concerned," said Libby Kelley of the California Council on Wireless Technology Impacts (see also p.8). ***Cell Phones, Antennas & Radio/TV Towers: The Health Risks of Going Wireless,*** which attracted close to 100 attendees, was organized by the council, the **Breast Cancer Fund** and a number of local grassroots citizens groups. Dr. **Neil Cherry** flew in from **New Zealand** to speak at the forum—his second visit to the San Francisco area in two years. Cherry, of Lincoln University in Canterbury, New Zealand, has long advocated strict RF/MW exposure standards (see *MWN,* M/A97 and M/A98). "The more I learn about research findings outside the U.S. that go unreported in our mainstream media, the more concerned I am that industry and the media are jamming the danger signal," said **Nancy Evans** of the Breast Cancer Fund in San Francisco, who moderated the forum. **Linda Evans**, the star of *Dynasty,* came from Washington state where she is challenging a cell phone tower. "I am committed to letting my voice stand in support of those who might suffer the health effects or financial losses due to such towers," she said. The Coalition for San Francisco Neighborhoods (CSFN), an alliance of more than 30 groups, urged Congress in February to repeal the clause of the 1996 Telecommunications Act that preempts local rules on radiation hazards from wireless facilities. The CSFN has also endorsed the "**Vienna Resolution**" calling for further research on possible RF/MW health effects (see *MWN,* N/D98). Nancy Evans decried the "media blackout" on the Vienna Resolution.

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Jerald Busse's lawsuit against the cellular phone industry was dismissed by Cook County, IL, Circuit Court **Judge Ellis Reid** on March 15. When Busse originally filed his suit in 1995, he charged that **Ameritech**, **Motorola**, the **CTIA, WTR** and **Epidemiology Resources Inc.** (ERI) were conducting illegal human testing (see *MWN,* J/F96). Busse argued that by examining billing records to see if customers were at increased risk for cancer, the industry was using them as research subjects—without their having been asked for their consent or informed that any such risk might exist. Busse also claimed that the examination of billing records constituted an invasion of privacy. But in 1997 Judge Reid dismissed the charge of human testing, and the suit went forward on the privacy claim alone (see *MWN,* N/D 97). "We are pleased with the judge's decision," CTIA spokesperson **Tim Ayers** in Washington told *Microwave News*. Busse's attorneys, Ben Barnow and Alan Goldberg of Barnow & Goldberg in Chicago, have filed a motion to reconsider, but a ruling is not expected for a couple of months. Barnow & Goldberg also represent Robert Kane, the only other cellular phone plaintiff in the United States. Kane is the former Motorola engineer who brought suit against the company in December 1993, charging that his brain tumor was caused by exposure to radiation from cellular phone prototypes (see *MWN,* J/F94).

WTR Reports Genetic Damage from Cell Phone Radiation

Cellular phone radiation can triple the number of chromosome abnormalities in human blood, according to a study sponsored by Wireless Technology Research (WTR), an industry group.

"This is a very important finding," stated WTR chair Dr. George Carlo. "These results are frankly quite positive—there's a dose-response and it's across all technologies," Carlo said in an interview. "This clearly points to the need for continued research and especially for post-market surveillance."

The study was conducted at Integrated Laboratory Systems (ILS) in Research Triangle Park, NC. "The results showed an effect with all four cellular phone technologies that we tested—analog, CDMA, TDMA and PCS," Dr. Ray Tice of ILS told *Microwave News*. The findings are all statistically significant, all but one of them highly so.

Tice, collaborating with Drs. Graham Hook and Don McRee of WTR, observed the increase in genetic damage at exposures of 5 W/Kg and 10 W/Kg using a test called the micronucleus assay. The increase was "only observed following extended (24-hour) exposures," the researchers told the *30th Annual Meeting of the Environmental Mutagen Society* (EMS) in Washington on March 29. Three-hour exposures had no effect.

No damage from 24-hour exposures was seen when the blood cells were examined by single cell gel electrophoresis, also known as the comet assay. The comet assay was used by Drs. Henry Lai and N.P. Singh of the University of Washington, Seattle, in several experiments in which they observed an increase in DNA breaks after microwave exposure (see *MWN,* N/D94).

Dr. Joseph Roti Roti of Washington University in St. Louis was unable to repeat the results of the Lai-Singh studies (see *MWN,* J/F98; also p.8). But Roti Roti used a different version of the assay, and the sensitivity and procedures of the comet assay have remained a subject of controversy.

Tice, Hook and McRee described the comet assay as "a very sensitive method for directly detecting DNA damage." But Carlo suggested that it may be a less effective tool than other tests. "The comet assay is not a validated assay," he argued. "There are numerous questions about the methodology, and questions about its interpretation" (see also pp.12-13).

Tice said that there are several possible explanations for the apparent conflict in results from the comet and micronucleus assays. One, he said, has to do with the two different mechanisms for formation of micronuclei. "If they're caused by chromosome breakage," Tice explained, "then it's a matter of structural damage to the DNA," which could be expected to show up in the comet assay. Alternatively, he said, micronuclei can be produced by interfering with the way that chromosomes segregate during cell division, resulting in an abnormality called a "lagging chromosome." Experiments are currently under way at ILS to determine the nature of the mechanism in this case.

Tice and colleagues also saw no effect in several other tests for genetic damage that use bacteria or cultured cells from rodents and humans. While most of these tests involved only three-hour exposures, one with a 21-hour exposure still revealed no effect.

Nonetheless, Tice said he is confident that the micronucleus results represent something real. He noted that the findings were the same when the experiment was repeated: "There's no way you're going to get positive results twice over for four different technologies as a chance result." He added that, "If it's an artifact, it's a consistent one."

"The biological relevance is being investigated," stated Tice. "One issue is whether this might be due to heat." Although the experiment was designed to proceed at a constant temperature, Tice acknowledged, "There could be some localized heating in the medium, and hyperthermia is known to cause micronuclei."

WTR disclosed the results from ILS to representatives of various federal agencies in a meeting on February 9, but, at WTR's request, the participants refused to disclose what Tice had found. The results were kept under wraps until the EMS meeting at the end of March.

Not all the micronucleus results were disclosed at the EMS meeting. Repeat exposures for CDMA and PCS signals were presented to federal agencies at a second meeting, on March 31, and these data have not yet been made public. Carlo said that all results will be presented at a WTR symposium in June.

"We're on the same page with the Food and Drug Administration and the interagency working group," Carlo told *Microwave News* in April. All are in agreement, he said, that while the ILS results "do not rise to the level that would require a public health intervention," more research is needed. "It's a bit early to say" what types of studies are required, Carlo added. "There is not yet any consensus on what the next steps should be."

WTR Epidemiological Study Nears Completion

There are "positive results" in a new study of cellular phone use and brain tumors, WTR's Dr. George Carlo told *Microwave News*. But Joshua Muscat, the researcher leading the study, said, "I would definitely not say that it's a positive finding."

"The findings are not straightforward, and they require a lot of interpretation," Muscat said in an interview. "Inevitably, if you chop up the data many different ways, you will find some positive associations." He added that, "There are two findings that are interesting, or suggestive, but it's really not the bulk of the data" (see also p.19). Muscat said that he plans to submit the study to a peer-reviewed journal after WTR's internal peer review is completed. Neither Muscat nor Carlo would detail the results of the study.

With colleagues at the American Health Foundation in New York City, Muscat examined 466 people with glioma, a type of brain cancer, and 420 controls. The study also included 90 people with acoustic neuroma, a benign tumor of a nerve that connects the brain stem to the inner ear, and another 86 controls. Several variables were examined, including the spatial distribution of tumors within the brain. WTR funded the study in 1996 (see *MWN,* J/A96).

Cell Phone Radiation Alters Gene Expression in Motorola Study

"The expression of specific genes could be affected by RF exposure," according to a new paper from Dr. Joseph Roti Roti and coworkers at the Radiation Oncology Center of the Washington University School of Medicine in St. Louis.

The changes were observed after exposure to mobile phone radiation at an SAR of 0.6 W/Kg—below the limit currently deemed safe by the FCC. Roti Roti called the results "a surprise," and told *Microwave News* that they occurred at nonthermal levels. The findings appear in the March issue of *Radiation Research (151,* pp.300-309, 1999).

Dr. Prabhat Goswami, along with Roti Roti and others, exposed cultures of mouse embryo cells to RF/MW radiation at cellular phone frequencies for a period of four days. They then looked for changes during cell growth in the activity of three proto-oncogenes—genes that can lead to cancer with only a small change.

"We want to see what RF fields at nonthermal levels do to cells, if anything," Roti Roti said. "We are looking for a response." He emphasized that cancer risk was not the only focus of the study: When functioning normally, the three genes examined in the study are part of a common response to stress. "If we'd seen all three genes change in the proper sequence, we would have concluded that these fields are sensed by the cell and trigger a stress response," Roti Roti explained. "But we only found the first step."

The proto-oncogene that did change, *fos,* doubled its activity after exposure to an analog signal (continuous wave radiation at 836 MHz). This was a statistically significant increase ($p=0.001$). The activity of *fos* rose 40% after exposure to a digital CDMA signal (848 MHz pulsed microwaves)—an increase that was also significant ($p=0.04$). There were no changes in activity in the two other genes in the study.

"The consequence of such an increase in the *fos* [activity] is unknown and may be insignificant," the paper states—especially in the context of the exponential growth that is a normal part of the cell cycle.

"Maybe these fields sort of tickle the cell," said Roti Roti, and produce only the beginning of a normal stress reaction. But, he noted, "It's possible that this is just a chance finding."

The study was funded by Motorola and the National Institutes of Health. A replication study, funded by Motorola alone, is already under way. Roti Roti said that any new results would probably not be announced for about a year. "We have an agreement that we don't talk about it until the study is done," he said.

EMR Network Advocates ALARA, "National Research Effort"

The statement excerpted below was adopted in late February and issued in March by the EMR Network, an umbrella organization of grassroots citizens groups established last November by 20 activists from across the U.S. (see MWN, *N/D98 and also p.15). The full text will soon appear on the network's Web site, <www.emrnetwork.org>. Janet Newton of Marshfield, VT, has recently replaced Libby Kelley of Novato, CA, as the head of the network.*

Mission Statement:

We believe that electromagnetic radiation (EMR), which includes the extremely low frequencies, the radio frequencies and microwave radiation, may be hazardous to life and may constitute a significant threat to public health. This belief is based on credible research spanning decades of scientific inquiry.

Our mission is to enhance local, regional, national and international efforts to reduce, mitigate and, where possible, eliminate hazardous exposure to EMR.

We are committed to fostering the appropriate scientific research. Our charge is to educate the public, government officials and those in other scientific disciplines about the biological effects and environmental concerns associated with EMR.

The EMR Network was created to provide a forum for effective and balanced information for citizen action groups, the media, municipal agents, government officials and scientists alike.

The Purpose of the EMR Network Is:

To foster intelligent laws at the state and federal levels to adequately protect the public regarding exposures from low-intensity non-ionizing radiation (NIR).

To reduce exposure levels of NIR to the public and EMR professionals to levels as low as reasonably achievable—the ALARA principle.

Research:

The EMR Network recognizes what some scientists have said for decades—that the military and allied RF industries have a stranglehold on the research. This creates conflicts of interest that do not always parallel the best interests of EMR professionals, independent research scientists or citizens/consumers.

The EMR Network supports:

A national research effort into the long-term, low-level, continuous exposures to RF/MW simulating real-life, real-time exposures;

Research that is unbiased and focused at the U.S. EPA and at the National Institutes of Health. It should not be allocated to the Department of Defense or [its] research laboratories, nor housed at the Department of Energy;

...that has access to the U.S. military's large database on EMR/RF/MW research, established over the last five decades at taxpayer expense;

...that is spread among independent researchers in public universities and other programs where disclosure of findings is in the public domain;

...that is not dependent on matching funds from industry;

...whose protocol formation and review committees have at least one representative with voting rights from citizens groups such as the EMR Network and one from the medical community representing public health.

Couple Wins $1 Million in Suit Over Cell Tower near Home

A jury has ordered GTE Wireless to pay more than $1 million to a suburban Houston couple for the intrusive noise and disturbing light associated with a cellular tower installation near their home. The case is believed to be the first in the U.S. to be based on the "nuisance" caused by a mobile telephone base station.

The February 22 decision awarded $720,000 in compensation to Adrien and Chantal Pascouet for the nuisance and invasion of their privacy caused by GTE Wireless. They also won $225,000 for mental anguish and $28,000 for the loss in value of their home. Including legal fees of $230,000 and interest, the Pascouets stand to receive as much as $1.5 million.

GTE Wireless, which is based in Atlanta, stated that it will file an appeal "if necessary." Judge Tracy Christopher of the Texas State District Court in Harris County, who presided over the jury trial, has asked the Pascouets and GTE Wireless to try to reach a settlement through nonbinding mediation.

The Pascouets live in Bunker Hill Village, an affluent community near Houston. They filed suit in late 1994, shortly after GTE Wireless finished building the 100-foot tower, which stands just over 20 feet from the property line behind their house. The facility is located on a three-acre lot owned by the city of Bunker Hill Village, which will receive $500,000 from the company over the course of a 50-year lease, as well as free space on the tower for a police radio antenna.

The suit contended that the installation is a nuisance—that is, it "causes an unreasonable interference with the use and enjoyment" of the Pascouets' home. Security lighting and mechanical noise from an equipment building next to the tower keep the Pascouets awake at night, they said. They also maintained that their privacy has been invaded because maintenance workers on the roof of the equipment building can see into their backyard.

An appraiser determined that the tower reduced the value of the Pascouets' home by about 10%.

"I asked several of GTE's witnesses whether they had ever considered the impact their tower would have on people living nearby," Thomas Sankey, the Pascouets' attorney, said in an interview. "Their answer was, 'No.'" Sankey is with Sankey & Luck in Houston.

GTE Wireless spokesperson Joann Riner in Atlanta told *Microwave News* that the company built a higher fence around its building and moved air conditioning equipment in response to the Pascouets' complaints.

Dean Hunt, an attorney at the Houston office of Weil, Gotshal & Manges, which is representing GTE Wireless, would not comment on the case. By Sankey's estimate, the company has spent about $400,000 to date on the lawsuit.

In addition to the compensatory damages awarded by the jury, the Pascouets had sought punitive damages, but Judge Christopher did not allow the jury to consider this claim. In recent years, Sankey explained, Texas judges have limited punitive awards.

The Pascouets also want GTE Wireless to take down the tower, which they contend violates local zoning ordinances and never received a valid permit. The jury trial did not consider that request. This spring, Judge Christopher will decide whether the tower must be moved.

The Pascouets contend that the 20-foot distance between the tower and their property line is well short of the 50-foot minimum setback required by local zoning ordinances. They believe that the tower violates rules stipulating that such structures be no taller than 35 feet and prohibiting commerical uses.

GTE Wireless' Riner said that the city of Bunker Hill Village chose the site for the tower. "We always follow local zoning regulations," she added. In a statement, GTE Wireless maintained that "the facility is consistent with the preexisting police and public works uses on the city property."

Initially, the Pascouets also sued the city of Bunker Hill Village, but this action was settled out of court last fall. The terms of the settlement are confidential, Sankey said.

The Pascouets' success raises the possibility that other plaintiffs will seek damages from tower owners, even when their sites comply with local zoning laws. Sankey is "looking at about 50 other potential cases in Texas," he said, adding that, "In Texas, a lawful business can still be found to be a nuisance." He has also received inquiries from other states in the U.S., as well as from Canada and Sweden.

RF/MW radiation is not at issue in the Pascouets' case. Their petition originally included fear of electromagnetic radiation, but that argument was dropped after GTE Wireless' lawyers disclosed that they had commissioned a voluminous report concluding that the installation did not exceed Federal Communications Commission (FCC) emissions limits. The report was writ-

Illinois Tower Suit Focuses on Property Values

Another lawsuit over a cellular tower and property values is expected to go to trial this spring, in Illinois state court.

In 1997, 21 residents of North Barrington, IL, sued the Village of North Barrington and Ameritech Mobile Communications after the village amended its zoning law to allow cellular towers on a 10-acre municipal lot near their homes. Ameritech paid the village a lump sum of $300,000 for a 25-year lease.

Like the Pascouets in Texas (see story above), the Illinois plaintiffs contend that the village failed to consider the impact a tower would have on the value of their homes. They are asking the state's Circuit Court in Lake County to declare the zoning amendment illegal and to force Ameritech to take down its tower.

Last fall, following completion of the tower, the plaintiffs asked for an official review of their tax assessments. As with the Pascouets, the assessor concluded that the tower reduced the value of their homes by about 10%, according to their lawyer, Daniel Shapiro of Moss & Bloomberg in Bolingbrook, IL.

The town challenged the valuations, but they were upheld by the Lake County Board of Review. North Barrington is appealing that ruling. Under the terms of its site lease, Ameritech is paying half the town's legal expenses.

ten by Dr. Jerrold Bushberg of Sacramento, CA, a frequent consultant to the cellular phone industry.

Sankey predicted that his clients' case would hold up if mediation fails and there is an appeal. He added that the Pascouets might appeal Judge Christopher's ruling on punitive damages.

Canada Health Agency: Need for Cell Phone-Drug Reaction Data

Canada's federal radiation health agency has urged that the government monitor whether cellular telephone use is linked to reports of adverse drug reactions. Health Canada's Radiation Protection Bureau (RPB) also called for study of whether mobile phone use is associated with cancer or headaches.

In a paper titled *Potential for Interaction Between Specific Classes of Prescription Drugs and RF Fields from Hand-Held Portable Telephones,* RPB scientists noted that RF/MW radiation can "increase the permeability of the blood-brain barrier and modulate the action of some psychoactive drugs."

The RPB urged that questions about the use of mobile phones be included in Canada's next National Population Health Survey. The biennial assessment is administered by another agency, Statistics Canada, which rejected the RPB's request on the grounds that the year 2000 survey is already quite long.

The RPB's Dr. Jack McLean, lead author of the paper, told the *Ottawa Citizen* (February 1) that his agency will try again when the survey for 2002 is prepared. "I think that eventually [the questions] will get on there," said McLean. "I don't think this issue will go away." Larry Swain of Statistics Canada, manager of the survey, told *Microwave News*, "Certainly it could be considered for the future."

Dated September 10, 1998, the drug interaction paper is stamped "Confidential" on every page. Though labeled "Draft," government sources confirmed that the copy obtained by *Microwave News* is in fact the final version of this internal memo.

The RPB paper argues that if the health survey included questions on cellular phone use, it would also help evaluate possible links to cancer or to neurological problems such as headaches, fatigue and depression. But the paper's main emphasis is on the drug interaction issue, which in the past has received far less attention. The RPB cites a wide range of studies "published in the 1970s and 1980s that imply RF fields, such as emitted by cellular telephones, have the potential to perturb some of the biochemical pathways involved in drug action."

These include studies by Dr. Allan Frey and by Drs. Kenneth Oscar and Daryl Hawkins on RF/MW exposure and the "breakdown of the blood-brain barrier"; Henry Kues's research on RF/MW exposure and the eye, including drug interactions (see box); and Dr. Henry Lai's studies of RF/MW effects on the dopamine-opiate and cholinergic systems in the brains of rats.

Kues's studies found that a common antiglaucoma drug caused eye damage in primates from RF/MW exposure at one-tenth the level of radiation that would otherwise be required. This finding has played a prominent role in internal Canadian government debates over whether cellular phones should have to meet a separate limit for exposure of the eyes (see *MWN,* S/O98).

The RPB paper summarizes evidence of RF/MW interaction with various other drugs, including amphetamines and various barbiturates. When these studies were done, few people were likely to have significant exposure to RF/MW radiation. Today, the RPB points out, "Widespread public exposure to RF fields from cellular telephones [is] a certainty."

Frey's work on the "microwave hearing effect" is also discussed by the RPB scientists (see *MWN,* M/J98). "Many human subjects, in addition to hearing microwave-induced 'clicks,' 'chirps' and 'buzzing,' also reported headaches," they write. "The interesting point is that the cellular telephones in use today have operating characteristics (in terms of frequencies and pulse modulation) very close to [this] experimental setup." The paper notes that headaches may be related to the dopamine-opiate system, or to breakdown of the blood-brain barrier.

There are 5 million cellular phone users in Canada, and the RPB expects this number to grow to 13 million by the year 2006. The paper ends by arguing that, "Failure to resolve the issue of cellular telephone use and health effects would have a serious economic impact on the telecommunications industry in Canada."

Radiation Protection Bureau on the Brain, the Eye and the Mobile

Below is an excerpt from the RPB paper, taken from a section titled, "The Effect of RF Fields on the Blood-Brain Barrier and Blood-Ocular Barriers."

...There is significant evidence, gathered long before cellular telephones came into widespread use, that the blood-brain barrier breaks down with exposure to low intensity microwave energy at frequencies similar to those used by the cellular telephones of today....Pulse-modulated RF energy (similar to the output from digital "PCS-type" cell phones) was more effective than continuous wave RF energy (similar to the output from analog cell phones)....The degree to which the blood-brain barrier was permeabilized was partly dependent on the pulsing pattern....

Experimental work on the eye found that the blood-aqueous and blood-vitreous humor barriers were also permeabilized by low-intensity RF fields. This work was later extended in nonhuman primates by H. Kues, who showed that microwaves, at frequencies close to those used today by cellular telephones, produced irreversible damage to the endothelial layer of the cornea. Subsequent work by this author showed that *pretreatment* of nonhuman primate eyes *with 0.5% timolol maleate* [a common antiglaucoma drug] significantly reduced, by tenfold, the power density threshold needed to induce corneal endothelial lesions and increase vascular permeability of the iris.

In the early days, interest in further study of low intensity RF field bioeffects waned because the possibility of widespread public exposure was extremely limited. Today, with widespread public exposure to RF fields from cellular telephones a certainty, the issue of blood-brain barrier effects will once again become a hotly debated issue....

government responded by announcing the formation of an expert group on mobile phone safety. "As a champion of the public health, I believe we need a definitive and rigorous assessment of existing research, and clear identification of areas where further research may be needed," declared Tessa Jowell, Minister for Public Health. She said the panel would evaluate "the implications of new developments," including the Preece study. At press time, the members of the group had not been named.

"My hunch is that it will turn out to be a very mild thermal effect," said Preece. He explained that localized heating in the brain could cause "expansion of the blood vessels and improved oxygenation" in the region of the brain closest to the phone's antenna.

That region is called the angular gyrus, and is known to serve as a link between the parts of the brain that handle vision and speech. "Damage to this part of the brain produces a condition known as alexia: an inability to read, although the understanding of spoken language remains intact," the researchers note.

This is important because the faster reaction times occurred mainly in the test that was most reliant on interpreting written words—a test known as "choice reaction time," in which volunteers must choose between a "yes" or "no" answer on a computer screen. Other tests relied more on matching nonverbal patterns, or on memory. Preece said that, "When my colleague Stuart Butler, who is a neurophysiologist, saw the results, he said immediately: 'You're getting this effect because the antenna is right above the angular gyrus.'"

Preece added that microwave exposure below thermal levels cannot be ruled out as an explanation. He noted that certain types of proteins (known as "heat shock proteins") can increase blood flow. If production of these proteins is affected by nonthermal exposure, he said, this would be an alternative mechanism for increased blood flow. If a nonthermal effect is at work, Preece stated, "Urgent further investigation will be needed." But he said there is no reason to favor "a more complex mechanism than temperature rise" unless the temperature increase is shown to be insignificant.

Preece's research received widespread coverage in the British press, much of it wildly inaccurate. Before the study was released, for example, the February 28 *Sunday Times* reported that Preece had found that, "Mobile phones can cause short-term memory loss." In fact, Preece had found no effect on memory one way or the other. "I told the reporters absolutely outright that they were wrong, wrong, wrong," Preece told *Microwave News*. "But they seem to prefer bad news."

"Effects on memory are not to be expected" with the type of exposures in his study, Preece's paper concludes. "The memory-associated areas of the brain are either too deep or too far away from the antenna to be affected" by either thermal or nonthermal means.

Using simulated analog and GSM digital mobile phone signals, both 1 W at 915 MHz, Preece's team found that the effect on cognitive function was strongest for the analog-style exposure. They write that it is "interesting...that the reaction times seem to decrease with increasing [average] field strengths." (Since the digital-style signal was pulsed, it had a lower average power: The full power of 1 W was "on" only 12.5% of the time, and, as a result, its average power level was only 0.125 W.)

All 35 volunteers were subjected to each of the three test conditions (analog, digital and sham exposures), with 48 hours between each test. The tests were double-blind, with both volunteers and the technicians administering the tests unaware of the order of exposure, which was selected at random in each case.

The exposures lasted about 25-30 minutes—the time needed to complete 10 separate cognitive tests. The data were grouped into four different categories for analysis: 1) accuracy on memory tests; 2) speed on memory tests; 3) accuracy on reaction/attention tests; 4) speed on reaction/attention tests. Only the last of these was affected by microwave exposure.

The results were not biased by alcohol or caffeine consumption, or by the amount of sleep that volunteers got the previous night. Speed, but not accuracy, declined the older the volunteer, and Preece said this tends to support the validity of the results.

Preece said that while some in the cellular phone industry have argued that power levels of mobile phones are too low to cause any significant heating, "actually the heating effect may be somewhat more than existing models suggest." Members of his lab are currently evaluating this hypothesis by conducting measurements of the specific absorption rates (SARs) of the radiation. They are also studying whether there is in fact any localized increase in brain blood flow.

The expert group announced by the Ministry of Public Health is being organized by the National Radiological Protection Board (NRPB) in Didcot, Oxon. "It is the current view of the NRPB that there is no firm evidence of serious adverse health effects from the use of mobile phones," the NRPB declared in a March 2 statement, responding to early press reports on Preece's research.

BT Engineer Plans, Then Drops, Lawsuit Over Memory Loss

Stephen Corney, a former British Telecom (BT) engineer, has dropped plans to sue BT over severe memory problems allegedly caused by his use of mobile phones. On March 14, Corney had announced that he would sue BT for more than £100,000 in damages (over US$160,000), but in mid-April, as the court's deadline drew near, his lawyers concluded that there was insufficient evidence to win the case.

Corney, who lives in Bedfordshire, U.K., worked for BT from 1986 to 1996, when he went on sick leave. In his job installing telecommunications equipment and testing cellular phone signal strength, he used a mobile phone for hours a day. After BT switched to digital phones for its employees, Corney said he started suffering from headaches, "like a steel band round my head."

Corney then began to have short-term memory problems so severe that he has been unable to do simple daily tasks. For example, Corney told London's *Express* (March 15), after going shopping and putting his groceries in the trunk of his car, he would see the shopping list and not remember that he had already done the shopping. Corney would then reenter the store and buy everything all over again.

Corney is represented by Tom Jones, a solicitor with the law firm Thompsons in London.

FROM THE FIELD

Letter to the Editor

Inside the WTR Research Program: "A Very Strange Experience"

March 19, 1999

To the Editor:

Unpleasant and intolerable circumstances have compelled us to write this letter. We are writing to tell you and your readers of our experiences with Wireless Technology Research LLC (WTR) since it was established over five years ago.

* * *

Our first interaction with WTR came after its December 1993 request for proposals. In February 1994, we sent in a joint proposal with Dr. C.K. Chou, then of the City of Hope National Medical Center in Duarte, CA, to study the effects of radiofrequency radiation (RFR) on the DNA of live rats.

The following June at the Bioelectromagnetics Society Meeting in Copenhagen, Denmark, Chou arranged a meeting with WTR Chairman Dr. George Carlo and Dr. Q. Balzano and others from Motorola, at which we presented our experimental data on RFR–DNA damage. For reasons unknown to us, the meeting was conducted in such great secrecy that Balzano sent one of his Motorola colleagues to stand by the door to prevent people from coming into the room.

WTR made two site visits to our laboratory, in June and July of 1994. During one visit, Carlo said that he was really interested in our data and a check would be sent to us the following week so that we could continue our research.

The check never came.

We did receive comments on our proposal and we revised it. In November, we were invited to discuss it at a meeting in Toronto, Canada. There we were told that a WTR panel had reviewed our data and found that they were flawed, mainly because of the version of the "comet assay" we had used in our experiment to determine the extent of DNA damage.

Interestingly, WTR also asked us to review a proposal by Dr. Martin Meltz of the University of Texas Health Science Center in San Antonio to study RFR-induced DNA damage in cells using the same assay. We understand that Meltz eventually received some money from WTR, apparently without a formal review of his proposal.

When we returned from Toronto, we sent Carlo a letter withdrawing our proposal. We wrote that we "strongly urge that this important series of experiments be replicated by Dr. Chou."

We then did not hear from WTR for several months. In April of 1995, WTR issued another request for proposals and in May we submitted a second joint proposal with Chou. Six months later, in October, Carlo wrote that we were one of three groups chosen to carry out genotoxic research, but without the participation of Chou. The other teams were led by Dr. Ray Tice of Integrated Laboratory Systems (ILS) in Research Triangle Park, NC, and Dr. Luc Verschaeve of VITO in Brussels, Belgium. In December 1995, members of the three groups met in Miami to plan the research.

After that, we heard nothing more from WTR for close to two years.

In August 1997, WTR's Dr. Don McRee wrote to tell us that we would be given a contract. It called for a series of experiments between March and August of 1998 on the possible effects of RFR on brain cell DNA of rats. The total amount of the contract was $86,260.

We soon found that the design of our experiments was being dictated by WTR staff members who, in our opinion, were and are completely ignorant about RFR research. We sent a letter to Carlo expressing our concerns, stating that, "The protocol [of the research] should be set up by the researchers involved in the experiments and not be interfered with by the administrator of the funding institute. Independence of the investigators is absolutely important in securing the trust of the public on the data." Carlo's reply was vague and basically discounted our concerns. From then on, there were constant confrontations between us and the WTR staff on how the experiments should be carried out.

The choice of the three research teams, as far as we know, was not based on a peer-review process. Verschaeve's team was dropped after the initial planning meeting, and we understand that WTR has never offered any explanation. This decision seems strange since Verschaeve's team had substantial experience in research on the effects of RFR on DNA, whereas the ILS group had none.

The two remaining teams were expected to perform an independent experiment, using the comet assay, in a central research facility at the City of Hope National Medical Center. To our surprise, the ILS team did not seem to know the experimental methodology—from obtaining brain cells from rats to the basic technique of electrophoresis. For example, the electrophoresis apparatus used by ILS did not provide for recirculation of the buffer, which is essential to the assay. When we pointed this out, the ILS group brought a pump to circulate the buffer. However, this pump was so powerful that, we were told, the samples from the first set of experiments were completely ruined. Eventually, the ILS team had to borrow our apparatus to do the experiment.

Later, some microscope slides from the ILS experiment were sent to us from North Carolina for evaluation. To our surprise, we could see from the labels on the slides that several of them were from the earlier experiment in which the samples were supposed to have been ruined. The slides used to prepare these samples were a different brand from those available in the research laboratory at the City of Hope. Where, then, did these slides come from? We asked WTR this question many times over a period of months, and we have never received a satisfactory response.

When we examined some of the ILS slides, we found that most of them were poorly prepared, which indicated that the ILS team did not know how to do the comet assay according to the set protocol. Several times we expressed our concern about ILS' performance to WTR, but we were completely ignored. WTR staff monitored the progress of the research and should have detected the deficiency of their North Carolina researchers. Why did they allow this poor-quality research to continue?

Our personal dealings with WTR were also distressing. One member of the WTR staff was belligerent, unprofessional and abusive throughout the experiments. On one occasion in the City of Hope laboratory, he yelled and shouted at one of us (NPS), saying that our methodology was completely no good. He also yelled and shouted when he visited our lab at the University of Washington.

On that occasion, our next-door neighbors later came over and asked what had happened: They thought there had been a physical fight.

The experiments were run blind; that is, we did not know the treatment the animals received, so that the sample slides could be evaluated in an unbiased fashion. At the end of the experiment, after we had turned in the data, we were sent a code sheet. After decoding our data, we had reason to believe that there could have been some mistakes in the code given to us.

In fact, we were surprised to find that the code sheet was prepared by WTR and not by the staff at the City of Hope who exposed the animals. (Chou, who originally was supposed to keep the record on the experimental animals, left the City of Hope to work for Motorola in the middle of the experiment. The code was apparently passed to WTR after he left.) We found this highly irregular and asked for the original hand-written record of the experiment by the City of Hope staff.

WTR stonewalled our requests over and over again. The reasons given, in sequence, were: (1) The record would be given to us after a quality check by WTR; (2) The hand-written record contained secrets of the experiment and could not be shown to us; and (3) Our contract and the contract with City of Hope were separate, and documents from one WTR contractor could not be shown to another. This behavior is highly irregular and suspicious. In the 20 or so years that we have conducted experiments, for a variety of funding agencies, we have never encountered anything like this in the management of a scientific contract.

At the end of the contract period, we sent WTR a final report. But WTR notified us that they would consider this a "draft" and would not send us the last installment of payment—more than $11,000—until there was agreement on a "final report." After getting some feedback from WTR in late September, we revised the report and sent it back on October 14, 1998.

At the same time, WTR asked us to attend a meeting in Washington, DC, on November 13 to present our data to the government's RF Interagency Work Group. We agreed, on the condition that the final report had to be finished before our presentation. WTR said this would be done by the end of October.

A week before the meeting, WTR informed us that the report was still not ready, and would not be completed until after the November 13 meeting. WTR demanded that we attend the meeting anyway. They claimed that it was required as part of WTR's general procedure to finalize research reports, though such a meeting does not appear to have been required of other researchers.

As the date drew closer, we found out that it was not really a meeting of the RF Interagency Work Group: The members of the working group did not consider it an official meeting, and one member had not heard until November 11 that it was going to take place.

At that point, we told WTR that, under such dubious circumstances, we refused to attend. On November 12, the meeting was canceled. We later heard that the reason given to those invited was that Lai and Singh had not had enough time to prepare their presentation.

In December, WTR gave us some more comments on the report: They wanted us to delete almost everything in the discussion section. We have made it clear to WTR that we will not change the interpretation of data or the conclusions of our report. Nevertheless, we have recently completed a third version of the report and have submitted it to WTR.

* * *

This has been a very strange experience for us. The WTR program is a disgrace to the American research establishment. It has shown a consistent pattern of chaotic corruption and deception. Much money and time have been wasted while the public and millions of cellular phone customers continue to wait for an answer to the possible health effects of wireless communication. Until we have an independent and reliable research program free from any control from the industry, the global impacts of cellular phone use will be assessed by "post-market surveillance"—in other words, by whatever effects may occur among users of these devices.

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Letter to the Editor

Washington State Electric Utility Workers Also Show EMF–Cardiac Risk

March 5, 1999

To the Editor:

The recently published study by Savitz et al.[1] shows a positive dose-reponse relationship between magnetic field exposure in electric utility workers and deaths due to arrhythmia-related conditions and myocardial infarction [see *MWN,* J/A98 and S/O98].

Interestingly, this may be corroborated in my occupational mortality analysis of Washington state deaths.[2] Electronics technicians and power station operators were first and second of 219 occupational titles for total cardiovascular disease mortality. Since about half of all deaths are due to cardiovascular diseases, a small increase in risk of deaths related to electromagnetic fields will translate to a large number of deaths.

In the near future, I will look more specifically at the cardiovascular disease causes of death to see exactly which causes are elevated in power station operators and electronics technicians, and to see whether other electrical workers have this excess.

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1. *American Journal of Epidemiology, 149,* pp.135-142, 1999.

2. S. Milham, *Occupational Mortality in Washington State 1950-1989,* Department of Health and Human Services (National Institute for Occupational Safety and Health) Publication No.96-133, 1997.

Hot New Papers

Tom Sorahan et al., "Maternal Occupational Exposure to Electromagnetic Fields Before, During and After Pregnancy in Relation to Risks of Childhood Cancers: Findings from the Oxford [U.K.] Survey of Childhood Cancers, 1953-1981 Deaths," ***American Journal of Industrial Medicine, 35,*** **pp.348-357, April 1999.**

"The study findings do not suggest that maternal occupational exposure to electromagnetic fields (EMFs) during pregnancy is a risk factor for childhood leukemias, childhood brain cancers or the generality of all childhood cancers. There were some statistically significant associations (excesses and deficits) with work categories held before the pregnancy, but on the basis of the stated ranking of EMF exposures across the work categories, the findings for this time period were not strongly suggestive of an EMF effect....In conclusion, earlier findings that suggested that working during pregnancy as a sewing machinist and working during pregnancy in the textile industry were risk factors for childhood leukemia are given no support from this investigation." (See *MWN,* J/A95 and M/J98.)

Samuel Cos et al., "Influence of Melatonin on Invasive and Metastatic Properties of MCF–7 Human Breast Cancer Cells," ***Cancer Research, 58,*** **pp.4,383-4,390, October 1, 1998.**

"Taken together, our results suggest that melatonin shifts MCF–7 human breast cancer cells to a lower invasive status by increasing the β_1 integrin subunit and E–cadherin expression and promoting the differentiation of tumor cells. Finally, our study points out the existence of the anti-invasive actions of melatonin as a part of the oncostatic action of melatonin."

Leeka Kheifets and Chantal Matkin, "Industrialization, Electromagnetic Fields and Breast Cancer Risk," ***Environmental Health Perspectives, 107, Supplement 1,*** **pp.145-154, February 1999.**

"Although most of the epidemiologic data do not provide strong support for an association between EMFs and breast cancer, because of the limited statistical power as well as the possibility of misclassification and bias present in much of the existing data, it is not possible to rule out a relationship between EMFs and breast cancer....Future study designs should have sufficient statistical power to detect small to moderate associations; include comprehensive exposure assessments that estimate residential and occupational exposures, including shift work; focus on a relevant time period; control for known breast cancer risks; and pay careful attention to menopausal and estrogen receptor status."

Risk of Low Blood Pressure from UWB Pulses

Shin-Tsu Lu et al., "Ultrawide-Band [UWB] Electromagnetic Pulses Induced Hypotension in Rats," ***Physiology & Behavior, 65,*** **pp.753-761, January 1-15, 1999.**

"The estimated threshold SAR (0.002 W/kg, high UWB pulse) for UWB-induced hypotension in rats was 200 times less than 0.4 W/kg, the basis for the IEEE C95.1-1991 safety standard in a controlled environment. The threshold peak electric field of the UWB was less than the allowable peak electric field (100 kV/m) used in this standard. Hypotension is known to possess adverse health implications. The UWB-induced hypotension is a recent finding that has not been addressed during the promulgation of personnel protection guidelines." (See also *MWN,* J/A92.)

EMI from ESUs

Robert Martin Nelson and Howard Ji, "Electric and Magnetic Fields Created by Electrosurgical Units [ESUs]," ***IEEE Transactions on Electromagnetic Compatibility, 41,*** **pp.55-64, February 1999.**

"Electric and magnetic field strengths created by a typical electrosurgical unit were measured in operating rooms at the Department of Veterans Affairs Medical Center in Fargo, ND....With the center of the antenna placed 1.0 m from the floor and 1.0 m from both the ESU and the specimen being operated on, all three components of the electric and magnetic fields were measured as a function of frequency. The maximum values of the total electric field were approximately 153 dB∝V/m for the CUT mode (at a frequency of 750 kHz), 138 dB∝V/m for the COAG mode (at a frequency of 250 kHz) and 147 dB∝V/m for the BLEND mode (at a frequency of 750 kHz). The maximum values of the total magnetic field were approximately 76 dB∝A/m for the CUT mode (at a frequency of 750 kHz), 59 dB∝A/m for the COAG mode (at a frequency of 1.625 MHz) and 71 dB∝A/m for the BLEND mode (at a frequency of 750 kHz). Interference was observed on monitoring equipment in the operating room during operation of the electrosurgical unit." (See also *MWN,* N/D85, S/O87 and N/D93.)

M.R. Scarfi et al., "Micronucleus Frequency and Cell Proliferation in Human Lymphocytes Exposed to 50 Hz Sinusoidal Magnetic Fields," ***Health Physics, 76,*** **pp.244-250, March 1999.**

"In the present study, micronucleus induction and cell proliferation in human peripheral blood lymphocytes cultured *in vitro* and exposed to 50 Hz sinusoidal magnetic fields for 72 hours at different intensities (1.0, 0.75, 0.5, 0.25 and 0.05 mT rms [10 G-500 mG]) were investigated. The results obtained from 42 healthy donors aged between 26 and 54 years indicate that, for the field intensities tested, no genotoxic effects were found, as assessed by the cytokinesis-block micronucleus assay. On the contrary, cell proliferation, evaluated by the cytokinesis-block proliferation index, was slightly affected by the field at the intensities tested....The mechanism(s) by which the magnetic fields we used in the present investigation are able to modulate lymphocyte proliferation is (are) unknown."

Robert Adair, "Effects of Very Weak Magnetic Fields on Radical Pair Reformation," ***Bioelectromagnetics, 20,*** **pp.255-263, 1999.**

"[E]ven under...singularly favorable conditions, fields as small as 5.0 ∝T (50 mG) cannot change the recombination rate by as much as 1%. Hence, we conclude that environmental magnetic fields much weaker than the Earth's field cannot be expected to affect biology significantly by modifying radical pair recombination probabilities." (See also p.3.)

C. Fanelli et al., "Magnetic Fields Increase Cell Survival by Inhibiting Apoptosis via Modulation of Ca^{2+} Influx," ***FASEB Journal, 13,*** **pp.95-102, January 1999.**

"Static magnetic fields with intensities starting from 6.0 G [0.6 mT] were found to decrease in an intensity-dependent fashion, reaching a

plateau at [60.0 G], the extent of cell death by apoptosis induced by several agents in different human cell systems. This is not due to a change in the mode of cell death (i.e., to necrosis) or to a delay of the process itself; rather, the presence of magnetic fields allows the indefinite survival and replication of the cells hit by apoptogenic agents. The protective effect was found to be mediated by the ability of the fields to enhance Ca^{2+} influx from the extracellular medium; accordingly, it was limited to those cell systems where Ca^{2+} influx was shown to have an antiapoptotic effect. Magnetic fields thus might interfere with human health by altering/restoring the equilibrium between cell death and proliferation; indeed, the rescue of damaged cells may be the mechanism explaining why magnetic fields that are not mutagenic *per se* are often able to increase mutation and tumor frequencies."

Om Gandhi et al., "Comparison of Numerical and Experimental Methods for Determination of SAR and Radiation Patterns of Hand-Held Wireless Telephones," *Bioelectromagnetics, 20,* pp.93-101, 1999.

"One of the important observations is that for AMPS telephones with maximum power of 600 mW at 800/900 MHz, the peak 1 g SARs would generally exceed the FCC-mandated limit of 1.6 W/Kg unless antennas are carefully designed."

Päivi Heikkinen et al., "Chronic Exposure to 50 Hz Magnetic Fields or 900 MHz Electromagnetic Fields Does Not Alter Nocturnal 6-Hydroxymelatonin Sulfate Secretion in CBA/S Mice," *Electro- and Magnetobiology, 18,* pp.33-42, 1999.

"[W]e investigated whether chronic (over 17 months) exposure to vertical 50 Hz magnetic fields with regularly varying intensity (1.3, 13 and 130 $\propto$T [13-1,300 mG]; 24 h/day) affects nocturnal 6-hydroxymelatonin sulfate (6-OHMS) production in female CBA/S mice. The effects of 900 MHz radiofrequency radiation (90 min/day) were also studied, using either continuous radiation with a specific absorption rate (SAR) of 1.5 W/Kg or pulsed radiation with a pulse repetition rate of 217 MHz and an SAR (average) of 0.35 W/Kg....Neither the extremely low frequency magnetic field nor the radiofrequency radiation affected excretion of 6-OHMS in nocturnal urine....To our knowledge, this is the first report on the effects of chronic RF radiation on melatonin metabolism in mice."

Clippings from All Over

Unrecognized risks are still risks; uncertain risks are still risks; denied risks are still risks! The precautionary principle embodies the belief that it is prudent to attempt to diminish risks with particularly severe consequences, even if the probability of occurrence is moderate or the uncertainty high. Excessive confidence in our own ability to solve problems after harm has been done could result in awkwardness or tragedy.

—Dr. John Cairns Jr., Virginia Polytechnic Institute and State University, Blacksburg, VA, in an editorial, "Absence of Certainty Is Not Synonymous with Absence of Risk," *Environmental Health Perspectives* (published by the National Institute of Environmental Health Sciences, Research Triangle Park, NC), p.57, February 1999

Someday there will be a glut of wireless towers.

—Michelle Conlin in "Tower Power," *Forbes,* p.56, March 22, 1999

"The Telecom Act of 1996 unleashed a low-level form of terrorism on citizens and zoning commissions throughout the U.S."

—Blake Levitt, EMR Network, quoted by Jeffrey Silva in "Vermont Delegation Aims To Return Tower-Siting Power to Locals Again," *RCR,* p.2, March 15, 1999 (see p.8)

"Cell phones have become the cigarettes of the 1990s."

—Danny Meyer, owner, Union Square Cafe and other restaurants, New York City, explaining why he favors the use of wireless phone jamming devices, quoted by David Wallis in "Noises Off: A Muzzle for Cell Phones," *New York Times,* Money & Business, p.4, April 11, 1999

We believe that fears about possible links [of power line fields] to cancer have been adequately addressed and see no reason to recommend further studies on this subject.

—Dr. John Moulder, Medical College of Wisconsin, Milwaukee, and Dr. Kenneth Foster, University of Pennsylvania, Philadelphia, in "Is There a Link Between Exposure to Power Frequency Electric Fields and Cancer?" *IEEE Engineering in Medicine and Biology Magazine,* p.115, March/April 1999

"MICROWAVE NEWS" FLASHBACK

Years 15 Ago

• The Occupational Safety and Health Administration decides to keep its voluntary 10 mW/cm^2 RF/MW exposure standard, eliminating the possibility of enforcing it in the workplace.

• Poland's Dr. Stanislaw Szmigielski reports that 2450 MHz radiation at 10 mW/cm^2 "enhances the teratogenic potency of other compounds and thus acts as co-teratogen."

• Miscarriage clusters are identified among VDT operators in San Francisco and in Atlanta, the ninth and tenth to be reported.

Years 10 Ago

• The state of Florida adopts the first power frequency magnetic field exposure standards in the United States. The limits are set on the basis of available technology, not possible health effects.

• Shore-to-ship communications signals from a Navy transmitter jam garage door openers in the San Francisco Bay area for two weeks.

• An American Medical Association panel concludes that pulsed EMF stimulation is safe, but not necessarily effective, for the treatment of nonunion fractures.

Years 5 Ago

• A Canadian-French utility-sponsored study finds that workers with greater-than-average magnetic field exposures are three times more likely than others to develop acute myeloid leukemia. No dose-response relationship is observed, however.

• The Tennessee Valley Authority releases guidelines stating that it "will not site transmission lines near schools and densely populated areas."

• Responding to a question from a child with leukemia, President Bill Clinton announces that he has asked the Environmental Protection Agency to prepare a report on the possible EMF–cancer link. He adds that Swedish studies supporting the link have "somewhat impressed" him.

Jerry L. Phillips, PhD

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UPDATES

BROADCAST RADIATION

Protests Over DTV on Lookout Mountain...A report from Colorado's Department of Public Health and Environment has added fuel to the fire in the controversy over the Lookout Mountain antenna farm in the Denver suburbs. Lookout Mountain is home to a dozen high-power radio and TV towers and more than 400 other antennas. Several Denver-area TV stations want to build another tower—over 800 feet tall—on the mountain for their digital TV (DTV) antennas. On February 17, the state health department released a study of brain tumors from 1985 through 1997 in each of the seven "block groups" in the census tract around Lookout Mountain. Last summer, a study of the entire census tract, without this breakdown, found a brain cancer rate 50% higher than expected, but that increase was not statistically significant (see *MWN,* J/A98). The new study found that the two block groups closest to the antenna farm had significantly more cases of brain cancer than expected: In one, three women had benign brain tumors, while in the other, five men developed malignant brain cancer. In each group, this was four to five times as many cases as expected. At the time of diagnosis, all of these people were living in homes with an unobstructed view of the towers. But four of the five men had worked in jobs with higher risks for cancer of the central nervous system, and two had lived near Lookout Mountain for less than five years. The state health department concluded that the evidence is contradictory. It pledged to monitor cancer statistics in the area, but noted that the state "does not recommend that existing antennas cease operation or be removed." This left open the question of whether new antennas should be built. "We do not wish to be unwilling subjects in a potentially tragic experiment," read a statement from the Jefferson County citizens group Canyon Area Residents for the Environment. Since then, the controversy has featured an exchange of letters between Colorado politicians and FCC head William Kennard, a mothers' and children's march against the proposed new tower and opposition from the Jefferson County school board. A Jefferson County health official voiced his support for an ALARA approach, investigating alternatives "before increasing the amount of EMR that is present on Lookout Mountain." An editorial in the April 14 *Denver Post* argued that a new DTV tower would be good for Jefferson County. In the *Denver Business Journal* (March 18), local resident Paul Stephen Dempsey expressed a different view: "Do we really want to risk the health of children so we can enjoy somewhat crisper TV?"

EMF CELL BIOLOGY

JB-6 Replication Fails...A team at NIOSH led by Dr. John Snawder has failed to repeat *in vitro* studies showing that magnetic fields can amplify the growth of JB-6 cells, act as tumor promoters or transform noncancerous cells into tumor cells. In 1994, Dr. Robert West of the National Center for Toxicological Research in Jefferson, AR, published a paper in *Bioelectrochemistry and Bioenergetics (34,* pp.39-43) indicating that JB-6 cells formed significantly more colonies when exposed to an 11 G, 60 Hz magnetic field than did controls. Importantly, West also suggested that he had seen similar effects at levels as low as 100 mG (see *MWN,* J/F95). At about the same time, Dr. Jeffrey Saffer of the Battelle Pacific Northwest Labs in Richland, WA, pointed to

some preliminary evidence showing that magnetic fields could induce enhanced JB-6 cell growth. The EMF RAPID program awarded Saffer a grant of more than $1 million to pursue this lead (see *MWN,* S/O94). But all efforts to repeat the JB-6 work independently have failed. In 1997, Saffer published a paper in *Carcinogenesis (18,* pp.1,365-1,370) announcing that he could not show that magnetic fields affected JB-6 cell growth or enhanced the transformation of the cells into a cancerous state. "Our data were very clean, convincing and in our lab very reproducible," Saffer told *Microwave News.* And now the NIOSH team appears to have closed the book on the JB-6 story. Writing in the March issue of *Environmental Health Perspectives (107,* pp.195-198, 1999), Snawder and coworkers conclude that neither a 1 G, nor a 9.6 G, 60 Hz magnetic field acts as a promoter or a copromoter in JB-6 cells. "This is a case in which we think we know why the two labs got different results," Dr. Gregory Lotz, the chief of NIOSH's Physical Agents Effects Branch in Cincinnati, told *Microwave News.* "We don't believe the cells are actually responsive to the magnetic fields." As the NIOSH paper explains, the differences in the two sets of results "could result from plating order"—that is, the cells were not well-randomized and the timing of the experiment could have led West to the wrong conclusion. West, who is now retired, could not be reached for comment. The Battelle and NIOSH labs have both given up this line of research. "We are not pursuing the JB-6 research anymore," Lotz said.

MEDICAL DEVICE EMI

Resource Manual... The Center for the Study of Wireless Electromagnetic Compatibility at the University of Oklahoma, Norman, has released *Managing Wireless Electromagnetic Compatibility Issues in Healthcare: A Resource Manual.* Dr. Bernard Segal of McGill University in Montreal, Canada, who edited the manual with the center's Dr. Hank Grant, writes that, "Education is the single most cost-effective means of minimizing EMI occurrences." The target audience is made up of those who run, or work in, hospitals. To make best use of each reader's time, Segal and Grant have assembled more than 75 articles and abstracted them, rating each as "must read," "should read" or "can read." In addition, there are some 30 Internet resources, which are also available on the center's Web pages, <www.ou.edu/engineering/emc>. The manual was sponsored by the CTIA in Washington. It costs $50.00 plus shipping; to order or for more information, contact Glenn Kuriger at the center, (405) 325-2429, Fax: (405) 325-2556, E-mail: <kuriger@ou.edu>.

MELATONIN

A Warning from Dr. Weil... Dr. Andrew Weil, America's leading advocate of alternative medicine and the author of *8 Weeks to Optimum Health* and other best-sellers, does not think it is safe to take melatonin even "on a short-term basis to ward off jet lag." Writing in *Self-Healing,* his monthly newsletter, he particularly recommends against the long-term use of hormone supplements such as melatonin "because of their effects on hormonally driven diseases such as prostate cancer and breast cancer." (For others who have expressed concerns, see *MWN,* M/A96, M/J96 and J/F98).

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"*Microwave News* has become required reading for anyone interested in the topic."

—Dr. Peter Polson, consultant on biological effects of RF/MW radiation, in the wireless industry trade magazine RCR, *February 8, 1999*

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1999 Conference Calendar (Part III)

Parts I and II appeared in our last two issues.

May 11-13: **9th High-Power Microwave and Radiofrequency Electromagnetics Symposium,** Kirtland Air Force Base Conference Facility, Albuquerque, NM. Contact: Association of Old Crows, 1000 N. Payne St., Alexandria, VA, 22314, (888) 653-2769, Fax: (800) 678-3324, Web: <www.aochq.org>. Attendees must have a Secret/U.S.-Only security clearance.

August 19-21: **6th Nordic Workshop on Biological Effects of Electromagnetic Fields,** Skejby Sygehus, Aarhus, Denmark. Contact: Dr. Sianette Kwee, Dept. of Medical Biochemistry, University of Aarhus, Bldg. No.170, DK 8000 Aarhus C, Denmark, (45) 8942-2869, Fax: (45) 8613-1160, E-mail: <skwee@biokemi. au.dk>, Web: <www/biokemi.au.dk/nemf99/home.htm>.

September 20-25: **2nd International Conference on Problems of Electromagnetic Safety of the Human Being,** Moscow, Russia. Contact: Prof. Yu. Grigoriev, 46 Zhivopisnaya St., Moscow 123182, Russia, (7+95) 1930187, Fax: (7+95) 1903590, E-mail: <CEMS.1@g23.relcom.ru>, Web: <www.chat.ru/~cems/emf/2conf.htm>.

September 21-23: **2nd IEEE Russia Conference: 1999 High-Power Microwave Electronics: Measurements, Identification, Applications (MIA–ME '99),** Novosibirsk State Technical University, Novosibirsk, Russia. Contact: V. Snournitsin, NSTU, 20 K. Marx Ave., 630092 Novosibirsk, Russia, (7+3832) 462598, Fax: (7+3832) 462598, E-mail: <crra@ref.nstu.ru>, Web: <www.ieee.org/society/eds> and <www.nstu.ru/miame99>.

September 27-October 1: **31st Annual Meeting of the Society for Radiation Protection, Non-Ionizing Radiation—Living with It at Work and in the Environment,** Gürzenich Auditorium, Köln, Germany. Contact: Norbert Krause, Berufsgenossenschaft Feinmechanik und Elektrotechnik, Gustav-Heinemann-Ufer 130, 50968 Köln, Germany, (49+221) 3778-444, Fax: (49+221) 3778-723, E-mail: <pollmann@bgfue.de>, Web: <www.bgfue.de>.

December 2-8: **6th International Conference and Workshop on Electromagnetic Interference and Compatibility,** New Delhi, India. Contact: Dr. T.K. Sarkar, Dept. of Electronics, Room No.2006, Electronics Niketan, 6 CGO Complex, New Delhi 110 003, India, (91+11) 436-0582, Fax: (91+11) 436-3106, E-mail: <tks@xm.doe.ernet.in>.

December 13-17: **7th International Symposium on Recent Advances in Microwave Technology (ISRAMT '99),** Malaga, Spain. Contact: Banmali Rawat, Dept. of Electrical Engineering/260, University of Nevada, Reno, NV 89557, (702) 784-6927, Fax: (702) 784-6627, E-mail: <rawat@munrcdu>, Web: <www.isramt99.ic.umaes>.

Keeping Current: Follow-Up on the News

◆ In the U.K., the BBC's *Panorama* news program is preparing a detailed documentary on the cellular phone health debate, to be aired in mid- or late May. Among those who have been interviewed are: Drs. Ross Adey, George Carlo, Henry Lai, Jerry Phillips and Louis Slesin.

◆ In Australia, test broadcasts of digital television (DTV) "almost wiped out" the medical telemetry system used by Melbourne's Epworth Hospital to monitor patients' heart function, *The Age* reported on February 26 (see *MWN,* M/A98). The Australian government has ordered the introduction of DTV by 2001.

◆ The International Microwave Power Institute will celebrate the 50th anniversary of the microwave oven at its annual meeting to be held July 18-21 in Washington. For more information, go to <www.impi.org>.

◆ In our last issue, we featured a short excerpt from the Canadian Broadcasting Corp.'s February 9 program *The Fifth Estate,* on cell phone health risks. Don Maisch, a consultant based in Tasmania, Australia, has now placed the entire transcript on his Web site, <www.tassie.net.au/emfacts>.

◆ Ten years after a similar event in the San Francisco area (see p.15), Hobart, Tasmania, was startled by garage-door EMI. Signals from two Australian navy ships caused "hundreds" of motorized door openers in that city to malfunction, according to the April 12 *Washington Post*.

◆ The April/May issue of *City and Mountain Views,* published in Golden, CO, reports that EMI from the Lookout Mountain antenna farm has caused electric gates at Buffalo Bill's grave site to "open and shut uncontrollably" (see also p.16).

◆ EPRI has awarded a contract to E^{x}ponent of Menlo Park, CA, for a study on EMF exposures and female breast cancer. Drs. Michael Kelsh and Jack Sahl will assess field levels to which women are exposed at work.

VIEWS ON THE NEWS

Translating the Precautionary Principle into Action

The Swiss government is about to adopt the toughest safety guidelines in the world for non-ionizing radiation (NIR). A decade or two from now, people may look back on this as a turning point.

For years, the evidence has been growing that current NIR safety standards allow exposures that cause biological effects. Last October, scientists at a conference in Vienna, Austria, declared that, "Biological effects from low-intensity exposures are scientifically established" (see *MWN,* N/D98).

But, as the Vienna Resolution acknowledges, "The current state of scientific consensus is inadequate to derive reliable exposure standards." Which frequencies, power levels or modulations produce biological effects? Which of these are harmful? For the most part, we just don't know. We have bits and pieces of evidence, not anything close to a comprehensive picture.

How do you protect public health under uncertainty? It's a knotty problem, and some people's instinct is to stick with the status quo. For example, the European Commission (EC) acknowledged last year that there might be some epidemiological evidence for an EMF–cancer link. But the EC argued that "epidemiological data are insufficient to allow the recommendation of an exposure limit" and left it at that (see *MWN,* J/F99). In other words, current standards may be inadequate—but we don't know enough to come up with anything better.

An alternative is prudent avoidance, also known as the precautionary principle. This policy was endorsed by the European Parliament in March, when it backed the ALARA approach: keeping exposure "as low as reasonably achievable," that is, without substantial extra costs.

Unfortunately, this support for pragmatic caution was left mostly at the level of good intentions. In principle, the European Parliament backed ALARA. But when it got down to specific limits on public exposure, the parliament threw up its hands and simply adopted the ICNIRP guidelines, which assume that low-level exposures are safe (see p.5).

Now Switzerland is taking the next step. Swiss public health and environmental officials have put flesh on the bones of the precautionary principle, by establishing exclusion zones around new sources of NIR. These measures to limit public exposure are not as radical as those proposed by the Greens in the European Parliament, but are far stricter than existing international guidelines.

The old guidelines are based on an old paradigm, the view that non-ionizing radiation can't possibly affect living things unless it causes heating. That view gets less credible every year, as evidence of nonthermal effects continues to grow (see, for example, p.8).

Now, for the first time, a government has said that guidelines based on thermal effects are not enough to protect the public. The old paradigm is crumbling, and more changes lie ahead.

"Positive Results" in WTR Brain Tumor Epi Study?

WTR has found links between cellular phone use and brain cancer, Dr. George Carlo told *Microwave News.*

"We have some positive results that will require further study," Carlo said. "It's clear that these findings will rattle some cages." The new study...

That's the article that we might have run if we weren't more skeptical. Carlo made the statements quoted above in an April interview, dangling the "positive results" in front of us the way you might tease a dog with a juicy bone.

Carlo made it clear that he wanted us to do a major story. And we nearly did—until we talked with the study's principal investigator, Joshua Muscat. "To say that I have positive findings is really not correct," Muscat told us. "When George Carlo says that I have positive findings, it really is in terms of a couple of isolated ways of analyzing the data. I would not say it is indicative of what we found" (see p.7).

What's going on?

Just as WTR's bank account starts to run dry, Carlo has started to say there might be something to cell phone health worries after all. Pardon our cynicism, but we've wondered if the two might be connected.

Carlo has also hailed WTR's genotoxicity results as "a very important finding." But concerns about RF/MW exposure and genetic damage have been around for a long time, and WTR never seemed too worried before. Five years ago, Lai and Singh announced that RF/MW exposure could produce breaks in DNA. Read the Lai-Singh letter on pp.12-13 to see how WTR follows up on interesting results.

In fact, WTR destroyed its own credibility long ago. It still won't say how much of its $25 million went to research grants. It can't cover up years of inaction by hyping ambiguous results.

We don't mean that there's nothing of interest in WTR's gene tox findings, or in the Muscat study. There is an urgent need for more research on wireless safety, and it's only right that industry should fund it. But that research should be run by a government health agency—not by WTR.

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The Stewart Report's Call to Action

Burying a Still Warm Body

U.K. Panel Discourages Use of Mobile Phones by Children

A high-level panel appointed by the U.K. government has recommended that children be discouraged from using mobile phones and that the industry not market phones to children. Although the Independent Expert Group on Mobile Phones, chaired by Sir William Stewart, found that there was no evidence of a health risk, it favored a "precautionary approach" given current "gaps in knowledge."

"I have got a grandchild of four and a grandchild of two and I would not be

Radiation from Mobile Phone Headsets
Special Report, p.4

recommending that they have mobile phones," Stewart told the BBC, noting that he would continue to use his own phone. Stewart was science advisor to the prime minister from 1990 to 1995.

The 12 members of the expert group issued their report on May 11. They asked that radiation exposure data for different phones — specific absorption rates (SARs) — be "readily accessible to consumers" and that there be no shortcuts in the planning process for the siting of mobile phone base stations. (For the main conclusions and recommendations, see p.10. A list of panel members appears on p.11.)

The U.K. Department of Health, which asked for the mobile phone report

(continued on p.10)

Strong Electric Fields Implicated in Major Leukemia Risk for Workers

Long-term employees of Ontario Hydro who worked in strong electric fields had much higher risks of leukemia, Canadian researchers have found. Significant risks were also found for non-Hodgkin's lymphoma (NHL) in a related study.

The elevated risks were seen among workers who spent the most time in electric fields above certain thresholds, in the range of 10 to 40 V/m. The largest increases occurred among those with more than 20 years on the job. Senior workers with the greatest time above the thresholds had an eight- to tenfold increase in the risk of leukemia — much higher than in past epidemiological studies of electromagnetic fields (EMFs).

"It's very interesting that there seems to be a threshold effect," Dr. Anthony Miller, a coauthor of the study, told *Microwave News*. "These studies confirm that electric fields are very important, if not dominant," Miller said. "I think

(continued on p.2)

that's a very important message." Both studies were based on data from Miller's 1996 study of Ontario Hydro employees, which put a spotlight on cancer risks and electric fields (see *MWN,* J/A 96). Formerly at the University of Toronto, Miller is now with the German Cancer Research Center in Heidelberg.

Paul Villeneuve of the University of Ottawa, who led the studies as part of his doctoral dissertation, said, "It's remarkable that we saw similar threshold effects for both leukemia and NHL." The threshold levels were "relatively consistent" in the two studies, he noted.

In an interview, Dr. Lois Green of Ontario Power Generation (formerly part of Ontario Hydro) in Toronto described this work as the first of its kind. "No one has ever taken a systematic look at threshold effects before," she said. Most previous studies have focused on cumulative effects or time-weighted averages, which Green called "a very limited way to view EMF exposures." The new work by Villeneuve, Miller and colleagues "shows that there are other important ways of looking at exposure," she said. "We can't close the door on this question."

The new Canadian results stand in sharp contrast with past EMF epidemiological studies, most of which have focused almost exclusively on magnetic fields. Dr. David Savitz of the University of North Carolina, Chapel Hill, told *Microwave News* that the new findings "suggest that those doing future studies reconsider the pessimism about the value of electric field data."

"Our results suggest that there is no association between exposure to magnetic fields and NHL," Villeneuve and colleagues write in the April issue of *Occupational and Environmental Medicine,* and no threshold effects were seen with magnetic fields in either study. In the leukemia study, some nonsignificant elevations in risk were observed for workers with higher average magnetic field exposure.

Miller's 1996 study also described electric fields as the main source of risk, but indicated that the highest risks came from combined electric and magnetic exposure. While the two new studies "tend to confirm the dominance of electric fields," he said, "I'm not sure they remove any effect for magnetic fields." For electric fields, however, Miller now believes that the threshold analysis in the new papers is a more precise way of measuring their impact.

The leukemia study, published in the June issue of the *American Journal of Industrial Medicine,* found that the amount of time spent above these thresholds was a "significant predictor of leukemia risk." While average exposure was also linked to an increase in risk, Villeneuve and colleagues write, their results indicate "that leukemia risk is more sensitive to exposures above a threshold."

For workers employed for more than 20 years, the findings were especially striking. Of these, the one-third who spent the most time above 10 V/m were ten times more likely than others to develop leukemia, a significant increase. The one-third with the most time above 20 V/m had a risk eight times higher than others. These odds ratios, however, had very wide confidence intervals.

The case-control study was based on 50 cases of leukemia and 200 controls, drawn from a cohort of over 31,000 male Ontario Hydro employees and retirees. Employment data were linked to a job-exposure matrix based on both job title and work site, with personal measurements from over 800 workers, and to incidence data from the Ontario Cancer Registry. These data were the basis of Miller's 1996 study, which was part of a three-utility study that included workers at Hydro-Québec (HQ) and Electricité de France (EDF) (see *MWN,* M/A94). The Ontario research used a more detailed exposure assessment — taking into account job location as well as title — than was used for the other utilities.

The NHL study was based on 51 cases and 203 controls from the same study population. It found that the one-third of workers who spent the most time in electric fields above 10 V/m had triple the risk of NHL. Those with the most time above 40 V/m were 3.6 times more likely to get the disease.

"Many of us, starting with Genevieve Matanoski around 1986, have long held that we need to look at alternative indices of exposure," Dr. Indira Nair of Carnegie Mellon University in Pittsburgh told *Microwave News*. Confirmation of this point is "the central importance of these papers," said Nair. "Until we are able to elucidate a mechanism, studies that include these alternate indices can provide us with understanding which may help us eventually to 'back into' the mechanisms."

A 1997 paper in *Bioelectromagnetics* by Nair and Dr. Jack Sahl, then of Southern California Edison and now a consultant based in Upland, CA, examined how using different indices of exposure influenced the exposure assessment of different job categories. While average field strength could be used for separating jobs into "high" or "low" exposure, they concluded, it "may be misleading" in ranking jobs which have significant exposure. For example, electricians were highest in average exposure, while substation operators were highest in time spent above certain magnetic field thresholds.

"We still don't know what is the biologically relevant exposure," commented Green. "Some of these exposures are very complex, and some of the effects are very subtle." While Ville-

RAPID Studies in "Radiation Research"

The National Institute of Environmental Health Sciences (NIEHS) has sponsored the publication of a collection of papers, many of which were carried out under the EMF RAPID program (see *MWN,* J/A99).

This collection of 14 papers and two reviews, which appears as Part 2 of the May 2000 issue of *Radiation Research,* is an effort to publish some of the as-yet-unavailable results of the EMF program, Dr. John Moulder, an associate editor of the journal, writes in his introduction.

Many of the papers are from studies carried out for the NIEHS at the IIT Research Institute in Chicago and at the regional labs set up to try and replicate other experimental findings. The papers report essentially no EMF-induced biological effects.

The two reviews, each written by a team headed by Dr. Gary Boorman, who led the RAPID program at the NIEHS in Research Triangle Park, NC, conclude that animal studies do not support leukemia, lymphoma or breast cancer risks.

neuve's studies are "very interesting and important," she said, they are certainly not the last word. She pointed out that while significant risks were observed, the numbers of cases are small and as a result the risk estimates are "unstable."

Miller noted that these latest findings cannot be directly extrapolated to work on childhood leukemia. "These studies involve occupational exposures, which of course are much higher than in a residential environment." Also, he noted, childhood leukemia is "a different disease from adult leukemia — it's a different histological type." Miller said that in a 1999 study of childhood leukemia in Toronto, which was led by Green, "We could find no effect at all of electric fields." When its findings were published, Green's team concluded that, "As exposure assessment is refined, the possible role of magnetic fields in the etiology of childhood leukemia becomes more evident" (see *MWN,* J/A99).

Villeneuve pointed to computer modeling work by Dr. Maria Stuchly and colleagues at Canada's University of Victoria, estimating the level of induced current in different organs of the body that might result from each type of exposure. Among other findings, they calculated that electric fields would be likely to produce especially high peak levels of induced current in the blood, while magnetic field exposure would produce higher currents in the brain and cerebrospinal fluid.

Villeneuve and colleagues conclude their leukemia paper by recommending that "similar analyses be pursued in other study populations." But it appears that few if any existing data sets would be suitable. Villeneuve said that the only studies he knew of that had the right electric field measurements were the EDF and HQ components of the tri-utility study. He noted, however, that the French researchers had not followed up with workers after retirement age and that the HQ data had fewer cases, both of which "would limit analyses."

"It's unfortunate that people haven't collected the data on electric field exposure," said Dr. David Agnew of Ontario Power Generation in Whitby, Ontario — a coauthor of the Villeneuve papers and of Miller's 1996 study. Agnew told *Microwave News* that any repetition of the Villeneuve studies would probably require completely new research.

"I somehow can't see this happening," commented Green, "which is a great disappointment." She noted that "funding is not coming forward to support follow-up studies in this area"— no matter how compelling the results. In the long run, though, Green thinks the issue will demand attention. Even if it is buried, she said, "I'm not sure it will stay adequately buried."

Paul Villeneuve, David Agnew, Anthony Miller, Paul Corey and James Purdham, "Leukemia in Electric Utility Workers: The Evaluation of Alternative Indices of Exposure to 60 Hz Electric and Magnetic Fields," *American Journal of Industrial Medicine, 37,* pp.607-617, June 2000.

Paul Villeneuve et al., "Non-Hodgkin's Lymphoma Among Electric Utility Workers in Ontario: The Evaluation of Alternative Indices of Exposure to 60 Hz Electric and Magnetic Fields," *Occupational and Environmental Medicine, 57,* pp.249-257, April 2000.

Jun Zhang, Indira Nair and Jack Sahl, "Effects Function Analysis of ELF Magnetic Field Exposure in the Electric Utility Work Environment," *Bioelectromagnetics, 18,* pp.365-375, 1997.

Trevor Dawson, Kris Caputa and Maria Stuchly, "A Comparison of 60 Hz Uniform Magnetic and Electric Induction in the Human Body," *Physics in Medicine and Biology, 42,* pp.2319-2329, December 1997.

Dutch Advisory Panel Limits Still in Line with ICNIRP

The Health Council of the Netherlands has again issued a report concluding that only acute exposures to power frequency EMFs present a known health risk and recommending exposure limits based on induced currents.

"It has not been demonstrated" that prolonged exposure to EMFs "at field strengths below the limits...for short-term effects induces any kind of disease or abnormality," a committee appointed by the council writes in the report, which was submitted to the government on March 7.

The panel did not favor an approach guided by the precautionary principle, such as is being taken in Switzerland and is being considered in Italy (see *MWN,* J/F00 and M/A00). The committee "did consider precautionary measures," said Dr. Eric van Rongen, a member of both the council and committee, and concluded that "there is no reason to take such measures."

In 1992, another panel assembled by the council recommended limits similar to those of the International Commission on Non-Ionizing Radiation Protection (ICNIRP), the American National Standards Institute (ANSI) and the Institute of Electrical and Electronics Engineers (IEEE) (see *MWN,* M/J92). At that time, the panel called for a reevaluation of research on health effects after five years.

The new report states that although "some epidemiological data point to a reasonably consistent association" between EMFs and increased risk of childhood leukemia, "experimental research has failed to produce any evidence of a causal relationship."

The eight-member committee based these conclusions on studies "of adequate quality" published in international peer-reviewed journals. Only reproducible, statistically significant effects explained by a plausible mechanism were considered in specifying exposure guidelines.

The panel recommends limits for public exposure to power frequency EMFs somewhat higher than those of ICNIRP: 1.2 G versus 1 G at 50 Hz. The corresponding proposal for occupational exposures at this frequency is 6 G, while ICNIRP calls for 5 G. Public and on-the-job guidelines are specified for frequencies up to 10 MHz.

According to the report, these limits are designed to protect against phosphenes, or perceived flashes of light, and nervous stimulation, which can lead to cardiac fibrillation.

The Netherlands currently has no mandatory limits for non-ionizing radiation exposures. The government will probably make either the council's or ICNIRP's limits legally binding, van Rongen told *Microwave News,* but has not yet decided which.

The committee, which was chaired by Dr. Eric Roubos of the University of Nijmegen, is calling for continued monitoring of health effects research.

The full text of the new report is available in Dutch (and may soon be available in English) on the Internet at: <www.gr.nl>.

Do Hands-Free Sets Triple Radiation Exposure? No Support for Claim by U.K. Consumer Group

The U.K. Consumers' Association (CA) caused an international sensation in early April when it published a warning that hands-free headsets actually triple radiation exposures.

Although the CA is a widely respected British institution, its claim was met with intense skepticism. This has grown into general disbelief as conflicting data have mounted.

Hands-free sets allow users to keep mobile phones at a distance, and have become increasingly popular among those concerned about the phones' potential health effects.

"If you are worried about levels of radiation from your mobile phone," said Graeme Jacobs, the editor of *Which?,* the CA's monthly magazine, "you shouldn't rely on a hands-free set."*

"They didn't know what they were doing," said Dr. Niels Kuster of the Foundation for Research on Information Technologies in Society, located in Zurich. "They used inappropriate methodology and instrumentation." Kuster has developed systems for measuring radiation exposures from hand-held phones that are used all over the world.

Kuster said that he had measured radiation from hands-free sets several times over the last few years and found that exposures were often reduced essentially to background levels. He is not alone. Tests carried out by or for Ericsson, Motorola, Nokia, Philips and Vodafone, among others, have all shown large reductions in specific absorption rates (SARs) with hands-free sets.

"I don't understand how the CA obtained its reported results. There must have been some misunderstanding somewhere," said Dr. Q. Balzano. Balzano is the director of Motorola's Electromagnetics Research Lab in Fort Lauderdale, FL.

Despite all these conflicting data, the CA is standing firm. "We are absolutely confident about the results," Antonia Chitty, a senior CA researcher in London, told *Microwave News*.

In an interview, Roy Brooker, a scientist at the CA research labs in Milton Keynes, said: "Whether we are right or wrong is not important, the point is that we have managed to raise the issue. In terms of future work, there are organizations that are far better equipped." Chitty noted that the CA would like to see more research in this area.

The radiation measurements were carried out for the CA by ERA Technology, which has offices in Leatherhead, U.K., and in Houston. ERA tested two phones, one from Ericsson and one from Philips. In one set of measurements, the phones were next to a model of a human head filled with gel, and in another the phone was placed one meter away, either horizontally or vertically, connected to a hands-free wire with the earphone placed in a rubber ear.

ERA did not measure SARs, defined as the amount of energy absorbed in a defined volume of tissue (usually 1g or 10g). Rather, it took a single set of readings of the electric and magnetic fields 4 cm inside the simulated skull at 902 MHz.

In response to the growing controversy over the measurements, CA Director Sheila McKechnie wrote to the *Guardian* (April 7) and noted that the CA had "never intended" to do SAR tests. Brooker explained that, "We decided not to do SARs because it would imply that there is a health problem."

Even without doing a full SAR test, many observers said that they were uncomfortable drawing conclusions from only one measurement for each phone and hands-free kit. "They should have done at least three measurements," said Dr. Alan Preece of the U.K.'s University of Bristol.

After repeated requests for the ERA test data, the CA released an abridged version of the report to *Microwave News*. Only one set of results was made available and these did not specify the levels associated with each type of phone. (Weeks later, however, just before *Microwave News* went to press, the CA offered to provide the full report.)

Delays in the availability of the ERA report irritated many industry representatives. Peter Harrison of Nokia in Camberley, Surrey, U.K., said it took him four weeks to get the test protocol.

The electric field was three times higher if the phone was connected to the earpiece compared to when it was next to the model head — but only when the phone was vertically below the head (as it is when strapped to the user's belt). If it was placed horizontally, the field was unchanged. In both configurations, the magnetic field was substantially reduced. ERA declined to

SAR Search

• The IEEE is getting close to a standard protocol for measuring SARs from cellular phones. "We now have a draft in rough form," said Howard Bassen, of the FDA's Center for Devices and Radiological Health in Rockville, MD. Bassen is the chair of SCC-34/SC-2, the IEEE group in charge of developing the testing procedures. He told *Microwave News* that section editors "still have a few things to clean up," but should be finished by May 15. The draft will be reviewed at the subcommittee's next meeting, June 1-2 at the FCC's offices in Washington, followed by a vote by e-mail, and the revised draft will then be considered by the full committee and finally by the IEEE Standards Board. Bassen expects the process to go smoothly: "At this point, I'm not aware of any significant controversies," he said. For over a year, the IEEE has been under pressure to finish the protocol. Both the FCC and the CTIA have urged the subcommittee to speed up its work (see *MWN,* J/F99 and N/D99).

• The Japanese government will soon require SAR testing of all new mobile phones, according to the May 16 *Financial Times (FT)*. Once a standard test procedure is adopted, which is expected this fall, the Ministry of Posts and Telecommunications will require manufacturers to show that their phones meet the ICNIRP SAR limit of 2 W/Kg. The new rules are scheduled to be in place by the spring of 2001. DoCoMo, the largest Japanese mobile phone operator, told the *FT* that its phones would have no problem complying.

* The full text of the *Which?* report, which appeared in its April issue, is available on the Internet at <www.which.net>. Interestingly, the CA suggested that those worried about cell phone radiation use a hands-free set in the April 1998 issue of its magazine, *Health Which?*

comment on the tests and referred questions to the CA.

In contrast, tests carried out at Ericsson's EMF Research Lab in Stockholm, using the same model Ericsson phone and an "identical" earpiece, found SAR values which "were about 2-3% of the maximum SAR value with the phone in a normal usage position next to the ear," according to a company statement.

SARTest, a testing firm based in Newdigate, Surrey, outside London, reported results similar to Ericsson's, with both the same phone and a Philips unit.† These measurements were carried out for Vodafone. Dr. Camelia Gabriel of Microwave Consultants in London, a director of SARTest and a leading expert on dosimetry, said that she supported these results.

Measurements for ABC News' television magazine show, *20/20,* by the Institute for Mobile and Satellite Radio Technology (IMST) near Düsseldorf, Germany (see *MWN,* N/D99), also showed that headsets produced a marked reduction in radiation exposures. "In various positions, we found SARs of 1.84 to 2.16 W/Kg for a Nokia 6160 analog phone," said Brenda Breslauer, a producer at *20/20* in New York City. "But with an earpiece, the SAR fell to 0.02 W/Kg."

Dr. Uwe Kullnick of the IMST told *Microwave News* that the institute had also tested a Philips phone with a hands-free set like the one tested by the CA, and had found that the SAR dropped to 0.02 W/Kg.

The Stewart report (see p.1), issued a month after the *Which?* claims were publicized, specifically asks that the "government set in place a national system which enables independent testing of shielding devices and hands-free kits to be carried out, and which enables clear information to be given about the effectiveness of such devices."

The *Which?* report was front page news in Britain on April 4, generating headlines as far away as Australia and New Zealand. 'HANDS-FREE' PHONE SHOCK, blasted the U.K.'s *Daily Mail*; NEW MOBILE PHONE DANGER, warned the *Express* and the *Times* headlined PHONE KITS 'TRIPLE RADIATION.' U.S. coverage was spottier, with more attention from television than newspapers.

† The SARTest report is available on the Internet at <www.sartest.com>. For another set of measurements showing large field reductions with the use of headsets, see <www.orauk.com>.

Exposure Limits Based on the Precautionary Principle Stir Controversy in Europe

Battle lines are being drawn over whether to use the precautionary principle as the basis for tightening limits on exposures to non-ionizing radiation. The controversy was prompted by tough new rules in Italy and Switzerland.

Frequently cited in European environmental regulations, the precautionary principle holds that steps may be taken to protect people or the environment against potential hazards in the absence of scientific certainty.

"Can one justify using the principle to limit public exposure to RF energy to levels far below the threshold for established hazards to address public concerns on the basis of scientific data that major scientific review committees find unpersuasive of a hazard?" ask Drs. Kenneth Foster, Michael Repacholi and Paolo Vecchia in the May 12 issue of *Science*.

They do not offer a direct response in *Science,* but the answer is No, according to a "backgrounder"* posted on the Internet in March by the World Health Organization (WHO) in Geneva, where both Foster and Repacholi work. It argues that this is especially true if standards are "lowered to levels that bear no relationship to established hazards."

"You cannot invoke the precautionary principle on the basis of fears alone," said Foster, who is working at the WHO while on sabbatical from the University of Pennsylvania in Philadelphia. "Careful analysis" must be applied, he said in an interview, adding that this is also the view of the European Commission.†

But the head of the Swiss federal government's non-ionizing radiation unit countered that his team did precisely that in writing his country's new rules. Dr. Jürg Baumann told *Microwave News* that the limits are technologically and economically based. "What can reasonably be done to reduce exposure has to be done," he said, citing Swiss environmental law. Baumann is at the Federal Agency for Environment, Forests and Landscape in Bern.

The WHO document warns that "arbitrary cautionary approaches" risk undermining "science-based exposure limits." But Baumann pointed out that taking precautionary action should not be confused with taking protective action against proven hazards. The choice of specific precautionary measures is "not a scientific but a political" process, he said.

Repacholi, Foster and Vecchia, who is at Italy's National Institute of Health in Rome, favor the limits established by the International Commission on Non-Ionizing Radiation Protection (ICNIRP) (see *MWN,* J/A98). The ICNIRP and ANSI/IEEE standards, they write in *Science,* are based on "painstaking evaluation of the relevant scientific literature" and "offer a high level of protection against established hazards."

Repacholi was the chair of ICNIRP from its inception until 1996. He now directs the WHO International EMF Project, which is promoting worldwide adoption of ICNIRP limits (see p.17 and *MWN,* M/A97, S/O99, N/D99 and J/F00).

Vecchia, the president of the European Bioelectromagnetics Association (EBEA), has also sought to secure EBEA backing for the ICNIRP limits. Last November, at an international standards harmonization meeting in Erice, Italy (see *MWN,* J/F00), he circulated a statement‡ noting that ICNIRP's guidelines have

* *Electromagnetic Fields and Public Health Cautionary Policies* is at: <www.who.int/peh-emf/publications/facts_press/EMF-Precaution.htm>.

† On February 2, the European Commission (EC) in Brussels affirmed the principle as a "key tenet" of European Community policy and offered guidelines for its use. *Communication from the Commission on the Precautionary Principle* is available on the Internet in PDF form at: <europa.eu.int/comm/off/com/index_en.htm>.

‡ The statement is on the EBEA Web site: <www.ebea.org/ebea/menu.html>.

been recommended by the European Union's Council of Ministers for adoption by member states (see *MWN,* J/A 99). Participants were invited to sign it and about 70 did, Vecchia said.

The Swiss and Italian ordinances contain precautionary limits for RF/MW radiation approximately 100 times stricter than ICNIRP's (see *MWN,* J/F00). But while the WHO backgrounder backs "low-cost measures to reduce exposure," it describes these as "framed in terms of voluntary recommendations rather than in terms of fixed limits or rules."

The WHO document allows that, "It is possible to introduce cautionary policies without undermining science-based standards." It cites with approval a draft "guidance" issued by the New Zealand government that suggests voluntary, "low- or no-cost interventions" to minimize RF/MW exposures and address public concerns (see *MWN,* S/O99).

Other measures to reduce exposure "may be appropriate," according to the backgrounder, including the use of an earpiece with a mobile phone, moving a clock radio away from the bedside and moving a child's bed.

But Repacholi, Foster and Vecchia have each criticized the advice of the U.K.'s Independent Expert Group on Mobile Phones that, as a precautionary measure, children be discouraged from using mobile phones (see p.1). Repacholi, a member of the group, told *Microwave News* that he had argued against this recommendation. Vecchia said in an interview that giving special advice for children "shows how precaution can be completely separate from science." He objected that this distinction is based "on *currently unrecognized* health effects" (his emphasis).

For his part, Baumann stressed that, "Precaution is a strategy that is chosen precisely because there is insufficient scientific knowledge about low-level, long-term effects." He added that, "Not all scientists agree with ICNIRP's evaluation of the scientific literature," pointing to the "Vienna Resolution," in which 16 researchers declared that biological effects from low-level exposures are "established" (see *MWN,* N/D98). Repacholi was in Vienna at the time but declined to sign the resolution.

"The claim that precautionary measures might 'undermine' science is a platitude," said Austria's Dr. Michael Kundi of the University of Vienna's Institute of Environmental Hygiene, who organized the conference that led to the resolution. "Any proposal for a guideline or limit value has to apply principles that are not purely scientific," he told *Microwave News*.

Health officials in Czechoslovakia share the view that current scientific knowledge justifies precautionary limits stricter than ICNIRP's, and have criticized the WHO's position (see p.14). While Eastern Europe and Russia have long had more stringent exposure limits (see *MWN,* N/D99), Western countries have generally favored looser limits based only on thermal effects.

In the U.S., the National Electrical Manufacturers Association (NEMA) has mounted its own "full-scale effort" backing the ICNIRP limits. Writing in the April 15 issue of *Electroindustry,* the association's newsletter, NEMA consultant Douglas Bannerman warned that without a common standard, governments may "enact legislation...which will be difficult and costly to meet."

According to Bannerman, who went on a fact-finding mission to Europe earlier this year, NEMA does not object to precautionary measures as long as they are voluntary. "Each individual has a right to take steps" to reduce exposure, he said in an interview.

At least one member of ANSI/IEEE's SCC-28 (see story below) does not see precautionary limits as a threat to prevailing standards. "I think the two can coexist very well," Arthur Varanelli told *Microwave News* from his office at Raytheon Co. in Lexington, MA. Precautionary measures, he said, "will give people a chance to have their concerns heard and may give the public a greater sense of protection."

ANSI/IEEE Group Favors a Single RF/MW Safety Standard

The subcommittee revising the American National Standards Institute (ANSI) safety limits for radiofrequency and microwave (RF/MW) radiation wants a single exposure standard that would apply to all members of the population, whether they are children, adults or workers.

A consensus for a one-tier standard was reached among members of Subcommittee 4 of Standards Coordinating Committee 28 (SCC-28/SC-4) attending a meeting held March 30-31 at Motorola's Fort Lauderdale offices. If approved — and the revision process still has a long way to go — the ANSI standard would revert to the way it was from 1966 until 1991, when two sets of limits were first adopted (see *MWN,* N/D91).

Most exposure standards make a distinction between the general public and workers, with stricter limits for the public in order to protect more vulnerable members of society, such as children, the elderly and the sick. The current ANSI/IEEE standard, designated C95.1, is structured somewhat differently, with separate limits for "controlled" and "uncontrolled" environments. Those in controlled environments are assumed to be aware that they are being exposed to radiation and therefore more knowledgeable about the potential health risks.

"All of us who attended the meeting at Motorola were in agreement that there should be a single-tier standard," said Dr. Eleanor Adair of the Air Force Research Lab at Brooks Air Force Base (AFB), TX. "I believe there is no real basis for a lower tier for a susceptible group," she added. Adair is the vice chair of SCC-28, which is a committee of the Institute of Electrical and Electronics Engineers (IEEE).

"We are trying to come up with a standard that is safe for everyone," commented Richard Tell, a consultant based in Las Vegas and a member of the subcommittee. "A two-tier standard is too complicated," he said.

When asked what the final standard might be, Adair responded that it was too early to tell. "It should be a science-based standard," she said.

Nineteen members of the subcommittee attended the March meeting. There were six representatives of the U.S. government — all from Brooks AFB. The remainder are either consultants or work for Motorola.

"There were not enough government health officials there," Dr. Mays Swicord acknowledged in an interview. Swicord, the director of biological research at Motorola, formerly represented the Food and Drug Administration on SCC-28/SC-4. "We have

to find a way around that," he said, pointing to the travel costs as a major barrier to participation.

Dr. C.K. Chou, also of Motorola and the cochair of SC-4, agreed with Swicord. "It is very important that other branches of the government, especially the regulators, participate in this revision process," Chou wrote in an e-mail to those SCC-28 members who are with government health agencies. "I am requesting your input [as to] where and when we should meet next time to ensure that you can participate."

Swicord said that he was "ambivalent" about a single-tier standard. And Dr. Gregory Lotz of the National Institute for Occupational Safety and Health in Cincinnati, one of those who did not attend the meeting, commented that, "You can talk about one level, but it is not clear what the level should be."

Chou stressed that the decision to have a one-tier standard "is not set in concrete — this was only the consensus of the people who were there."

Dr. Martin Meltz of the University of Texas Health Science Center in San Antonio, who is leading the literature review for the new standard, said that it is "still in progress."

Carlo's New $60 Million Program: Funding Sources Not Revealed

Dr. George Carlo formally announced the creation of his Radiation Protection Project on April 26. The project — which Carlo has talked about for months — has an ambitious agenda and a planned budget of over $60 million.

Among the project's goals are to collect reports of health problems among wireless phone users, to reevaluate current RF/MW standards, to sponsor studies on leukemia and on electromagnetic interference with defibrillators and to replicate past experiments by Carlo's Wireless Technology Research (WTR) that found genetic damage due to RF/MW exposure (see *MWN,* M/A99).

Only a small fraction of the planned budget has yet been raised. Carlo told *Microwave News* that he has $3 million in "definite commitments" for the next six months. He declined to say how much of this had actually been received or to identify any of the funders.

"I am unwilling to make the finances of the new project a public spectacle as they were with WTR," Carlo said, stating only that the funders include both individuals and foundations. "We have received money from the telecommunications industry — I will not reveal from who," he said. The press release indicates that the project will also seek government support. "I feel that, at this stage, I'm lucky to have anybody supporting me," Carlo added.

Carlo was the chair of WTR, which received over $25 million in funding from the Cellular Telecommunications Industry Association (CTIA). It closed down last year when the CTIA refused to renew its support (see *MWN,* J/A99).

The project is starting with "a skeleton staff," Carlo said. "My intention is to farm out almost all the work." He contrasted this with WTR, which he said "had a lot of infrastructure."

"Surveillance is the most important thing," Carlo said. "It's the industry that should be doing this, and it's not." Carlo has appealed to the public for help in this effort: "People who believe they are experiencing health effects from their phone use can help by sharing their experiences, confidentially."

So far the surveillance effort is the only part of the project's work program that has begun, and even that is still in its earliest stages. Its Web site, <www.HRMGroup.org>, states that an online questionnaire is "under development," and in the meantime urges mobile phone users to send in a form by regular mail.

WTR's finances have been a subject of controversy (see *MWN,* M/J96 and J/A98), but in mid-May Carlo defended WTR's record. He insisted that only "17% of the WTR money went to the infrastructure, people inside the program, but 83% went to outside labs and outside consultants." As in the past, however, Carlo declined to provide specific dollar amounts.

The formation of the Radiation Protection Project was announced in a press release from the nonprofit Science and Public Policy Institute, which has the same phone number, address and Web site as Carlo's consulting company, Health Risk Management Group Inc., in Washington. Carlo explained that "for the time being," the consulting group is "providing staff help to the project on a contract basis."

New Czech Study on Cell Phones and Brain Activity

Researchers in the Czech Republic are also reporting that mobile phone radiation can affect reaction time and electrical activity of the brain. This follows parallel findings in Britain, Finland and Germany (see p.16 and *MWN,* M/A99 and M/A00).

With a 900 MHz phone placed against the right ear, 17 volunteers were asked to press a key when a stripe appeared on a screen. In tests conducted when the phone was turned on, "Reaction time of the behavioral response was shortened on average by 20 ms" — a difference that was statistically significant.

Visual event-related potentials (ERP), a gauge of brain electrical activity, were measured during the behavioral test. ERPs showed some increase, but their timing was unchanged.

The study was mainly designed to investigate how mobile phone exposure might affect people with narcolepsy, a condition that causes repeated brief episodes of deep sleep. After 45 minutes of exposure at a specific absorption rate of 0.06 W/Kg, no episodes of narcolepsy occurred. In fact, the Czech researchers found "no effect on any parameter of the electroencephalogram" in measurements taken from 15 to 35 minutes after exposure.

The double-blind study was conducted by Dr. Robert Jech and colleagues at Charles University in Prague. It will be presented at the *10th European Congress of Clinical Neurology* in Lyon, France, this August.

Two previous Czech studies, conducted at the National Institute of Public Health in Prague, found no effect on brain activity from mobile phone exposure. These experiments were carried out by Drs. Pavel Urban *(Central European Journal of Public Health, 6,* pp.288-290, 1998) and Ales Hladký *(Central European Journal of Public Health, 7,* pp.165-167, 1999).

« Wireless Notes »

In the **U.K.**, journalists raced to be first to disclose the **Stewart report**'s findings — and in most cases guesswork and spin edged out accuracy. Some two weeks before the report's release, the ***Guardian*** (April 28) gave a positive slant that would later ring false: EXPERT REPORT GIVES MOBILE PHONES A CLEAN BILL OF HEALTH ran its headline. Rumors circulated in London that the story was leaked by the Blair government in an attempt to reassure telecom executives who had just given the treasury £22.5 billion (US$35 billion) for wireless licenses. The possible sources ranged from the Department of Trade and Industry (**DTI**) all the way up to the Prime Minister's office. On April 30, the ***Observer*** went in the opposite direction but was also off the mark: MOBILES TO CARRY HEALTH ALERT, it predicted. Finally, on May 3, Kathy Moran of the ***Express*** got it right (see p.1). Public attention and interest were also fueled by a British consumer group's claim that hands-free sets "triple radiation" (see p.4), and some editors may have decided that *any* story with the word "radiation" or "electromagnetic" was good enough. The April 16 ***Sunday Mirror*** grabbed readers' attention with the headline, BEWARE — USING A MOBILE CAN RUIN YOUR SEX LIFE. Even the more dignified ***Sunday Times*** ran major articles on "electro-crystal therapy" (March 19) and pendants said to "offer natural protection against harmful EMFs" (April 2).

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On May 25, California state Sen. **Tom Hayden**'s mobile phone safety bill was passed by the state senate by a vote of 23 to 12 and was forwarded to the assembly. The bill bears little resemblance to the one Hayden introduced in February, however (see *MWN,* M/A00). "It's like the fish in Hemingway's *The Old Man and the Sea,"* said Hayden aide Rocky Rushing. "It's a lot closer to shore, but large chunks of meat have been torn off." Specifically, he told *Microwave News,* requirements that retailers post information about possible health hazards of phone use and that earpieces be offered for sale have been cut. In its current form, SB1699 instructs the state Department of Health Services to review health research. The text and legislative history of SB1699 are on the Internet at: <www.sen.ca.gov>.

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Dr. **Quirino Balzano**, better known as **Q**, is retiring from **Motorola**. At the end of this year or early in 2001 — after 26 years with Motorola — he will step down as the director of the company's Electromagnetics Research Lab in Fort Lauderdale, FL. He will be replaced by Dr. **Larry Dworsky**, who is presently based in Phoenix. The senior management team at the lab will remain in place: Dr. **C.K. Chou** as director of the RF Dosimetry Lab, Dr. **Mays Swicord** as director of Biological Research and Dr. **Wei-Yean Howng** as director of the Portable Communications Lab. Balzano told *Microwave News* that his future plans are not yet finalized, but that he will remain a member of TEPRSSC, FDA's radiation safety advisory committee. In addition, he said that he looks forward to continuing to serve on the board of directors of IT'IS, the new lab set up by Dr. **Niels Kuster** in Zurich (see *MWN,* J/F00).

No Brain Tumor Risk Seen in WTR Epi Study

Joshua Muscat has found no increased risk of brain tumors from the use of cellular phones, he told *Microwave News* in May. His conclusion stands in sharp contrast to statements by Dr. George Carlo, whose group Wireless Technology Research (WTR) sponsored the study (see *MWN,* M/A99 and M/J99).

"The results are essentially negative," Muscat said. There was one "little finding" of an excess of neuromas, but Muscat explained that this was "an artifact." He also noted that he did not find any higher incidence of cancer on the side of the head a person used a phone. "It's a nonissue," he said.

Muscat has submitted a paper on his results to the *Journal of the American Medical Association*.

Carlo has often cited the excess of neuromas in the Muscat study in his campaign to gain new funding for mobile phone-health research (see p.7 and *MWN,* M/A99, J/A99 and N/D99). Last spring, preliminary reports of studies by Muscat and Dr. Lennart Hardell prompted renewed attention to brain tumor risks (see p.15 and *MWN,* M/J99)

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Citing "potential health risks as described by the national media and industry research," **Metrocall**, a major U.S. retailer of cellular phones and pagers, is urging its mobile phone customers to consider using a **headset**. A "health and safety bulletin" which Metrocall issued in January also suggested it may be better for **children** to use a pager instead of a wireless phone. "We're not trying to take a position on the research, because it's not clear yet," company spokesperson Mike Scanlon told *Microwave News*. "But we thought we'd err on the side of the angels here." He noted that notices have been put up in all the company stores. "We're kind of the Lone Ranger on this, in terms of the industry," he said. "We haven't gotten flak for it, but no one's praising us for it, either." About 90% of Metrocall's six million subscribers are paging customers, and the company has made the youth pager market a priority.

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Mobile Phones — Biological Effects, a symposium sponsored by the **French Academy of Sciences**, was held in Paris April 19-20. The approximately two dozen speakers included Jørgen Bach Anderson, Elisabeth Cardis, Om Gandhi, Jukka Juutilainen, Joshua Muscat (see box above), Joe Wiart and Zenon Sienkiewicz (see p.17). A communiqué issued at the meeting's close stated that wireless phone radiation poses no clear health risk and looked to ongoing and planned studies to clarify any remaining uncertainties. In October, the academy will hold a press conference and publish the proceedings of the meeting, according to Dr. **Bernard Veyret** of the University of Bordeaux, who helped organize the April symposium.

California Coastal Commission & Navy at Odds over Radar Facility

The California Coastal Commission has voted to oppose expansion of the U.S. Navy's electronic warfare test facility in Port Hueneme, CA. On May 24, the navy declared that it will go ahead with the project anyway, and the commission may file a lawsuit to stop it.

"We believe we are complying with all state and federal laws with this project, and that's as far as we had to go," Charles Giacchi, executive director of the navy's Surface Warfare Engineering Facility (SWEF), told the *Los Angeles Times* (May 25).

"The navy is operating in violation of the Coastal Zone Management Act," Coastal Commission chair Sara Wan told *Microwave News*. Technically, she said, the commission could have sued the navy long ago because a study of environmental effects was never submitted when SWEF was built (see *MWN,* N/D99).

The commission's April 14 vote against the expansion came in the wake of an expert panel's report on SWEF, released on March 23 (see box at right). While the panel did not cite SWEF's radars as an immediate danger to public health, four out of five members called on the navy to do more to protect people and wildlife. SWEF has 15 different radars, two of which have transmitters with a peak power of one million watts.

The commission and the navy reached agreement on several of the panelists' recommendations, but remained at odds over one: The navy rejected a request to include at least one person who is not a Department of Defense (DOD) employee in the planning and implementation of a radiation survey. This was first proposed by panel member Dr. Joe Elder, of the Environmental Protection Agency (EPA) in Research Triangle Park, NC.

In an April 13 letter to the commission, Captain J.W. Phillips said that while the navy had considered including a non-DOD expert, the law does not require it. The navy is "skeptical that this measure would further enhance public trust or confidence in the navy's RF safety program," Phillips wrote. "We do not believe that certain members of the public would be satisfied with any measure that the navy takes to better public relations."

"I'm at a loss as to why they won't agree to it," said Wan. "It would be such an easy thing for them to do." She noted that the navy has stated that its position is not based on any security concerns. Inclusion of a non-DOD expert is "essential to maintaining the objectivity of the survey panel," the commission told Phillips in an April 17 letter. Editorials in the *Los Angeles Times* and the *Ventura County Reporter* have supported the commission on this point. Local business leaders have backed the navy.

Lee Quaintance of the Beacon Foundation, a local environmental group based in Oxnard, CA, said the dispute was really about what kind of survey will be done. He said that the navy's existing RF/MW exposure surveys "are essentially focused on navy personnel—any measurements outside the base are incidental." A non-DOD expert must be involved in any public exposure study from the outset, Quaintance argued, because it will need a completely new design. He wondered why the navy is opposed to such a study: "Is it because they wouldn't pass it?"

"Safety is very important to the navy," declared a May 24 statement from the Port Hueneme base command. "The safety and well-being of all sailors is a top priority of this command." It added that navy studies show that SWEF is also safe "for our neighbors in the local community."

Wan said that the commission has tried to reach an agreement with the navy: "We've said we'll forgive their past sins if they take the necessary steps to assure the public that any expansion will not have negative effects." Without that guarantee, said Wan, the commission may have no choice but to file a lawsuit.

What Expert Panel Said About Navy's Port Hueneme Radars

The expert panel's report on the radars at SWEF in Port Hueneme was not a consensus document. Instead, each panelist was asked to come to his own conclusions. The five members expressed a wide range of views.

Dr. Ross Adey of the University of California, Riverside, concluded that SWEF is generally in compliance with DOD radiation limits. A "notable exception," he wrote, is that the limits could be exceeded on ships entering and leaving Port Hueneme harbor, which is open to civilian traffic.

Adey's sharpest criticism was directed at the military's RF/MW limits themselves. Like the ANSI/IEEE guidelines, they are based on thermal effects only and do not take modulation into account. This makes them "an increasingly inadequate and inappropriate guideline on issues of health risks" for "civilian residents in adjoining housing developments" and others in public areas, Adey declared. He recommended that "complete 360° rotation of any SWEF radar system should no longer be permitted," and that "antenna traverses across adjoining coastal zones" also be banned.

Dr. Robert Beason, an avian biologist at the State University of New York, Geneseo, concluded that there was a potential hazard to any birds nesting on the roofs of two of SWEF's buildings.

Dr. John D'Andrea of the Naval Health Research Center at Brooks Air Force Base, TX, expressed complete or substantial agreement with every point of the navy's position as submitted to the panel. D'Andrea did not recommend any changes in SWEF operating procedures.

EPA's Elder evaluated RF/MW exposure from SWEF in relation to Federal Communications Commission (FCC) limits, which are somewhat stricter than those of the ANSI/IEEE standard. Like Adey, Elder found that limits could be exceeded on ships that are entering Port Hueneme harbor. At a height of 100 feet above the water line, Elder observed, exposure could be 54 times the FCC standard.

Some of the strongest words came from the EPA's Edwin Mantiply, based in Montgomery, AL. "The SWEF facility is not intrinsically safe," Mantiply wrote. While safe if operated as directed, Mantiply wrote, failure to follow correct procedures could cause exposures in public areas 200 times higher than allowed by the National Council on Radiation Protection and Measurements. "Organ damage could occur before the exposure was recognized," Mantiply stated.

A summary of the report is available at SWEF's Web site: <www.phdnswc.navy.mil/SWEF/swef.htm>.

last spring (see *MWN,* M/A99 and S/O99), was quick to accept the panel's recommended precautionary approach.

In a statement posted on the Internet soon after the report was made public, the Department of Health said that it would make sure that parents are made aware of the panel's advice. It also stated that, "The government will expect SAR measurements to be displayed at all points of sale and with each mobile phone and on the World Wide Web."

The U.S. Federal Communications Commission (FCC) is also making SARs publicly available on its Web site (see p.11).

The expert group's report also calls for Britain to adopt the exposure standards of the International Commission on Non-Ionizing Radiation Protection (ICNIRP), which are stricter than the current limits developed by the U.K.'s National Radiological Protection Board (NRPB). This would mean an 80% reduction in allowable SARs for mobile phones sold in the U.K. A parliamentary committee made a similar recommendation last year (see *MWN,* S/O99).

The panel found that, "The balance of evidence to date suggests that exposures to RF radiation below NRPB and ICNIRP guidelines do not cause adverse health effects to the general population." But it also noted that, "There is now scientific evidence... which suggests that there may be biological effects occurring at exposures below these guidelines."

The Stewart group recommended that the government ensure that the public is exposed to "lowest practical levels" of RF radiation from mobile phone towers. It cautioned that while such radiation does not pose a health risk, there could be "indirect" effects such as anxiety prompted by the premature dismissal of nonthermal effects.

The panel asked for a radiation research program run by an independent group, to be funded on an equal basis by the industry and the government. The Department of Health agreed that there is an "urgent need for further research" and said that it will commission "a comprehensive program of research costing several million pounds," to be launched by this September.

The Federation of the Electronics Industry (FEI) "welcomed" the Stewart report on behalf of mobile phone companies. The FEI, which is based in London, accepted the recommendation that SAR information be made publicly available. With respect to the use of phones by children, the FEI stated that there is a "need to find a balance between appropriate precautionary measures and the personal safety benefits for children."

But there were also indications that some members of the industry are not pleased with the report. For instance, in a May 12 editorial, the *Financial Times* compared mobile phones to strawberries: "On the precautionary principle, therefore, children should not eat strawberries unless absolutely necessary and never with cream." The commentary went on: "Even if proved, [a mobile phone risk to children] would probably be far less than the danger from eating sweets or going to a disco." (For more on U.K. press coverage of the report, see p.8.)

Powerwatch, a citizens group based in Ely, north of London, applauded the call to publicize SARs. "I believe this will force manufacturers to compete on low SAR designs, which will result in much lower SAR phones, just like the MPR2 guidelines prompted low-radiation VDTs," said Alasdair Philips, the di-

Stewart Report's Conclusions and Recommendations

- Finds that "the balance of evidence to date suggests that exposures to RF radiation below NRPB and ICNIRP guidelines do not cause adverse health effects to the general population," but that there is now "scientific evidence" which "suggests that there may be biological effects occurring at exposures below these guidelines."
- Advocates a "precautionary approach" to the use of mobile phones, justified in part by "gaps in knowledge."
- Calls for the adoption of the ICNIRP exposure guidelines "for use in the U.K. rather than the NRPB guidelines."
- Discourages the "widespread use of mobile phones by children for nonessential calls," based on the precautionary principle, and asks industry to refrain from marketing phones to children.
- "SAR values for mobile phones must be readily accessible to consumers," with "information on the box"—based on an "international standard" for measuring SARs.
- The government should circulate "a leaflet to every household in the U.K. providing clearly understandable information" on the possible impacts of mobile phone technologies on health.
- "The balance of evidence indicates that there is no general risk to the health of people living near to base stations," but that, "there can be indirect adverse effects on their well-being in some cases."
- Recommends that the siting of "all new base stations should be subject to the normal planning process" and "the establishment of clearly defined physical exclusion zones around base station antennas."
- Wants planning authorities to have the "power to ensure that the RF fields to which the public will be exposed [from base stations] will be kept to the lowest practical levels."
- Recommends that the "beam of greatest intensity [of a base station] should not fall on any part of...school grounds or buildings [or playgrounds] without agreement from the school and parents."
- Seeks "a national database set up by the government giving details of all base stations and their emissions," together with "an independent, random, ongoing audit of all base stations...to ensure that exposure guidelines are not exceeded outside the marked exclusion zone." Also: "particular attention" should be paid to the auditing of base stations near schools and other sensitive sites.
- Seeks a "substantial research program [that] should operate under the aegis of a demonstrably independent panel." The program should be financed by mobile phone companies and the government on an equal basis.
- Calls for "a register of occupationally exposed workers" to allow the examination of cancer risks and mortality.
- Recommends the NRPB's work on non-ionizing radiation be "strengthened" and that the NRPB take "a more open approach" and be "more sensitive" to issues of public concern.

rector of Powerwatch. (MPR2 is a testing protocol with recommended emission limits for computer terminals which was prompted by pressure from TCO, the Swedish union for white-collar workers; see *MWN,* S/O90 and M/A95.)

The Stewart group was sharply critical of the NRPB. It urged the board to give a "greater priority" to being "more open" with the public and to be "more sensitive" to public concerns over risk. It also asked the NRPB to "strengthen" its program on non-ionizing radiation. In its own statement, the NRPB said it would provide a detailed response at a later date.

In the U.S., the reaction to the Stewart report was muted. Newspapers largely ignored the news, with only *USA Today* (May 12) giving the panel report prominent coverage. The Food and Drug Administration and the FCC, the two federal agencies with responsibilities for cellular phones, did not issue any formal response to the Stewart report.

The Cellular Telecommunications Industry Association (CTIA) in Washington commented that, "There is no scientific basis to restrict the use of a phone for children, but parents must make their own choice in this matter."

Norm Sandler, a spokesman for Motorola based in Washington, told *Wireless Week* (May 15) that SAR data, if made widely available, could cause consumer confusion.

The U.K. panel's report prompted ABC News to repeat a special report on cell phone safety on May 26. The extended segment of the news magazine show *20/20* was originally broadcast last fall (see *MWN,* N/D99).

The full text of the Stewart panel's report, *Mobile Phones and Health,* is available on the Internet at <www.iegmp.org.uk>. Copies are available for £20 each (approximately US$30), plus £2 postage per copy (up to a maximum of £5) from: IEGMP Secretariat, c/o Information Office, NRPB, Chilton, Didcot Oxon OX11 0RQ, U.K., (44+1235) 822742, Fax: (44+1235) 822746, E-mail: <information@nrpb.org.uk>. The Department of Health's response is posted at <www.doh.gov.uk/mobile.htm>.

The members of the panel were: Sir William Stewart (chair), Prof. Lawrence Challis (vice chair), Les Barclay, Marie-Noëlle Barton, Prof. Colin Blakemore, Prof. David Coggon, Prof. David Cox, John Fellows, Dr. Michael Repacholi, Prof. Michael Rugg, Prof. Anthony Swerdlow and T.R.K. Varma.

FCC To Make SAR Data Available on Its Web Site

The Federal Communications Commission (FCC) will soon post SARs for specific phones on its Web site.

"We plan to make SARs accessible in a user-friendly way," Dr. Robert Cleveland told *Microwave News*. He expects the system will be up and running by mid-summer. Cleveland is a senior scientist at the FCC's Office of Engineering and Technology in Washington.

Cleveland said that there is pressure from the highest levels of the FCC to make SARs available to the public.

At first, inquiries will have to be based on FCC equipment authorization numbers, but over time Cleveland hopes that the SARs will be available by the commonly used model numbers. The FCC's home page is <www.fcc.gov>.

Many consumers began asking the commission for SAR information last fall after *20/20,* ABC News' TV magazine show, commissioned its own measurements and reported wide variations in SARs from different phones. But the FCC had trouble responding because the staff could not easily access the SARs from the commission's own files (see *MWN,* N/D99).

Some industry representatives have resisted public disclosure of SARs. In theory, however, SAR numbers filed with the FCC are public information.

FROM THE FIELD

Across the Spectrum

Mobile phones have changed the way people work and communicate. But this independent group's report is right to recommend precautionary measures to encourage both manufacturers and users to limit microwave exposure until we can be more confident that the use of mobile phones is indubitably safe.

—Drs. Michael Maier, Imperial College School of Medicine, London, U.K., Colin Blakemore, University of Oxford, U.K., and Mika Koivisto, Center for Cognitive Neuroscience, University of Turku, Finland, in an editorial, "The Health Hazards of Mobile Phones," *British Medical Journal, 320,* p.1289, May 13, 2000 (see p.1 and also p.16)

Will mobiles be the next trigger for popular distrust of politicians' assurances?

—Photo caption, "Science 'Not Enough' To Allay Fears," *The Times,* (U.K.), April 14, 2000

No one seriously disputes whether cell phone radiation can and does rearrange brain tissue.

—Tom Hayden, California state senator, in a letter introducing his report, *Do Cell Phones Microwave the Brain?* April 10, 2000 (see also p.8 and *MWN,* M/A00)

It is obvious that a no-effect philosophy for the RF spectrum would be comparable to legislating human beings back to the pre-wireless society of the 19th century.

—Dr. James Lin, University of Illinois, Chicago, "Perspectives on Guidelines for Human Exposure to Radiofrequency Radiation" (in his regular column, "Telecommunications Health & Safety"), *IEEE Antennas & Propagation Magazine, 42,* p.148, February 2000

If people are opposed to EMFs they are more likely than not to be opposed to nuclear power and the use of pesticides. The nature of attitudes makes it extremely difficult (although not impossible) to change people's attitudes towards EMFs by explaining the science involved. It is my belief that we have to change people's *feelings*. But how? By publicizing their life-saving value in emergencies, showing that attractive people use them and, of course, by making them cheaper and more useful.

—Terence Lee, Environmental Psychology and Policy Research Unit, University of St. Andrews, U.K., "Concerns of Ordinary People About EMF Exposure," *Radiological Protection Bulletin* (published by the U.K. National Radiological Protection Board) p.9, April 2000

Hot New Papers

Shabnam Gangi and Olle Johansson, "A Theoretical Model Based Upon Mast Cells and Histamine To Explain the Recently Proclaimed Sensitivity to Electric and/or Magnetic Fields in Humans," *Medical Hypotheses, 54,* pp.663-671, April 2000.

"From the results of recent studies, it is clear that EMFs affect the [mast cells (MC)] and also the dendritic cell population, and may degranulate these cells. The release of inflammatory substances, such as histamine, from MCs in the skin results in a local erythema, edema and sensation of itch and pain, and the release of somatostatin from the dendritic cells may give rise to subjective sensations of ongoing inflammation and sensitivity to ordinary light. These are...the common symptoms reported from patients suffering from 'electrosupersensitivity'/ 'screen dermatitis'."

W. Kaune, T. Bracken et al., "Rate of Occurrence of Transient Magnetic Field Events in U.S. Residences," *Bioelectromagnetics, 21,* pp.197-213, April 2000.

"[T]he rate of occurrence of magnetic field events with 2-2000 kHz frequency content were measured over 24 h or longer periods in 156 U.S. residences. A dual-channel meter was developed for the study that, during 20 s contiguous intervals of time, counted the number of events with peak 2-2000 kHz magnetic fields exceeding thresholds of 3.3 nT and 33 nT. Transient activity exhibited a distinct diurnal rhythm similar to that followed by power frequency magnetic fields in residences. Homes that were electrically grounded to a conductive water system that extended into the street and beyond, had higher levels of 33 nT channel transient activity. Homes located in rural surroundings had less 33 nT transient activity than homes in suburban/urban areas. Finally, while transient activity was perhaps somewhat elevated in homes with OLCC, OHCC and VHCC wire codes relative to homes with underground (UG) and VLCC codes, the elevation was the smallest in VHCC and the largest in OLCC homes. This result does not provide much support for the hypothesis that transient magnetic fields are the underlying exposure that explains the associations, observed in several epidemiologic studies, between childhood cancer and residence in homes with VHCC, but not OLCC and OHCC, wire codes."

Ross Adey et al., "Spontaneous and Nitrosourea-Induced Primary Tumors of the Central Nervous System in Fischer 344 Rats Exposed to Frequency-Modulated Microwave Fields," *Cancer Research, 60,* pp.1857-1863, April 1, 2000.

"In a two-year bioassay, we exposed Fischer 344 rats to a frequency-modulated (FM) signal (836.55 MHz±12.5 kHz deviation) simulating radiofrequency exposures in the head of users of hand-held mobile phones. We tested for effects on spontaneous tumorigenicity of central nervous system (CNS) tumors in the offspring of pregnant rats and also for modified incidence of primary CNS tumors in rats treated with a single dose of the neurocarcinogen ethylnitrosourea (ENU) *in utero*.... Intermittent field exposures began on gestation day 19 and continued until weaning at 21 days, resuming thereafter at 31 days and continuing until experiment termination at 731-734 days. Energy absorption rates (SARs) in the rats' brains were similar to localized peak brain exposures of a phone user (female, 236 g, 1.0 W/Kg; male, 450 g, 1.2 W/Kg)....No FM field-mediated changes were observed in number, incidence or histological type of either spontaneous or ENU-induced brain tumors, nor were gender differences detected in tumor numbers. These negative findings with FM fields contrast with our study using standard digital phone fields pulsed on and off at 50/sec, where a trend was noted toward reduced incidence of both spontaneous and ENU-induced CNS tumors." (See also *MWN,* M/J96, J/A96 and S/O99.)

DNA Damage After Prolonged 50 Hz Exposures

Britt-Marie Svedenstål, Karl-Johan Johanson, Mats-Olof Mattsson and Lars-Erik Paulsson, "DNA Damage, Cell Kinetics and ODC Activities Studied in CBA Mice Exposed to Electromagnetic Fields Generated by Transmission Lines," *in vivo, 13,* pp.507-514, 1999.

"CBA mice were exposed outdoors to 50 Hz electromagnetic fields (EMFs), with a flux density of about 8 μT rms (root mean square), generated by a 220 kV transmission line. Assays were performed in order to investigate the possible genotoxic effects after 11, 20 and 32 days of exposure, as well as the effects on body weight, leukocytes, erythrocytes and the level of ornithine decarboxylase (ODC) activity in spleen and testis. DNA migration was studied on brain cells by single cell electrophoresis (comet assay). After 32 days of exposure a highly significant change of the tail/head ratio of the comets was observed ($p<0.001$), showing DNA damage. Further, a decreased number of mononuclear leukocytes ($0.02<p<0.05$) was observed in mice EMF-exposed for 20 days. In summary, our data indicate that transmission lines of this type may induce genotoxic effects in mice, seen as changes in the DNA migration. These results might have an important implication for health effects." (See *MWN,* N/D98.)

Britt-Marie Svedenstål, Karl-Johan Johanson and Kjell Hansson Mild, "DNA Damage Induced in Brain Cells of CBA Mice Exposed to Magnetic Fields," *in vivo, 13,* pp.551-552, 1999.

"DNA migration, using single cell gel electrophoresis (comet assay), was studied on brain cells of CBA mice exposed continuously to 50 Hz, 0.5 mT magnetic fields (MF) for two hours, 5 days or 14 days. No differences were observed in the groups MF-exposed for 2 hours and 5 days compared with controls. However, in the group exposed to MF for 14 days, a significantly extended cell DNA migration was observed ($0.02<p<0.05$). These changes together with results from previous studies indicate that magnetic fields may have genotoxic effects in brain cells."

Jacoba van der Zee et al. (for the Dutch Deep Hyperthermia Group), "Comparison of Radiotherapy Alone with Radiotherapy Plus Hyperthermia in Locally Advanced Pelvic Tumors: A Prospective, Randomized, Multicenter Trial," *The Lancet, 355,* pp.1119-1125, April 1, 2000.

"Complete-response rates were 39% after radiotherapy and 55% after radiotherapy plus hyperthermia ($p<0.001$). The duration of local control was significantly longer with radiotherapy plus hyperthermia than with radiotherapy alone ($p=0.04$). Treatment effect did not differ significantly by tumor site, but the addition of hyperthermia seemed to be most important for cervical cancer, for which the complete-response rate with radiotherapy plus hyperthermia was 83% compared with 57% after radiotherapy alone ($p=0.003$). Three-year overall survival was 27% in the radiotherapy group and 51% in the radiotherapy plus hyperthermia group. For bladder cancer, an initial difference in local control disappeared during follow-up."

Vijayalaxmi et al. (including Martin Meltz), "Primary DNA Damage in Human Blood Lymphocytes Exposed *in Vitro* to 2450 MHz Radiofrequency Radiation," *Radiation Research, 153,* pp.479-486, April 2000.

"Human peripheral blood samples collected from three healthy human volunteers were exposed *in vitro* to pulsed-wave 2450 MHz radiofrequency (RF) radiation for 2 hours....[T]he comet assay protocol used in this investigation...is very similar to that used by Lai and Singh. Contrary to the results reported by Lai and Singh, the results from this investigation, using three different comet slide-processing schedules to enhance the sensitivity of the comet assay, indicate that *in vitro* exposure of human blood lymphocytes to pulsed-wave 2450 MHz radiation did not induce primary DNA damage compared with sham-exposed cells." (See also *MWN,* N/D94, J/F98 and S/O99.)

Süleyman Daşdağ et al., "Do Cellular Phones Alter Blood Parameters and Birth Weight of Rats?" *Electro- and Magnetobiology, 19,* pp.107-113, 2000.

"[E]xposure of normal and pregnant rats to low-level [SAR=0.155 W/Kg] 915 MHz RFR did not cause detectable shifts of erythrocyte or leukocyte numbers in peripheral blood, nor did it influence the course and the outcome of pregnancy. The only consistent finding related to the RFR exposure was lowered birth weight, which was overcome in postnatal development during a three-month period. It is unclear whether this finding demonstrates a specific action of RFR or is the result of a nonspecific stress reaction."

Letters to the Editor

More On Measuring Polarization

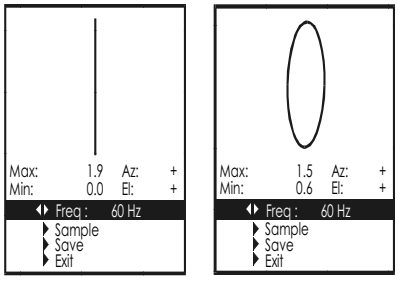
Enertech's WaveCorder

April 15, 2000

To the Editor:

The March/April 2000 issue of *Microwave News* featured an article on EMF polarization, including a sidebar on p.3 entitled "Measuring Polarization: Neither Easy, Nor Cheap." This sidebar stated that the Multiwave magnetic field meter is the only meter that can measure polarization of a magnetic field. However, we want to inform your readers that the EMDEX WaveCorder can also measure magnetic field polarization. The WaveCorder is a portable, state-of-the-art waveform capture instrument which has been used on many EMF studies, including the 1995-96 DOE EMF RAPID Project #3 (Non-Residential Environmental Fields Survey), the 1995-99 statewide survey of California schools for the California Public Health Foundation and other workplace environment surveys.

The EMDEX WaveCorder, manufactured by Enertech Consultants, can measure and display the polarization ellipse of the magnetic field. The polarization ellipse is displayed graphically on an LCD screen (see illustration at left). In addition, the minimum and maximum magnetic field ellipse values are displayed numerically. Using a scrolling list of frequency values, the user can view the graphical and numeric display of the magnetic field ellipse for the fundamental frequency (e.g., 60 Hz) and for its harmonics. Domestically priced at $7,000, the EMDEX WaveCorder also stores and records magnetic field waveshapes, downloads data to a personal computer and has custom software for magnetic field waveform display and analysis.



Samples of linear (left) and elliptical polarization magnetic field data as displayed on the EMDEX WaveCorder magnetic field meter LCD.

Contrary to what has been stated, it is both cheap and easy to make practical estimates of polarization. All it takes is a single-axis magnetic field meter ("Power Frequency Fields in the Home," *IEEE Transactions on Power Delivery, 4,* pp.465-478, January 1989). The user must measure the components (B_x, B_y, and B_z) of the magnetic field along three orthogonal axes. The resultant magnetic field, B_r, is equal to the square root of the sum of the squares of the three orthogonal components. Then, the user must adjust the orientation of the meter until the reading reaches a maximum (B_{max}). The field is linearly polarized when $B_r=B_{max}$ and is circularly polarized when $B_r=1.41B_{max}$. The degree of polarization, expressed by the axial ratio between the minimum and maximum axes of the field ellipse, is given by $[(B_r/B_{max})^2-1]^{0.5}$. Many three-axis meters, such as the EMDEX II, can record all three orthogonal axis values and also display a single axis value (to evaluate polarization). Although not exactly coincident in time, these three-axis measurements provide a practical and inexpensive evaluation of polarization.

Thank you for allowing us the opportunity to clarify this issue regarding our instrumentation and its capabilities.

Sincerely,

H. Christopher Hooper
Enertech Consultants
300 Orchard City Dr., Campbell, CA 95008
(408) 866-7266
E-mail: <chrishooper@enertech.net>

In preparing the article, Microwave News *contacted Enertech to see if the company had an instrument that measured polarization. We were told that the answer was no. In fact, a software upgrade does allow the WaveCorder to measure polarization.*

Monitor Industries' Analog Meter

May 1, 2000

To the Editor:

You reported that the impressive Electric Research Multiwave system is the only way to determine elliptical polarization of a 60 Hz magnetic field. Not so. While it is true that an ordinary three-axis meter can't do that task, any good single-axis meter can.

The major axis of the ellipse is simply the highest-reading field direction, while the minor axis is the highest-reading direction at right angles to that; and the two field strengths give the degree of elliptical polarization. This is not hard, but doing these maximizations accurately is quickest and easiest with a meter having a good *analog* readout (such as I sell for somewhat less than the ten kilobucks you mention). In addition, the directional capability of a single-axis meter is essential for various field-source tracking chores.

Sincerely,

Ed Leeper
Monitor Industries
6112 Fourmile Canyon, Boulder, CO 80302
(303) 442-3773

Czech Panel on the Precautionary Principle and Numerical Limits

This spring, Dr. Jan Musil, the chair of the National Institute of Public Health's Advisory Board on Non-Ionizing Radiation in the Czech Republic, sent Microwave News *the following statement on behalf of the ten-member board. He noted, however, that it does not represent an official position of the Czech Ministry of Health. Musil is the coauthor of* Electromagnetic Fields and the Life Environment *(San Francisco: San Francisco Press, 138pp., 1971), as well as many other publications.*

At their *3rd Ministerial Conference on Environment and Health* in June 1999, the World Health Organization's (WHO) European member states urged the WHO and other health agencies to take into account "the need to rigorously apply the precautionary principle in assessing risks and to adopt a more preventive, proactive approach to hazards." Unfortunately, in our view, this approach has not been consistently applied to the evaluation of EMFs.

Our perspective on the EMF problem was published by the Czech Republic's National Institute of Public Health (NIPH) in June 1999 as a supplement to the Czech translation of the WHO Regional Office for Europe's publication, *Electromagnetic Fields*.[1] We would now add the following to that statement:

We regret that the EU Council of Ministers' Recommendation of 12 July 1999, *On the Limitation of Exposure of the General Public to EMFs (0 Hz to 300 GHz)*,[2] ignored the opinion of the European Parliament. The parliament pointed out that the "basic restrictions" adopted by the council "include large safety factors only with respect to the thresholds for acute effects."[3]

Emphasis on the need for more caution in words only, without introducing more stringent limits for chronic exposure in numerical form, can be intended only for an ideal world with ideal people. The Italian and Swiss governments are taking a more practical approach to real-world situations, with stringent limits for long-term exposure.[4]

We also welcome the concerns expressed last year by the U.S. government's Radiofrequency Interagency Work Group on the revision of the ANSI/IEEE RF/MW exposure standard.[5] We refer particularly to the sections on acute and chronic exposures ("The past approach of basing the exposure limits on acute effects data with an extrapolation to unlimited chronic exposure durations is problematic"), on pulsed or frequency-modulated RF radiation ("Exposure guidelines based on thermal effects...and concepts...that mask any differences between intensity-modulated RF radiation exposure and CW exposure...may not adequately protect the public") and on time averaging ("The 0.1 hour approach historically used should be reassessed").

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1. *Electromagnetic Fields*, Local Authorities, Health and Environment Briefing Pamphlet Series: 32, Copenhagen, Denmark: World Health Organization Regional Office for Europe, 24pp., 1999.

2. *Official Journal of the European Communities, L199,* pp.59-70, July 30, 1999. [See *MWN,* S/O99.]

3. See Amendment 13 to "Proposal for a Council Recommendation on the Limitation of Exposure of the General Public to Electromagnetic Fields, 0 Hz-300 GHz," *Official Journal of the European Communities, C175,* p.132, June 21, 1999. [See *MWN,* J/A99.]

4. See, for example, "Switzerland Adopts Strict Limits for Cell Towers and Power Lines," pp.1,6-7, and "Italian Wireless Radiation Limits Enter Second Year," *Microwave News,* p.7, January/February 2000.

5. "U.S. Government Group Identifies 14 Issues To Be Addressed in Revision of ANSI/IEEE RF/MW Exposure Standard," *Microwave News,* pp.13-14, July/August 1999.

New Books: Short Reviews

Robert Park, ***Voodoo Science: The Road from Foolishness to Fraud,*** 234pp., $25.00, New York City: Oxford University Press, 2000.

Robert Park is a man on a mission. He has dedicated himself to debunking belief in UFOs, homeopathy, cold fusion, perpetual motion — and EMF health effects. Much of the book is clear-sighted, but Park goes astray when he enters the EMF debate, a controversy in which he has been personally involved. Readers get warm portraits of "Ellie" and "Bob" Adair and Allan Bromley, President Bush's science advisor. Park states flatly that nonthermal RF/MW bioeffects are impossible, but a large number of biologists disagree. Like physicist Park, these scientists also believe in the second law of thermodynamics and understand the difference between ionizing and non-ionizing radiation. Yet Park acts as if they were trying to sell him a perpetual motion machine. Much of what Park writes about EMF studies is simply wrong. He dismisses David Savitz's data on brain cancer among electric utility workers as a chance finding resulting from multiple comparisons. Park does not mention that an industry-sponsored analysis of 29 occupational studies found significant evidence for a brain tumor risk (see *MWN,* J/F96). Park states flatly that the NCI study "slammed shut" the possibility of an EMF–leukemia link — but does not mention that it found a significant risk for children with exposures over 3 mG (see *MWN,* J/A97). Park writes that too many people "judge science by how well it agrees with the way they want the world to be." To his credit, he acknowledges that scientists can fall prey to this as well.

Ferdinando Bersani, ed., ***Electricity and Magnetism in Biology and Medicine,*** 1,019pp., $199.00, New York City: Kluwer Academic/Plenum, 1999.

There is a lot here — some 250 papers first presented at the *2nd World Congress for Electricity and Magnetism in Biology and Medicine,* held June 1997, in Bologna, Italy (see *MWN,* J/A97). Although much has happened in the last three years and these papers are necessarily brief, this volume provides a useful snapshot of the research landscape for those interested in both hazards and medical applications. Bersani highlights papers on cellular phones and on EMF effects on melatonin, as well as the more general question of nonthermal bioeffects. But the greatest value of this book is in its breadth — there are few areas of bioelectromagnetic research that go unmentioned.

On the Internet

New from Hardell on Brain Tumors

Dr. Lennart Hardell has reported an even stronger link between mobile phone use and brain tumor location than the one he published last year (see *MWN,* M/J99). The new paper appears in the online journal *Medscape General Medicine,* at **<www.medscape.com/Medscape/GeneralMedicine/journal/public/mgm.journal.html>**. In a further analysis of the same 209 cases and 425 controls, Hardell found that those using cellular phones were 2.4 times more likely to develop a tumor in the brain lobes closest to the phone's antenna. When the effects of other risk factors such as ionizing radiation were taken into account, the risk from mobile phone exposure became stronger and was statistically significant. *Medscape General Medicine* is a peer-reviewed online journal, established last year. Its editor is Dr. George Lundberg, former editor of the *Journal of the American Medical Association*. Hardell is at Sweden's Örebro Medical Center.

Better BEMS Web Site

The Bioelectromagnetics Society (BEMS) has upgraded its Web site, **<www.bioelectromagnetics.org>**. The society's bimonthly newsletter is now available online, although members will continue to receive a copy by mail. BEMS members can also access the membership directory after completing a short registration form. The site is being run by Dr. Stefan Engström of the Neuromagnetics Institute at Vanderbilt University in Nashville, TN.

Andy Marino: Documenting the EMF Issue

Dr. Andrew Marino is putting his life's work on the Web. "My intention is to document the history and evolution of the whole issue of biological effects and health risks of electromagnetic fields," he told *Microwave News* in a recent interview. Marino, a professor in the Department of Orthopedic Surgery at the Louisiana State University Medical Center in Shreveport, has already put many of his research papers on his personal site, **<www.ortho.lsumc.edu/Faculty/Marino/Marino.html>**, and he is slowly catching up with the backlog. While most of the papers are linked to the abstracts in the National Library of Medicine database, there are complete PDF files of some of the more recent ones. Marino has also posted the full text of his 1982 book, *Electromagnetism & Life,* written with Dr. Robert Becker (see *MWN,* June82).

Cellphone Cyberpoll

"Are you afraid of getting brain cancer from using a cell phone?" That's the question posed in April by Etown.com, which bills itself as "the Web's most complete resource for consumer electronics." 53% of those who responded to the informal survey said Yes, while 41% said No. The other 6% said that they "don't need or want a cell phone, no matter what." Fear of developing a tumor had led 17% to reduce their phone use and 3% to stop using their phones altogether, while 16% had put off buying a phone and 4% had bought a shielding device. In addition to online shopping for tech toys, Etown.com offers what it describes as "behind-the-scenes, up-to-the-minute, no-holds-barred reportage and consumer advice." Go to: **<www.etown.com>**. An article in another part of the site describes hands-free devices as the "one solution short of chucking your Nokia into the trash" (see also p.4).

IEEE SCC-28 Standards Panel

Keeping track of the IEEE's Standards Coordinating Committee (SCC) 28 has gotten much easier. The committee develops guidelines on exposures to non-ionizing electromagnetic radiation, including the well-known C95.1 limits for RF/MW exposure. SCC-28's new site, **<grouper.ieee.org/groups/scc28>**, offers information on IEEE's standard-writing procedures and upcoming meetings, as well as capsule descriptions of the committee's ongoing projects. Also available, as a PDF file, is a 107-page list of papers reviewed in updating the C95.1 standard (see p.6).

"Microwave News" Flashback

Years 15 Ago

• A former radar technician sues the Federal Aviation Administration, claiming that his brain tumor was caused by exposure to microwave radiation. Two of his coworkers are also being treated for cancer.

• Researchers at Sweden's University of Göteborg find that radar workers exposed to microwave radiation develop abnormal protein patterns in their cerebrospinal fluids.

• The Soviet Union raises its standard for RF/MW (300 MHz-30 GHz) exposures of the general population from 5 $\mu W/cm^2$ to 10 $\mu W/cm^2$.

Years 10 Ago

• Two manufacturers announce they will introduce electric blankets that reduce magnetic field exposure by 95%.

• Environmental Protection Agency (EPA) staff recommend that ELF EMFs be classified as "probable human carcinogens," placing them in the same category as PCBs, DDT and dioxin, but senior managers later overrule this conclusion. Meanwhile, EPRI president Dr. Richard Balzhiser visits the White House; EMFs are on his agenda.

Years 5 Ago

• A Polish team finds that military personnel exposed to RF/MW radiation have significantly higher rates of leukemia and lymphoma. The ongoing study reports that younger soldiers are particularly at risk—with rates up to eight times higher than expected.

• EPA staff is concerned that an NCRP committee composed primarily of physicists and engineers may exceed its mandate and develop health standards for modulated RF/MW radiation.

• Separate studies at Mt. Sinai Medical Center in Miami Beach, FL, and the Mayo Clinic in Rochester, MN, conclude that cellular phones can interfere with cardiac pacemakers.

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UPDATES

CELL PHONES & THE BRAIN

More EEG Effects Observed... In a spoken-word memory test, mobile phone radiation produced significant changes in electroencephalogram (EEG) readings, according to a new study by researchers in Finland. "The effect which mobile phone signals seem to have on the EEG during cognitive processes might be one factor explaining our earlier behavioral findings," Dr. Christina Krause of the Helsinki University of Technology and the Center for Cognitive Neuroscience (CCN) in Turku told *Microwave News*. Krause was a member of a team led by Dr. Mika Koivisto, also of the CCN, which observed that volunteers exposed to mobile phone radiation performed faster on two types of tests of reaction time (see *MWN*, M/A00). In the latest experiment, published in the March issue of *NeuroReport (11,* pp.761-764, 2000), Krause, Koivisto and colleagues asked volunteers to listen to a list of four Finnish verbs. After a pause, a verb was read and volunteers indicated whether it had been part of the list of four. This test was repeated with different words for about an hour, with the phone turned on half of the time. Researchers knew whether the phone was on or off, but the subjects did not. The GSM signal caused no significant EEG changes while the initial list of verbs was being read—that is, during "memory encoding." But Krause found that during "memory retrieval"—when volunteers were deciding whether the fifth verb was part of the earlier list—RF/MW exposure significantly altered the shape and timing of the EEG response. Though the results were based on only 14 subjects, they were highly significant (with p values ranging from 0.0001 to 0.02). Exposure "appeared to decrease cortical activity during auditory information retrieval," the paper states, while accuracy was unchanged. Could mobile phone exposure be enabling the brain to achieve the same result with less work? "This might be the case, but we don't know yet," said Krause. She pointed out that in this study, "the subjects performed a very easy memory task." Repeating the experiment with more complex tasks, she suggested, will shed more light on the effects of mobile phone radiation on cognition. Krause added that her group has already done such a study. (She declined to discuss the results, since the study has been submitted for publication but not yet accepted.) "Of course," Krause and colleagues conclude, the "subtle effects" seen to date "do not allow any conclusions concerning the possible effects of long-term cellular phone use."

"JUNK SCIENCE"

Campaign "To Subvert the IARC Study".. The tobacco industry conducted an aggressive campaign "to stop, affect the wording of, delay and counteract" a study of secondhand tobacco smoke by the International Agency for Research on Cancer (IARC), according to an analysis in the April 8 issue of *The Lancet* by Elisa Ong and Dr. Stanton Glantz of the University of California, San Francisco. In a 1993 "Action Plan" on the IARC study, industry leader Philip Morris Inc. (PM) listed several goals, including: "Develop a program to generate support for [the concept of] 'junk science' and education on the use and abuse of epidemiology, possibly through a coalition on bad science." To that end, write Ong and Glantz, in 1993-1994 "PM and the public relations firm APCO Associates worked to launch the Ad-

vancement of Sound Science Coalition....PM wanted a similar organization in Europe at the end of 1994," and the apparent result was the European Science and Environmental Forum (ESEF). ESEF criticized IARC on secondhand smoke, argued against concerns over global warming and defended nuclear power. Ong and Glantz note that PM "expanded its 'sound science' discussion to issues beyond secondhand smoke, masking the industry's role as the initiator or sponsor of these programs." The tobacco industry not only tried to influence the public's view of the IARC study—it sought to affect the scientific process itself. Among the "IARC Objectives" listed in an internal PM memo in 1993 were: "Delay the progress and/or release of the study" and "Affect the wording of its conclusions and official statement of results." Industry consultants met with IARC researchers to influence the study's methodology and gain information — but Ong and Glantz note that in these meetings, "the consultants did not always disclose their industry affiliations." PM also commissioned two studies which it thought would have more favorable conclusions at a projected cost of $4 million, to be completed in advance of IARC's research. (The ten-year IARC study cost less than $3 million.) Ong and Glantz conclude that, "Scientists and policy makers need to understand that they function in an environment that is heavily influenced by covert tobacco industry efforts to subvert the normal decision-making process," in both research and regulation.

PEOPLE

Dr. **Thomas Tenforde** of the Battelle Pacific Northwest Labs in Richland, WA, has stepped down as vice president for non-ionizing radiation of the National Council on Radiation Protection and Measurements (NCRP) in Bethesda, MD. He has been replaced by **Ronald Petersen** of Lucent Technologies in Murray Hill, NJ. In April, Tenforde was elected an honorary member of the council. Among those newly named to six-year terms on the NCRP were Drs. **Kenneth Foster** of the University of Pennsylvania in Philadelphia (presently on sabbatical at the WHO in Geneva, see p.5), **John Moulder** of the Medical College of Wisconsin, Milwaukee, and **Daniel Wartenberg** of the Robert Wood Johnson Medical School in Piscataway, NJ. And Dr. **Larry Anderson**, also of the Battelle labs, was reelected to the NCRP.... **Jerry Ulcek**, who has long worked with Dr. **Robert Cleveland** at the FCC in Washington, is moving to Denver. Ulcek will continue to work on RF safety issues for the FCC, concentrating primarily on measurements and compliance matters. Meanwhile, the FCC is seeking to hire an RF policy analyst for its Washington headquarters....Dr. **Michael Repacholi** is usually identified in these pages as the director of the WHO's International EMF Project. But since last October he has also been the coordinator of Occupational and Environmental Health at the WHO. As a result, he is now leading another six programs....Catching up on two other Australians who have also moved to Europe: **Michael Dolan** left the Electricity Supply Association of Australia (ESAA) in Melbourne last year to join the Federation of the Electronics Industry in London, where he is with the mobile telecom advisory group; and Dr. **Jack Rowley**, formerly with Telstra, the Australian telephone company, has become the director of environmental affairs at the GSM Association in Dublin....**John Ott**,

Microwave News Gets There First

Microwave News, July/August 1998

"Magnetic Fields Seen as Possible Treatment for Malaria: In the Lab, EMFs Can Be Toxic to Parasites"

"Outwitting Malaria: Magnetic Fields May Poison Parasites, Overcoming Drug Resistance"

Newsday (NY), May 2, 2000

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—Dr. Robert Park, Forbes, *May 15, 2000*

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the author of *Health and Light* (1973) and *Light, Radiation & You: How To Stay Healthy* (1982), died in April at the age of 90.

RF & ANIMAL BEHAVIOR

Weak GSM Signal Does Not Affect Mice... Pulsed RF/MW radiation did not alter learning or short-term memory among mice in a new U.K. study. Animals were exposed over a ten-day period for 45 minutes each day to 900 MHz fields, pulsed at 217 Hz to mimic a GSM digital phone signal and with whole-body SARs estimated to be about 0.05 W/Kg. Following each day's exposure, the mice were placed in a maze with food rewards at the end of each of eight arms. The exposed mice were, on average, just as able to remember which arms of the maze they had already visited as were the controls, Dr. Zenon Sienkiewicz of the U.K.'s NRPB and colleagues report in the April issue of *Bioelectromagnetics (21,* pp.151-158). In 1997, Dr. Henry Lai of the University of Washington, Seattle, caused a stir in the British press when he discussed his finding that exposure to pulsed 2450 MHz microwaves at an SAR of 0.6 W/Kg impaired the performance of rats in a similar radial arm maze (see *MWN,* S/O99). Lai's research was originally published in 1994 *(Bioelectromagnetics, 15,* pp.95-104). In an interview, Lai said that he "was not surprised" by the new study's results. "We found no effect at 0.3 W/Kg." He noted that the SARs that did produce an effect were an order of magnitude higher than those used by the NRPB team. Sienkiewicz explained to *Microwave News* that the 0.05 W/Kg SAR in his study "was the highest we could produce with the available equipment." Experiments with exposures of 0.005, 0.01 and 0.5 W/Kg are under way, he said.

Keeping Current: Follow-Up on the News

◆ The mayor of San Francisco and other city officials are the focus of an influence-peddling investigation by the FBI after TV broadcasters were given permission to place new antennas on Sutro Tower without holding public hearings, the *San Francisco Examiner* reported on April 30 (see also *MWN,* J/A97).

◆ The Australian Senate is seeking public comment for its inquiry into mobile phone safety (see *MWN,* J/F00). Sen. Lyn Allison, who is leading the probe, plans to hold hearings. Meanwhile, proposals for the second set of mobile phone health studies sponsored by Australia's National Health and Medical Research Council were due on May 26 (see *MWN,* S/O98).

◆ On April 10, the FCC asked for public comment on whether it should preempt a local decision blocking a proposed DTV tower on Lookout Mountain near Denver (see *MWN,* J/F00). Comments were due May 25, and the FCC has put them on the Internet at: <www.fcc.gov/Bureaus/Mass_Media/Filings/index.html>.

◆ The Ear Task Force of SCC-34/SC-2 has developed an engineering method for averaging SARs in various parts of the body, including extremities (see *MWN,* N/D99 and J/F00). The full SC-2 is voting on whether to forward the proposal to SCC-28/SC-4 to evaluate its biological merits. Ballots are due May 26.

◆ Some recently released statistics: In Japan, mobile phone subscribers now outnumber those using fixed-line phones; China with more than 35 million users is the third largest mobile phone market after the U.S. and Japan; and Nokia's CEO has predicted that the number of U.S. users will double by the end of 2002. In May, the U.S. had more than 92 million wireless subscribers.

Late-Breaking News

◆ Motorola told *Microwave News* in mid-May that an Illinois judge had dismissed the lawsuit by Robert Kane, a Motorola engineer who charged that his brain tumor was caused by radiation from a prototype cellular phone antenna that he tested for the company (see *MWN,* J/F94, M/A94 and J/A 94). Kane's lawyer, Robert Barnow of Barnow & Goldberg in Chicago, did not return calls requesting comment. At press time, Motorola had provided no further details.

◆ Roundworms produce stress-response proteins after nonthermal levels of RF/MW exposure, according to a report in the May 25 issue of *Nature* by a team led by Dr. David de Pomerai of the U.K.'s University of Nottingham. The changes were observed at an SAR of only 0.001 W/Kg, and de Pomerai suggests that "current exposure limits for microwave equipment may need to be reconsidered."

The Stewart Report's Call to Action

Wireless phones may present a danger to public health — or they may not. The facts are uncertain, but the phones are already used by hundreds of millions of people around the world.

Until there is a clear verdict on mobile phone safety, how should we respond? It is a difficult question, but someone has finally taken it on. The common-sense recommendations of the expert group headed by Sir William Stewart (see p.1) should be implemented without delay — and not only in Britain. They are a model that other countries should follow.

The mobile phone issue has had its share of expert panels in the past. At most, they have issued calls for more research.

More research is certainly needed, but in the meantime we have large numbers of people using a product of uncertain safety. The Stewart panel is the first official group to recognize that some action is needed now.

If we wait for the final study to be published, it may turn out to be too late. That is why the commission calls for a "precautionary approach" to the use of mobile phones, until our "gaps in knowledge" are filled. This is what unites the specific measures advocated in its report.

Critics have called the Stewart report alarmist — especially for its recommendation that children not use wireless phones. Just because mobile phones have not been conclusively proven safe, they argue, does not mean we should be worried about a potential hazard. According to the expert group's logic, wrote London's *Financial Times,* "children should not eat strawberries unless absolutely necessary," since strawberries could also carry unknown risks.

What these arguments miss is that we are not operating in a complete vacuum of knowledge. We *do* know something about mobile phone safety, and what we do know is enough to raise concerns.

For example, existing exposure limits are based on the assumption that RF/MW radiation cannot harm health except by heating. But the Stewart expert group — like the Royal Society of Canada panel before it — concludes that there is growing scientific evidence of biological effects below these levels (see *MWN,* M/J99).

Several recent European studies have shown that short-term exposures to cellular phone radiation can alter brain function (see p.7 and p.16 and *MWN,* M/A99 and M/A00). These effects have not been shown to be harmful, but they do raise the question of what might happen over the long-term.

And there are individual studies that point to RF-induced increases in genetic damage or cancer risk. A doubling of the risk of lymphoma was observed in RF/MW-exposed mice over two years ago in a classical toxicological study by Dr. Michael Repacholi, now with the World Health Organization (WHO) (see *MWN,* M/J97). Repacholi — who served on the Stewart panel — is one of those who believe that its precautionary emphasis went too far (see p.5). "It seems to me that the committee wanted to address public concerns more than the science," he told *Microwave News* in May.

It would be absurd to ban cellular phones on the basis of the scattered data that point to some health risks. But it is just as absurd to pretend that these data do not exist, or that they should not affect our actions. The ostrich-like approach of the WHO does not serve what should be its primary mission — the protection of public health.

How do we cope with uncertainty? Not by ignoring it, but by taking some elementary precautions. The Stewart expert group has outlined what must be done.

Burying a Still Warm Body

The pendulum appears to be swinging back to electric fields. For 15 years practically all EMF research has focused on magnetic fields, but the latest epidemiological studies from Canada point to large risks when exposures to electric fields are taken into account (see p.1).

When we reported initial results from this same group four years ago (see *MWN,* J/A96), Dr. David Agnew of what was then Ontario Hydro predicted that its provocative findings would prompt further research. With the exception of his own colleagues, he was wrong.

Will the latest results also be ignored? We wondered the same thing a couple of months ago when we reported on the potential importance of EMF polarization.

While too many electric utilities seem increasingly inclined to dismiss the EMF issue, we are happy to acknowledge that the new work was supported by a Canadian utility.

In fact, it is ironic that a utility is more interested in learning about possible EMF public health risks than are U.S. health agencies, which have basically abandoned the field since the end of the RAPID program.

Indeed, funding for EMF studies has been shut off just as new results on a number of fronts suggest possible explanations for the EMF–cancer connection observed in 20 years of epidemiological studies: polarization, electric fields, threshold effects and charged particles, to name a few. The body of evidence for an EMF–cancer link, both in occupational and residential studies, is stronger than ever.

In short, the issue is being buried alive.

But anyone who has ever watched a horror movie knows what happens when you bury a still warm body. Just when you least expect it, a hand pops out of the freshly turned earth.

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Maximum EMF Exposure Emerges As Strong Miscarriage Risk

A new and innovative epidemiological study has found an up to sixfold increased risk of spontaneous abortions among women exposed to magnetic fields of 16 mG or greater. The results "should have wide implications," concludes Dr. De-Kun Li, who led the study team at Kaiser Permanente's research division in Oakland, CA.

Unlike past efforts, which have essentially all used average fields, Li focused on *maximum* magnetic field (MMF) as the key index of exposure. While Li found miscarriage risks that are significantly higher for women who had an MMF of at least 16 mG, he saw no excess for women with time-weighted averages (TWA) of 3 mG or more. Nor did he observe any increased risk for elevated spot electromagnetic field (EMF) measurements or with wire codes.

"With TWAs you are diluting any possible effect because you are combining relevant and irrelevant exposures," Li told *Microwave News*. In a paper summarizing his results, Li argued that, "It seemed more plausible to us that MF exposure has a threshold below which any exposure is biologically irrelevant." Li's paper is an appendix to the as-yet-unreleased final report of the California EMF Project (see p.2). An advance copy of Li's paper was obtained by *Microwave News*.

"My study convinced me that EMFs probably have a biological effect," Li said. "We are entering a new chapter in the field of EMF epidemiology. There is more evidence that there is an association — the better-conducted studies consistently show an association."

(continued on p.4)

Large Animal Studies on Cell Phone Radiation Planned in U.S. and Italy

The National Toxicology Program (NTP) will go forward with a series of long-term animal studies to investigate the cancer risk from mobile phone radiation. This is the first time a U.S. government health agency has sponsored a lifetime radiofrequency and microwave (RF/MW) cancer study.

In addition, by the end of the year another set of animal experiments will get under way at the Ramazzini Foundation in Bologna, Italy. "They will be the largest animal exposure studies ever done on electromagnetic radiation," Dr. Morando Soffritti, the scientific director of the foundation, told *Microwave News*. The studies, which will include both RF/MW and EMF exposures, will be paid for with private and public funds, he said.

These two new initiatives will complement the six animal studies that are being jointly sponsored by the European Commission and the mobile phone industry, under a project known as PERFORM-A (see *MWN*, M/A00 and J/A

(continued on p.9)

« Power Line Talk »

Two changes in the membership of the International Agency for Research on Cancer's (**IARC**) EMF Working Group, which will meet in Lyon, France, June 19-26: Dr. **Bernard Veyret** of the University of Bordeaux has joined the group and Dr. **Arnold Brown** of the University of Wisconsin, Madison, has withdrawn due to a medical condition. (For a complete list of the other 21 members, see *MWN,* J/F01.) There will also be at least six observers: Norbert Hankin of the U.S. **EPA**, Drs. Bill Jameson and Christopher Schonwalder of the U.S. **NIEHS**, Dr. David Longfellow of the U.S. **NCI**, Dr. Michael Repacholi of the **WHO** in Geneva and Dr. John Swanson of the U.K. **National Grid** Co. While the observers will not vote on the carcinogenicity of static and ELF EMFs, they will be allowed to present their views and participate in the discussions.

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It was supposed to be on a fast track for validation before the **IARC** review, but the repeat of an experiment that could yield a missing link in the EMF–cancer puzzle has not yet begun. Last fall, Dr. **Michael Repacholi** of the WHO International EMF Project pressured EPRI to repeat the work it had originally sponsored in Dr. **James Trosko**'s lab at Michigan State University in East Lansing. Trosko had shown that 40-50 mG magnetic fields could affect gene expression and, in some ways, act like a tumor promoter (see *MWN,* N/D00). Speaking through the EPRI media relations office, Dr. **Leeka Kheifets** told *Microwave News* that the institute is "definitely" planning to follow up the Trosko study, but as of May, there was "nothing definitive in place." Discussions are under way with potential researchers, she said.

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NIOSH and **EPRI** are jointly funding a study designed to see whether the use of new EMF exposure meters points to significantly higher cancer risks among electric utility workers, compared to the estimates based on data from the EMDEX or Positron meters. On May 4, NIOSH's Dr. **Joseph Bowman** hosted a peer review meeting in Cincinnati at which he and his collaborators, Drs. **Leeka Kheifets** and **Rob Kavet** from EPRI, presented the protocol for the new study. Over the next two years, they will measure full-shift EMF exposures of 500 workers at Southern California Edison Co. (SCE) in Los Angeles using the Multiwave III personal waveform monitor made by Electric Research and a new contact current meter developed by Enertech Consultants. If a higher risk is found, Bowman will seek additional funding to take a second look at the epidemiological cancer data collected by Dr. Jack Sahl at SCE (see *MWN,* M/A93 and J/A93), and perhaps those of Drs. David Savitz and Gilles Thériault (see *MWN* J/F95 and M/A94, respectively). Among the members of the review panel were Dr. **Dan Bracken**, a consultant based in Portland, OR, Dr. **Gary Marsh** of the University of Pittsburgh and Dr. **Teri Schnorr** of NIOSH. "The meeting produced many ideas for strengthening the study," Bowman told *Microwave News*. For more information, contact Bowman at (513) 533-8143 or by e-mail at <jdb0@cdc.gov>.

«« »»

Ahlbom and Feychting Reaffirm Support for Prudent Avoidance

Drs. Anders Ahlbom and Maria Feychting of the Karolinska Institute in Stockholm have again expressed support for a policy of prudent avoidance to deal with the still-uncertain risks associated with power-frequency EMFs.

In a commentary published in the April 14 *Lancet* (pp.1143-1144), the two Swedish epidemiologists endorse their government's recommendation to avoid "unnecessary heavy exposures" when it can be done "without excessive costs or technical difficulties." This has been the national policy since the mid-1990s (see *MWN,* N/D95 and N/D96). Last year, Ahlbom told *Microwave News* that, "In Sweden, with all the space and other resources, one should still exercise prudent avoidance" (see *MWN,* S/O00).

The editorial was prompted by the recent report from the U.K. panel chaired by Sir Richard Doll (see *MWN,* M/A 01). The British group agreed with the conclusion of Ahlbom and Feychting's pooled analysis: The statistically significant doubling of childhood leukemia above 4 mG (0.4 μT) is not likely to be explained by chance (see *MWN,* S/O00). But at the same time, Doll cited the lack of support from physical theory and experimental studies.

While the Doll panel played down the EMF risk to children in the U.K., Ahlbom and Feychting point out that even though leukemia is a rare disease and few English children are exposed to fields above 4 mG, "these small numbers in no way make the problem negligible" and they caution that "a thorough risk evaluation would require more data than [are] available."

Ahlbom and Feychting also write that, "The evidence for an effect of ELF EMF on risk of childhood leukemia remains unconvincing." But in an interview with *Microwave News,* Ahlbom said that "inconclusive" would have better expressed their assessment of the risk than "unconvincing."

An analysis of EMF health risks prepared by the **California EMF Program** is being held up by the state Public Utilities Commission (PUC). Dr. **Raymond Neutra**, the project leader, was set to release the risk report at a meeting of his science advisory panel on Monday, May 7, but late Friday afternoon May 4 the meeting was abruptly cancelled. **Ellen Stern Harris**, of the Fund for the Environment, in Beverly Hills, and a long-time EMF activist, has formally requested that the report be released. "Now that the state is considering the purchase of power lines owned by private electric utility companies, we need to know what the liabilities may be," Harris told *Microwave News*. Anything that can affect power supplies is a sensitive subject in California, which has suffered rolling blackouts. "The report is undoubtedly sitting on the governor's desk," Harris said. Neutra declined to comment, referring questions to the Department of Health Services' press office. At the end of May, a spokeswoman would only say that the PUC had asked for a briefing before the report is released but that it has not yet been scheduled. (See also p.1.)

David Savitz: EMF Epidemiology Has Reached Its Limits

In a commentary on a new study of Swiss railroad workers by Drs. C.E. Minder and D.H. Pfluger of the University of Bern (see p.13), Dr. David Savitz concludes that, "Additional studies similar to past ones are unlikely to yield important new insights." The Swiss paper and Savitz's editorial appear in the May 1 issue of the American Journal of Epidemiology. *Savitz is the chairman of the department of epidemiology at the University of North Carolina School of Public Health in Chapel Hill. He is the president of the Society for Epidemiologic Research and an editor of* Epidemiology. *Savitz talked to* Microwave News *in mid-May.*

***MWN*:** You propose suspending further epidemiological research on EMFs and brain cancer and leukemia until there are better laboratory data which point to a possible mechanism of interaction to guide future studies. Do you think that the existing epidemiological evidence is compelling enough to warrant further experimental work or should we simply resign ourselves to living with some uncertainty over EMFs and cancer?

DS: Based on the epidemiology that has been done so far, I don't think that the public health threat is great enough that the priority for EMF lab research should rise above its competition. Certainly, there is an inherent excitement in the possibility of understanding biophysical mechanisms. But here, too, I believe we need a striking new idea that competes for funding on its merits, not just a general concern with a health threat, before we spend any more money on toxicological studies. We are, in effect, stuck in gridlock.

***MWN*:** If we don't do any more epidemiology or any more lab studies, it's very unlikely we will get any new ideas. Isn't your position somewhat paradoxical, given the recent consensus among epidemiologists from all over the world that the childhood studies do indeed point to an EMF–leukemia risk?

DS: In order to extend that finding through epidemiology, one would need to either locate a population with markedly greater exposures, or identify a method of exposure assessment that is far superior to anything done to date. I believe that a proposal that met either of these conditions would be fundable.

***MWN*:** But even if we don't learn anything new about the EMF childhood cancer risk (the study under way in Japan where exposures are unusually high might surprise us), the majority opinion is that the childhood link does not appear to be a chance association. Are you willing to leave that unresolved too?

DS: Whether we should flesh out the uncertain association observed at high field strengths is not an all-or-nothing decision. Rather it's a question of urgency and opportunity. I think that the urgency is great enough to justify more studies, if there is an opportunity that is markedly better than the ones that have been pursued in the past.

***MWN*:** What about doing more epidemiology for noncancer endpoints such as possible EMF effects on neurological diseases (Alzheimer's and ALS), heart disease and suicides?

DS: For those endpoints, as I noted in the editorial, efforts that exploit data from past studies or that add EMFs to the factors being examined in new studies would be well justified. In other words, applying the tools that were appropriately applied to leukemia and brain cancer would undoubtedly move the issue forward. But whether such EMF risks alone could justify a major new study is open to question.

***MWN*:** Until we can get a clearer picture of the possible risks, do you agree with those who recommend a policy of prudent avoidance — that is, reducing exposures when one can do so at low cost?

DS: In principle, yes. The epidemiologic research suggests that limiting exposures to less than 0.4-0.5 μT (4-5 mG) could have a health benefit. But as a practical matter, given the uncertainty about causality and the magnitude of the risk, it's not clear to me that it's worth the bother. I'll leave that decision to the policymakers.

***MWN*:** In their response to your editorial, Drs. Minder and Pfluger argue that an EMF link to cancer *is* in fact biologically plausible. They point to a large body of work, including that which shows EMFs can cause chromosomal damage. If you had been given the chance, how would you have replied to the Swiss researchers?

DS: I'm really not conversant with EMF experimental work and have to defer to others who are.

***MWN*:** Some years ago in another published commentary* you made some very different arguments: "The value of epidemiologic evidence for decision-making may be the greatest when other biomedical disciplines have the least to offer." And: "Even without a clear understanding of mechanisms, [epidemiologic] observations may provide the basis to modify exposures in order to prevent disease." The glass now appears to be half empty, rather than half full. What prompted your change in outlook?

DS: I continue to believe that epidemiology is capable of addressing health concerns even in the absence of biologic understanding, but what has happened with EMFs is that we've pursued that strategy and gotten the most insight that we can. We've narrowed the range of possibilities, no doubt, but I am very pessimistic that more of the same will advance science or guide policy.

*"In Defense of Black Box Epidemiology," *Epidemiology, 5,* pp.550-552, September 1994.

EPRI's Kheifets To Manage WHO EMF Project in Geneva

EPRI's Dr. Leeka Kheifets will take over day-to-day management of the World Health Organization's (WHO) International EMF Project in early July. She will report to Dr. Michael Repacholi, who launched the project five years ago (see *MWN,* J/A96).

Kheifets will be the head of the WHO radiation program, which covers both ionizing and non-ionizing radiation, and will be the main point of contact for the EMF project, Repacholi said in an interview. She will be based in Geneva.

For the last five years, Kheifets has been the manager of EPRI's EMF program. EPRI, with headquarters in Palo Alto, CA, is the research arm of the U.S. electric power industry.

Dr. Stan Sussman, EPRI's vice president for environmental programs, said that Kheifets's replacement has not yet been named. He predicted that there will be no change in direction or funding of EPRI's EMF program. "If anything, there will be an increase in funding," Sussman told *Microwave News*; he pointed to the ongoing energy crisis in California and the need to build more power lines.

Repacholi announced last year that he would step down as the head of the EMF project, citing overwork and the sometimes heated criticism of his leadership (see *MWN,* N/D00).

Li stressed that 16 mG is not a rare exposure. He noted that approximately 75% of his study population had at least one exposure above this threshold in a 24-hour period. Li said that such peak fields are more likely to come from household electrical appliances and transportation sources than from local electrical distribution lines.

The Kaiser Permanente study has cleared peer review and is scheduled to be published in the November issue of *Epidemiology,* Li said. His results were first disclosed at a meeting convened by the California EMF Program on April 25. Kaiser Permanente is the largest and oldest health care provider in the U.S.

"It's quite exciting if it holds up," Dr. Nancy Wertheimer said in an interview. "More work needs to be done on thresholds and short-term high exposures." Wertheimer, who lives in Boulder, CO, was a member of Kaiser's internal peer review team. Wertheimer and Ed Leeper have themselves reported associations between miscarriages and EMF exposures from electrically heated beds and home electrical heating systems (see *MWN,* M/J86 and N/D88, respectively).

Others have also seen a miscarriage risk due to magnetic fields from video display terminals (see *MWN,* M/J88 and M/A 92) and from power lines (see *MWN,* M/A92).

"Taken together the EMF studies of spontaneous abortions paint a consistent picture," said one epidemiologist, who has read the new Li paper but who asked not to be identified.

The new study is the first prospective study ever done for EMF health risks and the first to use maximum magnetic field exposures to gauge risks. A total of 969 women who had been pregnant for less than ten weeks qualified for the study, and the outcomes of their pregnancies were monitored. They wore an EMDEX meter for 24 hours and were then asked if their activities during that particular day were "typical" of the pregnancy.

"One of the strengths of this study was that we measured MF exposure during the relevant period and used personal measurement to capture MF exposure from all sources encountered by a woman," Li wrote.

Li found that women who were exposed to MMFs of 16 mG or more had 80% more miscarriages compared to those exposed to less than 16 mG — a statistically significant increase. But when women who said that they had worn the EMDEX on an atypical day are eliminated from the study population, the miscarriage risk increases to three times that of the less-exposed women. And for pregnancies lost during the first ten weeks of gestation, the risk is close to six times that of the less-exposed women. All these results are also significant.

Of the 159 women who had spontaneous abortions, 132 had exposures above 16 mG, and of these 95 said that they had taken measurements on a typical day.

For women who were judged to be more susceptible to environmental insults — those who had already had two or more miscarriages or who had fertility problems — the miscarriage risk is three times higher when they were exposed to 16 mG or more. This risk rises to close to five times that of the unexposed women for those pregnancies that were lost before the tenth week of gestation, a time when the fetus is most sensitive to environmental insults. Both these risks are statistically significant.

"All this evidence points to an underlying biological effect of the magnetic field rather than bias or a chance finding," Li said. "If this were a chance finding, you would not expect there to be a difference between typical and atypical exposures and between early and late abortions."

In the interview, Li said that he was "a little disappointed" by the recent commentary on EMF epidemiology by Dr. David Savitz (see p.3).

A number of researchers have argued for the need to look beyond TWAs to measure biologically relevant EMF exposures. For instance, in the early 1990s, Drs. Richard Lovely and Bary Wilson of the Battelle Labs in Richland, WA, pointed specifically to MMF exposure as an alternative exposure index (see *MWN,* M/J93). Until Li, no one had followed up their suggestion.

In a previous epidemiological study, Li found that women with fertility problems who used electric blankets during pregnancy had a greater chance of having babies with birth defects (see *MWN,* S/O95). The risk was ten times higher among women who used electric blankets during the first trimester.

A "Robust" Association

"This population-based cohort study with prospectively measured MF exposure level revealed for the first time (based on our search of Medline) an increased SAB risk associated with a MMF exposure level of ≥ 16 mG. The adverse MMF effect appeared to have a threshold around 16 mG and persisted regardless of the sources/locations of MMF exposure. Prenatal MMF exposure had a greater effect on early spontaneous abortion (< 10 weeks of gestation) when embryos or fetuses are much more sensitive to environmental insults, and among women who may be more susceptible to environmental exposures. The association was much stronger when women whose 24-hour MF measurements may not reflect their true prenatal MF exposure were excluded. These biologically coherent observations, all based on a priori hypotheses, provide strong evidence that prenatal MF exposure above a certain level (possibly around 16 mG) may increase SAB risk. It is also unlikely that the observed association was due to biases or unmeasured confounders, because any such biases or confounders would have to explain the above observations simultaneously. The robustness of the association against potential confounders was further supported by the evidence that, despite adjusting for more than 30 variables of known or suspected risk factors for SAB, the estimates were barely altered. Moreover, prompted by the findings in this study, Lee et al.* reanalyzed the data from the study in which the findings related to TWA exposure led to funding the current study, and confirmed our observed association between MMF and SAB risk. These findings raise the question of the effect of MMF on reproductive outcomes and other health endpoints. The MMF exposure level in our study population was quite comparable to that found in a nationwide survey and our study population was racially/ethnically and socioeconomically diverse. Thus, the findings from our study should have wide implications."

De-Kun Li, "A Population-Based Prospective Study of Personal Exposure to Magnetic Fields During Pregnancy and the Risk of Spontaneous Abortion," unpublished manuscript, May 2001.

*G.M. Lee et al., "A Nested Case-Control Study of Residential and Personal Magnetic Field Measures and Spontaneous Abortions," *Epidemiology,* submitted.

HIGHLIGHTS

« Wireless Notes »

Is the mobile phone industry getting a wide enough range of opinions when setting priorities for health research? Do the skeptics who discount nonthermal, low-level effects have too much sway? These questions have been raised once again by a two-day seminar on ***Mechanisms for Interactions of RF Energy with Biological Systems***, sponsored by the Mobile Manufacturers Forum (**MMF**) and held in Washington, May 22-23. It was organized by Drs. **Mays Swicord** of Motorola and **Sakari Lang** of Nokia, with the assistance of Dr. **Asher Sheppard**, a consultant who works for Motorola under contract. Among the dozen or so invited experts who do not work for the industry were: Drs. **Ken Foster** and **Bill Pickard**, who have argued that we should stop wasting money on non-ionizing health research (see *MWN,* J/F 88), and Drs. **Dean Astumian** and **Jim Weaver**, whose models, at least up to very recently, set thresholds that make low-level EMF interactions very unlikely (see *MWN,* M/A97 and J/A00). Drs. **Ross Adey** and **Ted Litovitz**, each of whom does believe in weak field effects, received invitations but both declined. "They will never come up with mechanisms if they don't believe there are any," Litovitz, of Catholic University in Washington, told *Microwave News*. "People who believe in something work harder to try to find it." (For Adey's pointed views on another industry meeting, see p.12.) In a telephone interview, Swicord said that, "The workshop is not supposed to be controversial — it's not a political meeting," and that the MMF did try to get some fresh points of view. Dr. **Friedemann Kaiser**, a theoretical physicist at the Technical University in Darmstadt, Germany, had been planning to come but he cancelled at the last minute, Swicord said, adding that it's hard to find qualified people who would want to come because "it's not an exciting area." Dr. **Chris Davis** of the University of Maryland, College Park — an attendee who is also openly skeptical about nonthermal effects — pointed to the vicious circle fueled by lack of funding: "There are few scientists in the U.S. who have money to work in this area, and that limits the pool of available contributors to a discussion," he told *Microwave News* before the seminar. "There may be eminent physicists who, if funded, might come up with a mechanism — but no one is receiving any support." Even some corporate insiders see the need for new blood. "We need people with a broader outlook; otherwise it will be a sterile exercise," said Dr. **Q. Balzano**, a Motorola consultant (see p.17) who attended one day of the workshop. "They will have to do it again," he predicted.

CTIA Funds Genetic Studies

On June 1, the CTIA announced that it has awarded three grants to follow up genotoxic effects of mobile phone radiation first reported by Integrated Laboratory Systems (ILS) in Research Triangle Park, NC. This study, originally funded by the CTIA through WTR, found increased chromosomal abnormalities as measured by the micronucleus assay (see *MWN,* M/A99).

Dr. Ray Tice of ILS will receive one of the two grants for *in vitro* work. The other project will be run by Dr. Maria Scarfi of the University of Naples, associated with the Italian Interuniversity Center for the Study of Interactions Between EMFs and Biosystems. Scarfi also works on the EC's CEMFEC project (see *MWN,* M/A00). Dr. Bernd Görlitz of the Fraunhofer Institute in Hannover, Germany, will do an *in vivo* study as an add-on to its PERFORM-A effort (see p.1).

"The contracts follow the scope of work recommended by the FDA and the contractors are those recommended by the FDA," Jo-Anne Basile, a CTIA vice president in Washington, told *Microwave News*. (See also p.6 and p.9.)

British Medical Association Favors Precaution on Phones

The British Medical Association (BMA) in London is advocating a precautionary approach to the possible health effects of mobile phones, including limiting their use by children and keeping calls brief.

In an interim report released on May 24, the BMA notes "large gaps in knowledge" and states that precautions are appropriate "until more detailed and scientifically robust information on any health effects becomes available."

The BMA recommendations parallel those issued by the U.K.'s Stewart panel last year (see *MWN,* M/J00). The BMA states that it "supports the advice given in the Stewart report."

The report also includes a table that summarizes ongoing health effects research in the U.K., as well as some European projects.

The full text of *Mobile Phones and Health — an Interim Report* is available on the BMA's Web site: <www.bma.org>.

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Germany's ICNIRP-based national limits for public exposure to RF/MW radiation are "too high," according to the **Ecolog Institute** in Hannover. It recommends a precautionary limit of 1 $\mu W/cm^2$, independent of frequency. The institute's report cites evidence of adverse effects at levels as low as 20 $\mu W/cm^2$ and argues that reducing the exposures of phone users to 50 $\mu W/cm^2$ or less is an "urgent" priority. "SARs are inadequate for addressing nonthermal biological effects," Dr. **Peter Neitzke** told *Microwave News*. Neitzke is one of the authors of the report and the editor of the institute's quarterly newsletter, *EMF Monitor.* **T-Mobil**, formerly a unit of Deutsche Telekom, commissioned the Ecolog report as well as parallel assessments by Dr. **Jiri Silny** of the University of Aachen and Dr. **Roland Glaser** of Humboldt University in Berlin. The company is in the process of having the reports peer-reviewed, but Ecolog did not wait before publishing its main findings and recommendations, citing the "considerable demand for information." Soon afterwards, T-Mobil announced that the other reports do not call for stricter exposure limits. Ecolog's proposals, it said, are "not supported by science." A company spokesperson told *Microwave News* that it would provide the other reports, but they had not arrived at press time. The Ecolog report, *Mobile Telecommunications and Health,* is in German at: <www.ecolog-institut.de/emf-moni.htm>.

Congress Told Public Needs Better Info on Cell Phone Risks

Federal agencies are not doing enough to help consumers make informed choices about the health impacts of mobile phones, according to a new report from the General Accounting Office (GAO), the investigative arm of the U.S. Congress.

The GAO found that research to date "does not demonstrate" adverse effects, but that some studies "have raised questions about possible cancer and noncancer effects that require further investigation." It predicted that it will take "many more years" to obtain definitive answers. In the meantime, the GAO states that it is "particularly important" for the Food and Drug Administration (FDA) and the Federal Communications Commission (FCC) to give the public "clear, accurate and timely information."

The GAO also cast doubt on the adequacy of the FDA's oversight of the Cellular Telecommunications and Internet Association's (CTIA) ongoing research effort. The GAO calls on the FDA to publicly report whether the CTIA is heeding its advice.

The report was released on May 22 by Sen. Joseph Lieberman (D-CT) and by Rep. Edward Markey (D-MA). FDA's advice for consumers is "out of date and difficult to understand," Lieberman said. He added that the information on phone SARs provided by the FCC on its Web site is "difficult to locate" and "difficult to understand."

Markey emphasized the need to determine whether there are health impacts. With 110 million phone users in the U.S., he said, even a small effect could create "an epidemic size problem." And as long as health questions remain unresolved, consumers "will be required to make their own judgments about the level of risk and what precautions to take."

With respect to past U.S. research, the GAO stated that "many scientists and government and industry officials" questioned the "productivity and accountability" of the industry-sponsored WTR program. A 1994 GAO report noted potential concerns about WTR's "objectivity and credibility" (see *MWN,* N/D94).

Because the industry will choose, pay for and manage projects in the ongoing CTIA–FDA joint research effort, known as a CRADA (see p.5, p.9 and *MWN,* N/D99 and J/A00), Markey was adamant on the need for the FDA to play an active role: "We cannot have a cooperative agreement where an industry which has a stake in the results can handcuff a federal agency."

The GAO noted that the lack of a standard protocol for estimating radiation exposures "results in substantial variation in testing." Lieberman urged the FCC to expedite the completion of the IEEE protocol for measuring SARs, which got under way in 1997 (see p.18 and *MWN,* M/A97 and J/F99).

To assist consumers, the GAO advised, the FDA should develop a new statement on radiation health issues written for a general audience, while the FCC should provide "clear, consistent and easily accessible" information on phone SARs.

In separate letters, dated May 22, Lieberman and Markey told the FCC and the FDA to "implement these sensible steps expeditiously." The letters also proposed that the agencies work together to develop a "single, integrated Web site" for consumers, as well as a telephone information service.

At the press briefing, Lieberman demonstrated how to use a mobile phone with a hands-free set, and noted that he uses such a device himself.

A complete copy of the report, *Research and Regulatory Efforts on Mobile Phone Health Issues* (No.01-545), is available on the Internet at <www.gao.gov/new.items/d01545.pdf>, or may be ordered from GAO at (202) 512-6000, Fax: (202) 512-6061.

Conflict over Australian Senate Mobile Phone Health Report

The chair of a long-running Australian Senate investigation on mobile phones wants the government to do more to protect public health, but finds herself with little support from the other members of her own committee.

In a report issued on May 4, Sen. Lyn Allison, the chair of the six-member investigative panel of the senate's Committee on the Environment, Communications, Information Technology and the Arts, calls for a "rigorous precautionary approach," which would include keeping radiation exposures at levels "as low as reasonably achievable (ALARA)."

Allison recommends a delay in relaxing the Australian national limits for exposures to RF/MW radiation and an annual tax of Aus$5 on every phone user to pay for health research — a total of Aus$40 million (US$21 million) per year.

The other senators on the committee rejected these proposals. In a separate section of the report, the two panel members from the governing Liberal Party state that they see no need for what they call an "enormous increase" in research funding. The panel's three senators from the Labor Party filed their own minority report, which concludes that support for research "does not appear to be inadequate."

All five liberal and labor senators are also backing the adoption of less-stringent ICNIRP-based exposure limits, as proposed by the Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) (see *MWN,* M/A01). The labor senators contend that there is "no compelling scientific argument" for the lower limits that are currently in force.

Allison downplayed the lack of support for her recommendations. "The report gives people access to some of the mounting body of evidence" pointing to possible health risks, she told *Microwave News*. "I am hopeful that public pressure will bring about a more appropriate regulatory framework for radiation exposure in due course."

Sen. John Tierney, a liberal committee member, dismissed the inquiry as a "waste of time," according to the May 5 Sydney *Herald Sun*.

Allison is sharply critical of government health officials for their handling of the mobile phone safety issue. In a statement accompanying the report, she calls ARPANSA's standard-setting process a "sham."

Allison is also questioning the National Health and Medical Research Council's (NHMRC) management of its Aus$4.5 million research program on phones and health (see *MWN,* N/D96, J/A98 and N/D00), suggesting that industry bias has influenced its choice of projects. She recommends that the Commonwealth

Scientific Industrial Research Organization (CSIRO) be put in charge of most of the funds that would be generated by the proposed tax on phone users.

In their comments, the liberal and labor senators defend ARPANSA and the NHMRC.

On some points, the panel members are in agreement. The committee calls for government testing of radiation shields and hands-free kits for mobile phones, and asks the government to consider developing health advisories for parents whose children use mobile phones.

The committee as a whole also recommends the establishment of a national register for reports of health problems associated with phone use. This is based on concerns raised by Dr. Bruce Hocking in his testimony (see *MWN,* N/D00).

The senate authorized an inquiry on health research and exposure standards relating to mobile phones in December 1999 (see *MWN,* J/F00). The panel heard from 52 witnesses from the wireless industry, public health agencies and universities (see *MWN,* S/O00, N/D00, J/F01 and M/A01).

The report, *Inquiry into Electromagnetic Radiation,* is on the Internet at: <www.aph.gov.au/senate/committee/ecita_ctte/Emr/index.htm>.

Industry Group To Close Doors

The Electromagnetic Energy Association (EEA), a Washington-based industry lobby, is closing down.

"Times have changed," said Dr. John Osepchuk, one of its founders. "The focus is more on standard-setting," he explained, and EEA's members "want to concentrate their efforts on fewer paths." Osepchuk formerly worked at Raytheon and is now a consultant based in Concord, MA.

Osepchuk helped set up the Electromagnetic Energy Policy Alliance, as it was initially called, in 1984 to represent manufacturers and users of RF/MW technology (see *MWN,* Mar84). Its current members include AT&T Labs, Lucent, Nokia, Raytheon and the National Association of Broadcasters.

The EEA has sponsored conferences and short courses and issued fact sheets on the radiation safety of various technologies (see, for example, *MWN,* J/A87). In an interview, Osepchuk said that he expects some of EEA's work will be continued by the Institute of Electrical and Electronics Engineers (IEEE). Osepchuk is the chair of the IEEE's International Committee on Electromagnetic Safety.

EEA's difficulties were highlighted recently by the weak response to its conference on the precautionary principle scheduled for May 4 (see *MWN,* M/A01). An e-mail alert sent out by EEA's Washington office described the principle as a "potentially insidious 'virus' directed toward technology." The meeting was canceled soon afterwards due to lack of interest.

Electrosmog Embroils Italy; Vatican To Reduce RF Emissions

Public concern over electromagnetic radiation reached a fever pitch in Italy this spring. Electrosmog, as it is called there, was front-page news as the controversy over radiation health effects raged at the highest levels of government.

On May 3, Willer Bordon, the environment minister, resigned when it appeared that the prime minister would not support his demand that the Vatican radio station comply with Italian radiation limits. Bordon, however, changed his mind a couple days later.

Bordon insisted on enforcing Italy's strict 6 V/m limit for RF/MW radiation. At one point, he threatened to cut the power to the transmitters, which have been blamed for causing higher-than-expected rates of cancer in the nearby community of Cesano (see *MWN,* M/A01).

As the showdown over the Vatican radio was reaching a climax, Bordon tried to push through a 2 mG (0.2 μT) limit for EMFs from new power lines next to homes, schools and playgrounds. This rule was first proposed last year (see *MWN,* M/A00).

But Bordon did not have the support of other members of the cabinet. Dr. Umberto Veronesi, an oncologist who is the minister of health, favors the more lenient ICNIRP standard.

Nevertheless, in at least a partial victory for Bordon, on May 18 the Italian government and the Holy See agreed that the Vatican radio station would meet the Italian exposure standard for its shortwave antennas. Compliance of the Vatican's other transmitters, operating at different frequencies, has been delayed until the end of August.

In an interview with *Corriere della Sera* (April 10), a national newspaper, Veronesi said he was not convinced that electromagnetic radiation was a cancer agent, adding that in his view the control of electrosmog should not be a top government priority.

Dr. Morando Soffritti of the Ramazzini Foundation in Bologna countered in an accompanying interview that practically nothing is known about the health effects of long-term exposures. "There is a nearly total lack of experimental research," he said. The Ramazzini Foundation is a major research center on occupational and environmental health (see p.1).

"We cannot ignore the cancer cluster in Cesano," Soffritti told *Microwave News*. "There is a perception of risk and we have to respond."

In the uproar over RF radiation, two transmitters operated by the U.S. Navy on Camaldoli Hill overlooking Naples were ordered shut down by local authorities, according to April 13 wire service reports. At the end of May, the transmitters that broadcast the American Forces Network were still not operational, according to a military public affairs officer in Frankfurt.

The battle over electrosmog played out during contentious national elections, and some have accused Bordon of being motivated more by politics than by concerns over health. In the May 13 vote, the center-right alliance headed by Silvio Berlusconi came to power, as Bordon lost his own bid for reelection (though he may stay in Parliament with a seat granted by his political party). Also, the Green party, which backed Bordon's electrosmog campaign, did badly and has now lost much of its political influence. It is far from clear whether the new agreement over the Vatican radio and Bordon's EMF initiative will be honored by the new government.

Angelos v. Wireless Industry: Class-Action Lawsuits Filed

Peter Angelos has assembled a network of lawyers to take on the wireless industry. Together, they are pressing a number of class-action lawsuits to force manufacturers and service providers to include a hands-free kit with every phone and to reimburse those who have already bought a phone for the cost of a headset.

Ericsson, Nokia and Motorola, along with Sprint PCS, Verizon Wireless and AT&T, are among the more than 20 defendants.

In complaints filed in Maryland and New York state courts, both on April 19, Angelos argued that phone radiation is capable of producing biological injury, which, in turn, creates a risk to human health, but that hands-free kits can eliminate radiation exposure. In addition, he contended that the wireless industry "knew or...should have known" that phone radiation poses a potential health hazard, and that it sought to "suppress, discredit and/or minimize" research on phone safety.

Last year, Michael Allweiss of Lowe, Stein and Conrad Williams of St. Martin & Williams filed a similar lawsuit in Louisiana on behalf of consumers across the country (see *MWN,* N/D 00). They are now collaborating with Angelos and with another Baltimore lawyer, William Gately of Howell & Gately (see box below).

The Louisiana complaint — originally brought in state court but since removed to federal court — seeks the certification of a national class of plaintiffs, while the other suits cover those phone users living in the states in which they were filed.

Also on April 19, Angelos and Allweiss, together with Joseph O'Keefe of O'Keefe & Sher and Kenneth Jacobsen, filed a complaint in Pennsylvania state court. Jacobson plans to file suit in New Jersey as well. And lawyers at Weinstock & Scavo in Atlanta are working with Angelos on a class-action suit in Georgia.

The members of the network are "all trying to achieve a common goal — to bring these health concerns to people's attention," Allweiss told *Microwave News*.

Angelos is also working with Joanne Suder on a personal injury suit on behalf of Christopher Newman, a physician who claims he developed a brain tumor as a result of using a mobile phone (see *MWN,* S/O00 and J/F01).

The contention that using a wireless phone can lead to brain cancer is not part of any of the class-action suits — in fact, the complaints filed this spring specifically exclude phone users who have been diagnosed with a brain tumor or eye cancer. "In these cases, we're not trying to prove that using a phone has made anyone sick," John Pica Jr. of the Angelos firm said in an interview, noting that this would be harder to demonstrate to a judge or jury.

Responding to the filings, Motorola's Norman Sandler said that using a mobile phone, with or without a headset, poses no known health threat. "We have always maintained that any claim of health risks associated with the use of mobile phones is ground-

Angelos Gives Litovitz $500,000 for EMF Biomedical Research

Peter Angelos and his wife, Georgia, have awarded Dr. Ted Litovitz of the Catholic University of America in Washington $500,000 for EMF research.

"We will use the money to explore therapeutic applications," Litovitz told *Microwave News*. "For example, we will extend our studies on how 60 Hz magnetic fields can protect against damage caused by heart attacks, as well as continue our work on how EMFs can improve the efficacy of chemotherapeutic agents in the treatment of cancer."

Litovitz, a physicist by training, has published a number of papers on the way EMF-induced heat shock proteins help chick embryos survive cardiac stress (see *MWN,* N/D97 and M/J99). Researchers at the Food and Drug Administration have challenged those results, however (see *MWN,* J/A00 and S/O00).

His work on EMF synergy with chemotherapeutic drugs is less well known. Litovitz explained that he has not published these results while he seeks patent protection. He said that he has succeeded in increasing the toxicity of taxol by a factor of five with 60 Hz fields. Taxol is used to treat breast, ovarian and lung cancers.

Angelos made the award through the Peter and Georgia Angelos Foundation, which, like his law office, is in Baltimore. Angelos did not respond to a request for comment.

Angelos has made some major gifts to the Johns Hopkins University, and its medical school, in Baltimore. His firm has won billions of dollars in damages from the tobacco and asbestos industries.

Peter Angelos's Network of Mobile Phone Litigators

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Michael Weinstock

less," he told *Microwave News*.

Currently the lawsuits filed in April are in federal court, in response to a request by Motorola and the other defendants. The plaintiffs are contesting this move, Allweiss said.

The suits have also elicited some sharp criticism from the press. In an editorial headlined MORE DUMB LAWSUITS, the *Washington Post* (April 23) opined that the headset remedy "makes no sense" and that "there is no excuse to go after the phone makers on the basis of 'potential hazard'." The Annapolis, MD, *Capital* (April 25) described the litigation as "frivolous" and "bizarre."

Mobile Phone Animal Studies *(continued from p.1)*

00). In addition, another animal study is scheduled to get under way in China later this year (see *MWN,* N/D00).

Dr. Christopher Portier, the director of the U.S. Environmental Toxicology Program (ETP) and the associate director of the NTP, said that the studies will take about five years and cost approximately $10 million. "It was my decision and Dr. Olden concurred," Portier said in a telephone interview. "I want to see this done."

"With over one billion cell phones in use worldwide, it is critical to obtain scientifically rigorous laboratory studies of the potential for health effects from long-term use of these products," Dr. Kenneth Olden, the director of the NTP and the National Institute of Environmental Health Sciences (NIEHS), told the Raleigh, NC, *News & Observer* (May 22).

Portier said that while he was impressed with the European studies, "We felt that the exposures did not go high enough."

Both mice and rats will be exposed at a number of different levels in the NTP studies, according to Dr. John Bucher, the deputy director of the ETP. "The focus will be on cancer," he said, "but we will also do some general toxicological evaluations." Bucher led a team of ETP–NIEHS scientists that met with the leaders of the Italian and PERFORM–A projects in Europe. "We've been working on this for a long time," Bucher said.

The most important factor still to be decided is how the animals will be exposed. "Dosimetry is a key concern," Bucher noted. The choice is between controlling the dose by restraining the animals or letting them run free in an ambient RF/MW environment. Bucher said that the NTP is leaning toward an unrestrained exposure system.

The tradeoff, Portier explained, is between, on the one hand, accepting the possibility that the effects of the radiation will be hard to separate out from the stress caused by restraining the animals and, on the other hand, not having an exact handle on the dose each animal receives because they are allowed to move around in their cages. Portier is organizing a workshop to discuss these issues at the June 10-14 meeting of the Bioelectromagnetics Society in St. Paul, MN.

In one of the Bologna experiments, rats will be exposed to 1.8 GHz GSM radiation in the far field—there will be five rats to a cage and they will be free to run around. This study will start by the end of the year, at the same time as a parallel animal study on power-frequency EMFs. A second GSM exposure study, scheduled to get under way next year, will expose restrained rats in the near field.

Soffritti said that he would have liked to have done a second set of RF exposures at 900 MHz but did not have the necessary funds.

In the PERFORM-A studies, animals will receive whole-body exposures while restrained in plastic tubes. Pre-studies are about to begin at two of the four PERFORM-A labs: RBM on the outskirts of Ivrea, Italy, and the Fraunhofer Institute in Hannover, Germany. Full-scale studies will get under way at the end of the summer. Pre-studies are scheduled to begin in the two other labs — RCC in Itingen, Switzerland, and the Austrian Research Center in Seibersdorf — in August.

The U.S. studies will be carried out by a contractor to be selected by the NTP. Portier said that the contracting process alone will take a minimum of nine months.

The Food and Drug Administration (FDA) formally requested the NTP studies two years ago; last June, NTP's executive board endorsed the recommendation (see *MWN,* N/D99 and J/A00). Previously, the FDA had tried to convince the cell phone industry's research project, run by WTR, to sponsor animal experiments, but without success (see *MWN,* M/A97).

Mobile Phone Epidemiology: Kenneth Rothman's Proposal

Dr. Kenneth Rothman has proposed that the Cellular Telecommunications and Internet Association (CTIA) sponsor a prospective epidemiological study of 50,000 mobile phone users over the next 10 to 15 years.

"A very strong case" can be made for a cohort study that would estimate radiation exposures as people use their phones, not after cancer has developed, Rothman said at the close of an all-day brainstorming session convened by the Food and Drug Administration (FDA) and the CTIA. The meeting, which was held in Cincinnati on April 18, is part of the ongoing planning process for the FDA–CTIA Cooperative Research and Development Agreement (CRADA) on cell phone research (see p.5, p.6 and *MWN,* N/D99).

Rothman, one of the leading epidemiologists in the U.S., outlined other key features of his proposed study:

- Targeting highly exposed populations — for instance, realtors
- Looking not only at brain tumors but also at other health outcomes — including other kinds of cancers and neurological diseases
- Assessing exposures and monitoring health status on a regular basis, most likely every six months
- Using the Internet to follow participants, who could also answer questionnaires online
- Including a number of different technologies, not just mobile phones.

Rothman told *Microwave News* that he did not have an estimate of what such a prospective study would cost. Rothman teaches at Boston University and is the founder and editor emeritus of *Epidemiology.*

A transcript of the FDA–CTIA panel discussion is available by e-mail from FDA's Dr. Russell Owen at <rdo@cdrh.fda.gov>.

Poland To Tighten Non-Ionizing Radiation Limits for Workers

Poland's Ministry of Labor and Social Policy has set stricter standards for occupational exposures to non-ionizing radiation (NIR). When the new rules* take effect in July, the limits covering most Polish workers will be similar to those of ICNIRP at power frequencies, but significantly lower than ICNIRP in some parts of the RF/MW frequency band.

Poland thus joins Italy and Switzerland in resisting the call for "harmonizing" RF/MW exposure limits, which has been led by the WHO International EMF Project (see *MWN*, J/F00). China and Russia have also rebuffed attempts to loosen their strict standards (see *MWN*, S/O99). Australia, New Zealand and the Czech Republic, on the other hand, have recently favored the ICNIRP approach (see *MWN*, S/O99, J/F01 and M/A01).

Poland is also planning to revise the rules for public exposures to NIR, according to Dr. Stanislaw Szmigielski of the Military Institute of Hygiene and Epidemiology in Warsaw. The current limits, which were adopted in 1998, are generally more stringent than the strictest ("safety zone") occupational limits.

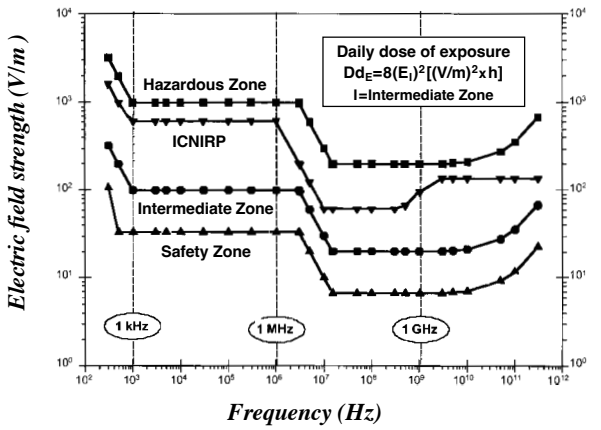
The new Polish occupational guidelines continue the existing system of a three-tiered standard (see figures 1 and 2, at right, and table below). Most workers are covered by the "intermediate" limits, which govern workdays lasting two to eight hours. A higher set of "hazardous zone" limits are for exposures lasting no more than a few minutes a day. Stricter "safety zone" rules cover workers who are not routinely exposed to NIR, as well as those exposed for more than eight hours a day.

At 50 Hz, the maximum allowable electric field exposure during an eight-hour day will be reduced from 15 to 10 kV/m — the same as ICNIRP. And 50 Hz magnetic fields must not exceed 200 A/m (2.4 G), compared to 400 A/m (4.8 G) under the current rules (the ICNIRP limit is 5 G).

At 900 MHz, the new rules specify a maximum of 20 V/m for an eight-hour shift, compared to the existing limit of 27.4 V/m and ICNIRP's 90 V/m. For potentially sensitive groups the new limit is 6.7 V/m. The rules also specify limits for exposures to pulsed radiation (see box at right).

The new limits for 500 kHz-50 MHz magnetic fields are in fact weaker than ICNIRP's. The current maximum level in this range is even higher and has drawn widespread criticism, Szmigielski told *Microwave News*. In response, the labor ministry has sought to find "a reasonable solution" for these frequencies, he said.

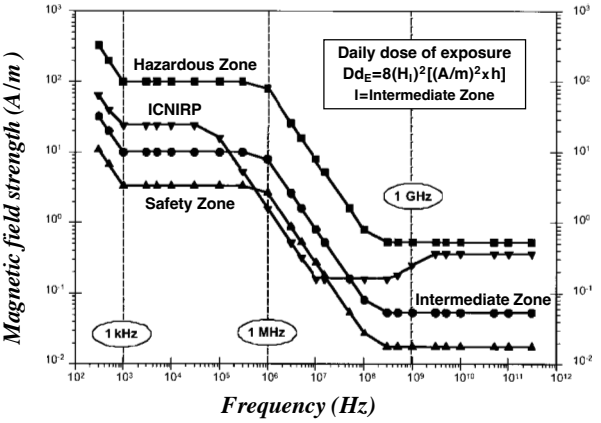
Figure 1: Limits for occupational electric fields



Limits for pulsed RF/MW fields

Frequency	100 MHz-3 GHz	3-10 GHz	10-300 GHz
Limit (kV/m)	4.5	$0.43f_{GHz}+3.2$	7.5

Figure 2: Limits for occupational magnetic fields



*Ordinance of the Polish Ministry of Labor and Social Policy, January 2, 2001, *Journal of Law,* No.4/2001, [para.] 36.

Poland's New Occupational Exposure Limits

	Limit for Electric Field Strength (V/m)			Limit for Magnetic Field Strength (A/m)		
FREQUENCY	SAFETY ZONE	INTERMEDIATE ZONE	HAZARDOUS ZONE	SAFETY ZONE	INTERMEDIATE ZONE	HAZARDOUS ZONE
0.5-50 Hz	5,000	10,000	20,000	20	200	2,000
50-300 Hz	5,000	10,000	20,000	$1/f_{kHz}$	$10/f_{kHz}$	$100/f_{kHz}$
300 Hz-1 kHz	$33.3/f_{kHz}$	$100/f_{kHz}$	$1,000/f_{kHz}$	$1/f_{kHz}$	$10/f_{kHz}$	$100/f_{kHz}$
1-800 kHz	33.3	100	1,000	1	10	100
800 kHz-3 MHz	33.3	100	1,000	$0.8/f_{MHz}$	$8/f_{MHz}$	$80/f_{MHz}$
3-15 MHz	$100/f_{MHz}$	$300/f_{MHz}$	$3,000/f_{MHz}$	$0.8/f_{MHz}$	$8/f_{MHz}$	$80/f_{MHz}$
15-150 MHz	6.7	20	200	0.053-0.0053	0.53-0.053	5.3-0.53
150 MHz-3 GHz	6.7	20	200	0.0053	0.053	0.53
3-300 GHz	$0.16f_{MHz}+6.5$	$0.053f_{MHz}+19.5$	$1.6f_{MHz}+195$	no limits established		

"Portability" of Bioeffects Across Frequencies and Modulations: A Report From an International Workshop Sponsored by the German Wireless Industry

Last December 4-5, a Workshop on Biological and Biophysical Research at Extremely Low and Radio Frequencies (ELF & RF): (1) Application of Research Results Across the Frequencies and Modulation Schemes of Present and Future Wireless Technologies and (2) Demodulation in Biological Systems *was held in Bad Münstereifel, Germany.*

The by-invitation workshop was sponsored by the German wireless industry research group Forschungsgemeinschaft Funk (FGF), in cooperation with BGFE, the occupational insurance provider for the electronics industry, and COST 244bis, the now-defunct European research coordination program; 42 specialists from Europe and the U.S. attended the meeting. The FGF is based in Bonn.

Drs. Roland Glaser (Germany), Christopher Portier (U.S.) and Asher Sheppard (U.S.) prepared an internal draft report on the workshop with the assistance of Drs. Kenneth Foster (U.S.), William Pickard (U.S.) and Bernard Veyret (France). Microwave News *obtained a copy of the draft. It has been edited for length and clarity, and is reprinted below. The FGF published a report on the workshop, based on this same draft, in the April issue of its newsletter, which is in German.*

Introduction

The number and variety of radio technologies have increased dramatically in recent years. In addition to existing cellular telephone systems that use FM, TDMA (GSM), CDMA and other modulations, prominent forthcoming technologies include UMTS cellular telephones and Bluetooth devices for local wireless networking and data transmission. This rapid expansion occurs at a time when evaluations of all potential categories of hazard are incomplete. A prohibitive number of studies would be needed if each modulation scheme were fully tested in a battery of experiments.

A large experimental database demonstrates hazards from acute and chronic exposures only if the body or localized tissues are heated, typically requiring an increase of several degrees. There is also a body of uncertain evidence for bioeffects under exposure conditions that, with varying degrees of certainty, do not produce significant heating. Lastly, there are data showing modulation-specific effects, but no direct evidence for hazardous effects specific to modulation.

Do similar biological effects occur over the range of frequencies and modulation types used in modern wireless communications, or do particular signals have unique biological effects? Rapid technical change in wireless communications and ever-wider human RF exposure add urgency to this long-standing question. The ability to apply biological research data broadly, rather than requiring specific testing for each signal type, has been called "portability."

The workshop addressed three main questions:

1) Whether biological systems respond to modulation of an RF field. A discussion of this topic was moderated by C. Davis (U.S.) and featured presentations by G. d'Inzeo (Italy), Pickard, J. Silny (Germany) and J. Weaver (U.S.).

2) Whether the results of research on ELF fields are relevant for RF modulated at ELF (ELF to RF portability). This session was moderated by C. Portier (U.S.), with talks by U. Bergqvist (Sweden), Foster, S. Johnston (U.K.), A. Lerchl (Germany), R. Meyer (Germany), M. Swicord (U.S.) and Veyret.

3) Whether results obtained with one modulation scheme are relevant for others (modulation scheme portability).

The biological significance of low-frequency signal components encoded in radio signals was addressed in light of normal nerve and muscle activity that produces low-frequency electrical activity in the body over the range from a few Hz to a few kHz. The workshop examined biophysical and biological information to address the hypothesis that biological systems respond to modulated RF signals through direct demodulation or other mechanisms.

For frequencies above ≈10 MHz, there is no evidence that ELF EMFs are produced at biologically significant levels in biological systems as a result of direct demodulation of modulated RF. Moreover, the mechanisms for producing bioeffects by exposure to an ELF field show low-pass properties and are not significant at RF frequencies. Consequently, physical principles indicate that the extensive literature from studies conducted at power frequencies (50/60 Hz) is not directly portable to RF.

An alternative RF research model stresses direct testing, emphasizing epidemiology and studies of laboratory animals exposed to specific signals and exposure scenarios. Guidance from physical mechanisms is given less emphasis than answering questions directly from human health experience and animal research. Generalizations permitting portability would be drawn from phenomenological databases and secondarily would make use of mechanistic models. This research model gives little opportunity to avoid a multiplicity of tests for each of the distinct modes of RF exposure, although in time, confidence in the research and interaction models can build sufficiently to permit setting rules for portability.

Principal Ideas from the Lectures and Discussions

Are results from ELF research relevant to the RF range?

Most participants felt there was no existing theory that would support the linkage of research findings on ELF to RF. No one expressed doubts about the conclusion that exposure to amplitude-modulated (AM) RF fields in the frequency range of mobile telephones is unlikely to produce biologically significant ELF electric fields across the cell membrane, or elsewhere in biological systems. This view is based on biophysical theory and a limited amount of supporting experimental data. Consequently, results from EMF bioeffects research are very unlikely to have any direct bearing on RF exposures.

Are there experimental observations that clearly indicate that modulated RF has specific bioeffects in contrast to unmodulated fields?

There are abundant data showing that modulated high-level RF fields have biological effects and that modulation is an important factor (e.g., microwave hearing). However, these have no direct bearing on RF signals typically used by communications systems.

Although a number of experimenters have reported effects that depend on AM at low levels of RF exposure ("nonthermal" SARs that are below exposure guideline limits set by ICNIRP and ANSI/IEEE), the effects remain isolated to particular *in vitro* systems and have not generated models that can be applied to portability across the various types of AM. Although a few experiments have been repeated successfully in independent laboratories, others have not, and the question of whether modulation is important for bioeffects remains open. Many participants emphasized that established hazardous RF effects of the kinds used in communications systems (pulsed and non-pulsed) are associated only with excessive heating.

What are the demonstrated and potential mechanisms for demodulation in biological systems?

Can biological systems extract an ELF signal from modulated RF fields? In answer to this basic question, the participants could not identify a biological structure that could demodulate the RF signals used in existing and emerging wireless technologies and thereby produce ELF fields at a biologically significant level. Identified nonlinear interaction mechanisms require responses at the carrier frequency of the field and these decline sharply for frequencies greater than a few kHz and

become very ineffective for RF. RF will induce membrane potential changes up to the GHz range, but the potential changes are very small above the cell cutoff frequency, which is typically in the low MHz range. Biological studies show that the maximum frequency at which demodulation can be measured in cell preparations is about 10 MHz, and at that frequency the process is extremely inefficient. It is highly unlikely that the identified nonlinear interactions would produce fields of a biologically significant magnitude by physical demodulation of RF fields induced in the body by low-powered communications equipment.

One idea is that at frequencies above 10 MHz biological structures may cause demodulation through a nonlinear response to RF. This has not been evaluated critically or tested experimentally and therefore remains speculative. Critics have stated that naturally occurring damping mechanisms would prevent nonlinear effects.

There is also a proposal that demodulation might occur because of a direct, time-varying influence on ongoing biochemical reactions. In this case, modulation patterns would be important because rapid variations in RF energy could affect the rates of chemical reactions. For example, reactions involving calcium ions might be affected by sinusoidal or pulsed modulation at ELF frequencies. This speculation has not been developed into a theory that can be subjected to critical review.

Are investigated modulation schemes relevant for other modulations and other carrier frequencies ("modulation scheme portability")?

There was agreement that this form of portability would be supportable only if there were agreement on mechanisms of interaction. At present, only the thermal mechanism satisfies the requirements for portability, and it does not suggest that modulation plays a role for exposures with comparable average SARs. Thermal considerations indicate that, with two exceptions (MW hearing and membrane depolarization), results with different modulation patterns are equivalent if their average heating effects are the same.

What do we know about mechanisms of RF interactions?

Thermal effects have been studied extensively in animals and hu-

Ross Adey Offers a Different Point of View

Microwave News *asked Dr. Ross Adey for his opinion of the FGF workshop report. It is reprinted below. For more than 35 years, Adey worked on the biological effects of modulated and unmodulated EMFs at the University of California (UC), Los Angeles, then at the VA Hospital in Loma Linda, CA, and most recently at UC, Riverside.*

This purported review is one of the most willful and pernicious distortions of a major body of scientific evidence. Its cluttered thinking pays no heed to the historical record of nonthermal bioeffects of amplitude- and pulse-modulated RF fields.

A careful review would have revealed benchmarks — hard won over more than three decades — which have led to a convergence of many key experimental findings and to a consensus strong enough to develop predictive biophysical models that now await experimental evaluation.

There is no discussion of existing support for a logical and hierarchical sequence of events that begins with the transduction of nonthermal EM energy at the surface of the cell membrane and leads to signal amplification and subsequent biochemical events. Nor is the ultrastructure of the cell membrane taken into account. This is critical because it leads to testable biophysical models of the detection of amplitude and pulse modulations.

Such models of ELF demodulation are the basis of the multinational PERFORM-A and REFLEX mobile phone studies, cosponsored by the European Union and the mobile phone manufacturers through the MMF [see p.1 and *MWN,* M/A00]. Yet this industry-based review reaches the egregious conclusion that, "At the present time, the concept of a demodulation process producing an ELF EMF field at a biologically significant level in biological systems exposed to AM RF fields used for telecommunication is not supported by either a defensible theory or direct experimental evidence." Clearly, the industry speaks with a divided voice on the most crucial aspects of its future research program.

Sensitivities to both ELF EMFs and ELF-modulated RF/MW fields have been reported in experiments at progressively more complex levels in the hierarchies of cellular organization.[1] Calcium efflux from brain tissue responds to ELF and to ELF-modulated RF fields. In the same and different cell culture lines, growth-regulating and stress-responsive enzymes respond to ELF fields and to ELF-modulated RF fields. Lymphocyte immune responses are sensitive to both ELF exposures and to ELF-modulated fields, but not to unmodulated fields. Cerebral amino acid neurotransmitter mechanisms are influenced by ELF fields and ELF-modulated RF fields, but not by unmodulated fields. A pivotal study by the U.S. Air Force has reported altered brain chemistry and behavior in mice exposed to pulsed ultrawideband fields at the low SAR of 37 mW/Kg, with evidence that these clearly nonthermal bioeffects involve free radical mechanisms.[2]

In addition, lifetime exposure studies carried out in my laboratory for Motorola showed clear and consistent trends in survival and the incidence of spontaneous and drug-induced tumors with digital exposures — but these results were in no way duplicated with analog exposures.[3]

Government panels have not ignored these important scientific discoveries. In June 1999 the U.S. RF Interagency Working Group identified 14 issues that it believes "need to be addressed to provide a strong and credible rationale to support RF exposure guidelines" [see *MWN,* J/A99]. One of these issues was based on studies that describe "biological responses to nonthermal ELF-modulated RF radiation exposures that are not produced by CW (unmodulated) RF radiation."

In like fashion, the U.K. Independent Expert Group on Mobile Phones (the Stewart panel) concluded in its May 2000 report that, "As a precautionary measure, amplitude modulation around 16 Hz should be avoided, if possible, in future developments of signal coding" (¶5.39). [See *MWN,* M/J00.]

For whom does the report presume to speak in such a crudely biased and uninformed fashion? What is its industrial and corporate constituency? In ancient words still so profoundly true, *res ipsi loquitur*, the matter speaks for itself.

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1. W.R. Adey, "Cell and Molecular Biology Associated with Radiation Fields of Mobile Telephones," *Review of Radio Science, 1996-1999,* pp.845-872. W.R. Stone and S. Ueno, eds. New York: Oxford University Press, 1999.

2. R.L. Seaman et al., "Hyperactivity Caused by a Nitric Oxide Synthase Inhibitor Is Countered by Ultra-Wideband Pulses," *Bioelectromagnetics, 20,* pp.431-439, 1999.

3. W.R. Adey et al., "Spontaneous and Nitrosurea-Induced Primary Tumors of the Central Nervous System in Fischer 344 Rats Chronically Exposed to 836 MHz Modulated Microwaves," *Radiation Research, 152,* pp.293-302, 1999; W.R. Adey et al.,"Spontaneous and Nitrosurea-Induced Primary Tumors of the Central Nervous System in Fischer 344 Rats Exposed to Frequency-Modulated Microwave Fields," *Cancer Research, 60,* pp.1857-1863, 2000.

man subjects and in a large number of *in vitro* biological preparations. Despite many attempts to devise biophysical models for nonthermal effects, none has been experimentally verified or is free from devastating theoretical criticism.

Strategies for future research activities to develop scientific data and tools for risk assessments of emerging RF technologies

There was little support for follow-up research on reported biological effects that were difficult to replicate and not supported by biophysical theory. There was strong support for hypothesis-driven research that could enhance understanding of mechanisms of interaction.

High-duty-rate pulsed fields and AM of the type used for spread spectrum communications (e.g., CDMA) appear less likely to have bioeffects than low-duty-rate pulses and sinusoidal AM signals. Furthermore, studies with low-duty-rate pulsed waveforms were thought more likely to be useful than those with sinusoidal AM.

Conclusions

• At the present time, the concept of a demodulation process producing an ELF EMF field at a biologically significant level in biological systems exposed to AM RF fields used for communications is not supported by either a defensible theory or direct experimental evidence.

• The problem of portability of bioeffects among modulations can be solved by knowing the relevant mechanisms of interaction.

• Or, portability may emerge by development of a substantial database from phenomenological research on each of several RF signals.

• The concept that RF bioeffects are caused by heating is well established. This suggests that average SAR (and not specific waveform characteristics) is the major dosimetric quantity of biological significance. However, controversy exists because, although heating can explain effects observed for high power levels, it does not appear to explain effects reported at low power levels. There often is controversy about the reliability of such effects because of conflicting data or the absence of independent experimental confirmation.

• Further research is necessary on the question of whether modulated and pulsed fields are more effective than unmodulated fields.

• Further research on microdosimetry that applies dielectric theory to cells and subcellular entities is needed to achieve a better understanding of the proposal that, in the absence of overall temperature change, RF energy might influence biochemical processes. However, existing research on heat transport at microscopic dimensions sets the challenge of how RF energy, which cannot introduce significant temperature gradients, might be biologically significant.

Hot New Papers

Julian Peto, "Cancer Epidemiology in the Last Century and the Next Decade," ***Nature, 411,*** **pp.390-395, May 17, 2001.**

"The increase in cancer incidence caused by increased exposure to a carcinogen might not be detectable for several decades, and laboratory testing must remain the first line of defense against potentially dangerous new agents....Epidemiological data on human cancer rates still provide the only reliable evidence that the cancer risks caused by long-established activities such as working in an oil refinery or living near a high-voltage power line are not large."

Yehuda Lerman, Ruben Jacubovich and Manfred Green, "Pregnancy Outcome Following Exposure to Shortwaves Among Female Physiotherapists in Israel," ***American Journal of Industrial Medicine, 39,*** **pp.499-504, May 2001.**

"Exposure to shortwaves [typically 27.12 MHz] was associated with a significantly increased odds ratio (OR) for congenital malformations (OR 2.24, CI 1.27-4.83, p=0.006) and low birth weight (OR 2.99, CI 1.32-6.79, p=0.006). This effect increased in a dose-related manner. After controlling for potential confounding variables, only low birth weight reached statistical significance (OR 2.75, CI 1.07-7.04, p=0.03) ....[T]his study provides further support to earlier reports that occupational exposure of female physiotherapists to shortwave radiation during pregnancy could have detrimental effects on pregnancy outcome, and that shortwave use during pregnancy may be considered as being a potential reproductive hazard."

James Gurney and Nina Kadan-Lottick, "Brain and Other Central Nervous System Tumors: Rates, Trends and Epidemiology," ***Current Opinion in Oncology, 13,*** **pp.160-166, May 2001.**

"The latest available data from SEER [Surveillance, Epidemiology and End Results] show that CNS [central nervous system] cancer incidence rates have stabilized since 1991 in all age groups, including the very elderly. Nevertheless, concern that the changes in environmental toxicants have caused or are causing increases in human neurocarcinogenicity should and will continue to be monitored, assessed and debated.... An area of current concern is the potential risk from exposure to nonionizing EMFs. The hypothesis that human brain cancer can be caused by exposure to ELF EMFs, such as those emitted from 60 Hz power-frequency equipment and power line distribution systems, has been explored in earnest for more than 25 years. The preponderance of the evidence, both biologic and epidemiologic, fails to support an ELF EMF causal relation with brain cancer. Nevertheless, this research area, because of inconsistent findings and public concern, will continue to be explored....Additionally, the rapid and extensive proliferation of handheld wireless RF devices, such as analog and digital mobile tele-

Leukemia and Brain Tumor Risks Among Swiss Railroad Workers

C.E.Minder and D.H. Pfluger, "Leukemia, Brain Tumors and Exposure to Extremely Low-Frequency Electromagnetic Fields in Swiss Railway Employees," ***American Journal of Epidemiology, 153,*** **pp.825-835, May 1, 2001.**

"[T]he authors compared occupations with high average exposures (line engineers: 25.9 μT [259 mG]) to those with medium and low exposures (station masters: 1 μT). The mortality rate ratio for leukemia was 2.4 (95% confidence interval (CI): 1.0-6.1) among line engineers....The mortality rate ratio for brain tumors was 1.0 (95% CI: 0.2-4.6) among line engineers and 5.1 (95% CI: 1.2-21.2) among shunting yard engineers....Two exposure characteristics were evaluated: cumulative exposure in μT-years and years spent under exposure to magnetic fields of ≥10 μT. There was a significant increase in leukemia mortality of 0.9% (95% CI: 0.2-1.7) per μT-year of cumulative exposure to extremely low-frequency magnetic fields. The increase by years spent under exposure of ≥10 μT was even stronger: 62% per year (95% CI: 15-129). Brain cancer risk did not show a dose-response relation. This study contributes to the evidence for a link between heavy exposure to extremely low-frequency magnetic fields and leukemia....Swiss trains run on 16 2/3 Hz [AC]."

See also accompanying invited commentary by David Savitz (pp.836-838) and Minder and Pfluger's reply (pp.839-840). In addition, see p.3 and *MWN*, S/O90, M/J94 and J/A96.

phones, has prompted studies to investigate the anecdotal reports of brain tumor occurrence associated with use of these phones....Although current scientific evidence suggests no brain cancer risk from use of wireless mobile phones, effects from long-term exposure await assessment, and many years will pass before resolution of this issue."

P. Heikkinen et al., "Effects of 50 Hz Magnetic Fields on Cancer Induced by Ionizing Radiation in Mice," ***International Journal of Radiation Biology, 77,*** **pp.483-495, April 2001.**

"A total of 150 female CBA/S mice were randomized into three equal groups at the age of 3-5 weeks. One of the groups served as a 'cage-control group.' The two other groups were exposed to ionizing radiation in the beginning of the study. One of these two groups was exposed 24 h per day, for 1.5 years, to a 50 Hz vertical MF, the intensity of which varied regularly between 1.3, 13 and 130 μT [13 mG, 130 mG and 1.3 G]. The other served as a control group and was sham-exposed to MF....MF exposure did not increase the incidence of any primary neoplasms. However, the incidence of basophilic liver foci, a probable pre-neoplastic change in liver, was increased. The incidence of hepatocellular adenomas was unchanged, whereas the incidence of hepatocellular carcinomas was slightly, but not statistically significantly, elevated. It is concluded that overall the results of this study do not support a role for MF as a tumor promoter."

J.M. Harrington et al. "Leukemia Mortality in Relation to Magnetic Field Exposure: Findings from a Study of United Kingdom Electricity Generation and Transmission Workers, 1973-97," ***Occupational and Environmental Medicine, 58,*** **pp.307-314, May 2001.**

"The mortality experienced by a cohort of 83,997 employees of the former Central Electricity Generating Board of England and Wales was investigated for the period 1973-97. All employees were employed for at least 6 months with some employment in the period 1973-82....[T]he standardized mortality ratio of 84 for all leukemias (observed 111, expected 132.3) was similar to that of 83 for all causes (observed 14,845, expected 17,918). No significant positive trends were found for the risks of various types of leukemia (chronic lymphatic leukemia, acute myeloid leukemia, chronic myeloid leukemia, all leukemia) either with lifetime cumulative exposure to magnetic fields or with such exposures received in the most recent 5 years." (See also *MWN,* M/J97.)

Why Low-Frequency EMFs Can Break Chemical Bonds

Arnt Inge Vistnes and Kristoffer Gjötterud, "Why Arguments Based on Photon Energy May Be Highly Misleading for Power Line Frequency Electromagnetic Fields," ***Bioelectromagnetics, 22,*** **pp.200-204, April 2001.**

"Low-frequency EMFs may result in both (indirect) ionization (as exemplified by the corona effect) and triggering of nerve activity, in spite of a quite negligible photon energy, as given by $E=h\nu$....The purpose [and] hope [of this paper] is that the incorrect use of photon energy arguments, with which we too often have been presented until now, when discussing possible biological effects of low-frequency EMFs, will disappear....There are substantial reasons to expect that physics may be very different for visible light and EM waves at 50 Hz. For visible light, the photons come as individual packages with plenty of empty room between the photons, and one-photon interactions are the normal situation. At 50 Hz an enormous number of photons are present simultaneously at every point in space, even at the realistic field strength found in a human body, and multiple-photon interactions will be common....A system like an electron may pick up just as much energy from a power-frequency EMF as from ionizing radiation. This may in the first place seem to contradict the quantum mechanical concept of photon energy, but on second thought it does not. The key to solving the apparent contradiction is to remember that energy is exchanged by 'independent' (noncoherent) single photons at visible light and higher frequencies. At radio waves and lower frequencies, however, energy is exchanged by a very large number of highly coherent photons that act together (additively) in a constructive way, which is manifested as classical EMFs.... There are, however, very different time-scales associated with ionizing and power line frequencies."

"MICROWAVE NEWS" FLASHBACK

Years 20 Ago

• China provisionally adopts a frequency-independent 50 $\mu W/cm^2$ standard for occupational exposures to non-ionizing radiation.

• During a House subcommittee hearing at which Rep. Albert Gore Jr. (D-TN) concludes that RF sealers and heaters pose serious health risks, Rep. Bob Shamansky (D-OH) says that he is "almost flabbergasted" by OSHA's lax enforcement effort on the devices, adding that he finds it "frankly shocking."

• The lead editorial in the British medical journal *Lancet* calls for more rigorous double-blind studies on healing non-union bone fractures with pulsed EMFs.

Years 10 Ago

• Members of the EPA Science Advisory Board's panel on EMFs want to weaken the agency's finding that EMFs are a "possible, but not proven, cause of cancer in humans."

• Computer industry officials call for a U.S.-European standard for VDT emissions to head off consumer pressure for stricter limits. "If we don't come up with something soon, we're going to pay the consequences," says Apple's John Chubb.

• Citing health concerns, state legislators in Michigan, Rhode Island and Tennessee propose temporary moratoriums on power line construction.

Years 5 Ago

• Due to a dispute with the CTIA over the management of funds, WTR cancels two major cell phone health research contracts and stops payment to other researchers.

• A NJ Superior Court jury finds no EMF–leukemia link, but orders utility Atlantic Electric to pay over $750,000 to plaintiff John Altoonian and his wife for emotional distress.

• Dr. Ross Adey of the VA Hospital in Loma Linda, CA, reports that rats exposed to radiation designed to mimic digital signals had fewer and smaller tumors than control animals.

Across the Spectrum

"It's a miracle. I'll leave it at that."

— Tom Brokaw, anchor, *NBC Nightly News,* telling the graduating class of Sweet Grass County High School, MT, that after 40 years in broadcasting he still does not understand how his picture reaches television sets, quoted by Marla Harper, "Names & Faces: Commencement Comments," *Washington Post,* p.C3, May 29, 2001

"We have to be prepared for the prospect of a terrorist driving a van loaded with an RF weapon by the New York Stock Exchange and destroying its equipment and records at the touch of a button. On May 1, members of Congress will see a demonstration at Aberdeen's unique testing facility of a prototype radiofrequency weapon built using off-the-shelf commercial components with information readily available from unclassified sources."

— Rep. Roscoe Bartlett (R-MD), Special Oversight Panel on Terrorism, House Armed Services Committee, in a press release, May 4, 2001 (see also *MWN,* N/D99 and N/D00)

"A federal dictatorship over land-use issues just won't work. States won't accept it. It's a nonstarter in Congress."

— Ralph Cavanagh, Natural Resources Defense Council, San Francisco, quoted by John Fialka, "States Protest Bush's Plan for Siting Power Lines," *Wall Street Journal,* p.A2, May 15, 2001

Within the ICNIRP and NCRP committees, the process is closed, informal and nontransparent, whereas the IEEE process is open and transparent....

In the last ten years, there has been a movement, mostly within environmentalist circles, for the widespread application of the precautionary principle....But now in Europe it is being examined for potential application to any technology, even electromagnetic energy. Of course, in a sense, this idea is merely the end point in the thinking of Paul Brodeur, history professor Steneck and Nair and Morgan, who promoted the concept of "prudent avoidance" at the height of the power line scare, which is now generally acknowledged as baseless.

— Dr. John Osepchuk, chair, IEEE SCC-28 International Committee on Electromagnetic Safety, formerly with Raytheon and now a consultant, Concord, MA, and Ronald Petersen, executive secretary, SCC-28, Lucent Technologies, Murray Hill, NJ, "Safety Standards for Exposure to RF Electromagnetic Fields," *IEEE Microwave Magazine,* p.64 and p.65, June 2001 (see also p.7)

Tax police said Monday they had confiscated 60,000 counterfeit cellular telephones from two trucks at Rome's international airport. The phones bore well-known brand names such as Nokia, Motorola, Ericsson, Philips and Siemens but in fact were cheap Chinese knockoffs that lacked safeguards against electromagnetic radiation. Police said they would pose a health hazard to anyone using them.

— "Shipment of Fake Cell Phones Is Intercepted at Fiumicino" (entire article), *Italy Daily* (Italy, published by *Corriere Della Sera* and the *International Herald Tribune),* p.1, April 24, 2001

"It's scary. Hopefully, you're never going to have to transmit within 300 feet of [Nextel's] towers. It's a little nerve-wracking for officers because they are not guaranteed reliable communication anymore."

— Gary Schrader, police captain, Tigard, OR, on interference caused by Nextel's mobile phone system, which uses 800 MHz frequencies previously reserved for law enforcement, quoted in "Cell Phone Towers Are a Police Radio Nightmare," *Law Enforcement News,* p.5, March 15, 2001

Do mobile phones cause headaches? In the case of third-generation (3G) telephones, the answer is undoubtedly yes — even though nobody is yet using them. Instead, they are causing technical and financial pain for all the companies around the world that are trying to build 3G networks.

— "Pass the Painkillers," *The Economist* (U.K.), p.51, May 5, 2001

New Books

James Lin, ed., ***Advances in Electromagnetic Fields in Living Systems Volume3***, 312 pp., New York: Kluwer Academic/Plenum, 2000, $95.50. Orders: (212) 620-8000, Fax: (212) 463-0742, E-mail: <info@plenum.com>, Web: <www.wkap.nl>.

H. Takebe, T. Shiga, M. Kato and E. Masada, ***Biological and Health Effects from Exposure to Power-Line Frequency Electromagnetic Fields — Confirmation of Absence of Any Effects at Environmental Field Strengths***, 382 pp., Tokyo: Ohmsha Ltd., 2001, $120.00 + $5.00 shipping (translated from the Japanese, originally published in 1999). Fax numbers of distributors: Germany: (49+341) 995-4255; U.K.: (44+1865) 750079; U.S. and Canada: (703) 323-3668.

Hubert Trzaska, ***Electromagnetic Field Measurements in the Near Field***, 227 pp., Atlanta: Noble Publishing, 2001, $69.00. Orders: (770) 449-6774, Fax: (770) 448-2839, E-mail: <orders@noblepub.com>, Web: <www.noblepub.com>.

Advice from a Swedish Tabloid: How To Hold Your Mobile Phone



"Earpiece" "Distance" "Cheek" "Angle" "Norwegian Style"

— Illustrations accompanying Sören Bloom, "Cell Phones of the Future," *Aftonbladet* (Sweden), p.45, March 25, 2001

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UPDATES

EMF MEASUREMENTS

Field Guide to the Chemical Industry... Quebec's Research Institute on Occupational Health and Safety (known by its French acronym IRSST) in Montreal has published a handbook on measuring magnetic fields in chemical processing plants. Originally intended for use by the Canadian province's health officials, the 53-page *Guide for the Measurement of Static and Alternating Magnetic Fields Around Power Bars and Rectifiers in the Electrochemical Industry* (No.R-244) is available, in French only, at no cost, from the IRSST Web site: <www.irsst.qc.ca>. A print copy costs C$6.42. Contact: (514) 288-1551 or Fax: (514) 288-7336.

MEDICAL APPLICATIONS

mm Waves Slow Tumor Growth... Tumors grew more slowly and an anticancer drug was more effective when test animals were exposed to millimeter-wave radiation, according to a team at the Russian Academy of Sciences' Institute of Radio Engineering and Electronics in Moscow. In one experiment, tumor growth was reduced by a third in rats exposed to 10 GHz pulsed radiation, Dr. N.D. Devyatkov and coauthors report in *Critical Reviews in Biomedical Engineering (29,* pp.98-110, 2001). The peak intensity of the radiation was 80 kV/cm, but its average energy level was low due to the short pulse width — 10 nanoseconds — and the 40-second intervals between pulses. When rats were treated with endoxan, a chemotherapy drug, both pulsed 10 GHz and 42 and 52 GHz continuous wave (CW) radiation produced similar growth-retarding effects. In addition, mice given endoxan and exposed to pulsed or CW radiation had slower tumor growth compared to mice that received only the drug. "The combined application of microwave radiation and a chemotherapeutic compound, such as endoxan, produced the best therapeutic effect," the team concludes. Interactive effects of RF/MW radiation and drugs have long been noted. Pulsed RF/MW radiation has been found to alter the effect of some tranquilizers, including Valium (see *MWN,* F81), and to cause greater damage to eye tissue when used in conjunction with anti-glaucoma drugs (see *MWN,* J/A87).

MEETINGS

Notes... Abstracts of the papers presented at the *2nd International Symposium on Nonthermal Medical/Biological Treatments Using Electromagnetic Fields and Ionized Gases (Electromed 2001)* are available on the Web at <www.ece.odu.edu/electromed2001>. The meeting was held in Portsmouth, VA, May 20-23...The *IEEE EMC International Symposium*, which will be held in Montreal, Canada, will feature an afternoon session on August 16 on *EMC in Health-care: EMI Risk & Dealing with It,* chaired by Dr. Bernard Segal of McGill University. E-mail: <emc2001@jpdl.com>, Web: <www.2001emcmtl.org>....City & Financial, a U.K. conference organizer, is holding a two-day course on *Mobile Telephones and Health — the Latest Developments* in London, June 6-7. Among those scheduled to speak are: Stan Barnett, Lawrie Challis, Roger Coghill, Camelia Gabriel, Henry Lai, Michael Milligan, Alasdair Philips, Alan Preece, Bernard Veyret and Arne Wennberg. The program is posted at <www.cityandfinancial.com>.

Upcoming Meetings... September 2-5: *13th Conference of the International Society for Environmental Epidemiology,* Garmisch-Partenkirchen, Germany. Contact: Conference Secretariat, ISEE 2001, Interplan, Albert-Rosshaupter-Str. 65, D-81369 Munich, Germany, Fax: (49+89) 54823444, E-mail: <gap2001@i-plan.de>, Web: <www.gsf.de/epi/gap2001>...October 2-6: *Biological Effects of Ionizing Radiations, Electromagnetic Fields and Chemical Toxic Agents,* Predeal, Romania. Contact: Dr. Ileana Petcu, National Institute of Physics and Nuclear Engineering "Horia Hulubei," Str. Atomistilor 109, PO Box MG-6, RO-76900 Bucharest-Magurele, Romania, (40+1) 404-2300, Fax: (40+1) 423-1701, Web: <www.nipne.ro/Cenex/cex_eur.htm>.

PATENTS

Using EMFs To Regulate Genes... Drs. Martin Blank and Reba Goodman of Columbia University in New York City have applied for a patent for a technique that uses magnetic fields to manipulate the activity of specific genes. Using what they call electromagnetic response elements (EMRE), which consist of varying numbers of nCTCTn sequences (where C and T stand for cytosine and thymine, two of the four bases in DNA), they claim they can turn on specific genes. Eight nCTCTn sequences are needed to activate c-*myc* expression by an 80 mG magnetic field, and only three such sequences are needed for the HSP70 promoter. In a paper appearing in the April 1 issue of the *Journal of Cellular Biochemistry (81,* pp.143-148, 2001), Blank and Goodman report that by inserting the 900 base pair segment of the c-*myc* promoter containing the eight nCTCTn sequences upstream of a usually unresponsive gene, they were able to activate that gene. They offer the following possible application: A weak magnetic field could turn on an exogenous insulin gene with one or more EMREs placed upstream. "This technique could be applied to any gene you may want to control," Blank told *Microwave News*. In a second paper, which will soon appear in the same journal, they present calculations that, they write, "suggest a plausible mechanism for initiation of transcription by the generation of repulsive forces between DNA chains when EM fields interact with flowing electrons." Blank and Goodman declined to release a copy of their patent application.

PEOPLE

Sir **Richard Doll**, the U.K. cancer researcher who has been much in the news over his evolving assessment of EMF health risks (see *MWN,* M/A01), has been elected a foreign associate of the U.S. National Academy of Sciences....Dr. **David Conover** will retire from NIOSH on June 30 after having worked on non-ionizing health issues for 30 years....The Bioelectromagnetics Society will present Dr. **Tom Tenforde** of the Battelle Pacific Northwest Labs in Richland, WA, its d'Arsonval Award at its annual meeting in St. Paul, MN, on June 11. Tenforde, who is being recognized for his "lifetime achievements in the field of bioelectromagnetics," will give a talk on the "Wonders of Magnetism."... Soon after retiring from Motorola, Dr. **Q. Balzano** is back at the company doing some part-time consulting (see also p.5)....**Julius Knapp** has been appointed the deputy chief of the Office of Engineering and Technology at the FCC in Washington.

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As We Go To Press

Male Breast Cancer Cluster Prompts Lawsuit

Three men who worked in the same basement office, next to equipment used to distribute electricity, developed breast cancer. On May 29, two of the men, Arthur Slater and James Montano, filed suit in state court in Albuquerque, NM, blaming their condition on exposure to EMFs and toxic chemicals.

"The odds of three men in one specific office getting breast cancer are a trillion to one," Sam Bregman of the Bregman law firm in Albuquerque told *Microwave News*.

The defendants are Bernalillo County and the City of Albuquerque, which jointly own the office building — the men work for the county. Bregman said that since 1988 there have been at least 14 cases of cancer and four known deaths among the office workers, who have "continually complained of magnetic interference problems." Magnetic fields in the center of the office were above 15 mG, according to a 1991 survey by the city. A second survey in 1996 showed that the levels had increased.

Bregman also cites repeated exposures to a host of different chemicals, including volatile organic compounds.

Slater, 78, worked in the building from 1985 to 1998, and Montano, 52, worked there from 1996 to 1998.

Dr. Genevieve Matanoski of Johns Hopkins University first reported a cluster of male breast cancers among EMF-exposed workers in 1989 (see *MWN*, N/D89 and M/A91). Three later studies also found an association (see *MWN*, J/A90, J/F91 and J/A92). There were about 1,300 new cases of male breast cancer in the U.S. in 1999, according to the American Cancer Society.

Keeping Current: Follow-Up on the News

◆ The GAO report (see p.6) has put new pressure on the IEEE SCC-34 subcommittee to complete its protocol for measuring SARs from mobile phones — the group recently marked its fourth anniversary. It will meet again during the first week of June in St. Paul, MN. The parallel European standard developed by CENELEC has been completed and is awaiting final approval by its technical board. This could happen in July.

◆ Howard Bassen of FDA's Center for Devices and Radiological Health in Rockville, MD, may have a one-year EMC engineering slot to study EMI to implanted medical devices by detectors and anti-theft systems. Contact Bassen at (301) 827-4950 or by e-mail at <hib@cdrg.fda.gov>.

◆ The April 26 *New England Journal of Medicine* features letters from Austria's Dr. Michael Kundi of the University of Vienna and a team at Hacettepe University in Ankara, Turkey, on the NCI epidemiological study of cell phone users, with NCI's response (see *MWN*, J/F01).

◆ In our last issue we presented Dr. Sam Milham's new thesis that residential electrification caused the emergence of the childhood leukemia peak. His paper has now been published in the March issue of *Medical Hypotheses (56,* pp.290-295, 2001).

◆ The Air Force Office of Scientific Research (AFOSR) is seeking proposals on the biomolecular and subcellular effects of RF/MW radiation in an effort to devise "synthetic RF sensors at the micro/nanoscale." It notes that, "It is critical that the DOD pioneer this area of research since the results will be far reaching. Understanding the genes and proteins expressed by nonthermal RF exposure will have a profound impact on a host of scientific fields." An AF spokesperson said that one project will be funded for up to $1 million a year for three to five years. For more information on "MURI Topic#16," go to: <www.onr.navy.mil/sci_tech/special/muri2002/topics.htm#16>.

◆ The IEEE's Committee on Man and Radiation (COMAR) has issued a technical information statement on "Safety Issues Associated with Base Stations Used for Personal Wireless Communications." It appears in the March/April issue of the *IEEE Engineering in Medicine and Biology Magazine*.

◆ An item posted on the Ananova Web site, <www.ananova.com>, on April 13 reports that geologists in Romania have discovered a "magic mountain" that can lower blood pressure and stop the pain from arthritis. Ananova reports that, "Scientists believe the mountain's power comes from an unusual configuration of magnetic fields."

Another Breakthrough, Another Dead End?

It's tempting to call Dr. Li's new study on miscarriages a breakthrough (see p.1). But that would assume that there will be a rush to extend his ideas about peak exposures and thresholds to other populations and to test it in the laboratory.

A rash assumption.

Many times over the last few years, epidemiological studies have offered new insights but were never properly followed up.

In 1994, Dr. Gilles Thériault reported a strong association between cancer and exposures to high-frequency transients that was greeted as a possible breakthrough by epidemiologists. Thériault, of Canada's McGill University, found an up-to-tenfold increased risk of lung cancer and what he called a "remarkable" dose-response relationship (see *MWN,* N/D94).

Hydro-Québec reacted swiftly and forcefully. It took the data set away from Thériault and locked it up. One of the most notable aspects of this corporate cover-up was the silence of the public health community. No one complained, no one seemed to care.

Thériault recently told us that he has been unable to raise any money to pursue the transient hypothesis after his brush with the giant electric utility. "From that day on, I have been out of the field," he said, adding that even today the memory of the experience remains painful.

Two years later, Dr. Tony Miller of the University of Toronto reported that when exposures to *both* electric *and* magnetic fields were taken into account, leukemia risks among some Ontario Hydro workers rose to up to 11 times the expected rate (see *MWN,* J/A96). To its credit, Ontario Hydro supported further analysis and last year the role of electric fields became clearer: The data pointed to a threshold effect (see *MWN,* M/J00). But these findings, like Thériault's, are gathering dust.

Thériault and Miller, like Li, had the imagination to look beyond average magnetic field exposures and were rewarded with provocative results. But the progress stopped there. Without funding institutions that are free of economic agendas, there is little hope that innovative ideas will get the attention they deserve.

The electric utility industry is currently the only source of EMF research funds. We recently asked EPRI how much is being spent and were told that such information could not possibly be divulged. Whatever the amount, it is clear that the industry is in no rush to understand EMF health risks.

An example: Seven years ago, Dr. Gene Sobel of the University of Southern California reported a strong association between EMFs and Alzheimer's disease (see *MWN,* J/A94). Despite very limited funding, Sobel continued to build on his original finding and, at the same time, Sweden's Dr. Maria Feychting reported some support for the EMF–Alzheimer's link (see *MWN,* J/F97). Then in 1998, EPRI hosted a workshop at a beach resort to see if it should get involved (see *MWN,* S/O98). "It was a very nice beach party," Sobel told us. That was EPRI's last act on Alzheimer's disease.

Another example: At the end of last year, Dr. James Trosko made a big splash when he showed that EMFs might indeed be able to act as a cancer promoter. WHO's Dr. Mike Repacholi asked EPRI to fast-track the replication effort so that the results would be available for the IARC review which will soon get under way in Lyon, France. Here again EPRI dawdled, and there will be nothing new ready for IARC (see p.2).

This has been a common strategy. Isolated and unreplicated findings are usually discounted as preliminary — and will of course remain that way, if no one supports follow-up work.

Dr. David Savitz says that there is no point in doing any more EMF epidemiology without some fresh ideas from the laboratory (see p.3). We disagree. As Thériault and Miller — and now Li — have demonstrated, epidemiologists have been stymied not by any lack of good ideas, but by lack of unfettered support. Researchers must have access to enough money to get the job done and must be given the freedom to take chances and follow their hunches. The current way is a series of dead ends.

If we are to solve the EMF enigma, what's needed first and foremost is a breakthrough on how research is funded and who controls the purse strings.

Animal Studies Galore

Kudos to the U.S. National Toxicology Program (NTP) and Italy's Ramazzini Foundation for embarking, independently, on a series of animal studies on mobile phone radiation (see p.1). Together with the six PERFORM-A animal experiments, the Australian repeat of the *Pim1* mouse study and Motorola's Iridium study, these initiatives will provide a wealth of new information.

One caveat however. The U.S. and Italian projects are a once-in-a-generation opportunity and both groups should make sure they get the most from their investments. The teams led by Drs. Christopher Portier and Morando Soffritti should solicit a wide range of opinions on the most appropriate exposure conditions and radiation signals. They must do better than the MMF and Germany's FGF. These two industry groups appear to have decided in advance what they wanted to hear at their recent workshops (see p.5 and p.11).

The NTP animal studies on power-frequency fields provide a further illustration of how the process can go awry. Only one type of exposure was investigated — sinusoidal 60 Hz fields. The fact that Dr. Gary Boorman, who led the project, had already made up his mind that there are no effects did not help. These were costly errors in judgment — which must not be repeated.

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Are Children at Greater Risk from Mobile Phone Radiation?

No Consensus Yet, Reviews Under Way

Expert panels in France, Germany, Spain and the U.K. have all recommended that children limit their use of cell phones, while a Dutch panel saw no reason to treat children any differently than adults.

In March, Dr. Gro Harlem Brundtland, the head of the World Health Organization (WHO), advised that children should be discouraged from using mobile phones (see *MWN*, M/A02). But Dr. Michael Repacholi, who runs the WHO's EMF project, has stood apart. Two years ago, he declined to join the other members on Sir William Stewart's expert panel who favored a precautionary approach for the use of phones by those under 16 (see *MWN*, M/J00).

Microwave researchers are similarly divided. In a paper published in May, Dr. Om Gandhi of the University of Utah, Salt Lake City, presents new calculations to support his widely cited finding that the smaller heads of children absorb more radiation than those of adults and that the radiation goes deeper into their brains.

On the other hand, Dr. Niels Kuster of the Foundation for Research on Information Technologies in Society (IT'IS) in Zurich maintains that the specific absorption rates (SARs) from cell phones are similar for young and old alike. Speaking at a workshop on *Mobile Phones and Children* in Rome on May 5, Kuster said that the evidence for a significant difference in exposure

(continued on p.9)

China Weighs Breaking Ranks, Adopting 1W/Kg SAR Limit for Mobile Phones

The Chinese government is considering setting a 1 W/Kg specific absorption rate (SAR) standard for mobile phones. If it makes the move, it would have the strictest SAR phone standard of any country in the world.

Both the Chinese Ministry of Health and the Environmental Protection Agency (EPA) are backing 1 W/Kg, but the Ministry of Information Industry favors adopting ICNIRP's 2 W/Kg SAR limit, Dr. Huai Chiang of Zhejiang University in Hangzhou told *Microwave News*.

"They cannot decide what to do," Dr. C.K. Chou of Motorola in Plantation, FL, told *Microwave News*. Chou visits China regularly.

The SAR decision will be made by the Joint Working Group (JWG), composed primarily of representatives of Chinese government agencies. Toward this goal, the JWG will send delegations to the U.S. and to Europe on fact-finding missions. Chou is helping plan the JWG's trip to the U.S.

"We would expect a further proposal to be circulated for comment fol-

(continued on p.6)

NSA Workers Lose Lawsuit Over EMFs and Brain Tumors

Two former National Security Agency (NSA) workers have lost their lawsuit claiming that the use of a powerful degausser caused them to develop a brain tumor. On April 30, after deliberating for only two hours, six jurors exonerated Electro-Matic Products Co. in Chicago, the manufacturer of the degausser, which is used to erase magnetic data-storage tapes.

A number of well-known members of the EMF community testified at the two-week trial, which was heard in a Maryland state court in Annapolis.

No appeal was filed before the May 31 deadline.

"We can't improve the scientific case we presented," said Ted Flerlage of Peter Angelos's law firm in Baltimore, who represented Tommy Grimes and Thomas Van Meter, both of whom had worked at NSA headquarters in Fort Meade, MD (see *MWN,* M/A00). "The science just isn't strong enough," Flerlage said. He pointed to the lack of supporting evidence from animal experiments as the critical weakness in his case.

Flerlage said that Dr. David McCormick of the IIT Research Institute in Chicago was "very compelling" in his testimony for the defense that animal studies had failed to show a cancer risk following long-term exposure to magnetic fields.

"The jury simply wasn't persuaded that EMFs are hazardous," said Harold Walter of Tydings & Rosenberg in Baltimore, who represented Electro-Matic Products. Walters said that the Angelos team had put on the strongest EMF case to date—by hiring "many of the leading names" to present evidence linking EMFs to brain tumors. In addition, he said, both sides agreed, and the jury acknowledged, that the men were exposed to magnetic fields of at least 1G from the degausser. Flerlage contended that the fields were much higher.

At a pretrial hearing on the scientific evidence held in mid-March, Judge Eugene Lerner refused to restrict the testimony of any of Angelos's expert witnesses. Lerner also denied a pretrial motion to dismiss the case.

The Angelos firm has also sued on behalf of three other workers who developed brain tumors after using a degausser at the NSA. A federal judge suspended two of these lawsuits — motions to reopen them can be filed until December 31, 2003. The third case was dismissed at the plaintiff's request.

At the trial Flerlage called Dr. Abe Liboff, an emeritus professor of physics at Oakland University in Rochester, MI; Dr. Roger McLendon, a neuropathologist at Duke University in Durham, NC; and Dr. Samuel Milham, an epidemiologist formerly at the Washington State Department of Health.

Dr. Henry Lai of the University of Washington, Seattle; Dr. Jerry Phillips of the Biological Sciences Curriculum Study in Colorado Springs, CO; and Dr. Daniel Wartenberg of the Institute of Environmental and Occupational Health Sciences in Piscataway, NJ, were ready but, in the end, were not called. "Expert testimony is expensive," Flerlage explained.

In addition to McCormick, the defense called Dr. Daniel Bracken, a consultant based in Portland, OR; Dr. Philip Cole, an emeritus professor of epidemiology at the University of Alabama, Birmingham; and Dr. John Moulder of the Medical College of Wisconsin in Milwaukee, who testified via a video link.

At the March hearing, Cole said that he was not aware of any study that linked EMF exposure to meningiomas, the type of brain tumor that both Grimes and Van Meter developed.

Bracken's measurements of an Electro-Matic unit similar to the one used by the plaintiffs showed that the men were exposed to fields no greater than 2 G. According to NSA documents, fields near the degausser that Grimes and Van Meter used were as high as 44 G (see *MWN,* J/F01; also N/D01).

Walter did not call Dr. Joseph Roti Roti of Washington University in St. Louis or Dr. Vijayalaxmi of the University of Texas Health Science Center in San Antonio. He explained that their testimony would have countered that of Lai and Phillips.

The Angelos law firm is still waiting to hear whether a federal judge will allow its cell phone–brain tumor case to go to trial (see p.18 and *MWN,* M/A02).

Italian Animal Studies Will Be Larger and Longer

The huge animal studies being planned at the Ramazzini Foundation in Bologna are "crucial" to understanding the cancer risk posed by EMFs, said Dr. Morando Soffritti at *Carcinogenesis Bioassays and Protecting Public Health,* a conference held in New York City, April 29-30, by the New York Academy of Sciences.

Soffritti, the scientific director of the foundation, explained that the animal studies carried out by the U.S. National Toxicology Program (NTP) had certain "limitations." The NTP may not have used enough animals to evaulate a low-potency cancer agent and may have ended the exposures too early (see *MWN,* J/F98 and M/A98). "More than half the animals were still alive at the end of the NTP experiment. Had we truncated our experiment on vinyl chloride, we would not have seen the tumor effect and there would be no regulation of vinyl chloride today," he said.

The Ramazzini Foundation will be using over 5,000 animals, many times more than the number in NTP's two-year bioassays. Soffritti detailed the different types of exposures, at different intensities of 50 Hz alone and in combination with ionizing radiation, microwave radiation, formaldehyde and aflatoxin.

The protocols for a parallel set of experiments with 1.8 GHz radiation are in the process of being finalized, Soffritti said. These will include the exposure of Sprague-Dawley rats in the near and far fields to mimic exposures from mobile phones and towers, respectively (see *MWN,* M/J01).

The meeting commemorated the work of Dr. Cesare Maltoni, who died last year. Maltoni, who led the Ramazzini Foundation, conducted long-term animal experiments on close to 200 different chemicals and is perhaps best known for demonstrating that vinyl chloride and benzene are carcinogens.

Canadians Link EMF Work to Risk of Aggressive Brain Tumors

EMF exposure at work can significantly increase the chances of developing an aggressive brain tumor, according to a new study from Canada.

Dr. Paul Villeneuve of the University of Ottawa and coworkers found a 33% increase in brain tumors among workers exposed to an average magnetic field of 6 mG or more. This finding was not statistically significant.

But for grade III and IV astrocytomas — especially aggressive types of brain tumors also known as glioblastoma multiforme — the odds of developing a brain tumor were up to 12 times higher, a significant finding. For less-aggressive tumors, Villeneuve sees no evidence of an increased risk.

These results are "consistent with the hypothesis that magnetic fields act at the promotional stage," Villeneuve concludes in the February issue of the *International Journal of Epidemiology (31,* pp.210-217, 2002).

Villeneuve analyzed the employment and EMF exposure histories of 543 Canadian men diagnosed with brain cancer between 1994 and 1997, and of an equal number of controls. The 18 of the 198 men with glioblastoma multiforme who had held a job with an average magnetic field exposure of 6 mG or more had an odds ratio (OR) of 5.5, with a confidence interval (CI) of 1.22-24.8. Villeneuve emphasizes that, due to the small number of cases, this and related findings should be interpreted cautiously.

For 10 of these 18 men, whose high magnetic field exposures occurred in their "earliest held job," the OR for developing a brain tumor is 4.81 (CI=0.94-24.71); for the eight whose high average exposures were in their "last held job," the OR is 12.59 (CI=1.50-105.6).

Dr. Maria Feychting of the Karolinska Institute in Stockholm previously reported a nonsignificant doubling of the risk of grade III and IV astrocytomas among those with EMF exposures above 2 mG both at work and at home (see *MWN,* J/A97).

In a combined analysis of the data from three large studies of utility workers, Dr. Leeka Kheifets, formerly with EPRI and now at the WHO in Geneva (see p.13), calculated a higher rate of brain cancer among those exposed to EMFs on the job (see *MWN,* S/O99). In an earlier meta-analysis of a larger number of occupational studies, Kheifets also found an increased risk of brain cancer (see *MWN,* J/F96).

IARC: Rationale for "Possible Carcinogen" Classification

The International Agency for Research on Cancer (IARC) has published its monograph reviewing the cancer risks associated with exposure to ELF and static EMFs.

In June 2001, a panel of experts convened by IARC in Lyon, France, unanimously found that there is "limited evidence" of an association between childhood leukemia and ELF magnetic fields and classified them as "possibly carcinogenic to humans (Group 2B)." The 21-member panel concluded that the epidemiological link is "unlikely to be due to chance" but noted that it "may be affected by selection bias" (see *MWN,* J/A01).

With respect to ELF electric fields and static electric and magnetic fields, the IARC panel found that they are "not classifiable as to their carcinogenicity in humans (Group 3)." In addition, it found that there is "inadequate" evidence linking ELF EMFs to any other cancers in humans or to cancer in experimental animals and that the evidence on the carcinogenicity of electric fields is inadequate.

The expert panel noted that, if the link to childhood leukemia "were causal," the increase in risk above 3-4 mG could be greater than the doubling found in two recent meta-analyses (see *MWN,* S/O00).

The 444-page report, *IARC Monographs on the Evaluation of Carcinogenic Risks to Humans: Volume 80—Non-Ionizing Radiation, Part I: Static and Extremely-Low-Frequency (ELF) Electric and Magnetic Fields,* is available for $50.00 from: IARCPress, 150 cours Albert Thomas, 69008 Lyon, France, Fax: (33+4) 72 73 83 02, E-mail: <press@iarc.fr>.

Genotoxic Effects Are "Proven"

The excerpt below is from a progress report for the EC's REFLEX research project, which was distributed by Dr. Franz Adlkofer at the COST281 meeting in Rome on May 2 (see p.8). It covers the project's first two years, through January 31, 2002. Adlkofer, who is with the Verum Foundation [for Behavior and Environment] in Munich, is the project coordinator of the REFLEX project, which is addressing both EMF and RF/MW biological effects (see MWN, *M/A00 and N/D01).*

Based on the data related to research on biological effects of ELF EMFs which have been obtained in the REFLEX project so far, it can be stated that a genotoxic effect of EMFs on primary cell cultures of human fibroblasts is to be considered as proven. DNA strand breaks at a significant level are produced by EMFs at a flux density as low as 70 ∝T [700 mG] and there is a strong correlation between the increase in DNA strand breaks and the increase in micronucleus frequencies. With regard to the genotoxic effect of EMFs a considerable interindividual variance exists. Furthermore, there is evidence that EMF influences the expression of genes in embryonic stem cells of mice if the stem cells are deficient of the p53 gene, the so-called guardian of the genome. In these cells the regulatory genes egr-1, p21 and c-jun are upregulated after exposure to EMFs. Since the flux density must be as high as 2.3 mT [23 G] before a significant difference in gene expression between exposed and sham-exposed stem cells can be observed, it is not clear yet how to assess the biological relevance of the findings. At present the data suggest that it may be the genetic background [that determines] whether or not stem cells respond to EMFs. No differences in DNA synthesis, cell cycle and apoptosis between exposed and sham-exposed primary human peripheral blood mononuclear cells were observed after EMF exposure. More data dealing with cell proliferation and gene expression in various transformed cell lines need to be confirmed before firm conclusions can be drawn.

HIGHLIGHTS

«Eye on Europe»

A survey of RF levels near mobile phone base stations in **Salzburg**, **Austria**, is fueling the controversy over the 0.1 ∝W/cm^2 exposure limit favored by local health officials (see *MWN,* J/A 00 and N/D01). Researchers from the Austrian Research Centers Seibersdorf (**ARCS**) and **BAKOM**, the Swiss communications agency, found that 8 of 13 random spot measurements exceeded the Salzburg limit — one by a factor of 40. The standard "cannot be met for those living near antennas in urban areas," the **Swiss** government, which commissioned the survey, concluded in a recent report. The Mobile Communications Forum, which represents Austria's wireless industry, declared that the measurements show that the Salzburg limit is "political PR, not reality." Dr. **Gerd Oberfeld** of the Salzburg State Public Health Department countered that the survey is "worthless." He said that the limit is not legally binding and that most of the antennas in the survey belong to carriers who have never agreed to comply with it. **Georg Neubauer**, who led the ARCS survey team, explained that the results are due in part to the measurement protocol stipulated by BAKOM. It assumes that all antennas are operating at maximum power output, an approach consistent with the way Swiss officials apply their own standard for mobile phone antennas. In contrast, the Salzburg limit applies to normal operation, according to Oberfeld. Two years ago, Neubauer reported that RF levels were below the limit "in most, but not all" of Salzburg. He sees no contradiction between the two sets of results, because of the differences in the protocols. "Direct comparisons have little meaning," he told *Microwave News*. According to BAKOM, the new survey was prompted by Swiss tower activists who want to adopt the "Salzburg model." BAKOM's report, *Non-Ionizing Radiation Emissions in Salzburg,* is available in German at <www.bakom.ch/de/funk/elektromagnetisch/immission/index.html>. (See also p.5 and p.11.)



AUSTRIA'S GEORG NEUBAUER LED THE MEASUREMENT TEAM

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Dr. **Gerard Hyland**'s response to **COST281**'s critique of his report to the **European Parliament** on the potential health hazards of low-level EMFs is now available on the COST281Web site, <www.cost281.org>. Hyland's original report and COST's commentary are also posted there (see *MWN,* N/D01). Hyland calls the COST281 document a "diatribe," which "deliberately misrepresented and distorted the sense of much of my text." He concludes: "Given the industrial connections of certain influential members of COST281, however, perhaps this is only to be expected." Hyland is at the University of Warwick in Coventry, U.K.

Vatican Antennas May Have Caused Excess Cancers, New Report Says

A new report prepared by a four-member panel for a local court suggests that the Vatican transmitters in Cesano outside Rome could indeed present a leukemia risk, according to articles in the Italian news media.

In an open letter, dated May 12 , to *Corriere della Sera,* a leading national newspaper, Frederico Lombardi, the program director of Vatican Radio, stressed that "the association is far from proven" and that the new report should not be interpreted as "definitive."

Dr. Pietro Comba, a member of the review panel, told *Microwave News* that, although parts of his report have been leaked to the press, he cannot comment because it has not been officially released. Comba is the director of the Environmental Epidemiology and Biological Monitoring Section at the National Institute of Health in Rome.

The new analysis appears to directly contradict an earlier report by a different four-member committee, which concluded that there is no cancer risk and that epidemiological surveys are unlikely to resolve the controversy (see *MWN,* S/O 01). Interestingly, the chair of this panel, Dr. Donato Greco, is also at the National Institute of Health, where he is the director of the Laboratory of Epidemiology and Biostatistics. Not surprisingly, Greco has criticized the new report.

Comba and his three colleagues — Dr. Paolo Crosignani, the director of the Varese cancer registry at the National Cancer Institute in Milan; Dr. Augusto D'Angiolino, a forensic physician in Rome; and Dr. Gaetano Licitra, the head of the environmental physics unit at ARPAT, the Tuscan regional agency for environmental protection in Pisa (see p.5) — have written a response to Greco and submitted it to the court.

Referring to the new report, Angelo Bonelli, the head of the local Green party, told *il Nuovo* (May 10) that, "This is a break in the code of silence."

Comba's panel had access to the epidemiological study by researchers at the regional health authority in Rome, which points to an elevated leukemia risk among the residents of Cesano (see *MWN,* S/O01). That analysis, which was presented at a conference last year, will appear in the June 15 issue of the *American Journal of Epidemiology.*

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More **Germans** worry about mobile phone base stations than about mobile phones — but an even larger number are concerned about power lines. In a poll released on April 29 by the Federal **Radiation Protection Office**, 29.7% expressed "strong" or "very strong" concerns about the health effects of base stations, compared to 27.9% over phones and 14.7% over radio or TV towers. But 31.4% were worried about high-voltage lines. More than 40% of those who use a mobile phone 90 minutes per day or more were concerned about possible health consequences. Asked

whether they would curtail their mobile phone use if a health risk was demonstrated, 67.5% of the respondents said yes. But there were noticeable differences between the young and the old, with 55% of teenagers saying yes, compared to 77.5% of those 50-59 years of age. Six percent believed that radiation from phones or base stations had harmed their health. The most widely cited concerns were tobacco (46.5%), alcohol (39.4%) and air pollution (38%). *Results of a National Survey on Fears and Concerns of the Population in Connection with Mobile Telecommunications* is available in German at <www.bfs.de/presse/index.htm>.

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By July 1, the **Swiss** government will decide how to apply the country's precautionary limits for RF/MW radiation when mobile phone antennas are clustered together. **Moritz Leuenberger**, the cabinet minister responsible for environment, transportation, energy and communications, will have to mediate between the competing interests of **BUWAL**, the environment agency, and **BAKOM**, the communications agency. BUWAL has proposed treating all antennas within 100 meters of each other as a single site, in effect turning Switzerland's 4 V/m emission limit for telecom towers into an urban ambient standard (see *MWN,* N/D00 and S/O01). BAKOM has stated that such a standard would be "nearly impossible" to meet without "substantial economic consequences" (see p.4). The wireless industry wants to measure the radiation from each antenna separately as long as the antennas are operated by different service providers. At a March 4 debate in the National Council—roughly equivalent to the U.S. House of Representatives—Georges Theiler, who represents Lucerne, warned that BUWAL's proposal would "lead to safety factors 500 times larger than in other countries." Switzerland "should not become the world champion on this issue by leaving international guidelines behind," he said. Pia Hollenstein, a delegate from St. Gallen, east of Zurich, disagreed. "The right of the affected population to precautionary protection of health" should take precedence over "narrow economic interests," she argued. At the close of the debate, Leuenberger told the legislators that the guidelines will "neither undermine nor tighten" the original ordinance adopted more than two years ago (see *MWN,* J/F00). There will be more consultations before the rules are finalized, he said.

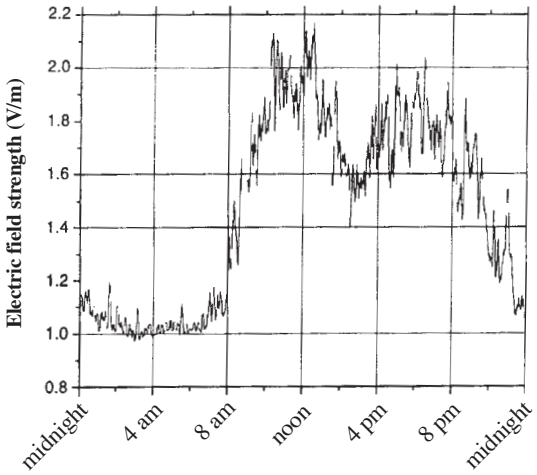
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The **U.K.**'s National Radiological Protection Board (**NRPB**) is carrying out a comprehensive assessment of the scientific basis for its exposure guidelines from DC to 300 GHz. The board is also reviewing whether there is "any need to invoke a **precautionary approach**" in cases where "scientific information may be lacking," NRPB's Dr. Michael Clark told *Microwave News*.... In May, the board posted its **corporate plan** and **scientific program** for the five-year period, 2002-2007, as well as its business plan for 2002-2003 on its Web site, <www.nrpb.org>. There may be some changes, however. As these documents were being finalized, the U.K.'s chief medical officer announced that the NRPB would be folded into a newly established health protection agency by next April (see *MWN,* J/F02).

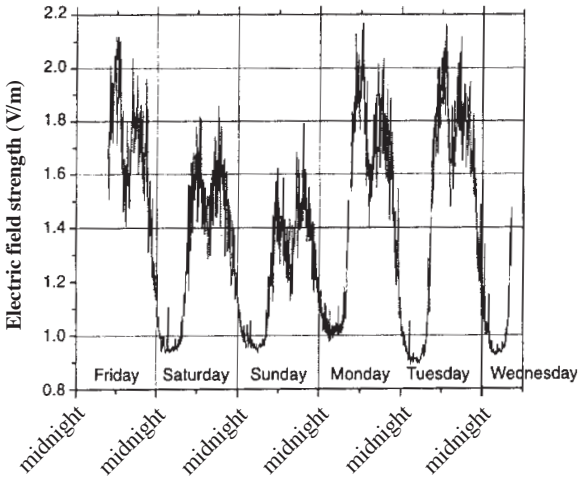
Changes in Ambient Mobile Phone Radiation in an Italian Home

The measurements below were taken in an apartment in Pisa, Italy, by Dr. Alberto Maria Silvi and coworkers at the Tuscan regional agency for environmental protection (ARPAT) in Livorno (see p.4). The apartment is in the "immediate neighborhood" of wireless base stations and was chosen because prior evaluation indicated "significant levels." The Italian exposure standard for mobile phone radiation is 6 V/m (see *MWN,* J/F00).

Over 24 Hours



Over 1 Week



Source: A.M. Silvi, A. Zari and G. Licitra, "Assessment of the Temporal Trend of the Exposure of People to Electromagnetic Fields Produced by Base Stations for Mobile Telephones," *Radiation Protection Dosimetry, 97* (4), pp.387-390, 2001. This is a special issue on *Physical Agents and Measurements in the Environment, Selected Papers from a Workshop held in Ivrea, Turin, Italy, April 3-5, 2001*. Silvi is at: <am.silvi@arpat.toscana.it>. The figures are reprinted with permission.

Mobile Phone Tumor Risks: Conflicting Interpretations

Use of analog mobile phones was associated with an increased incidence of brain tumors in a Finnish study, but the authors are downplaying their results. At about the same time, a U.S. research team reported no increased risk of acoustic neuromas while the study's sponsor says the data were manipulated.

In the Finnish study, those who used analog phones had twice the risk of developing gliomas, a statistically significant result. The risk rose 20% with each year of use — a significant trend.

But Dr. Maila Hietanen of the Institute of Occupational Health in Helsinki advised caution in interpreting her findings. "This was a feasibility study," she told *Microwave News*. "We were checking on the methodology, that's why we don't rely on the results too much."

Dr. Anssi Auvinen of the Finnish Cancer Registry first reported the findings at the EBEA meeting in Helsinki last year and issued similar caveats (see *MWN,* S/O01; also M/A98).

The phone records of 432 Finns diagnosed with brain or salivary gland tumors in 1996 were analyzed, as were those of close to 2,000 controls. There was no increased risk among users of digital phones. The results appear in the May *Epidemiology.*

The U.S. results are drawn from the study led by Dr. Joshua Muscat of the American Health Foundation in Valhalla, NY, which reported no link between phone use and brain cancer (see *MWN,* J/F01). In a paper appearing in *Neurology,* Muscat now also concludes that the data do "not support the hypothesis that use of hand-held cellular telephones causes acoustic neuroma."

Dr. George Carlo, who headed Wireless Technology Research (WTR), which sponsored the Muscat study, maintains that it initially showed a significant increase in acoustic neuromas for those with the most phone use (see *MWN,* M/A99). Carlo contends that Muscat altered his analysis to weaken this association.

Carlo told *Microwave News* that he will detail these charges this summer in the *Environmental Claims Journal*.

Muscat compared 90 patients with acoustic neuromas with 86 controls. The risk was no higher for those with the most hours of phone use per month or with the most total phone use. While the cancer risk was higher among those who had used a phone the longest — from three to six years — this difference was not statistically significant.

Anssi Auvinen, Maila Hietanen et al., "Brain Tumors and Salivary Gland Cancers Among Cellular Telephone Users," *Epidemiology, 13,* pp.356-359, May 2002.

J. Muscat et al., "Handheld Cellular Telephones and Risk of Acoustic Neuroma," *Neurology, 58,* pp.1304-1306, April 23, 2002.

China Weighs 1W/Kg SAR Limit for Mobile Phones *(continued from p.1)*

lowing JWG's consideration of the reports of the two delegations," Dr. Ken Joyner, Motorola's Australian RF strategist, said in an interview.

"From a health standpoint, some of us want the standard to be stricter," Dr. Zhao-Jin Cao of the Ministry of Public Health, part of the Ministry of Health, told the Bloomberg news service. The Chinese health ministry has long had one of the world's strictest standards for exposures to microwave radiation for both the public and workers (see *MWN,* Jn81 and S/O99).

Cao and Chiang are members of the JWG, as are representatives of China's EPA and Ministry of Information Industry.

"Phone makers will have to bear the brunt of higher costs in research and development to comply with the more stringent standard," Chen Yujian, a director of the China Mobile Communications Association, told Bloomberg (May 24).

Dr. Klaus Ebermann, the EU ambassador to China, is also lobbying China to go with ICNIRP. "Our plea to China is don't go it alone," he told AFXpress, a subsidiary of Agence France-Presse (May 31). "It's not the point to have European standards, but to have common standards."

In its statements to the business press, the mobile phone industry is framing the 1W/Kg SAR proposal as irrational. "We don't understand why the government is considering doing this," Michael Milligan, the secretary general of the Mobile Manufacturers Forum (MMF) in Brussels, told AFXpress (May 24).

And Motorola's Joyner told the *Wall Street Journal* (May 28) that, "It's hard to see why China would impose such a standard on itself and risk its industry development for no consumer gain."

In comments to the JWG which Milligan provided to *Microwave News,* the MMF addresses the health issue directly, arguing that, "There [are] no known adverse health effects to users from exposures below the levels recommended by ICNIRP."

In late 2000, China's Ministry of Health was preparing to adopt the ANSI/IEEE SAR standard of 1.6 W/Kg,* averaged over 1g of tissue (see *MWN,* N/D00). At that time Cao said that this would help China sell phones in international markets.

Then last October, Chiang reported at a WHO conference in Seoul that the JWG had proposed a 1 W/Kg limit, averaged over 10 g — with the SAR standard becoming even stricter after two hours of mobile phone use.

The MMF states in its comments to the JWG that "the requirement to have SARs reduce over two hours is totally impractical and technically unworkable."

In its own comments to the Chinese government, the World Health Organization's (WHO) EMF project urged the adoption of ICNIRP's limits, according to the MMF, and confirmed by WHO's Dr. Michael Repacholi.

Repacholi told *Microwave News* that, "To date, WHO's reading of the science indicates that [the ICNIRP] standards are pro-

* Whether ANSI/IEEE or ICNIRP has the strictest SAR limit for mobile phones depends on how the ear is treated. Under a change recently adopted by the IEEE, the ear is now considered an extremity and governed by a more lenient exposure standard, 4 W/Kg (see *MWN,* N/D99 and J/F01). In a new paper *(Phys Med Biol,* see p.10), Dr. Om Gandhi argues that, under this new formulation, the IEEE standard is considerably weaker than ICNIRP's, even though the IEEE mandates averaging over 1g of tissue, while ICNIRP calls for averaging over 10 g.

tective." He declined to release a copy of WHO's comments.

In her paper presented in Korea last year, Chiang wrote that the ICNIRP limits "are based on short-term, immediate health effects," but that "there is a body of literature which suggests that biological effects can be shown at levels of radiation which do not produce heating or stimulation."

The Swedish white-collar union, TCO, has adopted a standard of 0.8 W/Kg for the certification of phones under its initiative, *TCO'01 Mobile Phones* (see *MWN,* J/F01).

China has over 166 million mobile phone users, more than any other country. The U.S., the second-largest market, has over 135 million subscribers.

Flat Standard Out, ICNIRP In: Australia Relaxes RF/MW Limits

As expected, on May 7, Australia adopted a new RF/MW exposure standard that closely follows the recommendations of the International Commission on Non-Ionizing Radiation Protection (ICNIRP). The maximum SAR for mobile phones will be at least double that allowed under the previous standard.

As a precautionary measure, the new standard requires "minimizing, as appropriate, exposure which is unnecessary or incidental" when this "can be readily achieved at reasonable expense." This language is stronger than that in the draft released for public comment last year (see *MWN,* M/A01).

The approval of the new guidelines by the Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) is a victory for advocates of harmonizing national standards with those of ICNIRP. The new rules replace the frequency-independent, or "flat," standard in effect since 1985 (see *MWN,* M/A86).

The new standard follows ICNIRP because, it states, no "significant benefit" would result from deviating from it. New Zealand, which also had a flat standard, abandoned it three years ago in favor of ICNIRP-based rules (see *MWN,* M/J99).

The limit for SARs from mobile phones will be 2.0 W/Kg under the new standard, compared to the old 1.6 W/Kg. SAR averaging volume will also increase from 1 g to 10 g — a change that effectively permits exposures to rise by a factor of two or more. Public exposure limits will also increase. For example, the limit will change from 200 to 450 $\propto W/cm^2$ at 900 MHz.

"The new standards reflect the needs of the telecommunications industry rather than the need to protect human health," said Senator Lyn Allison on May 10. Allison was the chair of a senate inquiry on mobile phones that ended last year. At that time, she called for a delay in adopting new rules (see *MWN,* M/J01).

The IEEE-based SAR limit was scrapped because it would have been inconsistent with the use of ICNIRP values elsewhere in the new standard, according to Dr. Colin Roy, the director of ARPANSA's non-ionizing radiation division in Yallambie. In an interview, Roy added that the ICNIRP guidelines are "more health-based and more widely accepted than those of the IEEE."

A government-appointed panel began work on new guidelines after Standards Australia let the flat standard lapse in 1999 and was unable to agree on a replacement (see *MWN,* M/J99 and S/O99). The government has continued to enforce the flat standard, but is expected to make the new limits legally binding soon (see *MWN,* N/D01). *Maximum Exposure Levels to Radiofrequency Fields—3 kHz to 300 GHz* is available at <www.arpansa.gov.au/rf_standard.htm>.

Telecom companies will also be subject to a new code on *Deployment of Radiocommunications Infrastructure* adopted by the Australian Communications Industry Forum in April, available at <www.acif.org.au>. The code also calls for precautionary measures. In addition to minimizing unnecessary exposures, it requires network operators to consider alternatives to siting base stations close to "community sensitive locations" such as schools. The government is expected to adopt the code as law.

U.K. Report: Shields Little Help

Many mobile phone shields do not reduce the user's radiation exposure, and those that do often impair the phone's performance, according to tests commissioned by the U.K. Department of Trade and Industry (DTI).

Some shields — phone cases and antenna clips — can reduce SARs by "large amounts," according to a report by Dr. Mike Manning and Matt Densley of SARTest Ltd. in Newdigate, near London. But SARTest's measurements showed that most shields attenuate the phone's signal — and that many also reduce its ability to pick up incoming signals.

In urban areas where there are many base stations and a phone is not operating at full power, it compensates by increasing output power. But this, SARTest points out, "negates the benefit of the shield." If the phone is already at maximum power, the shield will then affect signal quality.

"In buildings, cars and rural areas, shields will reduce the performance of the phone," Manning told *Microwave News*.

One of the devices lowered exposure without impairing communication, but its brand name was kept secret — as were those of the other products. Critics pointed to the lack of specific information to guide consumers.

"Absorbing buttons" and "earpiece pads" were found to have little effect on SARs. The U.S. Federal Trade Commission recently took action against two sellers of earpiece pads for making false claims (see p.18 and *MWN,* M/A02).

The SARTest report is dated June 2001 but, for some reason, was released by the DTI a year later, on May 10, 2002. The report comes in response to a recommendation of the U.K. expert panel on mobile phones chaired by Sir William Stewart (see p.1).

The DTI has still not taken a position on the safety of hands-free kits. The U.K. Consumers' Association claims that hands-free kits can *increase* radiation exposures (see *MWN,* M/J00 and N/D00). But Manning, whose earlier measurements for the DTI showed much lower SARs with hands-free kits (see *MWN,* S/O00), is satisfied that the matter is settled. In the new report, he advises those who wish to reduce their exposures to use hands-free kits or shop for low-SAR phones .

On the Effectiveness of Various Types of Mobile Phone Radiation Shields is available on the Web at: <www.dti.gov.uk/cii/regulatory/telecomms/index.shtml>.

The Talk of Rome

Beyond the food, the wine, the coffee, the springtime air and the hospitality of the Romans, here are some highlights of the meetings* of the COST281 committee on the potential health impacts of mobile communications and the European Bioelectromagnetics Association (EBEA), held May 2-5.

Jamming 3G

Can a disgruntled anti-tower activist shut down a city's third-generation (3G) mobile phone system using a simple, off-the-shelf 100-watt transmitter? asked Dr. Niels Kuster of IT'IS in Zurich, following Dr. Jørgen Bach Andersen's presentation at the workshop on *Emerging Technologies*.

Andersen, of the Center for Personkommunikation at Denmark's Aalborg University, had explained that the new 3G systems, unlike current GSM networks, keep the power received by the tower at a constant level. So, Kuster wondered, could a noisy signal from a rogue transmitter override the 3G power-control system and close it down?

You can interfere with a GSM network but only one cell at a time, Kuster explained later. With 3G, however, you may be able to disrupt the whole system in 30 seconds with one transmitter.

"Before Kuster mentioned it, I had never thought about it," Andersen told *Microwave News*. Andersen was not quick to dismiss the possible threat. On the one hand, it is "fairly easy" to generate an interfering signal, he said, but on the other hand, "it is also fairly easy to locate."

Second-Hand Radiation: Cell Phones in a Rail Car

A Japanese researcher predicts that if 30 passengers are using cell phones in a commuter rail car, the ambient levels of microwave radiation could exceed the ICNIRP limits.

Dr. Tsuyoshi Hondou of Tohoku University in Sendai has shown that as window space in a rail car decreases, the radiation has nowhere to go. It is reflected off the metal surfaces until absorbed by passengers or other materials.

Exposures are much higher than would be predicted by models which assume that the radiation decreases with the inverse square of the distance from the source, he writes in the February issue of the *Journal of the Physical Society of Japan (71,* pp.432-435, 2002). An English version of his abstract is at: <jpsj.jps.or.jp>.

As Hondou explained to *Microwave News,* the law of conservation of energy must apply: If there is no absorber in the train carriage and no windows, the energy is not lost. He cited the example of using a wave guide to transfer microwave energy from one location to another.

On May 22, Bitkom, a German mobile phone trade association, issued a press release arguing that Hondou's analysis contains "serious errors." And Michael Milligan of the MMF (see p.6) wrote to Singapore's *Straits Times* (May 28) that Hondou's model is based on "flawed" assumptions.

"You could do it once, you could do it twice," commented Georg Neubauer of the Austrian Research Centers Seibersdorf, "but then you will get caught."

Doubts About RF Genotox Experiments

Dr. Franz Adlkofer of the Verum Foundation in Munich, who is coordinating EC's REFLEX research project, has backed off from earlier claims about RF radiation effects on DNA. "I have a lot of doubts about the RF experiments," he said.

In a progress report last fall, Adlkofer reported that he was impressed with Dr. Rudolf Tauber's work at the Free University of Berlin showing RF-induced single- and double-strand DNA breaks (see *MWN,* N/D01). But in Rome, Adlkofer was much more skeptical: "The Berlin results are not reliable at all," he said. "I am not as sure as I was in Brussels." But, he added, "I trust absolutely the ELF EMF data" (see p.3).

With respect to the work on RF effects on gene expression by Finland's Dr. Dariusz Leszczynski, which has just been published (see p.15), he said that he would reserve judgment until the experiment was repeated with a new exposure system supplied by the IT'IS team in Zurich.

Cell Phone Exposures Are "Complex"

Assessing radiation exposures for the IARC Interphone epidemiological study is turning out to be "much more complex than we expected," reported Dr. Paolo Vecchia of the National Institute of Health in Rome.

A validation study using specially modified mobile phones carried out in Rome shows that they are operating at maximum power most of the time — especially at the beginning and end of the call. This is a "totally unexpected" result, Vecchia said.

There are clear differences in exposures when the phone is operating at 900 MHz compared to 1800 MHz, as well as when the user is stationary as opposed to in motion, he said. (For more on the Interphone study, see *MWN,* J/F98, S/O98 and M/A00.)

The Next (Needless) Safety Panic

"The next big safety panic will be pregnant women wearing a phone on their belts," predicted Dr. Peter Excell of U.K.'s University of Bradford at the end of his flamboyant presentation.

When asked by *Microwave News* if he thought there was a real health risk, Excell quickly tried to put the matter to rest. "There's no hazard at all — not for children, nor for women with a phone on a belt," he said. Any risk would be "negligible" compared to those associated with driving a car, he added.

Excell also maintains that the introduction of 3G phones and the future 4G video phones means that "the days of holding a phone to the head are dead." Bach Andersen made a similar prediction, though in a more low-key manner, some years ago.

Three New EC Projects

There were presentations on three new projects that have recently gotten under way — in addition to the EC's ongoing CEM-

FEC, PERFORM-A, REFLEX and Interphone projects (see *MWN,* M/A00 and S/O01).

Dr. Gian Piero Gallerano of ENEA in Frascati, Italy, described the THz–BRIDGE project on terahertz and infrared frequencies (100 GHz-10 THz; BRIDGE stands for biological research investigation on diagnostics and genetic effects). It involves nine research groups in five European countries. A workshop will be held in Capri in the fall (see p.12).

The second new project is known as RAMP, which is short for risk assessment for exposure of nervous-system cells to mobile phone EMFs: from *in vitro* to *in vivo* studies. The three-year effort, which began on April 1, has a budget of €1.1 million ($1 million). Dr. Bruno Bianco of the University of Genoa is leading RAMP with the participation of France's Dr. René de Seze, Sweden's Dr. Yngve Hamnerius and the U.K.'s Excell.

GUARD, the third project, addresses potential risks of phone radiation to hearing and cognitive function. Dr. Paolo Ravazzani of Italy's National Research Council in Milan heads this three-year, €1.5 million ($1.4 million) effort.

Few Americans at the Meetings

Apart from this reporter, only three Americans were at the COST/EBEA meetings. Dr. Mays Swicord represented Motorola and Dr. Lawrence Goldstein came on behalf of WHO's EMF project in Geneva. Goldstein was recently recruited by Dr. Leeka Kheifets — both used to work at EPRI, the electric utility group based in Palo Alto, CA. The third American was sent by Alston & Bird, a law firm helping the wireless industry defend itself against brain tumor compensation claims (see p.18 and *MWN,* M/A02).

* Workshops on *Emerging Technologies* and on *Mobile Phones and Children* were held on May 4 and 5, respectively, at the University of Rome. They were sponsored by COST281 and the EBEA. In addition, on May 2, COST281 and the EBEA hosted a public forum for researchers to present progress reports on ongoing European Commission (EC) projects (see *MWN,* M/A00, J/A00 and N/D01). COST281 has posted many of the workshop presentations on its Web site, <www.cost281.org>.

Children and Mobile Phones *(continued from p.1)*

between children and adults is "weak." Kuster noted that he was picking his words carefully in an effort to be "diplomatic."

"Gandhi's studies suffer from severe methodological flaws," Kuster later explained to *Microwave News*. When Gandhi reduced the adult head to a child's size, Kuster argues, he also changed a number of other parameters, each of which could raise or lower the SAR by 50% or more. "Gandhi's resulting differences in SARs are somewhat random," Kuster said.

The disagreement between Gandhi and Kuster is years old. Gandhi first argued that children were at greater risk in 1996, and members of Kuster's lab challenged that claim in 1998. Each side has criticized the other's models and neither has yielded any ground (see *MWN,* N/D01).

At the June meeting of the Bioelectromagnetics Society, Dr. Bill Guy will emerge from semiretirement to join Kuster in questioning Gandhi's calculations. "For all practical purposes, there is very little difference in peak SARs for different-sized heads," he said in an interview from his home in Seattle. Guy's work was funded by Motorola, which also supports Kuster.

Guy says that Gandhi's higher SARs are a natural result of reducing the size of the voxels (three-dimensional pixels) in modeling the child's brain: With a smaller averaging volume, the SAR will be higher, in the same way that an SAR averaged over 1 g is always greater than one averaged over 10 g.

"It has nothing to do with voxel size," replies Gandhi. "Children have smaller ears, which brings the phone up to 4 mm closer to the head and the brain, and that leads to SARs that are 40-50% higher."

Guy allows that the radiation will penetrate children's heads more deeply because of their smaller size — with the radiation deposited in regions of their brains that are relatively unexposed in adults. But Gandhi contends that this is only part of the story. "Here again, the real issue is the proximity of the phone to the child's brain," he said.

Beyond physical considerations, there is also the question of

WHO Report on Risks to Children — Written by Utility Industry Staffer

A World Health Organization (WHO) report states that children may be at greater risk than adults from non-ionizing radiation (NIR), but stops short of endorsing a policy of prudent avoidance.

Dr. Kristie Ebi, the author of the chapter on NIR, is a manager of EMF programs at EPRI, the electric utility research group in Palo Alto, CA. EPRI has never endorsed precautionary approaches to EMF health risks.

The report, *Children's Health and the Environment: A Review of Evidence,* was prepared by WHO's European Center for Environment and Health in Rome, with the support of the European Environment Agency. Ebi is currently working part-time at the center and part-time for EPRI and will return to EPRI this summer. The WHO report does not identify her EPRI affiliation.

Ebi writes that any EMF risk — evidence for which comes primarily from epidemiological studies of childhood leukemia — is "likely to be small." With respect to RF/MW radiation, she states that studies of possible risks have been "not particularly informative."

Ebi cautions that children and fetuses "may be more susceptible than adults to any adverse effects" due to their still-developing tissues. She concludes that further research is needed and that prudent avoidance measures to reduce exposures are "one approach to dealing with uncertainty."

Many chapters were originally written for the *3rd Ministerial Conference on Environment and Health,* held in London in 1999. The meeting closed with a resolution to address "areas of emerging concern to children's health on the basis of the precautionary principle."

The report is on the Internet at: <reports.eea.eu.int/environmental_issue_report_2002_29/en>.

whether a child's brain, skull and skin are sufficiently biochemically and biophysically different from those of an adult to result in significantly higher SARs.

At the Rome workshop, Dr. Camelia Gabriel of MCL in London presented her measurements — which were published last year — showing that the dielectric properties of rat tissue change over the first 70 days of life. She has found that as a rat grows older the conductivity and permittivity of its brain tissue decrease, which could lead to lower SARs.



"No reason" to limit mobile phone use by young children

—Dr. Eric van Rongen

"Children are not little adults," Gabriel said in Rome. As an example, she pointed to changes in the distribution of red and yellow bone marrow with age: The bone marrow of newborns is almost all red, but that goes down to approximately 50% at the age of 20.

"We cannot afford not to do more research," Gabriel told *Microwave News*. Earlier this year, Gabriel received £350,000 ($500,000) from the U.K. mobile phone research program to make more dielectric measurements (see *MWN,* J/F02).

According to Gandhi, "The peak 1g and 10 g SARs are up to 80% higher if Gabriel's dielectric data are correct and applicable to children." That is, young children would have higher SARs not only because of their different-sized heads and ears but also due to differences in the electrical properties of their tissues.

There is an "urgent need to generate data on the dielectric properties of tissues for children to validate the finding for younger animals such as rats and mice," Gandhi concludes in his new paper.

Gabriel commented that Gandhi's new paper is "most interesting and should be seriously considered by the relevant standard-setting committees." But, she pointed out, an 80% increase in a peak 1g SAR is based on the assumption that a child's dielectric constants are twice those of an adult. The trend is there, but the actual numbers must still be determined, she said.



"It is important to study this question further"

—Dr. Camelia Gabriel

Many of those who argue that children are no different from adults point to the recent analysis by the Health Council of the Netherlands. In Rome, Dr. Eric van Rongen, the council's scientific secretary, reiterated the council's conclusion that there is no reason to limit children's access to mobile phones (see *MWN,* J/F02).

Van Rongen noted that the statements in the U.K.'s Stewart report pointing to a greater health risk for children are based on assumptions and are "not backed by scientific data." In fact, he said, it is "unlikely from the developmental point of view" that there is any change in electromagnetic sensitivity after two years of life.

In an interview following his talk, van Rongen took a somewhat softer stance, agreeing with Gabriel that more research is "very important." "We had to deal with the information we had available," he said, referring to the council's report. "Our conclusions are not definitive."

COST281 is establishing a panel to review the literature and make recommendations on how to address the use of mobile phones by children.

Dr. Luc Martens of Ghent University in Belgium is chairing this "short-term mission."* He plans to have a draft report ready by the next COST meeting, to be held in London in November (see p.12).

The WHO EMF project in Geneva is planning to issue its own recommendations on the use of cell phones by children. Repacholi will assemble a special review committee, probably in the late fall, to investigate children's sensitivity to EMFs.



Evidence for a difference in absorption is "weak"

—Dr. Niels Kuster

"It is *very* important that this issue be investigated thoroughly by WHO before firm recommendations can be made," Repacholi emphasized to *Microwave News*.

Repacholi pointed out, however, that the ICNIRP standard includes a safety factor for the public "because the very young and older people may be more sensitive to EMFs."

"The WHO has tentatively taken the position that children are currently protected by this additional safety factor in the exposure limits and that no specific additional measures appear necessary to protect health," Repacholi said. Those who wish to take precautionary measures, he added, should limit their calls or use hands-free kits.

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*A description of the COST281 mission on *Mobile Communication and Children* is available on its Web site, <www.cost281.org>.

For more on the various expert panels, see *MWN,* J/F01 for France; J/F01 and J/A 01 for Germany; J/F02 for Spain; and M/J00 and M/J01 for the U.K.

O. Gandhi, G. Lazzi and C. Furse, "Electromagnetic Absorption in the Human Head and Neck for Mobile Telephones at 835 and 1900 MHz," *IEEE Transactions on Microwave Theory and Techniques, 44*, pp.1884-1897, October 1996.

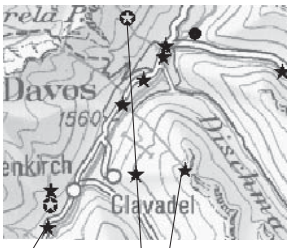
O. Gandhi and G. Kang, "Some Present Problems and a Proposed Experimental Phantom for SAR Compliance Testing of Cellular Telephones at 835 and 1900 MHz," *Physics in Medicine and Biology, 47,* pp.1501-1518, May 7, 2002.

A.W. Guy, C.K. Chou and G. Bit-Babik, "FDTD Derived SAR Distributions in Various Size Human Head Models Exposed to Simulated Cellular Telephone Handset Transmitting 600 mW at 835 MHz," Paper No.7-3, to be presented at the *24th Annual Meeting of the Bioelectromagnetics Society,* Quebec City, Canada, June 23-27, 2002.

A. Peyman, A. Rezazadeh and C. Gabriel, "Changes in the Dielectric Properties of Rat Tissue as a Function of Age at Microwave Frequencies," *Physics in Medicine and Biology, 46,* pp.1617-1629, June 2001.

F. Schönborn, M. Burkhardt and N. Kuster, "Differences in Energy Absorption Between Heads of Adults and Children in the Near Field of Sources," *Health Physics, 74,* pp.160-168, February 1998.

Around Davos Switzerland

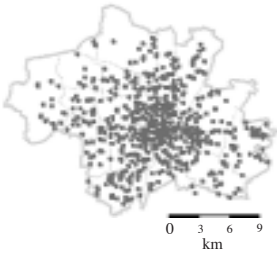


GSM: 10-100 W
TV/Radio: 910 W
GSM: 100-1,000 W

★ Mobile phone tower
● Radio/TV tower
✪ Multiple use tower

Source: Swiss Federal Office of Communications; go to: **<www.bakom.ch/de/funk/freq_nutzung/standorte.index.html>**

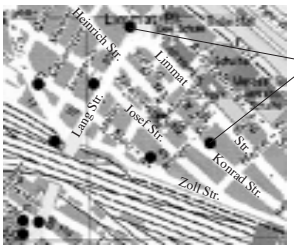
Munich Metro Area



Source: Munich Department of Health & Environment; go to: **<www.muenchen.de/referat/rgu/frames/datfakt/strahlenschutz/Fstrahlenschutz.htm>**

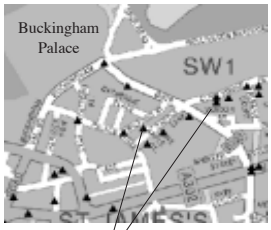
Each • is a telecom site

Central Zurich



Source: Zurich Department of Buildings; go to: **<www.stzh.ch/mfa>**

Queen Elizabeth's London Neighborhood



Mobile phone antennas

Source: Radiocommunications Agency, U.K. Department of Trade and Industry; go to: **<www.sitefinder.radio.gov.uk/home.htm>**

Telecom Towers in Europe: Public Has Detailed Information

The Swiss and U.K. governments have set up Internet sites to provide the public with the locations of telecom antennas. City officials in Munich and Zurich have established their own Web pages for information on tower sites.

Each set of maps is different, both in the types of RF/MW sources covered and the specific information offered for each antenna. For instance, only mobile phone base stations are shown in the U.K. and Zurich maps, while the Swiss and Munich maps also include data for many other types of RF/MW sources.

The Swiss Federal Office of Communications (known by its German acronym, BAKOM) covers GSM, radio and TV towers — TETRA and point-to-point antennas will be added later. The Munich Web site is the most comprehensive, listing mobile phone, broadcast, public safety and taxi radio antennas.

The U.K. maps, which are difficult to navigate, give the name of the mobile phone service provider at each location, as does the city of Zurich. BAKOM identifies radio and TV broadcasters but not the owners of GSM antennas. Munich has opted to omit the names of all the tower operators.

The height of each tower and the output power are included in the U.K. maps. For GSM antennas, BAKOM and Zurich classify power output in one of four categories — from "very small" (<10W) to "large" (>1,000W). For radio and TV transmitters, BAKOM specifies the precise power output in watts.

The Munich site offers information on the frequency and the type of signal (analog or digital) at each location, but not the output power. It also gives the distance between a transmitter and the closest place where people spend time.

The federal authorities in Germany are planning to make information on telecom antennas available to the public, according to *EMF Monitor,* a German newsletter based in Hannover. No details are yet available, however. The Munich site is maintained by the Department of Health and Environment, which is controlled by the local Green Party.

The Zurich maps have a unique feature. You can obtain the precise distance between an antenna and any other location — such as a particular building or another antenna site. This makes it easy to identify which antennas are close enough to each other (<100 m) to be considered as a single source under the city's interpretation of Switzerland's 4 V/m limit (see p.5).

U.S. Data Available at a Price

The U.S. government has no plans to make the location of mobile phone antenna sites available to the public. In fact, the Federal Communications Commission (FCC) does not even have such information.

The FCC's Wireless Telecommunications Bureau requires its licensees to register antennas only if towers are higher than 200 ft (61 m) or if they raise "environmental issues," according to FCC spokesperson Meribeth McCarrick.

Many state and local governments have more extensive data because they issue zoning and construction permits, McCarrick told *Microwave News*. Whether they make this information available to the public is a "local zoning issue," she said.

Janet Newton, the director of the EMR Network in Marshfield, VT, said she does not know of a single city or state that has done so. The EMR Network is concerned with radiation exposures from telecom towers and other sources.

Information on U.S. antenna sites is available at a price. For instance, Tower Maps, a consulting firm based in Lovettsville, VA, has a database on more than 220,000 sites in North America. Prices start at $495 per county. For details, call (540) 822-5092, or go to <www.towermaps.com**>**.

Meeting Notes

• The next meeting of **COST281**, the European committee on the potential health effects of mobile phone radiation, will be held in London, November 12-13. A discussion of a draft report on the radiation impacts on children is on the agenda (see p.10). The U.K. **Mobile Telecommunications and Health Research Program** (MTHR) will meet earlier that same week. On November 11, MTHR will hold a session that is open to the public, followed by a closed session the next day.

• Dr. **Michael Repacholi** will review "WHO's Assessment of the Health Effects of EMF Exposure" — one of three plenary lectures — at the ***27th URSI General Assembly*** in Maastricht, the Netherlands, on August 21. URSI Commission K on Electromagnetics in Biology and Medicine has scheduled ten different sessions for platform presentations as well as a number of additional poster sessions during the weeklong conference. The full program is now posted on the Web; see listing at right.

• The December 2001 issue of *Radiation Protection in Australasia* features 11 papers presented at the March 2001 conference, ***The RF Spectrum: Managing Community Issues.*** The contributions are diverse. Dr. **David Mercer** of the University of Wollongong asks government agencies to stop portraying the public as scientifically ignorant and prone to panic, the media as sensationalistic and the RF community as having reached a consensus on potential health impacts, barring the need for precautionary policies and increased research funds. On the other side of the spectrum, Dr. **Vitas Anderson** of EME Australia, his consulting firm in the Melbourne suburbs, warns against using the precautionary principle to appease the public: There will be economic and legal consequences and science-based standards will be undermined. A few copies of the issue are still available at A$20 each. The journal is published by the Australasian Radiation Protection Society (ARPS). Order from: Judi Anderson, ARPS Secretariat, PO Box 7108, Upper Ferntree Gully, VIC 3156, Australia, E-mail: <arps@21century.com.au>.

New Listings

May 31: **International Seminar on EMFs, New Technologies and Health,** Congress Hall, Ljubljana, Slovenia. Contact: Dr. Peter Gajšek, (386+1) 244-1493, Fax: (386+1) 244-447, E-mail: <peter.gajsek@ivz-rs.si>, Web: <www.gov.si/ivz>.

July 5-6: **Theory and Evidence of EMF Biological and Health Effects,** Catania, Sicily, Italy. Contact: Dr. Michael Kundi, E-mail: <michael.kundi@univie.ac.at>, Dr. Wilhelm Mosgoeller, E-mail: <wilhelm.mosgoeller@univie.ac.at>, or Dr. Livio Giuliani, E-mail: <l-giuliani@libero.it>, or Fax: (39+041) 504-0189, E-mail: <ispeslvenezia@tin.it>.

September 29-October 2: **THz–BRIDGE Workshop on Tera-Hertz Radiation in Biological Research,** Palazzo dei Congressi, Capri, Italy. Contact: Giulia Bartolomei, ENEA, PO Box 65, 00044 Frascati, Italy, (39+06) 9400-5605, Fax: (39+06) 9400-5607, E-mail: <thz-bridge@frascati.enea.it>, Web: <www.frascati.enea.it/THz-BRIDGE/Workshop>.

Selected Upcoming Meetings

(For a complete list, see MWN, *N/D01, J/F02 and M/A02.)*

August 17-24: **27th General Assembly of the International Union of Radio Science (URSI),** Exhibition and Congress Center, Maastricht, The Netherlands. Contact: Dr. Leon Kamp, Dept. of Applied Physics, Eindhoven University of Technology, PO Box 513, NL-5600 MB Eindhoven, The Netherlands, (31+40) 247-4292, Fax: (31+40) 244-5253, E-mail: <URSI2002@tue.nl> ,Web: <www.ursi-ga2002.nl>.

October 7-11: **2nd International Workshop on Biological Effect of EMFs,** Aldemar Paradise Royal Mare Hotel, Rhodes, Greece. Contact: Prof. Panos Kostarakis, (30+1) 650-3129, Fax: (30+1) 653-2910, E-mail: <conf2002@imm.demokritos.gr>, Web: <www.uoi.gr/conf_sem/bioeffects>.

Across the Spectrum

"There are a handful of [mobile phone] studies. None has shown an increase in cancer risk. But I don't think the existing studies are good enough to draw any conclusions."

— Dr. Anders Ahlbom, Karolinska Institute, Stockholm, and chair, ICNIRP Standing Committee on Epidemiology, quoted by Per Snaprud, "Facts About Cell Phone Radiation" (in Swedish), *Dagens Nyheter* (Sweden), *LördagSöndag* (weekend magazine), p.15, March 9, 2002

Convenience 1, Fear 0. Consumers have shown little interest in the specific absorption rate information included now with all new-model mobile phones sold in Australia, according to the chief executive officer of the Australian Mobile Telecommunications Association (AMTA), Ross Monaghan.

— Rachael Quigley, "Consumers 'Show Little Interest' in Data on Mobile Phone Radiation: Associations," *Canberra Times* (Australia), p.16, April 22, 2002

If exciting progress (e.g., "evidence of the existence of a unified biological system, EM field theory") does not emerge in the next two to three years, there is little doubt that a continued decline in both membership and the importance of BEMS and other like societies will result.

— "The Bioelectromagnetics Society's Long Range Plan," distributed with the *Bioelectromagnetics Newsletter,* March/April 2002

"We are the law in this area — not the guards or the government in Dublin. And what we say is done. We are implementing the will of the people; they want you out of here. You have an hour to leave or we'll empty this revolver in your head."

— One of five masked, armed men threatening workers erecting a Digiphone mobile phone base station in Hackballscross, County Louth, Ireland, as reported by John Lee and Maeve Sheehen, "Technology in the Sights of Terrorism," *Sunday Times* (Republic of Ireland edition), p.16, February 17, 2002; Digiphone has dropped its plan for the site

Brillouin Precursors: Robert Adair, Albanese and Oughstun

Ten Million Times Too Weak

April 19, 2002

To the Editor:

In an interview published in your last issue, Prof. Kurt Oughstun pontificates on Brillouin precursors. He and Dr. Richard Albanese argue that pulses in the background emissions of the PAVE PAWS defense radar system on Cape Cod produce these precursors, which then affect the health of those who are exposed to these emissions.

To borrow phrasing from Mary McCarthy, just about every word Oughstun and Albanese say about PAVE PAWS, including the "and"s and "the"s is wrong. However, I will limit myself here to brief comments on two central points: (a) possible biological effects of Brillouin precursors, and (b) conditions for the existence of such precursors.

Brillouin precursors are bumps in the electric field at the beginning and end of pulses of high-frequency radiation found after those pulses have been strongly absorbed by passing through water or tissue. The precursors will occur only if the original pulses entering the tissue have turn-on and/or turn-off times much smaller than the basic period of the radiation (2.2 nanosec for PAVE PAWS).

Oughston's graph (*MWN,* M/A02, p.12), which is in accord with my own calculations, shows that given an incident PAVE PAWS pulse with instantaneous turn-on and turn-off times, at a depth of 25 cm in the brain (of an elephant or whale?) the amplitude of the precursors is about three times that of the rest of the pulse.

The energy density in that pulse at that depth is about 10,000 times less than on the surface, and the energy in the precursors is no more than 1/1,000 of the pulse energy — or about 1 part in 10,000,000 of the energy of the original very weak innocuous background pulse. In short, the precursors are too weak by at least a factor of 10,000,000 to affect biology.

But the instantaneous turn-on and turn-off used in Oughstun's calculations and graph are a mathematician's artifact. Real systems, like PAVE PAWS, radiate the low frequencies that make up the precursors inefficiently and turn the pulse on and off relatively slowly. When I put the real PAVE PAWS turn-on and turn-off times in my calculations, I find no precursors at all. (Such calculations are quite simple.)

So in summary, (a) precursors are innocuous — and (b) they don't exist.

However, to my mind, that is not the only lesson to be learned or, perhaps, even the most important lesson. If a scientist comes to you and says that he has studied the flight of animals and has concluded that elephants can fly by wiggling their ears, you do not conclude that he has just made a mistake — after all, we all make mistakes — but you never believe anything he says again. Oughstun and Albanese: After your indictment of Brillouin precursors for their effects on biology, I will never believe anything you two ever write on science.

Robert Adair, PhD
Department of Physics, Yale University
New Haven, CT 06520
<adair@hepmail.physics.yale.edu>

Membrane Depolarization May Occur

May 3, 2002

To the Editor:

With a simple sinusoidal signal in tissue, the negative half cycle of the signal cancels the prior positive half cycle so there is no net voltage except within a single cycle (about 2 nanosec at PAVE PAWS frequencies).

However, when a Brillouin precursor occurs at the leading edge of an electromagnetic pulse, or when there is phasing or steep amplitude modulation, this balancing may not occur and a net voltage can exist in tissue for some time (several nanoseconds to milliseconds). I believe this will cause membrane depolarization.

To support this concern, I direct your attention to poster P-116* by members of the Air Force Radiation Research Labs at Brooks AFB at the upcoming BEMS meeting in Quebec City.

Richard Albanese, MD
San Antonio, TX
<jelena-2@swbell.net>

* W. Rogers et al., "Extension of the Single-Pulse, Contact Stimulation Strength-Duration Curve Down to 5 Nanoseconds," Poster No.P-116, to be presented at the *24th Annual Meeting of the Bioelectromagnetics Society,* Quebec City, Canada, June 23-27, 2002.

Detailed Measurement Program Needed

April 26, 2002

To the Editor:

In a letter I wrote last November to the PAVE PAWS Public Health Steering Group, I argued that it is absolutely critical that an independent set of time-domain measurements be taken of the electric and magnetic field pulses emitted by the individual elements of the PAVE PAWS radar and that, with this detailed information, the penetration of pos-

WHO EMF Project on Brundtland's Precautionary Approach to Phones

In our last issue, we reported on an interview with Dr. Gro Harlem Brundtland in which she advised a precautionary approach to the use of mobile phones. Brundtland is the director general of the World Health Organization (WHO) in Geneva. At the time, we could not reach Dr. Michael Repacholi of WHO's International EMF Project. In mid-April, after we went to press, Dr. Leeka Kheifets, who works with Repacholi, offered the following comment:

In the interview with the Norwegian newspaper, Dr. Brundtland clearly states that: "We don't have backing in science at this stage for going out with warnings about cell phones. But I believe one should be cautious and not use cell phones more than is necessary." She then refers to the EMF study.

WHO's International EMF Project is actively promoting research [on mobile phone radiation]. As part of the EMF study, the issue of the precautionary principle will be studied closely. In earlier publications, WHO has also advised "concerned individuals" to limit their use of cell phones. WHO cannot see any inconsistencies or contradictions in any of these statements.

sible pulse sequences may be accurately computed in known dispersive bodies such as water, muscle, etc., thereby beginning to directly address the health and safety issues that are central to this entire study.

Robert Adair sent me a highly personal and vitriolic response, which stated in part, "I do know that time-domain measurements will be useless — and quite difficult to implement."

Sifting through the rhetoric, Adair's scientific argument emerges: "As to the strange pulse effects, etc. that Albanese advances...for the most part they simply don't exist. Albanese's cartoons of such waveforms have about the same relation to reality as Donald Duck cartoons. Phenomena such as Brillouin precursors — manifestly harmless as they are — are insignificant."

This letter concludes: "All in all, you are pronouncing voodoo science. I don't know your motives, but your irresponsible letter can help no one and can be damaging to the Air Force and its role in the defense of the United States — *my* country and *my* Air Force — and I resent your writing that letter." Such comments merit no reply.

In his letter to *Microwave News* Adair first admits that "Brillouin precursors are bumps in the electric field...," but then once again states that precursors are "innocuous" and "don't exist." He not only contradicts himself but his statements are contrary to a large body of published scientific research. Important applications of Brillouin precursors have been reported by R.W. P. King and T. T. Wu of Harvard University as well as others, on such diverse topics as undersea communications and hyperthermia treatment.

Although the precursor field amplitudes from PAVE PAWS may indeed be too small to produce thermal effects, that is not the reason for my concern. As I told *Microwave News,* my concern lies entirely with nonthermal effects, particularly with the possibility that a single Brillouin precursor could open small channels through cellular membranes. In order to answer these and related health questions regarding the PAVE PAWS system, we need a detailed measurement program.

In his concluding remarks, Adair states that "I will never believe anything you ever write on science." The last time someone said something like that to me, he took his baseball and went home to his mommy. I bid him good riddance.

Kurt Oughstun, PhD
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University of Vermont
Burlington, VT 05405
<oughstun@emba.uvm.edu>

Hot New Papers

Frank Groves et al., including Robert Tarone, John Boice and Gilbert Beebe, "Cancer in Korean War Navy Technicians: Mortality Survey After 40 Years," *American Journal of Epidemiology (AJE), 155,* pp.810-818, May 1, 2002.

"This study reports on over 40 years of mortality follow-up of 40,581 Navy veterans of the Korean War with potential exposure to high-intensity radar....Deaths from all diseases and all cancers were significantly below expectation overall and for the 20,021 sailors with high radar exposure potential. There was no evidence of increased brain cancer in the entire cohort...or in high-exposure occupations....Nonlymphocytic leukemia was significantly elevated among men in high-exposure occupations but in only one of the three high-exposure occupations, namely, electronics technicians in aviation squadrons (SMR=2.2, 95% CI: 1.3, 3.7)....This is the second follow-up of a cohort of U.S. Navy veterans with possible microwave exposure from radar units aboard ships or in airplanes during the Korean War [the first was the Robinette study, *AJE, 112,* pp.39-53, 1980]....The strengths of our study include its size and long duration of follow-up. The weaknesses of the study include the lack of dosimetry for microwave exposures and other occupational and environmental chemical exposures, misclassification of exposures due to the reliance on job titles, the absence of exposure information after Naval duty...."

Reprints: F. Groves, Medical University of South Carolina, Charleston, E-mail: <grovesf@musc.edu>.

Satoru Takahashi et al., "Lack of Mutation Induction with Exposure to 1.5 GHz Electromagnetic Near Fields Used for Cellular Phones in Brains of Big Blue Mice," *Cancer Research, 62,* pp.1956-1960, April 1, 2002.

"The possible mutagenic potential of exposure to 1.5 GHz electromagnetic near field (EMF) was investigated using brain tissues of Big Blue mice (BBM). Male BBM were locally exposed to EMF in the head region at 2.0, 0.67 and 0 W/Kg specific absorption rate for 90 min/day, 5 days/week, for 4 weeks. No gliosis or degenerative lesions were histopathologically noted in brain tissues, and no obvious differences in Ki-67 labeling and apoptotic indices of glial cells were evident among the groups. There was no significant variation in the frequency of independent mutations of the *lac*I transgene in the brains. G:C to A:T transitions at CpG sites constituted the most prevalent mutations in all groups and at all time points. Deletion mutations were slightly increased in both the high and low EMF exposure groups as compared with the sham-exposed group, but the differences were not statistically significant. These findings suggest that exposure to 1.5 GHz EMF is not mutagenic to mouse brain cells and does not create any increased hazard with regard to brain tumor development....The present experiment was limited to only 4 weeks and does not directly reflect the human situation because cellular phones are often used much longer in daily life. However, the 4-week experimental duration was sufficient because we focused on whether EMF exposure can cause mutations in brain DNA *in vivo* and whether EMF exposure possesses initiating activities on brain carcinogenesis. The manifestation time for fixing mutations is varied among tissues, depending on their proliferation activity. A sampling time of 4 weeks is generally recommended to examine the genotoxic effects in lower proliferating tissues such as brain. Regarding the effects of 1.5 GHz EMF near field exposure on brain tumor development, a long-term experiment using rats is in progress in our laboratory."

Reprints: S. Takahashi, Nagoya City University Graduate School of Medical Sciences, Japan, Fax: (81+52) 842-0817, E-mail: <sattak@med.nagoya-cu.ac.jp>.

D. Maisch, J.Podd and B. Rapley, "Changes in Health Status in a Group of CFS and CF Patients Following Removal of Excessive 50 Hz Magnetic Field Exposure," *Journal of the Australasian College of Nutritional & Environmental Medicine, 21,* pp.19-23, April 2002.

"The present paper briefly reports the results of a small-scale pilot study utilizing 49 subjects suffering from [Chronic Fatigue Syndrome (CFS)] or ongoing [Chronic Fatigue (CF)], who were exposed to varying strength magnetic fields in their home environment. Some subjects were found to have prolonged exposure to magnetic fields >2 mG, which was used as a benchmark level. These subjects (group A) were provided with advice and assistance regarding reducing their exposure level. The re-

mainder of the subjects (group B: <2 mG exposure level) were given no such advice or assistance. Changes in health status in both groups were recorded over a 6-month period....Of the 49 subjects, 14 had prolonged magnetic field exposures >2 mG (28%), and of these 14, 9 were over 4 mG (18%). Interestingly, only two of the 14 exposure situations were due to proximity to power lines....Group B (exposure <2 mG) consisted of 34 subjects with a group average exposure of 0.67 mG.... 55% of the more highly exposed subjects (group A) reported definite improvement in their symptoms....[O]nly 14% [of group B] reported a definite improvement...An unexpected change in this pilot study was a marked improvement in sleep quality for the group A subjects."

Reprints: D. Maisch, Australia, E-mail: <emfacts@trump.net.au>.

S. Dasdag et al., "Effects of Extremely-Low-Frequency Electromagnetic Fields on Hematologic and Immunologic Parameters in Welders," ***Archives of Medical Research, 33,*** **pp.29-32, January-February 2002.**

"Electric arc welding is known to cause considerable exposure to ELF EMFs. Welders handle cables that carry currents in the range of 100-500 amperes very close to their bodies. Normally, a welder directly grasps a handle with the cable during welding, and sometimes the cable is in contact with other parts of the body (wearing the cable over the shoulder is common). A [magnetic field] survey...showed levels of several hundred microtesla just 10 cm from the trunks of welders....The study was carried out on 16 male welders and 14 healthy males between 20 and 40 years of age from the same geographic area and with similar lifestyles....Some of the hematologic and immunologic parameters under investigation were similar in both groups. Although T lymphocyte surface antigens, such as levels of CD4 and CD8, were found to be lower in the welders than in the control subjects ($p<0.001$, $p<0.05$), the hematocrit levels of the welders were found to be higher than those of the control subjects ($p<0.05$). However, the differences observed were not clinically significant. ELF EMF intensities in the welding areas varied between 0.1 and 0.25 mT [1-2.5G]....These results suggest that ELF EMFs do not affect the hematologic and immunologic parameters of welders."

Reprints: S. Dasdag, Dicle University, Turkey, Fax: (90+412) 248-8440, E-mail: <dasdag@dicle.edu.tr>.

Stress Protein Activation by GSM: Key to Cancer and BBB Effects?

Dariusz Leszczynski et al., "Nonthermal Activation of the hsp27/p38MAPK Stress Pathway by Mobile Phone Radiation in Human Endothelial Cells: Molecular Mechanism for Cancer- and Blood-Brain Barrier [BBB] Related Effects," ***Differentiation, 70,*** **pp.120-129, May 2002.**

"[I]t is here hypothesized that mobile phone radiation-induced activation of hsp27/p38MAPK-dependent cellular stress response might: (i) lead to the development of brain cancer due to the inhibition of cell apoptosis and (ii) cause increased permeability of [the] BBB due to stabilization of endothelial cell stress fibers. Stress proteins are known to regulate cell apoptosis. RF-induced deregulation of apoptotic processes might be a risk factor for tumor development because it could lead to the survival of cells that 'should' die [as suggested by French et al., see *MWN,* J/A01]. We suggest that the apoptotic pathway regulated by hsp27/p38MAPK might be the target of RF radiation. Hsp27, stress protein shown in this study to be affected by mobile phone radiation exposure, is a member of a family of small heat shock proteins that is ubiquitously expressed in most cells and tissues under normal conditions....We propose that the induction of hsp27 phosphorylation and increased expression by RF exposure shown in this study to occur *in vitro*...might be the molecular signaling event that triggers the cascade of events leading to the increase in BBB permeability....Proving or disproving this hypothesis using *in vitro* or *in vivo* models will provide evidence to either support or discredit the existence of some of the potential health risks suggested to be associated with the use of mobile phones." (See also p.8 and *MWN,* J/A01.)

Reprints: D. Leszczynski, STUK, Helsinki, Finland, E-mail: <dariusz.leszczynski@stuk.fi>.

"MICROWAVE NEWS" FLASHBACK

Years 20 Ago

• A New York State appeals court unanimously upholds a worker's compensation award to the widow of Samuel Yannon, a New York Telephone Co. technician who worked near MW transmitters on top of the Empire State Building. The company appeals again.

• The solicitor-general's office in Ottawa, Canada, is the latest to report a cluster of abnormal pregnancies among its VDT operators.

• Dr. Ken Klein takes over as head of the DOE's research program on EMFs and health, as its 1983 budget is cut to zero.

Years 10 Ago

• Susan and David Reynard file suit against NEC America and GTE Mobilnet, alleging that the use of a cell phone promoted the development of Susan's brain tumor.

• Concerned over EMF exposures, the Utility Workers Union asks Detroit Edison to adopt a policy of prudent avoidance.

• In Connecticut, a week after U.S. Sens. Christopher Dodd and Joseph Lieberman called for national studies to investigate possible radar-cancer links, Governor Lowell Weicker signs a bill outlawing the use of hand-held radar units by the police.

Years 5 Ago

• "I believe this is the first animal study showing a true nonthermal effect," declares Dr. Michael Repacholi after revealing that more than twice as many mice exposed to GSM radiation developed lymphoma, compared to controls.

• Electric utility workers with over 20 years of exposure to EMFs are three times more likely to develop ALS (Lou Gehrig's disease), according to Dr. David Savitz of the University of North Carolina.

• Motorola threatens to sue U.K.-based Microshield Industries for printing "deceptive" and "grossly misleading" brochures for their mobile phone shields. The company demands that Microshield stop distributing materials that imply cell phones are not safe.

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New Books

Vladimir Binhi, ***Magnetobiology: Underlying Physical Problems,*** 485pp., $149.95, London: Academic Press, 2002. Contact: <www.academicpress.com>.

Binhi, who is at the Russian Academy of Sciences' General Physics Institute in Moscow, develops a theoretical framework to explain "the biological action of weak low-frequency magnetic fields, whose energy is incomparable by far with the characteristic energy of biochemical transformations." According to the late Dr. Aleksandr Prokhorov, a Nobel laureate in physics, Binhi has succeeded. In the foreword, Prokhorov wrote that, "Binhi draws on fundamental physical principles to derive a reasonable model" that "agrees well with experiment."

Riadh Habash, ***Electromagnetic Fields and Radiation: Human Bioeffects and Safety,*** 413pp., $175.00, New York: Marcel Dekker, 2002. Contact: (800) 228-1160, Fax: (845) 796-1772, Web: <www.dekker.com>.

This reference book on non-ionizing radiation, biology and health is written for a general audience. Its greatest strength is its breadth — EMF and RF sources, dielectric properties of tissue, possible mechanisms of interaction, epidemiological studies and exposure standards. Its greatest weakness is prose that is too often muddled.

Edward Leeper, ***Silencing the Fields: A Practical Guide to Reducing AC Magnetic Fields,*** 351pp., $49.50, Boulder, CO: Symmetry Books, 2002. Contact: (303) 442-3773, E-mail: <edleeper@mymailstation.com>.

Dr. Nancy Wertheimer's partner in pioneering research on childhood cancer, Leeper offers "good low-cost ways to mitigate magnetic fields — as a precaution." Much of the information here is for electricians who are installing or troubleshooting electrical wiring, but homeowners will also find useful advice — for instance, on working with electric utilities to address problems with distribution lines.

Rüdiger Matthes, Jürgen Bernhardt and Michael Repacholi, eds., ***Biological Effects, Health Consequences and Standards for Pulsed Radiofrequency Fields,*** 422pp., $60.00, Oberschleißheim, Germany: ICNIRP, 2002. Contact: EarthPrint, Stevenage, U.K., Fax: (44+1438) 748-844, E-mail: <customerservices@earthprint.com>, Web: <www.earthprint.com>.

Papers presented at a November 1999 seminar in Erice, Sicily (see also *MWN,* J/F00). The contributors include many current and former members of ICNIRP.

Lyn McLean, ***Watt's the Buzz? Understanding and Avoiding the Risks of Electromagnetic Radiation,*** 260pp., Aus$30.00 (US $17.15), Melbourne, Scribe Publications, 2002. Contact: E-mail: <scribe@bigpond.net.au>, Web: <www.scribepub.com.au>.

McLean, an activist who leads the EMR Association of Australia (EMRAA), provides an accessible, well-illustrated survey of health concerns related to radiation from power lines, household appliances, cell phones and other sources, with suggestions on how to reduce exposures. (See also p.18.)

CONSUMER REPORTS

Waiting for a Definitive Answer... In a letter appearing in the June issue of *Consumer Reports,* a reader writes that he is "appalled" that the magazine's guide to cell phones did not touch on possible radiation risks (see *MWN,* J/F02). The editors reply, in part, that: "We didn't mention radiation and cell phones because studies in Europe and the U.S. have yet to demonstrate definitively that cell phone radiation is harmful."

PEOPLE

Dr. **Howard Cyr** is the new interim chief of the radiation biology branch and manager of cell phone studies at FDA's Center for Devices and Radiological Health (CDRH) in Rockville, MD. Cyr takes over from Dr. **Russell Owen**, who left the center to join the EPA in Research Triangle Park, NC (see *MWN,* J/F02). Meanwhile, the FDA–CDRH is searching for a permanent replacement. Cyr, whose research has focused on UV and ionizing radiation, got his doctorate in biophysics from Penn State University in 1972. FCC's Dr. **Robert Cleveland** and Motorola's Dr. **Joe Elder**, formerly with the EPA, were graduate students in the same department during Cyr's time at Penn State....Dr. **Gayle Woloschak** of the Argonne National Lab outside Chicago has become the 11th member of the NAS–NRC committee investigating possible health impacts of the USAF's PAVE PAWS radar on Cape Cod (see *MWN,* J/F02 and M/A02). Dr. **Evan Douple**, the director of NAS–NRC's Board on Radiation Effects Research, declined to reveal whether Woloschak has clearance to see classified documents. He said that this was the NAS–NRC policy — although previously *Microwave News* was told which members of the PAVE PAWS panel and NRC staff hold security clearances. Among Woloschak's interests are mechanisms for the development of radiation-induced tumors. She won a $467,000 grant from the EMF RAPID program to study possible changes in gene expression following exposure to power-frequency magnetic fields (see *MWN,* S/O94)....As expected, Dr. **Thomas Tenforde** was elected president of the National Council on Radiation Protection and Measurements (NCRP), replacing **Charles Meinhold** (see *MWN,* J/F02*).* **Ron Petersen** and Dr. **Marvin Ziskin** were reelected to the NCRP's board of directors. Dr. **Jerrold Bushberg** of the University of California, Davis, has been elected to the council....On May 23, Governor Michael Leavitt presented Dr. **Om Gandhi** of the University of Utah, Salt Lake City, with the Governor's Medal for Science and Technology.

STANDARD SETTING

ICNIRP Explains... The International Commission on Non-Ionizing Radiation Protection (ICNIRP) has issued a description of its "philosophy and general methodology" for evaluating the scientific literature on possible health risks. For example, in its discussion of reduction (safety) factors, the members of the commission note that, "Uncertainties in the knowledge are compensated for by reduction factors, and the guidelines will accordingly be set below the thresholds of critical effects....There is no definite basis for determining the precise magnitude of the reduction factors, and the choice of the reduction is a matter of scientific judg-

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Cell Towers

Wireless Convenience? or Environmental Hazard?

Edited by B. Blake Levitt with chapters contributed by:
Carl Blackman, EPA; Robert Cleveland, FCC; Albert Manville, F&WS; Henry Lai and Andrew Marino, among others



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ment. As with all the procedures, setting reduction factors should be free of vested commercial interest." A draft of this document was reviewed by other standard-setting groups, including IEEE's ICES/SCC-28. Ron Petersen, the secretary of ICES, commented that ICES, as well as an IEC committee (TC106), had provided ICNIRP with "extensive and detailed comments," particularly with respect to addressing uncertainty and safety factors: "ICNIRP thanked us for the comments and then ignored each and every one." There has long been tension between the two groups as they vie for control of the standard-setting process (see *MWN,* J/A00). "General Approach to Protection Against Non-Ionizing Radiation" appears in the April issue of *Health Physics (82,* pp. 540-548, 2002). A copy can be downloaded at no charge from the "activities" section of ICNIRP's Web site, <www.icnirp.de>.

AS WE GO TO PRESS

Daubert Dispute Continues... The Angelos law firm and the cell phone industry are not waiting passively for Judge Catherine Blake to issue her decision on whether the Christopher Newman brain tumor case can go to trial (see *MWN,* M/A02). On May 29 at the request of Jeffrey Silva of *RCR Wireless News,* Blake released a series of letters concerning the publication of the Swedish and Finnish epidemiological studies (see *MWN,* M/A02 and p.6, respectively). Russell Smouse of the Angelos firm notified Blake on April 2, a month after the Daubert hearing ended, that Dr. Lennart Hardell's paper had been accepted by the *European Journal of Cancer Prevention*. He followed up on April 23 to tell the judge that the Finnish paper had been published. Each letter prompted reply comments from Jane Thorpe of Alston & Bird on behalf of the wireless industry defendants.

Keeping Current: Follow-Up on the News

◆ On May 31, Minnesota Judge Rex Stacey ordered the town of Sunfish Lake to approve Xcel Energy's planned upgrade of a 115 kV power line (see *MWN,* M/A02). The town's denial of a permit was "unauthorized, unreasonable, arbitrary and capricious," ruled Stacey. At press time, the town had not yet decided whether to appeal. But the Power Line Task Force, a local group, will, according to its director, Roger Conant. Stacey's ruling is "replete with errors," Conant said. Stacey's decision is available at <www.sunfishlake.org/news.htm>.

◆ *Cell Phone Facts,* the joint FDA–FCC Web site for consumer information on cell phones, is up and running. Issues are addressed in a question-and-answer format. For example, *Q*: "Do hands-free kits for wireless phones reduce risks from exposure to RF emissions?" *A*: "Since there are no known risks from exposure to RF emissions from wireless phones, there is no reason to believe that hands-free kits reduce risks...." For more, go to: <www.fda.gov/cellphones>.

◆ The five mobile phone–brain tumor lawsuits filed on February 25 by a team led by Mayer Morganroth of Detroit have been moved to the federal court of Judge Thomas Penfield Jackson in Washington, DC, who consolidated them with the *Michael Murray* suit, which Morganroth filed last November (see *MWN,* N/D01 and M/A02).

◆ The EMR Alliance of Australia is now the EMR Association of Australia Inc. (EMRAA). Headed by Lyn McLean of Sutherland, south of Sydney (see p.16), the EMRAA promotes "a society that enjoys the benefits of technology safely." For more information, go to <www.ssec.org.au/emraa>.

◆ The state of Maryland will pay Baltimore attorney Peter Angelos $150 million for his work on litigation against the tobacco industry, the *Washington Post* reported on April 25 (see *MWN,* J/F02). Angelos could have received up to $1 billion under his original agreement with the state. He has still not heard whether his cell phone–brain tumor case against Motorola and other wireless companies can go to trial (see above and *MWN,* M/A02).

◆ On May 14, the FTC announced that it is suing Meristar International Inc. in Dallas for marketing mobile phone shields that are ineffective. The agency says that Meristar was in a joint venture with Stock Value 1, one of two companies sued by the FTC in February for similar reasons (see *MWN,* M/A02).

The True Risk to Children: Our Ignorance About Health Effects

The underlying assumption at the heart of the Rome workshop on *Mobile Phones and Children* (see p.1) was that when exposure standards are met, the safety of adults is assured. From that vantage point, speaker after speaker considered possible differences between adults and children to see if the young may be at greater risk.

The central question none of the speakers addressed was the reliability of the 1.6 and 2.0 W/Kg SAR standards. That's not surprising since the sponsors of the meeting — COST281, EBEA, ICNIRP and the WHO — are, in one way or another, committed to ICNIRP's 2 W/Kg limit for mobile phones.

No one wanted to rehash familiar arguments about nonthermal effects or possible cancer and neurological risks, and especially not about leakage through the blood-brain barrier.

But it is these still-open health issues, much more than the possible physical and biological differences between children and adults, that point to a need for precautionary policies — for instance, limiting children's access to mobile phones. This approach was first endorsed by the Stewart panel in the U.K., and later by similar groups in France, Germany and Spain.

Some in China recognize the importance of the large data holes and want to set the standard at 1W/Kg (see p.1). As Dr. Huai Chiang pointed out last year, the ICNIRP limits are based on short-term health effects, not on the body of literature suggesting that there are biological effects at levels that do not produce heating or stimulation (see p.7).

The Swedish white-collar union, TCO, has opted for an even stricter standard, 0.8 W/Kg.

For its part, the wireless industry insists that setting stricter exposure standards is simply a waste of money because safety has been assured (see *MWN,* M/J99).

Dr. Eric van Rongen of the Health Council of the Netherlands, whose recent report has become a brief for those who see no reason to give children special treatment, takes a pragmatic view. One must deal with the information that is available, he says, and there is no direct evidence showing that children are more sensitive than adults (see p.10).

On the other hand, there are those who emphasize that not all the evidence is in. As Sweden's Dr. Leif Salford said a couple of years ago, mobile phones are "the world's largest biological experiment ever" (see *MWN,* S/O00).

It is an experiment, moreover, in which young people constitute a significant proportion of the exposed population. The BBC reported last year that two-thirds of all British 11-to-15-year-olds own their own mobile phones, and close to nine in ten use one. That's in a country where the Stewart panel advised against this and where a hyperactive press has blared constant warnings about the perils of mobile phones.

In all other branches of environmental health, it is axiomatic that children need special protection because of their special vulnerabilities and because they will be exposed for longer periods of time. So, why not in RF and microwave land? There is nothing to worry about, the experts tell us, because they understand everything that needs to be known. And just to be safe, they have added an appropriate safety factor that covers all age groups (see p.17).

Anyone who has followed the shameful history of ionizing radiation exposure standards knows how wrongheaded this argument is. Safety limits were tightened as more research pointed to effects at lower and lower levels. The principle that less exposure is better — call it ALARA — is the way to deal with our general ignorance. Clearly, it should also apply to non-ionizing radiation.

Dr. Luc Martens of the University of Ghent is leading COST 281's short-term project to prepare a report on mobile phone risks to children (see p.10). He and the rest of his committee must not ignore the fundamental uncertainties and assume the heart of the problem away, as was done in Rome.

A Mickey Mouse Policy

In November 2000, just as ABC News was about to air a TV program expressing concern over the use of cell phones by children, the Walt Disney Co. announced that it would no longer allow its cartoon characters to be used to market wireless phones. ABC is a subsidiary of Disney.

This new policy will remain in effect "until there is reliable evidence establishing the absence of any [health] risks," a Disney spokesman said. "The well-being of our customers is our first priority" (see *MWN,* N/D00).

In a recent visit to our local wireless store, we noticed that Mickey Mouse phone covers were still on the shelf. "He is one of our best sellers," the manager told us. Minnie Mouse was also there. Goofy was out of stock, but, she quickly added, "You name it, we can get it."

We then checked the Internet, where we found numerous offers for Nokia faceplates with Disney characters.

Our next step was Disney corporate communications. We asked whether it had changed its policy. Not at all, said Maria Gladowski, a Disney spokesperson. "We stand by it." The company has discontinued licensing its characters for cell phones, she said.

Disney is known to be hard as nails about who gets to use its cartoon characters. Just ask the Florida day care center that was forced to remove unauthorized murals of Mickey Mouse and Donald Duck.

Do we need Disney's permission to call this a Mickey Mouse policy?

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Changes in Protein Folding: A Nonthermal RF Mechanism

Is There a Risk of Neurological Disease?

In a series of new experiments, Dr. David de Pomerai has shown that very weak microwave radiation can change the shape of proteins, prompting them to clump together. He has also found that the radiation can lead to the formation of long strands of proteins called fibrils. De Pomerai argues that these changes in protein structure can in turn trigger the production of heat shock proteins, previously reported by his and many other laboratories.

"This is the first direct evidence suggesting that the microwave-induced heat shock response could involve damage brought on by changes in protein conformation," de Pomerai told *Microwave News* from his lab at the U.K.'s University of Nottingham.

If de Pomerai is right, he has added an important new piece to the jigsaw puzzle that might one day explain the mechanism for a nonthermal effect.

Writing in the May 22 issue of *FEBS Letters,* he raises the possibility that the protein fibrils he has observed following microwave exposure may be similar to those associated with neurological diseases like Alzheimer's, Parkinson's and Creutzfeld-Jakob.

(continued on p.6)

WHO Flip-Flops on EMFs, Precautionary Principle Now Revoked

The World Health Organization (WHO) has decided not to invoke the precautionary principle for electromagnetic fields (EMFs), Dr. Michael Repacholi has told *Microwave News*.

Less than three months after releasing a draft position paper that called for applying the precautionary principle to both extremely-low-frequency (ELF) and radiofrequency (RF) EMFs, the WHO has backed off from this recommendation (see *MWN*, M/A03). The draft had been circulated at a WHO workshop held February 24-26 in Luxembourg. Attendance was by invitation.

"The draft we submitted to the Luxembourg workshop was purely a discussion draft to provoke comment....It was very successful at that," Repacholi, the head of the WHO International EMF Project, wrote in a May 22 e-mail.

The decision caught many of those who attended the meeting by surprise. It "really *does* surprise me because in Luxembourg we agreed, more or less, that the precautionary principle *should be invoked*, especially for ELF," Dr. Mirjana Moser of the Swiss Federal Office of Public Health in Bern told *Microwave News*.

(continued on p.11)

RF/MW Epidemiological Studies: Cell Towers and Beyond

As an English team begins the first major epidemiological survey of people living near mobile phone base stations and a German group is working on a feasibility study for a similar effort, the debate rages on as to whether such studies should be done at all.

Speaking at a May workshop on *Mobile Phone Base Stations and Health** in Dublin, Dr. Norbert Leitgeb of Austria's Technical University of Graz reiterated his now well-known view that they are a waste of time and money. They can neither detect a possible small risk nor demonstrate the absence of harm and can therefore do nothing to settle the issue, he argued. Late last year, COST281, the European mobile phone research group, which Leitgeb chairs, issued a statement† that spells out the argument against pursuing this line of research.



The situation is more complex than for ELF magnetic fields
— Norbert Leitgeb

Leitgeb drew a parallel between RF radiation from mobile phone antennas and magnetic fields from power lines. Base stations present a "more complex" problem than power lines, he said. After a large number of studies over the last 24 years covering more than a million people, the cancer risk from power-frequency EMFs remains mired in uncertainty. Leitgeb maintains that public concerns stem from perception — or more precisely misperception — of the risks.



We must test the hypothesis that there is no risk
— Stan Szmigielski

Dr. Paolo Vecchia, a physicist at Italy's National Institute of Health in Rome, offered another reason for not supporting base station epidemiological studies: They can amplify the perceived risk. "Doing a study may increase public concerns," Vecchia argued.

Dr. Stanislaw Szmigielski looked at the matter from a different perspective: If the objective is to calm public anxiety, some data are better than no data at all. Szmigielski and Elzbieta Sobiczewska, both of the Military Institute of Hygiene and Epidemiology in Warsaw, have been investigating public attitudes on base station radiation for the last five years. In Dublin, they reported that there is "strong" evidence that as people learn more about the radiation, concerns about health risks diminish.

"You can turn Leitgeb's argument around," Szmigielski said. "Residents are not convinced that there is no risk, so you need to test the hypothesis of no risk." Leitgeb was unswayed. "The absence of risk is difficult to prove," he replied. Szmigielski has carried out a major epidemiological study of military personnel exposed to RF radiation (see most recently *MWN,* J/F98).



The Vatican RF study is the best to date
— Joachim Schüz

Some of those at the workshop believe that a better strategy is to look for observable health impacts among populations that have greater exposures than do those living near base stations.

"I am not convinced by Leitgeb's argument," Dr. Joachim Schüz told *Microwave News*. "Epidemiologic studies, if well-designed, can contribute significantly to the clarification of this issue."

"The first step is to look at highly exposed people," said Schüz, an epidemiologist at Germany's University of Mainz. "Can you imagine if [Sir Richard] Doll and [Richard] Peto had looked at passive smoking first, instead of heavy smokers?"

"Michelozzi's study of the Vatican transmitters is the best so far," Schüz said. Last year, Dr. Paola Michelozzi, an epidemiologist with the regional health authority in Rome, reported a higher rate of childhood leukemia close to the high-power antennas in Cesano, outside Rome (see *MWN,* J/A02; also S/O01).



What is the right hypothesis to test?
— Mirjana Moser

Other studies of people living near radio and TV antennas, carried out in Australia and England, have also suggested that RF radiation can lead to higher rates of leukemia, Schüz said. But, he warned, they, like the Vatican study, were small and suffered from methodological problems.

Dr. Mirjana Moser of the Swiss Federal Office of Public Health in Bern agreed with Leitgeb that a base station study should not be a high priority. But she does favor looking at the health of highly exposed workers.

"We are a long way from having a clear picture of what is the right hypothesis to test," Moser warned.

In a recent report, the Health Council of the Netherlands recommended doing an epidemiological study of people who are highly exposed to RF radiation, possibly including those living near radio and TV towers, but discouraged doing a base station investigation (see *MWN,* M/A03).

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* *Mobile Phone Base Stations and Health,* a COST281 Workshop, Dublin, Ireland, May 15-16, 2003. The agenda and abstracts of the presentations are available at <www.cost281.org>. A very limited number of CDs containing the slide presentations of the papers is available from Dr. Tom McManus, who organized the meeting. For more information, write to: <Mary.Leavy@dcmnr.ie>. The German feasibility study is being done in Lower Saxony by Dr. Rainer Frentzel-Beyme at the Bremen Institute for Prevention Research and Social Medicine; see also *MWN,* J/F02. For the U.K. study, see *MWN,* N/D02 and M/A03; also p.3.

† *Scientific Comment on Epidemiologic Studies on the Health Impact of Mobile Communcation Base Stations,* November 2002 (see *MWN,* N/D02, J/F03 and M/A03). It, too, is on the COST281 Web site.

The Talk of Dublin

Imelda O'Connor of County Cork, who describes herself as electrosensitive, wanted everyone at the COST281 workshop to know that Dr. **Gro Harlem Brundtland**, the Norwegian director-general of the WHO, says she, too, is electrosensitive. For instance, Brundtland does not use a mobile phone or allow anyone nearby to use one (see *MWN,* M/A02). Dr. **Gunnhild Oftedal** of Sør-Trøndelag University College in Trondheim, Norway, then rose to say that Brundtland's condition is still something of a mystery because she has not undergone any confirmatory tests. A little later, we asked Oftedal if anyone had approached Brundtland to see if she would allow herself to be tested. "No comment," she immediately replied, "I can't say anything." We did not let it end there: "Does that mean you are holding something back?" Oftedal smiled and said, "I have promised not to say anything."



GUNNHILD OFTEDAL WOULD NOT COMMENT — OR DID SHE?

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Dr. **Eric van Rongen** of the Health Council of the Netherlands in The Hague is investigating the claims of those who say they are electrosensitive. He presented the protocol for a study which will expose 36 self-described **electrosensitives** and 36 controls to various microwave signals at a power level of 1 V/m. "My impression is that this is a zero experiment," commented Dr. **Niels Kuster** of IT'IS in Zurich. He wondered why van Rongen had not used higher exposures so that he would have had a better chance of picking up a response. Van Rongen acknowledged that the field was very low but said that he was bound by the instructions of the ethics committee that had reviewed the experiment. "It's very interesting that the committee would not allow exposures up to the ICNIRP level," replied Kuster. (The Dutch health council has endorsed ICNIRP-type guidelines: see *MWN,* M/J 97; ICNIRP allows exposures of up to 61 V/m at 2 GHz.) Results are due this summer. "My expectation is that we will not see anything," van Rongen said.

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The COST281 workshop highlighted the different approaches to the mobile phone mast issue in Europe and in the U.S. Public concerns are being aggressively addressed in a host of countries across the continent. In his welcome, **John Browne**, Ireland's minister for communications, explained why: He spends more time talking to his constituents about towers than all other issues combined. On the day before the workshop, the ***Irish Times*** brought the point home, with a big picture of a vandalized phone mast with damage estimated at €100,000 (US$115,000).

U.K. Pledges $8 Million To Study Long-Term Effects of TETRA

The U.K. government will spend £5 million (US$8.3 million) to assess whether its new terrestrial trunked radio (TETRA) digital communication system has any long-term health effects.

The project will "provide further reassurance to users about long-term safety," said Bob Ainsworth, a minister at the Home Office, on May 23. The Home Office oversees the U.K. police, who, among others, will use the TETRA system.

The new program will monitor the health of as many as 100,000 police officers over a 15-year period. A much smaller study with volunteers will look for changes in cognitive function (see also p.8).

The project will be carried out at the Imperial College in London. The lead investigator has not yet been announced. Prof. Paul Elliott of the college was recently awarded a contract to study the health of people living near mobile phone base station antennas (see *MWN,* M/A03; also p.2).

This is the first major prospective study of users of handheld communication devices. "The government is spending more on this one project than on the whole MTHR program," said Alasdair Philips of Powerwatch, the U.K. advocacy group. Philips was referring to the ongoing research effort that grew out of the Stewart report on mobile phone health risks (see *MWN,* M/J00, J/F02 and M/A03).

Questions have been raised about possible adverse effects of TETRA's 17.6 Hz pulse modulation frequency, but an NRPB advisory panel has discounted such concerns (*MWN,* J/A01).

The TETRA system has already been the target of complaints from police officers, who blame the radios for headaches and other symptoms (see *MWN,* J/A02). A police employees' group in Lancashire is threatening legal action. (See also p.15.)

American Cancer Society: Cell Phone Cancer Risk Is a Myth

The American Cancer Society (ACS) wants to pull the American public back from the "brink of paranoia" by setting us straight about what can and cannot cause cancer.

On May 26, the ACS joined forces with the Discovery Health Channel to air the *Top 10 Cancer Myths* on cable television.

Myth 8: "Electronic devices, like cell phones, can cause cancer in the people who use them." Dr. Ted Gansler, ACS' director of medical content, advises that microwave radiation cannot cause changes in DNA.

Last year, Dr. Eugenia Calle, an ACS epidemiologist, testified for the cell phone industry in the Newman brain tumor case (see *MWN,* M/A02; also p.18).

IEEE Move To Relax Cell Phone SAR Exposure Limit Under Fire

A proposal by IEEE's International Committee on Electromagnetic Safety (ICES) to relax the limit for exposures to mobile phone radiation is generating controversy.

The plan would create "the most relaxed RF safety standard in the world," warned Dr. Om Gandhi in a December 9 open letter to ICES' Subcommittee 4, which is drafting the new standard. Gandhi, who is at the University of Utah in Salt Lake City, pointed out that the proposal would make the IEEE SAR limit 3-5 times higher than the standard set by the International Commission on Non-Ionizing Radiation Protection (ICNIRP).

"The newly proposed ICES/IEEE RF safety standard would potentially allow cellular telephone radiations that would be 8 to 16 times those allowed in the U.S. at present," Gandhi told *Microwave News*. "They would also be larger than twice those allowed under the ICNIRP guidelines — thus vitiating the desire to have a harmonized safety standard for cellular telephones."

The ICES subcommittee, which is chaired by Drs. C.K. Chou of Motorola and John D'Andrea of the U.S. Navy, has voted to increase the averaging volume for measuring specific absorption rates (SARs) from 1 g to 10 g of tissue. This change alone would effectively allow exposures to be 2-3 times higher. The subcommittee also wants to relax the SAR limit from 1.6 W/Kg to 2 W/Kg (see *MWN,* S/O01).

The combined effect of these two changes would appear to bring the IEEE mobile phone standard in line with the ICNIRP limit of 2 W/Kg over 10 g. But the IEEE recently approved a separate relaxation in which the SAR for the outer ear (the pinna) was increased from 1.6 W/Kg over 1 g to 4.0 W/Kg over 10 g (see *MWN,* N/D99 and M/J02). ICNIRP does not treat the ear differently than the rest of the human head or body.

On March 15, Richard Tell, a consultant based in North Las Vegas, NV, replied to Gandhi on behalf of ICES, arguing that simple arithmetic shows that the ICES limit of 4 W/Kg in the ear would be at most twice that of ICNIRP's 2 W/Kg.

Gandhi responded that Tell's argument is moot because U.S. manufacturers do not measure SARs in the pinna for compliance purposes — indeed, the pinna has been replaced with a plastic spacer. "Test procedures only focus on the 2 W/Kg for any 10 g of head/body tissues," Gandhi wrote in a March 28 letter to Tell.

The important question is whether the Federal Communications Commission (FCC), which sets the U.S. safety standard for mobile phones, will follow IEEE's lead. "We would be under some obligation to consider new guidelines after they are adopted," said FCC's Dr. Robert Cleveland (see box at right).

In the past, the FCC has favored the RF standards recommended by the National Council on Radiation Protection and Measurements (NCRP), an organization chartered by the U.S. Congress. NCRP Scientific Committee 89-5, now in the midst of updating its 1986 RF biological effects report, has been barred from recommending its own set of exposure limits (see *MWN,* M/A03). Interestingly, Dr. James Lin of the University of Illinois in Chicago, the chair of SC89-5, has been one of the most outspoken critics of raising the averaging volume from 1 g to 10 g. He has said that such a move is not "scientifically defensible" (see *MWN,* J/A00 and N/D00).

Dr. Alastair McKinlay of the U.K.'s NRPB, who serves as the chair of ICNIRP, told *Microwave News* that the commission is now embarking on a major review of all aspects of RF radiation and health. He said that ICNIRP has "no plans to alter its RF guidelines at this stage," including raising the limit for the ear. Nor does the NRPB, he added (see p.7).

Standards Watch

• The U.S. **FCC** will soon propose revisions to its **RF exposure guidelines**. On May 1, **Michael Powell**, the chairman of the commission, revealed that this would be part of an "action plan" to "protect valuable historic and environmental resources." He did not offer any details, however. Dr. **Robert Cleveland** advised that the agency has been preparing draft rules that address a number of compliance issues. They will be released for public comment "probably sometime in June," he said. Cleveland, who is at the Office of Engineering and Technology in Washington, told *Microwave News* that the proposed changes will cover both fixed and portable sources, but that the exposure limits themselves will remain unchanged. "After six or seven years of experience, we've determined that there are several areas where some fine-tuning may be needed," he explained. The FCC issued rules for evaluating compliance in 1997 (see *MWN,* S/O97).

• **Kent Jaffa** of **PacifiCorp** has stepped down as the chair of **ICES**' subcommittee 3 (SC-3), which addresses the **0-3 kHz** frequency band. **Thanh Dovan**, an engineer with **SPI Powernet** in Australia, has agreed to serve as a cochair of SC-3. A search is under way for another cochair. Dovan is a member of the recently assembled ELF working group that is preparing a set of Australian exposure limits (see *MWN,* M/A03); previously, he worked with Enertech Consultants in Campbell, CA. SPI Powernet owns and operates 6,000 km of high-voltage power lines in Victoria....Dr. **Bob Ashley** has resigned from **ICES** and all its subcommittees. He had challenged ICES' new ELF standard, but those concerns were rejected by the IEEE Standards Board (see *MWN,* N/D02 and J/F03; see also M/A03). Ashley explained that he is "professionally embarrassed" to be named as a contributor to the new standard when his advice was ignored. By resigning, he said, his name would not appear on the published standard. ICES is also known as SCC-28. (See also p.16.)

• **Australia**'s code of practice for **siting telecommunications antennas** became fully mandatory on April 10. Under the code, carriers must provide RF exposure assessments of existing sites on request, as well as notify and consult local officials and nearby residents about new sites. All transmitters must be designed and operated in such a way as to minimize unnecessary exposures (see *MWN,* M/J02 and N/D02). The Australian Communications Authority (ACA) granted a six-month transition period when it adopted the rules last October. The code was originally developed by industry.

« Eye on Europe »

Vatican officials are not immune from prosecution in the Italian courts, Italy's supreme court ruled in early April. The decision clears the way for three Vatican officials, including the director-general of **Vatican Radio**, to face charges for endangering the health of those living near the **antennas** in Cesano, outside Rome (see p.2). The case had been dismissed in February 2002 under a 1929 treaty that established the Vatican as a sovereign state (see *MWN,* M/A02). Italian prosecutors were delighted by the decision. "I could have not received a better birthday present," one of the prosecutors told BBC News. No word yet on when the trial might begin.

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On April 28, **Switzerland**'s Federal Agency for Environment, Forest and Landscape (known as **BUWAL**) released its assessment of possible **health risks of RF radiation**. According to Dr. **Gerhard Leutert**, who heads BUWAL's division for air quality and non-ionizing radiation, the report confirms the need for the national precautionary limits adopted three years ago (see *MWN,* J/F00). A continued and consistent application of the precautionary limits is advised "without qualification," Leutert writes in the introduction to the report. He points to indications of health effects at levels below ICNIRP's limits, including increased brain cancer risks and changes in cognitive function. BUWAL asked the report's authors, Drs. **Martin Röösli** and **Regula Rapp** of the Institute for Social and Preventive Medicine in Basel, to take a more finely shaded approach than simply determining whether biological effects are established or not. Effects may now be assigned to one of five categories: "established," "probable," "possible," "improbable" or "not assessable" (see *MWN,* M/A 03). The full report is available in German, with summaries in English, French and Italian, at <www.umwelt-schweiz.ch>. Abstracts of most of the more than 200 studies cited in the report will soon be available (only in German) in an online database accessible to the public, < www.unibas.ch/elmar >.

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Germany's **Office of Technology Assessment** in Berlin is proposing a new way to help consumers minimize their exposure to mobile phone radiation: Include a continuous readout of antenna output power on the display screen of every phone. In a report released on May 21, the office's Dr. **Christoph Revermann** contends that the **Blue Angel** label for low-SAR phones promoted by the German government "ultimately does not ensure safety"

Swedish BBB Research Faulty, Says German Wireless Group

Reviews commissioned by FGF, the German telecom industry research group, cast doubt on the validity of the Salford-Persson experiments on the effects of RF radiation on the blood-brain barrier (BBB).

FGF is now sponsoring *in vitro* studies of RF radiation and the BBB, according to Dr. Gerd Friedrich, FGF's managing director in Bonn. Cells are being exposed to UMTS (3G) phone radiation; experiments with GSM signals are being planned. Results are scheduled to be released at the 2004 annual meeting of the Bioelectromagnetics Society.

Friedrich declined to say who is leading the study, but *Microwave News* has learned that the principal investigator is Dr. Florian Stögbauer of the University of Münster.

Earlier this year, Drs. Leif Salford and Bertil Persson of Sweden's University of Lund reported that extremely low levels of GSM radiation can increase the permeability of the BBB and cause nerve cell damage in rats (see *MWN,* J/F03).

FGF is also hosting a workshop on RF and the BBB, to be held in Reisensburg, near Ulm, Germany, November 3-6 (see p.12). Salford has been invited, Friedrich told *Microwave News,* adding that Persson is also welcome.

In the first of three sharply critical reviews published in the March issue of the *FGF Newsletter,* Dr. Roland Glaser contends that the Lund researchers made many errors and violated the rules adopted by the international scientific community to assure high-quality research. Among the alleged shortcomings are: the exposure of a small number of rats; the lack of a double-blind protocol; poorly characterized exposures; and the failure to include appropriate controls in the study design.

According to Glaser, who is a professor emeritus at Humboldt University in Berlin, Salford and Persson also fail to address previous research by other labs that failed to see effects.

In the second critique, Drs. Helmut Franke, Frank Gollnick and Sheila Johnston contend that the Swedes' measurements of nerve cell degeneration and leakage through the BBB are unreliable. They argue that the type of degeneration observed is common and could be the result of aging rather than radiation.

Johnston, a consultant based in London, states in a separate comment that the Lund team overreached in raising the possibility that the reported effects could have an impact on neurological health. Like Stögbauer, Franke is at the University of Münster; Gollnick is an advisor to FGF.

In concluding his commentary, Glaser writes that it is "a pity" that such results are presented to the public without peer review. In fact, *Environmental Health Perspectives* stated on its Web site that Salford and Persson's paper "has been peer-reviewed, revised and accepted for publication." Their paper, which was first posted on the Web in January, is now in print in the June issue of *Environmental Health Perspectives (111,* pp.881-883, 2003).

The March issue of the *FGF Newsletter* is available in pdf format at: <www.fgf.de>. It is currently only in German, but an English translation will soon be posted on the Web site, Friedrich said.

(see *MWN,* J/A02). The label's maximum SAR of 0.6 W/Kg has little bearing on the user's average exposure, Revermann argues, because the phone's actual radiation output varies continuously. The technology assessment office is an arm of the **Bundestag**, the lower chamber of the German parliament.

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On April 16, the **French Agency for Environment and Health** (AFSSE) recommended a continuation of a precautionary approach to mobile phone health risks. Two years ago, a report by a panel headed by Dr. **Denis Zmirou** had advised such a strategy (see *MWN,* J/F01 and J/A02). Zmirou is the scientific director of the AFSSE, which was set up last year. Dr. **Bernard Veyret** of the University of Bordeaux led a seven-member group that prepared a 100-page update of the Zmirou panel's findings. "Our report is reassuring for base stations, but not for mobile phones," Veyret told *Microwave News*. "One of our main conclusions is that there remains uncertainty over leakage through the blood-brain barrier, over headaches and over the activation of heat shock proteins." AFSSE's advice, Veyret's report and an assortment of related documents are available on the Internet at <www.afsse.fr>. At present, these are only available in French.

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There is no evidence of any health risk from using a mobile phone or living near a base station, according to a report issued on April 2 by the **Norwegian Radiation Protection Authority** (NRPA) in Oslo. But NRPA's advisory panel recommends "continued caution" in the use of phones, especially by children and teenagers, explaining that it "cannot exclude the possibility" of adverse effects. Dr. Gunnar Brunborg of the Norwegian Institute of Public Health in Oslo is the chair of the panel; NRPA's Dr. **Tore Tynes** and Dr. **Gunnhild Oftedal** of Sør-Trøndelag University College in Trondheim are among its members (see also p.3). ***Mobile Telephones and Health*** is available in Norwegian only at: <www.nrpa.no>.

RF-Induced Changes in Protein Folding *(continued from p.1)*

He stresses that it would be premature to extrapolate this new finding to any link between mobile phone use and neurological disease. Indeed, de Pomerai suggests that the microwave-induced synthesis of heat shock proteins may be protective. "It is conceivable that modest microwave exposures might even prove beneficial rather than harmful," he concludes.

He goes on to state: "What is clear is that microwaves can exert nonthermal effects in biological systems, at least partially arising from alterations in the conformation of cellular proteins."



MWs may be more beneficial than harmful
— David de Pomerai

In de Pomerai's latest experiments, the exposures were at 1 GHz with specific absorption rates (SARs) ranging from 0.015 W/Kg to 0.05 W/Kg. He notes that these are higher than those implicated in his earlier experiments, published in *Nature,* in which he observed heat shock responses in *C. elegans,* better known as nematodes or roundworms.

The SARs used in the new work are still at least 100 times less than those required to produce thermal effects, according to de Pomerai. The temperature increase in the medium surrounding the cells was less than 0.2°C (see also *MWN,* N/D02).

De Pomerai cites the work of Drs. Henrik Bohr and Jakob Bohr, physicists at the Technical University of Denmark in Lyngby. Three years ago, the Bohrs reported* that 1-10 GHz radiation can, under very specialized conditions, modulate the folding and unfolding of proteins through a nonthermal mechanism.

In an interview this May, Jakob Bohr told *Microwave News* that he now believes that the most likely route for microwave excitation of a protein molecule is through an interaction with its side chains.

This is not the first time that questions have been raised about a possible link between microwaves and neurological diseases. In 1986, Dr. Sam Koslov of the Johns Hopkins University Applied Physics Lab in Laurel, MD, reported that he had observed the characteristic pattern of fibrils associated with Alzheimer's in a monkey chronically exposed to microwaves (see *MWN,* S/O86). But Koslov, whose work with Henry Kues was supported by the U.S. Navy, was unable to obtain funding for a follow-up study to pursue their hypothesis that the biological events that led to the formation of the fibrils began with leakage through the blood-brain barrier.

In addition, Samuel Yannon, a New York Telephone technician who had worked for 15 years near microwave transmitters on the top of the Empire State Building in New York City, died in 1974 after developing severe neurological symptoms. In a workers compensation case brought by his widow, the late Dr. Sol Michaelson testified for the defense that his symptoms were probably those of Alzheimer's disease. Nettie Yannon's legal battles ran for more than a decade, but she eventually prevailed, winning her compensation claim and later a $250,000 settlement from RCA Corp., which manufactured the equipment used by Yannon (see *MWN,* M/J89).

David de Pomerai et al., "Microwave Radiation Can Alter Protein Conformation Without Bulk Heating," *FEBS Letters, 543,* pp.93-97, May 22, 2003; see also: *Nature, 405,* pp.417-418, 2000.

* Henrik Bohr and Jakob Bohr, "Microwave-Enhanced Folding and Denaturation of Globular Proteins," *Physical Review E, 61,* pp.4310-4314, 2000.

U.K. NRPB Proposes To Adopt ICNIRP's Exposure Limits

The U.K.'s National Radiological Protection Board (NRPB) has proposed adopting the exposure guidelines recommended by the International Commission on Non-Ionizing Radiation Protection (ICNIRP). The ICNIRP limits for both ELF EMFs and RF/MW radiation are significantly stricter than the NRPB's current guidelines.

"There appears to be neither scientific justification nor...any practical merit" in adopting new limits different from ICNIRP's, the NRPB states.

The NRPB cites the need to harmonize its approach with those of other EC member states. In its "consultation document," released for public comment on May 1, the NRPB notes that the U.K. government "fully supported" the EC's 1999 resolution endorsing the ICNIRP limits (see *MWN,* J/A99).

The new proposal is also in line with the recommendations of a Parliamentary committee in 1999, which were reaffirmed the following year in a report on mobile phone safety prepared for the Department of Health by a panel chaired by Sir William Stewart (see *MWN,* S/O99 and M/J00). Sir William is now the head of the newly established Health Protection Agency and, since April 1, the chairman of the NRPB (see *MWN,* M/A03).

At a meeting held in late May 2000, the members of the NRPB backed stronger limits at mobile phone frequencies. Previously, the U.K. had the most lenient SAR standard for mobile phones — 10 W/Kg. And at its next meeting later that year, the board noted that it "may be appropriate" to adopt the ICNIRP guidelines for ELF EMFs and RF radiation.

The NRPB has close ties to ICNIRP. Dr. Alastair McKinlay, the head of the physical dosimetry department at the NRPB, is a longtime member of ICNIRP and is its current chairman. McKinlay led the NRPB team that drafted the board's proposal.

In the new proposal, the NRPB states that it will consider applying the precautionary principle to exposures of children to ELF EMFs (see excerpts at right). It will also consider precautionary measures for RF/MW radiation from mobile telecommunications, although it considers the evidence of any health risk to be "much weaker" for RF than for ELF fields. But the NRPB will not propose any specific steps until the WHO EMF project has completed a framework for applying the precautionary principle (see p.1).

Both NRPB's existing limits and those of ICNIRP are designed to prevent injury due to induced currents at the lower frequencies and heating at high frequencies. But they specify different limits to protect against these potential hazards, with ICNIRP taking a somewhat more restrictive approach. They will now be the same.

In its report, the NRPB advises that future revisions of its exposure guidelines will consider two additional changes: (1) whether the basic restrictions for time-varying EMFs below 100 kHz should be based on limiting the electric field strength inside the body; and (2) whether the basic restriction for partial-body SARs for occupational exposures to RF/MW radiation should be reduced from 10 to 5 W/Kg.

NRPB Proposals: Key Excerpts

The International Agency for Research on Cancer (IARC) has classified power-frequency magnetic fields as a possible carcinogen. This conclusion is considered by NRPB as a powerful stimulus to addressing the case for adoption of further (precautionary) measures to limit the exposure of children to EMFs. ...NRPB takes the view that exposure of children to power-frequency magnetic fields is an issue requiring consideration for application of the precautionary principle. (§6.3.4.2)

The scientific evidence linking RF exposure in everyday life with cancer or other possible adverse health consequences is much weaker than that for power-frequency magnetic fields. However, factors other than scientific ones should also be considered in assessing the applicability of the precautionary principle. There is clearly considerable public concern about exposure to RF radiation from mobile phone masts. It is the view of NRPB that RF mobile phone radiation should also be considered as an issue for application of the precautionary principle... (§6.3.4.2)

In respect of general public exposure [to frequencies below 100 kHz, the] view is taken that those exposed might include people potentially susceptible to electrical stimulation, i.e., people with epilepsy, a family history of seizure or using tricyclic antidepressants, neuroleptic agents and other drugs that lower seizure threshold and people with serious heart disease or with increased intracranial pressure....[S]uch sensitive people should be adequately protected at lower induced electric field strengths, possibly about a factor of five lower than for normal adults.... (§7.2.2.2)

General community protection, including people potentially susceptible to heat related disorders, will be assured if the whole-body RF heat load is below about an SAR of 0.1W/Kg. This will provide protection to older people, infants, children, pregnant women, other adults taking certain medications and to people undertaking cognitively demanding tasks. For frequencies between 100 kHz and 10 GHz this is a factor of 4 more restrictive than the current U.K. exposure guidelines...for the general public but agrees reasonably well with the ICNIRP...restriction of 0.08 W/Kg for the general public. (§7.2.3.2)

For exposure to mobile phones, there are conflicting reports as to whether there is a significant increase in the SAR absorbed in the head, and particularly in the brain, for children compared to adults. This is an area where clarification is needed. (§7.4)

In a report released last October, the NRPB told the government that levels of non-ionizing radiation in many workplaces exceeded the ICNIRP limits (see *MWN,* N/D02).

Proposals for Limiting Exposure to Electromagnetic Fields (0-300 GHz) is available free at: <www.nrpb.org/publications/consultation_documents/index.htm>. "Hard copies" of the document can also be ordered for £30 (US$50), plus £3 for postage, from the NRPB Information Office, Chilton, Didcot, Oxon OX11 0RQ, U.K., Fax: (44+1235) 822746, E-mail: <information@nrpb.org>. The deadline for comments is July 28.

Sorting Out Mobile Phone Cognitive Effects

Increasingly, research into the effects of mobile phone radiation on human brain function has been hampered by a lack of consistency.

In one recent paper, a U.K. team describes seeing an effect on memory in men, but not in women. In another, a Nordic group reports failing to confirm an earlier finding that phone signals can speed up reaction times.

Despite what appear to be confusing results, some patterns are emerging. First, the observed effects are mostly, though not always, improvements in performance rather than impairments.

Second, there are indications of an exposure threshold. "At 1 W/Kg, it is relatively easy to detect the effect," the U.K.'s Dr. Alan Preece told *Microwave News*. "It gets progressively harder as you turn the power down." Four years ago, Preece, who is at the University of Bristol, reported faster reaction times in volunteers exposed to analog and digital phone signals at 1W/Kg (see *MWN,* M/A99).

Here are some highlights of some recent findings:

• A team led by Christian Haarala of the University of Turku in Finland performed various reaction time tests with volunteers exposed to 900 MHz GSM radiation at 0.88 W/Kg. No significant differences were observed in comparison with sham exposures, Haarala reports in the May issue of *Bioelectromagnetics (24,* pp.283-288, 2003). These results contrast with the Turku group's three-year-old finding that exposed volunteers had shorter reaction times in several tests (see *MWN,* M/A00).

• A follow-up study by the Turku researchers has provided only partial support for their earlier work showing that exposure to phone signals altered the electroencephalograms (EEGs) of subjects performing cognitive tasks (see *MWN,* M/J00). "We observed some effects, but were unable to replicate the findings we reported three years ago," explained Dr. Christina Krause, who has led the investigation of EEG effects. And volunteers made more mistakes when exposed to phone radiation, Krause told *Microwave News*—a result that stands in contrast to the trend of enhanced performance. A paper detailing these tests will appear in *Bioelectromagnetics*.

• When male volunteers were exposed to 1800 MHz phone signals at 0.79 W/Kg, they made fewer mistakes in memory tests than they did when the radiation was switched off, Drs. Brenda Costall and James Smythe of the U.K.'s University of Bradford report in the February 10 issue of *NeuroReport (14,* pp.243-246, 2003). No such effect on accuracy was seen among female volunteers, however.

• SARs greater than 0.5 W/Kg, in combination with greater daily phone use, "may be an important factor" in the incidence of dizziness, discomfort and warmth behind the ear, a new analysis of data on headaches and other symptoms among 17,000 mobile phone users in Norway and Sweden suggests (see *MWN,* M/J 98). Drs. Jonna Wilén, Monica Sandström and Kjell Hansson Mild of the National Institute for Working Life in Umeå, Sweden, report their results in the April issue of *Bioelectromagnetics (24,* pp.152-159, 2003).

• Subjects were able to hit the brakes faster in response to a visual cue when driving and not using a phone, reports Dr. William Berg of Miami University in Oxford, OH, in the July *Accident Analysis and Prevention (35,* pp.495-500, 2003). But slower reactions were also observed when the phones were used with hands-free kits, suggesting that phone radiation was not a factor.

For a recent review of cognitive and sleep effects of mobile phone radiation, see "Hot New Papers," *MWN,* J/A02.

Phone Shields Still for Sale Despite Government Crackdown

The Federal Trade Commission (FTC) says that it has stopped two companies from making false claims for the effectiveness of mobile phone shields — but they are still selling the devices on the Internet.

The FTC sued Comstar Communications Inc. and Stock Value 1 (SV1) last year, contending that the two companies lacked scientific evidence to support their claims that their shields protect phone users from radiation (see *MWN,* M/A02).

Both Comstar's WaveShield and SV1's NoDanger are small disks of metal mesh that stick to the phone's earpiece. The FTC maintains that the devices are ineffective because most of the radiation emitted by a mobile phone does not come from the ear-piece.

On May 7, the FTC announced that the U.S. District Court in Sacramento, CA, had approved a settlement barring Comstar from asserting that its shields are effective unless the company can support such a statement with "competent and reliable scientific evidence."

Previously, the U.S. District Court in Miami had ordered SV1 and an affiliate, Meristar International, to pay the FTC $726,874 and prohibited the companies from making unsubstantiated claims about their shields.

According to Serena Viswanathan, an attorney in the FTC's Bureau of Consumer Protection in Washington, SV1 had failed to respond to the FTC's charges. The company appears to be defunct, she told *Microwave News,* and it could be difficult to collect the money awarded by the court.

But an Internet search showed that both SV1 and Comstar still have Web sites offering shields for mobile phones — their statements about effectiveness are essentially the same.

For example, SV1's site continues to claim that NoDanger "is able to filter out 99% of the EMF waves emitted from the ear piece of a mobile phone." Although the site has been revised to note that radiation is "present throughout the entire surface of a mobile phone," it does not state, as required by the court, that the "vast majority" of the radiation is emitted by the antenna and other parts of a phone and that an earpiece shield does not reduce the user's exposure to this radiation.

When told about the sites, Viswanathan said that she would investigate. She noted, however, that the FTC "can't stop someone from selling a product — it depends on the claims they're making."

Jury: Workplace EMFs Did Not Cause Male Breast Cancer

A jury in Albuquerque, NM, has refused to compensate two men who developed breast cancer after working in a basement office next to an electrical vault. James Montaño, 54, and Arthur Slater, 80, had sought damages from the owners of the building — Bernalillo County, their employer, and the City of Albuquerque — charging that exposure to magnetic fields had caused their breast cancer.

"The jury did not believe the science was there," said Paul Yarbrough of Butt, Thornton & Baehr in Albuquerque, who is representing the county. He told *Microwave News* that other factors, including age and family histories of cancer, increased the men's cancer risk.

In its April 23 decision, the 12-member jury found that the county had failed to take adequate steps to protect the men against EMF health risks. But they concluded that magnetic fields were not responsible for the cancers and refused to award the two men any money. The trial lasted two weeks.

Sam Bregman, an attorney in Albuquerque, who represents Montaño and Slater, said he was pleased that the jury had found the county had been negligent, but expressed disappointment that his clients had not received a financial settlement. "It is hard to understand how [the jury] can find [the county] negligent [for] not informing them about electromagnetic fields, and then not compensate them," Bregman told the *Albuquerque Journal* (April 24).

At the end of May, Bregman told *Microwave News* that he does not intend to appeal.

Shortly before the start of the trial, the City of Albuquerque settled, agreeing to pay each man $70,000. Montaño and Slater, who worked as property assessors, filed suit in state court two years ago (see *MWN,* M/J01 and M/A03). A third man who worked in the same office developed breast cancer, but did not join the lawsuit.

Male breast cancer is a rare disease. Approximately 1,300 new cases are diagnosed in the U.S. each year, according to the American Cancer Society (ACS).

The fact that three men in a relatively small office had breast cancer was a key part of Bregman's case. He called Dr. Sam Milham, an epidemiologist based in Olympia, WA, who testified that only three cases of male breast cancer in 4,000 years would be expected among the cohort working in the office.

Dr. John Moulder of the Medical College of Wisconsin, Milwaukee, countered for the defense that Milham's statistical analysis was inappropriate. One cannot judge the accuracy of a Texas sharpshooter by drawing a bull's eye around three bullet holes, he argued: The target must be drawn before the shooting begins. Similarly, an epidemiologist must identify a study population before anything is known about the rate of illness within the group.

The link between male breast cancer and EMFs was first made by Dr. Genevieve Matanoski of the Johns Hopkins University school of public health in 1989. She found a cluster of up to six cases among a group of New York Telephone workers (see *MWN,* N/D89 and M/A91). Soon afterwards, a number of other researchers found similar excess rates of male breast cancer among EMF-exposed workers (see *MWN,* J/A90 and J/F91).

Two years ago, Dr. Thomas Erren of the University of Cologne in Germany reported that a meta-analysis of 15 epidemiological studies pointed to "a fairly homogeneous increased risk" of breast cancer among men with elevated EMF exposures. But Erren noted that the results of individual studies were inconsistent and cautioned that it would be "premature" to conclude that the association reflected a real increase in risk (see *Bioelectromagnetics, Supplement 5,* pp.S105-S119, 2001).

Michael Silva of Enertech Consultants in Campbell, CA, testified on behalf of the county that the magnetic fields in the locations where the men worked were below 5 mG, according to Yarbrough.

Bregman disputed this estimate. In a survey he commissioned, Cindy Sage, a consultant in Santa Barbara, CA, measured levels ranging from 5 to 20 mG in the men's work area. But, following a motion from the defense, Sage was barred from testifying.

In an interview with *Microwave News,* Sage suggested that Silva's figures may have been 24-hour averages, which would include much lower readings from the overnight period, when the office was not occcupied. Silva refused to comment. "I do not want to get further involved in any way," he said.

Workplace EMFs Increase Prostate Cancer Risk

Male electric utility workers exposed to high EMFs had a greater risk of developing prostate cancer than those less exposed, according to a new epidemiological analysis. There was no increased risk, however, among those exposed to both EMFs and polychlorinated biphenyls (PCBs).

The new findings are reported by Dr. Luenda Charles and coworkers in the April 15 issue of the *American Journal of Epidemiology (157,* pp.683-691, 2003).

The data used in the study — on 138,905 men employed by five U.S. electric utilities — were originally collected by Drs. David Savitz and Dana Loomis, both of the University of North Carolina, Chapel Hill (see *MWN,* J/F95). Charles, who was Loomis's doctoral student, is now at the Centers for Disease Control in Atlanta.

For the 10% of the workers with the highest EMF exposures — but with low PCB exposures — the risk of dying from prostate cancer was twice that of controls, a statistically significant difference.

Charles suggests that EMFs might be inhibiting melatonin, leading in turn to elevated levels of testosterone which can increase cancer risk in the prostate gland as well as other tissues whose growth is regulated by testosterone.

"You would expect to see an increase in prostate cancer following EMF exposure if you believe in Stevens's melatonin hypothesis," Loomis told *Microwave News,* referring to Dr. Richard Stevens's 1987 paper, which has prompted many studies on the possible link between EMFs and breast cancer (see *MWN,* J/F87).

The Letter BEMS Refused To Print

In its January/February 2002 issue, the Bioelectromagnetics Society Newsletter *ran a commentary by Asher Sheppard and Quirino Balzano under the title "All the News That Is Fit To Spin." The two Motorola consultants made it clear that they took strong exception to our news item on their recent paper which attacked the application of the precautionary principle to RF radiation in general and to mobile phones in particular. They also were stung by a short item on our "Wish List for 2003," in which we questioned their state of mind when writing that paper.*

Sheppard and Balzano accused us of "outrageous and distorting journalistic excesses," and of mocking not only their work but also the "distinguished scientists" who had helped them prepare their paper. They also berated us for making what they called a "snide editorial comment."

After reading this, we immediately asked Mays Swicord, the Motorola staffer who serves as the editor of the BEMS Newsletter, *for an opportunity to respond. Our contribution would be "most welcome," he replied. But when we later forwarded our letter, BEMS refused to publish it.*

Janet Lathrop, the managing editor of the newsletter, told us that our comments about George Carlo were "closer to libel than the BEMS Newsletter *is prepared to go."*

We called Swicord, who told us that the objective of the newsletter is to address "scientific" issues and that publishing our letter would take the newsletter "in a direction that is unhealthy for the society." We asked how our statement that Carlo had run a "confidence game" was any more libelous than the accusations leveled against Microwave News *by Sheppard and Balzano. "We should have removed [them] from the letter," he said, adding that the society should "apologize openly" for allowing them in print.*

We then appealed to Frank Prato, the president of BEMS. He replied that he, too, was concerned about the liability issue and would therefore not overrule the editors' decision.

Reprinted below is our response to Sheppard and Balzano which BEMS declined to publish in the March/April newsletter. BEMS' apology did not appear in that issue either. See also p.19 for a commentary on this affair and the state of BEMS on its 25th anniversary.

Note that after we sent our letter to BEMS, the WHO EMF project decided not to invoke the precautionary principle (see p.1 and p.19). The others on the list below, to the best of our knowledge, are holding firm.

April 9, 2003

To the Editor:

Asher Sheppard and Quirino Balzano say that *Microwave News* ran an unfair news item about their paper, which was critical of the precautionary principle. They do not, however, point to a single factual error in our 300-word item.

Sheppard and Balzano take offense at our subhead, "The Decline and Fall of Modern Society." Readers of the *BEMS Newsletter* can judge for themselves whether this headline does damage to their message. Here, in its entirety, is the last paragraph of their conclusions, which is also the last paragraph of their paper:

> Unless current efforts lead to its successful reformulation, the precautionary principle could institutionalize excessive caution and thus deepen rather than alleviate alarm from the doom-laden hypothetical risks called "perceived threats." The resulting suppression of innovation and technological progress would inevitably have disastrous effects on society, leaving it susceptible to the decay that over time turns great civilizations into antique ruins. It is hopeful that from the inherent contradictions of the precautionary principle will be born new environmental and health policies that use the uncertainties of scientific discovery for beneficial stewardship of life and human society.

Perhaps we should have run a headline such as: "Fixed Precautionary Principle Would Make Society Better." Perhaps not. The note of optimism in that last sentence is out of step with the nonstop attacks on the precautionary principle that make up most of what is written on the other 17 pages of their paper. We continue to believe that our article accurately reflects their message.

Sheppard and Balzano are also in a huff over our editorial comment. They call it sarcasm. We call it satire. Whatever you call it, it is our opinion and is clearly labeled as such. We each have our own opinions: Theirs took 18 pages, ours three lines. We thought about writing a detailed editorial, but their rant struck us as so wrongheaded in so many ways that we opted for brevity.

What are other people doing and saying? In February, the World Health Organization (WHO) International EMF Project announced that it is invoking the precautionary principle to address RF health risks. (They have a similar outlook on power-frequency EMFs.)

The WHO is one of the most recent converts. Here are some others who have either set precautionary exposure limits or advised precaution with respect to the use of mobile phones and the siting of mobile phone antennas:

- Government of Italy (1998)
- Advisory Board on Non-Ionizing Radiation to the Czech National Institute of Public Health (1999)
- Government of Switzerland (1999-2000)
- U.K. Independent Expert Group on Mobile Phones, also known as the Stewart Committee (2000)
- Advisory Committee to the Director-General of Health of France, also known as the Zmirou Committee (2001)
- British Medical Association (2001)
- German Academy of Pediatrics (2001)
- German Radiation Protection Commission (2001)
- Advisory Panel to the Spanish Ministry of Health (2001)
- German Federal Office for Radiation Protection (2002)
- Russian National Committee on Non-Ionizing Radiation Protection (2002)
- City of Paris (2003)

Sheppard and Balzano would have us believe that invoking the precautionary principle is equivalent to succumbing to some vague and illegitimate fear. Here, again, we disagree. Over the years, *Microwave News* has reported on a number of key experimental findings that point to the possibility of serious health effects. They must be either refuted or confirmed — not simply denied. Until then, a precautionary approach is the appropriate response in order to give fair warning to the more than one billion people who regularly place an RF transmitter next to their brains.

One reason these findings remain unresolved is that the wireless industry allowed (encouraged?) George Carlo to play a six-year, $25-million confidence game instead of running the RF research program that the industry promised. Motorola, for which both Sheppard and Balzano are consultants, and the other companies never exposed Carlo's deception.

Sheppard and Balzano say that we also mocked the significant contribution of John Graham, whom they acknowledge in their paper. Graham himself was an active player in Carlo's con game. The Center for Risk Analysis, which Graham used to run at the Harvard School of Public Health, received more than $419,000 from Carlo so that his Wireless Technology Research program would have a veneer of respectability. (Sheppard was a member of the Harvard peer-review panel.)

Finally, we wonder why Motorola's Mays Swicord allowed Sheppard and Balzano to voice their complaints in the *BEMS Newsletter*. Custom dictates that offended parties write to the publication that they believe did them wrong, not to a publication where one of their coworkers runs the show.

Louis Slesin
Editor, *Microwave News*
New York City

WHO Revokes the Precautionary Principle for EMFs *(continued from p.1)*

"My understanding, based on the draft position paper and from what the staff of the EMF project said in Luxembourg, is that they were planning to invoke the precautionary principle for EMF," said Dr. Joel Tickner of the University of Massachusetts, Lowell. "There was absolutely no question about applying it to ELF EMFs; the case for RF was less sure," he added.

Prof. Mike O'Carroll of REVOLT, an advocacy group based in northern England, has a similar recollection. "Repacholi made it very clear. He directed the workshop not to waste time on 'whether' but to focus on 'how' to invoke the precautionary principle," O'Carroll said.

Others see things differently. Dr. Kenneth Foster of the University of Pennsylvania in Philadelphia commented, "I am not surprised at all. This was the first inkling of a new idea." Foster went on to say, "In several long discussions, Repacholi has made it clear to me that he is trying to develop an overarching framework for using the precautionary principle and not, at this point, to invoke it for EMFs. That might come later."

And Dr. Anders Ahlbom of the Karolinska Institute in Stockholm offered the following opinion: "I honestly think they are in the process and have not decided anything. The draft report certainly suggested the precautionary principle should be applied to power-frequency EMFs."

The draft position paper, presented to the Luxembourg workshop in February, stated in bold type:

> In the EMF context there is sufficient evidence, judged against these criteria, to invoke the Precautionary Principle both for extremely low frequencies (ELF) and radiofrequency (RF) electromagnetic fields.

The draft, which was written by WHO's Dr. Leeka Kheifets, continued:

> This conclusion is based on several factors:
> • The classification by IARC in 2001 of ELF magnetic fields as a possible carcinogen based on studies of childhood leukemia;
> • The comparable radiation levels of existing mobile phones to established international guidelines;
> • The availability of some low-cost exposure reduction options.

When asked how their present view is consistent with the one they offered in February, Repacholi and Kheifets responded in a joint e-mail: "We have not changed our minds and have not made [a] 180° turn, but rather we have developed a comprehensive risk management framework in which precaution plays a role at every stage, thus there is no need to evoke it — it is always a consideration in the process. Once this framework is finalized we plan to apply it to EMF and other case studies."

Repacholi said that he will address pesticides, mad cow disease and SARS, among other agents. "The case studies for EMF will be completed over the next couple of months," he said.

With respect to recommending policies for exposures to EMFs, Repacholi said that they would be "worked up over time and be presented to a WHO task group next year."

On May 2, Repacholi and Kheifets released a new draft position paper, *Precautionary Framework for Public Health Protection*. It makes no specific mention of EMFs or RF radiation.

Kheifets To Leave WHO EMF Project

The WHO is looking for a new head for its radiation program in Geneva. The successful candidate will replace Leeka Kheifets, who joined Michael Repacholi at the International EMF Project two years ago (see *MWN*, M/J01).

Repacholi told *Microwave News* that he hopes to have her replacement on the job as soon as possible.

Kheifets has made no secret of her desire to return to California, where she worked for EPRI, the research arm of the electric utility industry, before joining the WHO (see *MWN*, M/A03).

A couple years ago, Repacholi announced that he was giving up the reins of the EMF project because he could no longer stand the constant criticism he was being subjected to (see *MWN*, N/D00).

Meeting Notes

• The ***22nd Annual Conference of the Society for Physical Regulation in Biology and Medicine***, which was to be held June 8-11 in San Antonio, has been tentatively rescheduled for January 7-10. The delay was caused by a lack of financial support compounded by travel restrictions arising from the SARS epidemic. "It was a painful decision, but we had to make it," said Dr. Michael Cho of the University of Illinois in Chicago, the president of the society. The budgets of two major sponsors, the U.S. Air Force (USAF) and NASA, were cut back due to the war in Iraq and the shuttle disaster, respectively. The meeting was designed to coincide with ***ElectroMed2003***. That meeting is going ahead as planned, according to the USAF's Dr. Michael Murphy. He said that the proceedings of ElectroMed will be published in a special issue of *IEEE Transactions in Plasma Physics*.

• The next COST281 workshop will be held in Budapest in November (see listing at right). Two others are being planned for next year: ***Mobile Telecommunications and Cellular Effects*** will be held in May, probably in Paris, and ***Specific Effects of 4G Mobile Telecommunications Systems*** is scheduled for September at a location still to be determined. For reports on the Dublin workshop, see pp.2-3.

New Listings

November 3-6: **RF Effects on the Blood-Brain Barrier,** Reisensburg, near Ulm, Germany. By invitation. Contact: Gerd Friedrich, FGF, see below; Web: <www.fgf.de>. (See p.5.)

November 15-16: **COST281 Workshop: Mobile Telecommunications and the Brain,** Budapest, Hungary. Contact: Gerd Friedrich, FGF, Rathausgasse 11a, D-53111 Bonn, Germany, (49+228) 726220, Fax: (49+228) 7262211, E-mail: <info@fgf.de>, Web: <www.cost281.org>. The workshop will follow the **6th International Congress of the European Bioelectromagnetics Association** (EBEA), which will be held November 13-15.

• The USAF and the WHO's ***Asia Pacific EMF Conference,*** slated for November 6-12, has been rescheduled — for the second time. The meeting was originally going to be held in October 2002 but was postponed following the 9/11 attacks (see *MWN*, J/F02). This time it has been delayed due to the SARS epidemic. The Thai Ministry of Health has been lined up as a cosponsor, according to the USAF's Murphy. "We plan to reschedule at the earliest opportunity," he said.

On the Internet

Russian Destinations

Thanks to the following Web sites, recent developments in Russia and other successor states of the Soviet Union are now much more accessible.

Russian National Committee on Non-Ionizing Radiation Protection (RNCNIRP), <www.pole.com.ru/news_en.htm>: The section in English offers a lot of detailed news, including the RNCNIRP's advice on mobile phone safety (see *MWN*, M/A03). There is also information on research reports, meetings and standards — including one for exposures to 50 Hz magnetic fields being developed by the Research Institute of Occupational Health and the Center for Electromagnetic Safety. The committee is chaired by Prof. Yuri Grigoriev.

Center for Electromagnetic Safety, Institute of Biophysics of the Russian Ministry of Public Health, <www.tesla.ru/news_en.html>: The English-language page offers a brief description of the center's activities, which focus on measuring and mitigating electromagnetic emissions from the power grid, household appliances and telecommunications antennas.

Magnetobiology and Electromagnetobiology, <www.biomag.info>: A site devoted to the work of Dr. Vladimir Binhi, the head of the Radiobiology Lab at the Russian Academy of Sciences' General Physics Institute. It explores the mechanisms of interaction between electromagnetic radiation and biological tissue. Binhi is the author of *Magnetobiology: Underlying Physical Problems* (see *MWN*, M/J02).

Mobile Telecommunication and Human Health, <www.ecopole.ru>: This site is in Russian only.

Two Reviews by Ross Adey

The EMR Network has posted two reviews by Dr. Ross Adey on its Web site, **<www.emrnetwork.org>**. They address the interaction of EMFs with brain tissue — one is a general discussion, the other is on the effects of cell phone signals. Both will be published next year in Elsevier's *International Encyclopedia of Neuroscience*. Adey is at Loma Linda University in California.

NRPB's RF Primer

The U.K.'s NRPB has added an animated introduction to RF radiation to its Web site, **<www.nrpb.org>**. *Radio Waves at a Glance* provides a basic overview of the sources, physical properties and health effects — established and possible — of 30 kHz–300 GHz radiation (for instance, decreasing field strength with increasing distance from the source). It is adapted from an updated version of a pamphlet that was first published six years ago (see *MWN*, J/F97). To access the tutorial from NRPB's home page, click on "Understanding Radiation" and then on "Radiowaves." The NRPB is planning a similar Internet "module" on ELF EMFs (see *MWN*, J/F95). See also p.7.

Hot New Papers

Yoon Hee Cho and Hai Won Chung, "The Effect of Extremely-Low-Frequency Electromagnetic Fields (ELF EMF) on the Frequency of Micronuclei [MN] and Sister Chromatid Exchange [SCE] in Human Lymphocytes Induced by Benzo(*a*)pyrene [BP]," *Toxicology Letters, 143,* pp.37-44, June 5, 2003.

"[T]he possible carcinogenic or cocarcinogenic potency of 60 Hz ELF EMFs with a flux density of 0.8 mT [8 G] in human lymphocytes with the genotoxic agent BP was examined with MN and SCE analysis. BP, the well-known carcinogen, was applied as an initiator in this experiment. Following BP treatment, the frequency of SCE and MN increased in a dose-dependent manner. An 0.8 mT ELF EMF exposure alone could not induce MN and SCE inductions in human lymphocytes.... [C]o-exposure of human lymphocytes to BP and 0.8 mT ELF EMFs for 24 h followed by BP exposure alone for 48 h increased the MN frequency significantly ($p<0.05$), compared to those in BP-treated sham-exposed cells...BP and ELF EMF co-exposure for 24 h followed by BP exposure alone for 48 h increased the frequency of SCE by BP treatment alone ($p<0.001$)....This suggested that ELF EMFs interacted with cellular systems by an indirect mechanism, probably as an enhancer of initiation or as a cocarcinogen, leading to increased MN and SCE formations *in vitro*."

Reprints: H.W. Chung, School of Public Health, Seoul National University, South Korea, E-mail: <chunghw@snu.ac.kr>.

Jianqing Wang and Osamu Fujiwara, "Comparison and Evaluation of Electromagnetic Absorption Characteristics in Realistic Human Head Models of Adult and Children for 900 MHz Mobile Phones," *IEEE Transactions on Microwave Theory and Techniques, 51,* pp.966-971, March 2003.

"In view of the inconsistent controversy caused by Gandhi's and Kuster's groups on the dosimetry in children's heads for mobile telephones, we did a double check for their calculation results in order to [clarify] the contradiction. We employed two newly developed children's head models that were scaled with different scaling factors for different parts based on Japanese children's statistical data on external head shapes. Using the children's head models, we calculated the local peak SAR under almost the same conditions as those previously employed by Gandhi's and Kuster's groups. Compared to the local peak SAR in the adult head model, we found an increase of 31.5% in the 1 g averaged spatial peak SAR and 21.6% in the 10 g averaged spatial peak SAR in the children's heads when we fixed the output power of the monopole-type antenna, but a difference [of] less than 10% when we fixed the effective current of the dipole-type antenna. This finding suggests that the contradictory conclusions of Gandhi's and Kuster's groups may be due to the different conditions in their numerical SAR evaluations. Moreover, we also showed that all these results can be explained from the variations of the resistive components of the antenna input impedance. For a real-world mobile telephone, there is not a definitive answer to how the antenna input impedance or the antenna output power varies."

Reprints: Dr. Jianqing Wang, Department of Electrical and Computer Engineering, Nagoya Institute of Technology, Japan, E-mail: <wang@odin.elcom.nitech.ac.jp>.

For more on the differences between Gandhi's and Kuster's SAR estimates, see *MWN,* N/D01 and M/J02.

Suchinda Jarupat et al., "Effects of the 1900 MHz Electromagnetic Field Emitted from Cellular Phone on Nocturnal Melatonin Secretion," *Journal of Physiological Anthropology and Applied Human Science, 22,* pp.61-63, 2003.

"The study group consisted of 8 young females, average age 27 years ranging from 16-36 years old...all in the follicular phase of menstrual cycle. The subjects had not used a cellular telephone at least one week before the experiment, and led a well-regulated life for a week prior to participation. The subjects entered the climatic chamber at 10 a.m....The light intensity was controlled 1000 Lx from 10:00 h to 18:00 h and 50 Lx from 18:00 h to 01:00 h, then completely dark from 01:00 h to 07:00 h in the next morning. Salivary melatonin was collected at 19:00 h and 2:00 h. For 30 min every hour from 19:00 h to 01:00 h the subjects used a cellular telephone continuously (on one day it emitted electromagnetic fields and on the other day it did not). The receiver was directly attached to the left ear without distance....[T]he average salivary

Melatonin Hypothesis Rejected: Chronic 50 Hz Exposure Has No Effect

Yvan Touitou et al., "Magnetic Fields and the Melatonin Hypothesis: A Study of Workers Chronically Exposed to 50 Hz Magnetic Fields," *American Journal of Physiology—Regulatory, Integrative and Comparative Physiology, 284,* pp.R1529-R1535, June 2003.

"In this study, we examine the circadian rhythm of melatonin in 15 men exposed chronically and daily for a period of 1-20 yr, in the workplace and at home, to a 50 Hz magnetic field in search of any cumulative effect from those chronic conditions of exposure. The weekly geometric mean of individual exposures ranged from 0.1 to 2.6 ∝T [1-26 mG]. The results are compared with those for 15 unexposed men who served as controls (individual exposures ranged from 0.004 to 0.092 ∝T). Blood samples were taken hourly from 2000 to 0800. Nighttime urine was also collected and analyzed. This work shows that subjects exposed over a long period (up to 20 yr) and on a daily basis to magnetic fields experienced no changes in their plasma melatonin level, their urinary 6-sulfatoxymelatonin level or the circadian rhythm of melatonin. Our data strongly suggest that magnetic fields do not have cumulative effects on melatonin secretion in humans and thus clearly rebut the "melatonin hypothesis" that a decrease in plasma melatonin concentration (or a disruption in its secretion) explains the occurrence of clinical disorders or cancers possibly related to magnetic fields....It is possible that the difference in the effects observed in animals and humans is the result of both the anatomical configuration of the pineal gland and the principally nocturnal rhythm of rodent activity. A different sensitivity to magnetic fields between species could also be part of the explanation, as it is known that some species detect and perceive magnetic fields differently. It is also possible that some subjects are more sensitive to magnetic fields than others; this is very difficult to demonstrate in a case-control study because of the enormous inter-individual variability of melatonin secretion and plasma melatonin concentrations in humans."

Reprints: Prof. Yvan Touitou, Department of Biochemistry and Molecular Biology, Faculty of Medicine Pitié-Salpétrière, Paris, France, E-mail: <touitou@ccr.jussieu.fr>.

For some different results, see papers by Burch, *MWN,* M/A00, p.1, and N/D02, p.11. See also Jarupat et al. at left.

melatonin...was significantly lower in [exposed] compared with [shams] ($p<0.05$, by paired t-test)....Unknown factors which we do not recognize might be responsible for these discrepancies."

Reprints: Prof. Hiromi Tokura, Institute of Textiles and Clothing, Hong Kong Polytechnic University, Hung Hom, Kowloon, E-mail: <tchiromi@polyu.edu.hk>. Full text available at: <www.jstage.jst.go.jp/en>.

See also Burch et al., "Hot New Papers," *MWN,* N/D02.

W. Boivin, J. Coletta and L. Kerr, "Characterization of the Magnetic Fields Around Walk-Through and Hand-Held Metal Detectors," *Health Physics, 84,* pp.582-593, May 2003.

"Magnetic field strength measurements were made around 8 hand-held and 10 walk-through metal detectors....Special magnetic field probes specifically designed for metal detector measurements were used.... Magnetic field strength measurements were collected on one hand-held metal detector in the laboratory. The remaining data were collected at airport terminals, federal and state government buildings and a local high school. Walk-through metal detectors had considerably higher magnetic field strengths (up to 299 A/m p-p [peak-to-peak] (3,741 mG)) than hand-held metal detectors (up to 6 A/m p-p (76 mG)). The frequencies of the magnetic field signal for walk-through detectors were between 0.1 kHz and 3.5 kHz while those for hand-held detectors were between 89 kHz and 133 kHz. Waveforms for all hand-held metal detectors were sinusoidal; those for walk-through metal detectors varied, with most being saw-toothed or pulsed....With the increasing use of metal detector systems in environments such as federal and local government buildings, hospitals and schools and the increase in the prevalence of portable medical devices, the potential for EMI between metal detectors and body-worn medical devices also increases. Body-worn medical devices should be immune to field-strength levels comparable to the data reported here if they are intended for use in the everyday environment."

Reprints: W. Boivin, U.S. FDA, Engineering and Analytical Center, Winchester, MA, E-mail: <wboivin@ora.fda.gov>.

For more on possible EMI from anti-theft systems to cardiac pacemakers, see *MWN,* N/D98.

Hironori Yamaguchi et al. (including Shoogo Ueno and Masao Taki), "1439 MHz Pulsed TDMA Fields Affect Performance of Rats in a T-Maze Task Only When Body Temperature Is Elevated," *Bioelectromagnetics, 24,* pp.223-230, May 2003.

"This study sought to clarify the effects of exposure to electromagnetic waves (EMW) used in cellular phones on learning and memory processes. Sprague-Dawley rats were exposed for either 1 h daily for 4 days or for 4 weeks to a pulsed 1439 MHz time division multiple access (TDMA) field in a carousel type exposure system. At the brain, average specific absorption rate (SAR) was 7.5 W/Kg, and the whole-body average SAR was 1.7 W/Kg. Other subjects were exposed at the brain average SAR of 25 W/Kg and the whole-body average SAR of 5.7 W/Kg for 45 min daily for 4 days. Learning and memory were evaluated by reversal learning in a food-rewarded T-maze, in which rats learned the location of food (right or left) by using environmental cues. The animals exposed to EMW with the brain average SAR of 25 W/Kg for 4 days showed statistically significant decreases in the transition in number of correct choices in the reversal task, compared to sham-exposed or cage control animals. However, rats exposed to the brain average SAR of 7.5 W/Kg for either 4 days or for 4 weeks showed no T-maze performance impairments....These results suggest that the exposure to a TDMA field at levels about four times stronger than emitted by cellular telephones does not affect the learning and memory processes when there are no thermal effects....Wang and Lai (2000) reported that the exposure to pulsed 2450 MHz EMW at the whole-body average SAR of 1.2 W/Kg for 1 h daily for 6 days caused deficits in spatial reference memory in rats using a Morris water maze....Our study differs from theirs in several respects....Under their exposure conditions, it is very likely that their rats heard the sounds that can be generated by pulsed EMW. Several studies suggest this auditory effect can affect behavioral performance....This auditory effect also might have caused the operant learning deficits reported by Lai et al. [1994]."

For more on Dr. Henry Lai's water maze experiment, see *MWN,* J/F00.

Reprints: Hironori Yamaguchi, Department of Surgical Oncology, Graduate School of Medicine, University of Tokyo, E-mail: <yamaguchih-tky@umin.ac.jp>.

"MICROWAVE NEWS" FLASHBACK

Years 20 Ago

• In a WHO report, Prof. R. Hauf in Freiburg, Germany, deems 50/60 Hz electric and magnetic fields of 20 kV/m and 3 G to be safe.

• The *Washington Post* reveals that E-bombs (which propagate electromagnetic pulses) are being developed at two U.S. national labs.

• A woman in her 50s continues to experience pain in her arms four years after reaching into a still-active microwave oven, Dr. Henry Fleck writes in the *Bulletin of the New York Academy of Medicine*.

Years 10 Ago

• A jury finds that San Diego Gas & Electric was not negligent for failing to warn customers of potential EM health risks. Ted and Michelle Zuidema had filed the lawsuit alleging that the utility's power lines caused their daughter to develop a rare kidney cancer.

• Rep. Bill Richardson (D-NM) requests that the Air Force identify the source of a low-frequency "hum" in Taos, NM.

• The Air Force's Ground Wave Emergency Network poses a "minimal to nonexistent" public health risk, the NAS–NRC concludes in a new report.

Years 5 Ago

• A Swedish-Norwegian study of 17,000 mobile phone users finds that those who talked for long periods reported more headaches and were more likely to sense warmth behind their ears.

• In a survey, Dr. Luciano Zaffanella finds that, while most Americans are exposed to power-frequency magnetic fields of less than 1 mG, over 1 million are exposed to more than 10 mG.

• The Norwegian Navy releases a report that discounts the role of EM radiation in a suspected cluster of birth defects among children whose fathers serve aboard the *Kvikk,* a torpedo boat equipped for electronic warfare. The families accuse the navy of a cover-up.

Across the Spectrum

Once the experiments are done and the data are out there, scientists may argue forcefully for the appropriateness of their conclusions and for the policies they believe should follow. Others will criticize them for this, arguing that it's important for scientists to be "objective." Indeed they should be — in doing their analyses and in reporting their results. But in advocating policies based on what they have learned, it's good for them to take sides. Indeed, it's their responsibility.

— Dr. Donald Kennedy, editor-in-chief, *Science,* former commissioner, U.S. Food and Drug Administration, in an editorial, "Research Fraud and Public Policy," *Science,* p.393, April 18, 2003

The Stewart Report is a milestone in the way that issues of public concern are addressed.

— National Radiological Protection Board, Chilton, U.K., "Mobile Phones and Health — an Update," *eBulletin* (formerly *Radiological Protection Bulletin*), March 2003 (full text available at: <www.nrpb.org/publications/bulletin/no3/article3.htm>)

"It's nutty to require conclusive evidence when the risk, if it comes to fruition, is extremely serious."

— Prof. Cass Sunstein, University of Chicago Law School, quoted by Samuel Loewenberg, "Precaution Is for Europeans," p.14, Week in Review, *New York Times*, May 18, 2003; Sunstein cites President Bush's preemptive strike on Iraq's putative weapons of mass destruction as an example of precautionary action

Lost Opportunities? MW Health Risks — 30 Years Ago

It may be that little pathology has been observed because the bulk of the exposure is at low dose levels where any risk of untoward sequelae is not large enough to produce effects that can be easily detected. Perhaps the protective guides and standards have served to prevent the escalation of occupational exposure as the uses for microwave radiation multiplied and the power of equipment steadily advanced. It may also be that systematic efforts have not been made to identify and follow exposed and nonexposed persons adequately and for sufficiently long periods of time. The growing body of Russian and eastern European literature describing a wide variety of functional changes and clinical effects, leading to consideration of "radiowave sickness" as a possible independent nosologic entity, cannot simply be ignored. With increasing uses and power, the stage is set for the appearance of late effects previously undetected possibly because of their infrequency, lack of distinctiveness or mild character. There may now be a better opportunity to resolve the uncertainties of present knowledge in the face of an increasing risk.

— Dr. Charlotte Silverman (1913-2003) in a review and commentary on "Nervous and Behavioral Effects of Microwave Radiation in Humans," *American Journal of Epidemiology, 97,* p.223, April 1973 (see also p.17)

Only the Good News, Please

Excerpted below is an exchange of letters, published in the June 2003 issue of Health Physics *(p.788), concerning a review by Geoffrey Eichholz of the International Agency for Research on Cancer's (IARC) monograph on static and ELF EMFs, which originally appeared in the journal's December 2002 issue (see* MWN, *J/A01 and M/J02).*

Eichholz leads the reader to believe that there is no evidence to support a link between exposure to extremely low frequency [ELF] magnetic fields and increased health risk by summarizing the IARC's findings in the following terms: "The general conclusion seems to be that the studies indicate no discernible pattern of increased risk associated with increased duration or frequency of exposure to ELF fields." His summary is a considerable departure from IARC's overall evaluation that [ELF] magnetic fields are possibly carcinogenic to humans (Group 2B). The IARC conclusion never appears in [the] review.

— Norbert Hankin, Office of Radiation and Indoor Air, Environmental Protection Agency, Washington, DC

I essentially summarized statements in the summary of the monograph [that indicate no consistent associations]...I believe that such positive statements by a renowned panel of experts need to be aired and are important in allaying public apprehension and fears...

— Dr. Geoffrey Eichholz, emeritus professor of nuclear engineering, Georgia Institute of Technology, Atlanta

In spite of the great improvements in analytical techniques, the difficulties in assessing toxic risks are not on the decline, but rather, the reverse seems to be true. What we observe is a general increase in toxicophobia. Perhaps we have to consider the paradoxical situation that the steady progress of analytical sensitivity produces more and more data that nobody can yet appraise with respect to factual risk. This often results in an irrational attribution to toxic strain. Some well-known examples are multiple chemical sensitivity (MCS), electrosensitivity syndrome and sick building syndrome.

— Dr. Hugo Rüdiger, Division of Occupational Medicine, University of Vienna, Austria, "Challenges to Occupational Medicine in a Changing World of Labor," p.172, *International Archives of Occupational and Environmental Health, 76,* April 2003

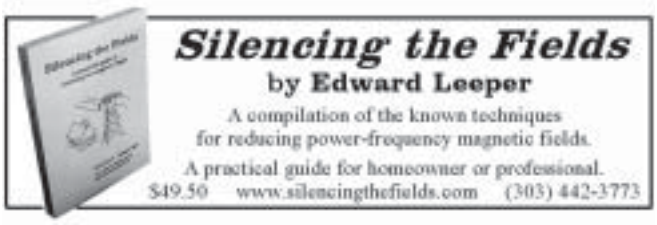
"With the TETRA roll-out, we could be seeing a pandemic of brain tumors in 10 years....I'm certain that if there were the same degree of uncertainty over a food or medicine, the government would never have licensed it."

Dr. Gerard Hyland, Warwick University, U.K., on the terrestrial trunked radio (TETRA) network for police and emergency crews, quoted by Victoria Silverman, "Poles Apart," the *Guardian,* May 21, 2003 (see also p.3)

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UPDATES

MOBILE PHONE EMI

U.K. Tests Confirm Avionics EMI... Radiation from mobile phones produced "various adverse effects" in aircraft electronic equipment tested under controlled conditions, according to a report released by the U.K. Civil Aviation Authority (CAA) on April 30. Electromagnetic interference (EMI) caused navigation displays and indicators to give incorrect readings; made a gyroscopic compass freeze or indicate an incorrect bearing; and reduced the sensitivity of a radio receiver for the instrument landing system. In view of these findings, the CAA advises that the U.K. continue to ban the use of phones on aircraft once doors are closed in preparation for departure, and that carriers take additional preventive measures such as making sure that all phones in checked luggage are switched off. The CAA also recommends alerting the general aviation community to potential EMI hazards in small aircraft. In its testing, the CAA found that malfunctions could result from signals above 30 V/m — a level that can be produced by a mobile phone operating at maximum power and within 30 cm of sensitive equipment or its associated wiring. The tests covered 900 MHz GSM and 1700 MHz radiation, as well as 412 MHz signals from TETRA handsets. Most of the EMI problems were observed with 1700 MHz signals. Three years ago, the CAA reported that several phones operating simultaneously in the cabin of an aircraft produced readings as high as 4.5 V/m on the plane's flight deck — well above the 1 V/m standard for immunity from interference for older electronic equipment (see *MWN,* J/A00). Commercial airline crews have long suspected EMI from mobile phones or other electronic equipment to be the culprit in some malfunctions of navigation systems and other equipment (see, for example, *MWN,* S84, N/D88 and S/096). In its new report, the CAA notes that, from 1996 through 2002, crews reported 35 safety-related incidents citing mobile phones as a factor. *Effects of Interference from Cellular Telephones on Aircraft Avionic Equipment* is available at <www.caa.co.uk>.

PEOPLE

Thorne Auchter, who served as the administrator of OSHA during President Reagan's first term (1981-1984) and more recently as the chief operating officer of Dr. **George Carlo**'s consulting firm, Health & Environmental Sciences Group Ltd. (see *MWN,* S/O98), is now the CEO of Grace News Network. The GNN "is dedicated to transmitting the evidence of God's presence in the world today," according to information posted on its Web site, <www.gracenewsnetwork.com>....Dr. **Tom McManus** officially retired as the chief technical advisor of Ireland's Department of Public Enterprise at the end of last year, but he was pressed back into service on a temporary basis until a replacement is found. McManus told us that he will continue to represent Ireland on COST281. He is also a long-standing member of the executive committee of IEEE's ICES (SCC-28), but it is not yet clear whether his department wants to support his continued participation on this standard-setting committee (see also p.4)....Dr. **Gayle Woloschak** of the Northwestern University medical school in Chicago has been elected to the National Council on Radiation Protection and Measurements (NCRP), which is based in Bethes-

da, MD. Woloschak is also a member of the NRC panel investigating the potential health effects of the Air Force's PAVE PAWS radar on Cape Cod. Among those reelected to the NCRP are Dr. **John Boice Jr.** of the International Epidemiology Institute in Bethesda and **Susan Wiltshire** of JK Research Associates (emeritus) in South Hamilton, MA....On January 1, 2004, Dr. **Peter Boyle** will become the director of the International Agency for Research on Cancer (IARC) in Lyon, France (see *MWN,* M/A 03). Boyle, age 51, currently leads the Division of Epidemiology and Biostatistics at the European Institute of Oncology in Milan. He was a member of a team that discounted the leukemia risks associated with the Vatican RF transmitters in Cesano, outside Rome (see *MWN,* S/O01)....Prof. **Colin Blakemore**, the head of the Center for Cognitive Neuroscience at Oxford University, has been appointed the chief executive of the London-based Medical Research Council, the principal sponsor of biomedical research in the U.K. He takes over on October 1. Blakemore is a member of the National Radiological Protection Board's Advisory Group on Non-Ionizing Radiation and was a member of the Stewart panel on mobile phones. Last year he served as an expert witness opposing compensation in a case of two tower workers who claimed to have been overexposed to RF radiation (see *MWN,* S/O02)....Dr. **Charlotte Silverman**, an epidemiologist who worked at what is now known as FDA's Center for Devices and Radiological Health from 1968 to 1992, died of congestive heart failure on April 17. She was 89. She is a coauthor, with Dr. **Dennis Robinette** and **Seymour Jablon**, of the 1980 study on the potential effects of radar radiation on the health of navy personnel — the first of its kind. (See also p.15.) ...Dr. **Carl Sutton** died on April 12 in Tampa, FL, at the age of 73. Sutton retired from the Medical College of Wisconsin and the VA Hospital in Milwaukee in July 2001....Dr. **Neil Cherry** died in New Zealand on May 24 at the age of 56. He was diagnosed with motor neuron disease less than two years ago. Cherry was arguably the world's most active campaigner for tough EMF exposure limits. One of his last public appearances was testifying at the Newman brain cancer–mobile phone trial in Baltimore in February 2002 (see *MWN,* M/A02). Cherry, a meteorologist by training, was an associate professor of environmental health at Lincoln University in Canterbury.

RF ANIMAL STUDIES

NTP Study Moving Forward... On May 28, NIEHS toxicologist Dr. Ron Melnick hosted a meeting in Research Triangle Park, NC, to brief and to get feedback from the RF Interagency Work Group on the multimillion-dollar RF animal studies being planned by the National Toxicology Program (see *MWN,* M/J 01). "We are still planning to go ahead," Melnick told *Microwave News*. Under the current study design, rats and mice will be exposed to either 900 MHz or 1900 MHz microwaves in reverberation chambers that will allow unrestrained animals to be exposed for more than six — perhaps as many as twenty — hours a day. Among those present were representatives from EPA, FCC, FDA and NIOSH, as well as Dr. Perry Wilson of NIST in Boulder, CO, and Dr. Niels Kuster of IT'IS in Zurich, who are working on the dosimetry for the new project.

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Keeping Current: Follow-Up on the News

◆ The U.S. Court of Appeals in Richmond, VA, has delayed oral arguments in the Newman brain cancer–mobile phone lawsuit (see *MWN,* S/O02 and N/D02). Originally scheduled for June, they will be probably now held in late September, though at press time no date has been set.

◆ The *Wall Street Journal* (May 23) reports that EMI may have caused Patriot missile defense systems to shoot down a British fighter jet, killing its two pilots, and an American F/A-18 Hornet fighter during the Iraqi war. Analysts suspect that the Patriots, built by Raytheon, were placed too close together, causing their high-power radars to interfere with the systems' electronics.

◆ Officials in Zurich are measuring fields in schools and other buildings owned by the city to find out which transformers will have to be shielded to meet Switzerland's 10 mG precautionary limit for locations where people spend several hours or more a day (see *MWN,* J/F00). About 50 substations are located in or near schools, a spokesperson for Zurich's department of urban development told the *Neue Zürcher Zeitung* (April 15). The survey should be completed by the end of the summer.

◆ Papers from the WHO EMF project's workshop on *Adverse Temperature Levels in the Human Body,* held in Geneva last year (see *MWN,* J/F02), are available in a special issue of the *International Journal of Hyperthermia* (May-June 2003).

◆ In the May 1 issue of *Nature,* researchers report a new example of the potential significance of polarization in triggering biological effects: Male *Heliconius cydno* butterflies — found in Central American jungles — detect polarized light reflected by the wings of females of their species, and rely on these signals to locate prospective mates in the dappled shade beneath the forest canopy. (See also *MWN,* M/A00.)

◆ Recently published by the Neuromagnetics Group at Vanderbilt University in Nashville: *Magnetotherapy: Potential Benefits and Adverse Effects*. The 292-page collection of 15 papers is available for $45.00 from <magnetotherapy.spellgen.com>. Two of the papers, including a review of ELF EMF effects by Dr. Wolfgang Löscher, may be downloaded for free from this Web site.

VIEWS ON THE NEWS **Conflicts at BEMS Taint Research Agenda** *(continued from p.19)*

not, see p.10.)

WTR's $25-million research budget was by far the largest pot of money ever earmarked for RF research. It was squandered. The public is a loser because Carlo brought us no closer to understanding the health risks from cell phone radiation. BEMS suffered, too, and more directly. For close to a decade, its members were denied the chance to do the promised research.

Carlo's strategy was clever and effective. By dangling a huge amount of money in front of the cash-starved RF community, Carlo guaranteed silent obedience. Anyone who dared complain risked being cut off from his millions. There was the added benefit that scientists were discouraged from helping lawyers who were thinking about suing cell phone companies.

WTR's bank account is now empty, but BEMS still refuses to speak out — on behalf of its members or the public interest.

Donald Kennedy, the editor of *Science,* recently urged scientists to add their voices to public policy debates because they have knowledge others often lack (see p.15). Yet, BEMS is unable to admit that promises were made and broken, and that a huge amount of money disappeared with no accounting ever offered. Its members were cheated, but BEMS keeps silent.

The cell phone industry has never admitted that Carlo's WTR was a sham. If it did so, there might be calls for a real research effort. The reason BEMS is still unwilling to speak out appears to be that it, too, speaks for industry.

Support for this view comes in the March/April issue of the the *BEMS Newsletter,* in which our rebuttal should have been published. What appears to be a news item from a London conference is actually nothing more than industry propaganda. Nokia's Sakari Lang is cited as saying that the RF literature "does not support a need for studying nonthermal effects" and that there is "clearly" no necessity to do any more research on third-generation phone signals. If accepted, this would save the mobile phone companies millions. No other view is offered.

And in the same item, Eleanor Adair, now retired from the U.S. Air Force, is reported to have decried "shoddy" RF experiments that were "more like entertainment than science." Here again, Motorola's Swicord, the editor of the newsletter, saw no need to offer any specific examples or any opposing opinions.

Not long ago, the *BEMS Newsletter* devoted a page and a half to the opinions of five Swedish scientists — none of them members of the society — who trashed other Swedish researchers for daring to publish research which suggests that mobile phones might present a health risk. Someone went to the trouble of translating the text from the original Swedish, but no one thought of giving those who were attacked a chance to respond, even though one of them was a former president of BEMS.

BEMS seems willing to promote corporate ideas, even when they could drive the society into bankruptcy. Last year, BEMS, feeling the pinch of deteriorating finances and declining membership, issued a strategic plan. Here is the closing thought: "The long-range plan might have to include an exit strategy."

Maybe this was BEMS' strategy all along: Give industry and the military control of the research agenda and, when the inevitable stagnation follows, quietly turn off the lights and lock the door.

In late June, BEMS will hold its annual meeting in Hawaii and celebrate its 25th anniversary. Maybe some of those who are committed to science will take a break from the festivities and take control of their society.

Corporate Conflicts at the Bioelectromagnetics Society Taint Research Agenda

Bioelectromagnetic research should be exciting. It is, after all, about one of the most basic questions in biology: How do electromagnetic signals affect us?

Instead, it is mostly about politics, often nasty politics. One side says the radiation is nothing more than a source of energy and, at high enough levels, can heat us up. Otherwise, the question is not worth thinking about. This is — no surprise — the position of industry and the military, who don't want any restrictions on their use of the radiation.

Others counter that we are, by our very nature, electromagnetic beings, and it is highly likely therefore that some types of signals will have some types of effects.

This argument has been raging for 30 years — without resolution.

The Bioelectromagnetics Society was founded in the late 1970s to bring the two sides together and to get some answers. That mission has failed because BEMS is an organization at war with itself. The society has been so co-opted by special interests that it is now ambivalent about doing research. Many of its members aren't even excited by experiments that presage scientific breakthroughs.

Take, for example, a series of recent animal studies which suggest that RF/MW radiation can actually protect against the development of cancer (see *MWN*, S/O02). These were chance findings and remain somewhat fuzzy, but they are certainly fascinating. What could be more rewarding than identifying those electromagnetic signals that can delay, or even prevent, cancer? Yet, you would never know it by hanging out at at a BEMS meeting. One hardly ever hears a word about these experiments within the society. Why isn't BEMS interested?

The simple answer is that most members of the society still will not look beyond the thermal dogma. At BEMS, scientific curiosity takes a backseat to economic and political imperatives.

BEMS was created by the U.S. military. Today, the mobile phone industry is the major force within the society. Not long ago, it was the power companies, but they are taking a more relaxed approach now that their campaign to write off the EMF–cancer link has been so successful. Motorola alone has eight staff members in the society, more than from all the American electric utilities combined.

A disagreement between BEMS and *Microwave News* provides a good example of how vested interests keep BEMS from promoting research. A recent issue of the *BEMS Newsletter* featured an attack on *Microwave News* by two Motorola consultants. Asher Sheppard, a past president of BEMS, and Q. Balzano, a runner-up for the presidency a few years earlier, took offense at what we wrote about one of their recent papers. Instead of taking the matter up with us, they turned to BEMS, where Motorola's Mays Swicord runs the newsletter.

We submitted our response, but BEMS refused to print it because, we were told, we wrote that George Carlo's Wireless Technology Research (WTR) had run a confidence game on behalf of the mobile phone companies. Our point is that Carlo and the industry he represented never wanted to do any actual research. This is, in fact, the majority view within BEMS — even among those in industry, if asked in private. (We are publishing the full text of our response because the BEMS leadership would

(continued on p.18)

WHO Do You Trust?

We admit it, we got sucked in. We believed what most of those who were at the February WHO workshop told us: Michael Repacholi has accepted a precautionary approach to EMF health risks.

Repacholi now says that it was all a misunderstanding. He was only floating a trial balloon to provoke discussion (see p.1). The EMF project is instead devising a framework for applying the precautionary principle to all types of environmental risks, something many others have already done.

It's the usual Repacholi doubletalk — not unlike when he tried to convince us that exposure to power line EMFs, like drinking a cup of coffee, might be good for our health (see *MWN*, N/D02).

What makes Repacholi's latest flimflam especially cynical — some would say hypocritical — is that invoking the precautionary principle does not require any specific action. It is a symbolic act that simply puts the public on notice about an uncertain risk.

Repacholi is sending a different message: Industry can be confident that he will fend off precautionary policies.

What's he up to? The only thing we can think of is that he is positioning himself as industry's candidate to become the WHO honcho on the precautionary principle. If he succeeds, he would be Geneva's replicant of John Graham, the Bush Administration's czar for regulatory reform, who recently said: "We consider [the precautionary principle] to be a mythical concept, perhaps like a unicorn."

Memo to Dr. Jong-Wook Lee, the incoming head of the WHO: It's time to clean house.

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PEMFs and Chick Eggs: Results Mixed, Mechanism Elusive

A consistent picture of the effects of weak pulsed electromagnetic fields (PEMFs) on developing chick embryos continues to elude researchers. PEMFs have been found to be biologically active in Finland but not in Sweden — perhaps because the PEMFs and exposure conditions were different. Researchers are also at work in the U.S. and in Belgium using more complex PEMF waveforms.

Looking at all the studies completed to date, there is no agreement on the mechanism of PEMF action (see also *MWN*, March 1983, June and December 1984 and January/February 1986). Current hypotheses include (1) direct action of the magnetic and/or the electric field, (2) an effect dependent on the time rate of change of the magnetic field and, of course, (3) the possibility that the positive results are artifacts.

Juutilainen in Finland

Jukka Juutilainen and coworkers have shown that PEMFs can cause significant abnormalities in chick eggs; the results point to a direct magnetic field effect, with a threshold at about 1 A/m (1.2 uT) for fields above 30 Hz.

Juutilainen, who is at the Department of Environmental Hygiene at the University of Kuopio in Finland, has been studying PEMFs for about five years and began working with chick embryos three years ago, after Delgado's group published its first findings.

(continued on p.10)

EPA Issues RF/MW Options

On June 12, the Environmental Protection Agency (EPA) released four options for regulating general population exposures in the 10 kHz to 100 GHz frequency range. Following publication in the *Federal Register*, the options will be subject to a 90-day public comment period; a public meeting will be held in Washington, DC, during that time.

As described in our January/February issue, the EPA is proposing power density limits of 100, 200 or 1,000 uW/cm² — or no regulatory action at all. Two years ago, the agency was set to propose a 100 uW/cm² limit but backed off in the face of intense opposition from the EPA's policy office (see *MWN*, June and July/August 1984).

The radiofrequency and microwave (RF/MW) options were cleared by the Office of Management and Budget in January but were delayed when EPA Administrator Lee Thomas coordinated the U.S. response to the Chernobyl nuclear accident.

HIGHLIGHTS

Research on ELF-Cancer Link Intensifies

The literature on the relationship between exposures to extremely low frequency (ELF) fields and cancer continues to grow. Here are the latest results.

Occupational Trends

Combining data sets from 11 different epidemiological surveys, Drs. David Savitz and Eugenia Calle discern an "enhanced" risk of acute myeloid leukemia (AML) and a "modest" risk of all leukemias among some types of electrical workers.

In a paper scheduled to appear in the *Journal of Occupational Medicine,* they report that telegraph, radio and radar operators have 2.6 times the risk of AML, as well as a twofold increased risk of acute leukemia, compared to other workers. Power and telephone linemen are also more likely to develop AML, and aluminum workers and power station operators have a greater risk of getting acute leukemia.

The overall relative risk for all workers with potential exposures to electromagnetic fields was 1.5 for acute myeloid leukemia, 1.4 for acute leukemia and 1.2 for all types of leukemia. Savitz, of the University of North Carolina's School of Public Health in Chapel Hill, and Calle, of the Centers for Disease Control in Atlanta, GA, were struck by the "consistency" of the elevated cancer risk among these occupations.

The observed excess may be due to occupational factors other than ELF fields or to some confounding variable, Savitz explained in a telephone interview. On the other hand, the lack of quantitative exposure data coupled with the inclusion of many unexposed individuals could dilute what might be a much higher risk. As Savitz and Calle explain in their paper: "If there really is an association . . . [it] would have to be substantial to account for the modest positive results which have been reported." (See also *MWN,* March/April 1986.)

Unexpected Finding Among Shipyard Workers

Another tie between ELF and cancer among naval shipyard workers has surfaced rather unexpectedly. A large team led by Frank Stern of the National Institute for Occupational Safety and Health was studying the possible association between leukemia deaths and exposures to ionizing radiation or solvents. No such link was found but the researchers did detect a significant excess of leukemia among electricians and electrical welders. Electricians had sixfold and threefold increased risks of lymphatic leukemia and all leukemias, respectively. Welders had a significantly elevated risk (nearly four times the expected rate) of myeloid leukemia, but not for all leukemias. The study results are presented in the June 1986 *American Journal of Epidemiology, 123,* pp.980-992.

Inconsistent Swedish Results

An ongoing series of studies by Swedish researchers at the National Board of Occupational Safety and Health (NBOSH) and at the National Institute of Environmental Medicine in Stockholm continues to yield inconclusive and erratic results.

The latest paper – by a team led by NBOSH's Dr. S. Tornqvist – shows that power linemen had a slightly elevated risk of leukemia and brain tumors but that power station operators had *normal* cancer rates. In contrast to other studies, none of the workers were found to have an increased risk of any particular type of leukemia.

An unexpected risk of kidney and other urinary cancers was found in both groups, but the researchers did not attempt to explain this result, except to say that both groups were exposed to chemicals on the job.

As in the Savitz-Calle study, the authors point out that study participants with little or no ELF exposure may mask a larger effect among those who are more heavily exposed. The Swedish paper appears in the *British Journal of Industrial Medicine, 43,* pp.212-213, 1986.

Tomenius Paper Published

Dr. Lennart Tomenius, a former health officer in Stockholm, Sweden, has published his study that supports Dr. Nancy Wertheimer and Ed Leeper's observed link between childhood cancer rates and magnetic fields from ELF sources, primarily power lines. Tomenius's results on 50 Hz fields in Stockholm, which were first reported in 1982 (see *MWN,* November 1982), appear in the most recent issue of *Bioelectromagnetics, 7,* pp.191-207, 1986.

In a review paper, Dr. Kazim Sheikh of the University of Michigan School of Public Health in Ann Arbor criticizes past occupational and population ELF studies for their lack of adequate exposure assessments and for their failure to establish dose-response relationships or latency periods. Writing in the *Archives of Environmental Health, (41,* pp.56-63, January/February 1986), he emphasizes the need for further research before accepting or rejecting the hypothesis that ELF fields are leukemogenic.

Major Study Planned in Canada

It is very likely that a large-scale epidemiological study of the possible link between ELF fields and leukemia (and cancer in general) will begin later this year in Canada.

Hydro Quebec's Dr. Michel Plante told *Microwave News* that there is about an 80 percent chance that the project will be approved in August following the review of a feasibility study. Plante explained that the cancer study was requested by the Quebec government after a public hearing in 1983.

Dr. Gilles Theriault of McGill University's School of Occupational Health in Montreal will soon forward his feasibility study to the utility company. In an interview, he said that the full-scale study, if and when completed, should provide "a definitive answer" to the question of cancer risk.

To gauge individual exposures, Hydro Quebec engineers have designed a small, portable monitor capable of measuring ELF fields once a minute for two weeks.

NCRP Recommends 200 uW/cm² RF/MW Population Limit

The National Council on Radiation Protection and Measurements' (NCRP) long-awaited report on radiofrequency and microwave (RF/MW) radiation has been published and, as expected, it recommends a 200 uW/cm² standard in the 30-300 MHz band for the general population. The standard covers the 300 kHz to 100 GHz frequency range.

For occupational exposures, the NCRP recommends the same limits as those adopted by the American National Standards Institute (ANSI) in 1982. But for the public, the NCRP wants a standard stricter than ANSI's by a factor of five. Dr. Bill Guy of the University of Washington in Seattle chaired both the NCRP and ANSI standards-setting committees.

In its report, the NCRP explains that the limit for the public is one-fifth that for workers because the ratio of the number of hours in the average work week (40) to the total number of hours in a week (168) is approximately 0.2. Asked at the NCRP's annual meeting in Washington, DC, in early April, why the committee did not apply the more commonly used safety factor of ten to convert an occupational standard to a population standard, Dr. Edward Alpen of the University of California in Berkeley, a member of the NCRP committee, replied that it would be "gross overkill," adding that the committee thought the 1 mW/cm² standard was already conservative.

The time-averaging provision for public exposures is more lenient than that for workers, however. For population exposures, the recommended limits are averaged over a 30-minute interval, while occupational exposures are averaged over six minutes.

Special Precautions for Modulated Fields

One original aspect of the NCRP recommendations is the provision that, "If the carrier frequency is modulated at a depth of 50 percent or greater at frequencies between 3 and 100 Hz, the exposure criteria for the general population shall also apply to occupational exposures." This added precaution is based on calcium efflux research by Dr. Ross Adey of the VA Hospital in Loma Linda, CA, which has been confirmed by Dr. Carl Blackman of the Environmental Protection Agency. Adey was a member of the NCRP RF/MW committee.

The NCRP report notes that while it is not known whether the biological effects of low frequency modulation pose a health risk, "their reliability and their independent confirmation in avian and mammalian species dictate the need for caution."

No special precautions are recommended for pulsed radiation because of "limited data."

Effects To Watch

The NCRP report took nine years to complete and is based only on research published through 1982. Nevertheless, the committee took special note of two more recent findings, which, it advises, could result in a tightening of the exposure guidelines in the future:

- The risk of RF shocks and burns at frequencies above 1 MHz, based on the research of Drs. Om Gandhi of the University of Utah in Salt Lake City and Bill Guy (see *MWN*, July/August 1985).
- The possible link between exposures to RF/MW radiation and the increased incidence of cancer indicated in the first long-term, low-level exposure study, which was carried out in Guy's lab in Seattle (see *MWN*, July/August 1984 and March 1985).

The 353-page NCRP report, *Biological Effects and Exposure Criteria for Radiofrequency Electromagnetic Fields* (No.86), includes 63 pages of references. It is available for $20.00 from NCRP Publications, 7910 Woodmont Ave., Suite 1016, Bethesda, MD 20814, (301) 657-2652. (See also *MWN*, January/February 1986.)

Radio Technician's Widow Sues Over RF Exposure

A Kentucky woman whose husband died of leukemia after working 22 years as a radio technician has sued the manufacturer of an FM transmitter system for failing to protect him from, or to warn him about, the health risks associated with exposure to radiofrequency (RF) radiation.

In a civil suit filed May 1, Marie Lafferty stated that, "The radiation to which [William Lafferty] was exposed while working in the intended manner on and near the equipment was of such a level as to be the proximate cause of his death." The suit against Collins Radio Co., a subsidiary of Continental Electronics Manufacturing Co., Inc. (both in Dallas, TX), asks for an unspecified amount of money for Mr. Lafferty's death, for punitive damages and for mental harm and other injuries to Mrs. Lafferty and the couple's two sons.

William Lafferty died at age 41 of acute myelomonocytic leukemia on August 11, 1983, approximately a month after his doctor diagnosed the disease. Mrs. Lafferty contends in her complaint that this type of leukemia is "known in the medical profession to result from exposure to high quantities of RF radiation." Mr. Lafferty was in good health until 1983, when he began to complain of a "burning or boiling sensation internally and on the surface of his skin," according to the court papers.

Lafferty maintained and repaired the equipment for WQHY-FM (95.5 MHz), one of two stations owned and operated by WDOC, Inc., of Prestonsburg, KY; on at least some occasions, he worked on the station's tower while it was broadcasting. In 1981, Collins Radio Co. upgraded WQHY's antenna and transmitter.

Mrs. Lafferty first suspected that her husband's death was due to RF radiation exposure when she learned in 1985 that the Environmental Protection Agency (EPA) had identified the WQHY site as one of approximately 200 in the U.S. where RF levels in publicly accessible areas exceeded the American National Standards Institute's (ANSI) exposure guidelines (see *MWN*, January/February 1985). In a telephone interview, she told *Microwave News* that her oldest son sometimes went to the station with his father and returned home dizzy. "There is something going on," she said. "I have got to know why my husband died."

As we go to press, attorneys for Collins Radio Co. have asked the Floyd Circuit Court to move the case to federal court. C.V. Reynolds, the attorney representing Lafferty, said in an interview from his office in Prestonsburg that he expects the court to approve the request. Stuart Lemle of the Washington, DC, law firm of Land & Lemle is co-counsel for Mrs. Lafferty.

Collins is represented by Linda Hopgood of the Lexington, KY, firm of Clark, Ward, Stuart & Hopgood; Continental Electronics is represented by Mike Schmitt of the Paintsville, KY, firm of Wells, Porter, Schmitt & Walker.

FCC Drops FM-Aircraft EMI Rules

The Federal Communications Commission (FCC) has suspended plans to develop criteria to ensure compatibility between FM broadcasts and aircraft navigation and communication systems. The commission concluded that there is insufficient information to continue work on the rules it proposed in April 1985 (see *MWN*, May 1985).

The Federal Aviation Administration (FAA), which opposed the FCC's rulemaking proposal, will continue to work with the FCC on electromagnetic interference (EMI) problems on a "case-by-case" basis, the FAA's Gerald Markey told *Microwave News*. John Wong, chief of the FCC's Engineering Policy Branch, confirmed that the commission will continue to investigate reported cases of interference.

In its *Memorandum Opinion and Order* closing the proceeding, the FCC stated that although the 12 sets of comments submitted on its proposal "raised significant concerns about the aeronautical interference issues, they did not provide enough substantive information from which final rules could be adopted." In addition, the order noted that a panel of the International Radio Consultative Committee (CCIR) plans to review the FM-aeronautical EMI problem later this year. The FCC concluded that final action at this time would be "premature" and advised that it will consider taking up the issue again after the CCIR group meets.

Markey, acting manager of the FAA's Spectrum Engineering Division, said that the FCC's decision does not alter his agency's position that broadcasters, rather than airlines, should bear the burden of ensuring compatibility. The FAA contends that low power avionics signals are simply overpowered by broadcast transmissions. The FCC suggested in its April 1985 proposal that poor receiver design was a major cause of EMI.

Markey added that he believes the FCC issued its proposal at least partly to force the FAA to move up the effective date of its rules requiring improved immunity in avionics receivers. Those rules are scheduled to take effect in 1995, and the agency has no plans to alter its schedule.

Wong responded that the FCC was not trying to pressure the FAA: "We had been receiving complaints from broadcasters." He added that both broadcasters and airlines bear unnecessary burdens as the situation stands.

While the increasing risk of EMI prompted the FCC's proposal, both sides agree that no accidents have been caused by interference. FM radio broadcast frequencies at 88-108 MHz abut aircraft very high frequency (VHF) systems at 108-137 MHz. The FAA's Markey said that television broadcasts can also cause interference, although the FCC excluded both TV and AM transmissions from its 1985 proposal. In addition, though the FCC contends that only general aviation, and not commercial, airplanes face a potential risk, the FAA says that all planes can be affected.

FCC Seeks Comments on Federal Preemption of RF/MW Standards

Reacting to continuing pressure from the broadcasting industry, the Federal Communications Commission (FCC) is now seeking public comments on the impact of state and local radiofrequency and microwave (RF/MW) radiation safety standards.

In response to the National Association of Broadcasters' (NAB) latest petition asking for federal preemption (see

Naval EMC: Incompatibility Sinks Ship

The lack of electromagnetic compatibility (EMC) led to the sinking of a British destroyer by an Exocet missile during the 1982 Falklands War with Argentina. Radar and electronic countermeasures which could have protected the H.M.S. Sheffield were temporarily jammed by the ship's satellite communications system. Twenty crew members died in the attack.

The Daily Mirror, a London tabloid, featured this story in a series of front page articles in mid-May, reporting that a telephone call from the Sheffield's captain had rendered its anti-missile radar system useless. The Ministry of Defense confirmed the story: a spokesman said that the Royal Navy had taken steps to prevent a repetition of the incident.

Dr. Robert Haislmaier, the EMC coordinator for the U.S. Navy, told *Microwave News* that he knew about the Sheffield incident, and that, since learning about it, his staff has taken an even closer look at potential compatibility problems. Incidents like this, he said, are the reason we have an aggressive EMC control program in the Navy.

The Associated Press picked up the Sheffield story, which then ran in the May 16 *Washington Post* and *New York Times*, even though it had already been reported in a book on the Falklands war: Military historian Martin Middlebrook described how the Sheffield's SCOT satellite communications system was used to send "routine messages in what appeared to be a quiet period" and that they "automatically blotted out the particular radar frequencies" used by the Exocet missiles. Middlebrook's *Operation Corporate: The Story of the Falklands War, 1982* was published last fall by Viking-Penguin in London.

MWN, March/April 1986), the commission issued a Public Notice on May 1, asking for information concerning "the extent to which state and local RF radiation standards have or have not adversely affected communications services by imposing unreasonable burdens, economic or otherwise, upon permittees and licensees."

Several earlier NAB pleas for preemption have been rejected by the FCC. (See *MWN*, September 1982, April and September/October 1985.)

Comments on the NAB petition must be filed no later than August 1 and reply comments are due by September 1. For more information, contact the FCC's Joseph McBride, (202) 254-6530.

The Electromagnetic Energy Policy Alliance (EEPA) has already submitted a 3-page letter in support of the NAB petition.

RF Lighting: FCC Proposes Radiated Limits Below 30 MHz

The Federal Communications Commission (FCC) has proposed limits for radiated emissions from radiofrequency (RF) lighting devices below 30 MHz to protect against interference to AM and other broadcasters.

According to the commission, the proposed radiation limits for RF lights are based on those applied to other RF devices that can cause harmful RF interference (RFI) below 30 MHz: For 9-450 kHz: 2.4/F uV/m at 300 meters; for 450 kHz-1.705 MHz: 24/F uV/m at 30 meters (where F is in MHz); and for 1.705-30 MHz: 15 uV/m at 30 meters.

The commission expressed ambivalence as to whether radiated RFI rules are necessary, however. In its proposal, released on May 8, the FCC invited comments, particularly with respect to whether limits "below 30 MHz are, in fact, needed or if our present conducted limits below 30 MHz are sufficient to mitigate our interference concerns."

Consumer RF lighting devices will continue to fall under the commission's certification requirements, while non-consumer devices need only meet verification requirements. Under certification, manufacturers must submit test data to the FCC, while under verification, they retain their test data.

FCC Rejects NAB Petition

When it revised its rules for industrial, scientific and medical (ISM) equipment – including RF lighting devices – last September, the FCC did not set a standard to limit radiated interference below 30 MHz. The National Association of Broadcasters (NAB) responded immediately by petitioning the commission to reconsider: it specifically asked for an emission limit of 25 uV/m at 10 meters (see *MWN*, September/October 1985). On the same day that it proposed the new RF lighting rules, the FCC denied the NAB's petition.

In its current proposal, the FCC rejected the limits requested by the NAB, stating that it agreed with the National Electrical Manufacturers Association (NEMA) that the NAB's measurement techniques are not sufficiently sophisticated to justify a 25 uV/m limit.

Summaries of both the FCC's proposal and its denial of the NAB petition appear in the May 16 *Federal Register*, 51 *FR* 18004 and 17970, respectively. Comments on the FCC's proposal are due on June 30 and reply comments are due on July 15. For more information, contact Liliane Volcy at the FCC's Office of Engineering and Technology, (202) 653-7316.

NAS-NRC on Non-Thermal Effects

An advisory committee to the National Academy of Sciences-National Research Council (NAS-NRC) has acknowledged the existence of non-thermal effects due to non-ionizing radiation but has reserved judgment on their health hazards.

Following a one-day meeting at which Drs. Ross Adey, Glenn Edwards, Reba Goodman and Nancy Wertheimer, among others, described their research on low-level effects (see *MWN*, November/December 1985), the Advisory Committee on the Non-Thermal Effects of Non-Ionizing Radiation reported that "Abundant fragmentary evidence has been presented in support of possible biological effects from non-ionizing radiation, at both transmission line and microwave frequencies. These effects often appear to be unaccompanied by macroscopic thermal changes."

In its report to the NAS-NRC's Board on Radiation Effects Research (BRER), the committee noted that the research raises "important scientific questions in the areas of developmental biology, neural function, dosimetry and mechanism. To answer these questions and to assess their implications for potential health hazards will require high quality research, fastidious reporting and independent replication of experiments."

The committee, which was chaired by Dr. Robert Hofstadter of Stanford University in Stanford, CA, also recommended that human epidemiological studies be replicated and extended, that collaborative research with scientists outside the non-ionizing radiation community be encouraged and that funding agencies use "reviewers with a broader vision and a more critical approach than seems to be currently the case."

Dr. Stephen Brown, staff officer of BRER, told *Microwave News* that the board has decided not to pursue the non-ionizing radiation issue actively for the present time, but that it will continue to track developments. Brown recently left the NAS-NRC to join ENVIRON, a Washington, DC, group, to work on chemical risk assessment. Dr. Bill Ellett will take over as BRER's staff director. Ellett, who has been at the NAS-NRC for about 18 months, used to work at the Environmental Protection Agency's Office of Radiation Programs.

Summary

Reprinted below is a summary of the committee's report:

- Bioelectromagnetics research has produced abundant reports of a wide variety of individual biological responses to low-level non-ionizing radiation. At least three mechanistic biophysical theories have been offered to explain how non-thermal interactions could develop. However, the connections among the various experimental findings and the theoretical constructs do not lead to a comprehensive conceptual structure for the reported phenomena sufficient to enable an evaluation of the significance of the theories.
- Few bioelectromagnetics experiments have been exactly and independently replicated. At this point in the development of the field,

it may be more important to replicate some key experiments with simple and well-characterized systems than to generate entirely new experimental designs. Experiments that impose specialized and restricted conditions should probably be avoided.

• To give meaning to the bioelectromagnetic observations that can or will be replicated will require a comprehensive theory for the mechanisms of action. Several complementary or competing mechanistic theories have been proposed. Some are descriptive, others are phenomenological, and a few invoke fundamental biophysical principles and are quantifiable. With a few exceptions, however, these theories have not been used to generate critical, experimentally verifiable predictions, and thus remain largely speculative. The cycle from theory to hypothesis to prediction to experimental test of prediction to modified theory needs to be rigorously followed.

• To see that sufficient emphasis is given to replication and investigation of mechanisms, adoption of stringent procedures for reviewing grant proposals and administering contract research programs will be necessary. Special attention should be given to ensuring full consideration and reporting of uncertainties derived from both systematic and statistical errors.

• Infusion into bioelectromagnetics research of expertise from other fields may prove desirable. Such enrichment might come about through using consultants to assist in ad-hoc review panels and arranging for a pool of potential collaborators and highly regarded research teams with strengths complementary to those already represented within the field.

A limited number of copies of the report, *Non-Thermal Effects of Non-Ionizing Radiation,* are available free from the Board on Radiation Effects Research, NRC, 2101 Constitution Ave., NW, Washington, DC 20418.

Electric Blankets Linked to Fetal Loss

Pregnancies among couples who use electric blankets (EBs) are more likely to end in miscarriages than those among couples who do not heat their beds electrically, according to a recently published study by Dr. Nancy Wertheimer and Ed Leeper, of the Department of Preventive Medicine and Biometrics at the University of Colorado Medical School in Boulder. In general, their findings also indicate a trend toward slower fetal development among babies born to parents who use EBs or water beds (WBs).

Wertheimer and Leeper, who are well-known for their studies linking power line fields with cancer, observed a clustering of spontaneous abortions from September to June among EB users — the period of greatest reliance on electrically-heated beds. For those who rely on either EBs or WBs, the miscarriage rate was significantly higher during the September-January period. No such seasonal pattern was observed among non-users.

Fetal growth rates may be affected by EBs and WBs: the study showed that infants conceived during the winter months had significantly longer gestation periods and were more likely to be "slow-growing" — defined as having a below-median weight despite an above-median gestation period — than those conceived during July and August. Wertheimer and Leeper explain in their paper that these patterns "may represent a successful compensation for some effect of [EB] or [WB] use, which temporarily retards *early* development " (their emphasis).

In an interview with *Microwave News,* Wertheimer offered the following overview: "The results of this study could be attributed to either electromagnetic field exposure or to excessive bed-heating. However, our ongoing research suggests that the field exposure is important."

The study, first presented at the New York Academy of Sciences in 1984 (see *MWN,* May 1984), has now been published in *Bioelectromagnetics, 7,* pp.13-22, 1986.

Exposures Estimated

EBs and WBs generate extremely low frequency (ELF) electric and magnetic fields — the electric fields have been better studied.

For instance, researchers at Carnegie-Mellon University in Pittsburgh, PA, have constructed theoretical models to estimate the electric fields associated with EBs and WBs. At the 1985 Bioelectromagnetics Society meeting, Keith Florig, a graduate student in the Department of Engineering and Public Policy, presented an EB model, predicting that, for an *ungrounded* individual, a maximum local surface field of 4.9 kV/m occurs when the current is on. In his WB model, the maximum field is about 0.1 kV/m when the current is *off.*

High electric field exposures can occur even when the current is off, according to Florig, because there is a 50 percent chance that the EB or WB is plugged into the "hot" side of the outlet. Therefore, even though the unit is switched off, the heating element is at 115 V and is generating ELF electric fields — but not magnetic fields, since there is no current flowing. Polarized plugs would ensure that EBs are at ground potential, rather than at 115 V.

In the unlikely event that the individual is grounded and the heater is plugged in and at 115 V, the local electric field can be as high as 16 kV/m for EBs and 20 kV/m for WBs, Florig recently told *Microwave News.* If the person is not grounded, the exposure from EBs drops off considerably — to 0.3 kV/m.

Florig will present a revised version of his 1984 data at this July's summer meeting of the IEEE Power Engineering Society in Mexico City. His paper will be published in a forthcoming issue of the *IEEE Transactions on Power Delivery.* (A copy of Florig's paper is available for $3.00 for IEEE members, $6.00 for others, from IEEE Service Center, 445 Hoes Lane, Piscataway, NJ 08854: Order No.86-SM410-5.)

Mike Silva of Enertech (also in Pittsburgh) has measured human exposures from EBs for the Electric Power Research Institute (EPRI) and his preliminary data generally agree with those from Florig's models. Silva also found that the worst case exposure occurs when a grounded individual is under an EB which is turned off but at 115 V. Speaking at the 1984 EPRI contractors meeting in St. Louis, he said that he was in the process of developing a computer model of the magnetic fields associated with EBs.

Some of Silva's preliminary data are in his interim EPRI report, *AC Field Exposure Study: Human Exposure to 60 Hz Electric Fields,* (No.EPRI EA-3993, April 1985). Silva writes that in 1978 there were more than 51 million EBs in use and that in 1981 five million EBs were sold in the U.S.

EPRI's Dr. Robert Patterson told *Microwave News* that Silva's more recent measurements will be published next year.

CONFERENCES

New Listings

August 18-22: **5th Annual Society of Magnetic Resonance in Medicine Meeting,** Montreal Convention Center – Palais des Congres de Montreal, Quebec, Canada. Contact: Society of Magnetic Resonance in Medicine, 15 Shattuck Square, Suite 204, Berkeley, CA 94704, (415) 841-1899.

September 11-13: **Scientific Conference on Electropathology,** Physiologisches Institut der Universitat Freiburg, Federal Republic of Germany (F.R.G.). Contact: Conference Secretariat, Forschungsselle fur Elekktropathologie, Reutebachgasse 11, D-7800 Freiburg, F.R.G., (0761) 56201.

September 17-19: **1986 Symposium on Antenna Applications,** Allerton House, Monticello, IL. Contact: Paul E. Mayes, Dept. of Electrical and Computer Engineering, University of Illinois, 1406 W. Green St., Urbana, IL 61801, (217) 244-0543.

September 21-24: **3rd Congress of the European Society of Magnetic Resonance in Medicine and Biology,** University of Aberdeen, Scotland. Contact: Dr. Margaret A. Foster, Dept. of Biomedical Physics and Bioengineering, University of Aberdeen, Foresterhill, Aberdeen AB9 2ZD, Scotland, U.K., (0224) 681818, ext. 3208.

September 24-26: **Physiological NMR Spectroscopy from Isolated Cells to Man,** Vista International Hotel, New York, NY. Contact: Conference Director, New York Academy of Sciences, 2 East 63rd St., New York, NY 10021.

September 30-October 3: **5th International Conference and Tutorial Day on Electromagnetic Compatibility,** University of York, U.K. Contact: The Conference Secretariat, Institution of Electronic and Radio Engineers, 99 Gower St., London WC1E 6AZ, U.K., (01) 388-3071.

November 2-6: **1986 IEEE Conference on Electrical Insulation and Dielectric Phenomena,** Hilton Hotel, Claymont, DE. Contact: Roy Wootton, 501-3W57, Westinghouse R&D Center, 1310 Beulah Rd., Pittsburgh, PA 15235, (412) 256-2108.

November 10-12: **RF Expo East,** Marriott Copley Place, Boston, MA. And February 11-13, 1987: **RF Technology Expo 87,** Disneyland Hotel, Anaheim, CA. Contact: James MacDonald, RF Technology Expo, 6530 S. Yosemite St., Englewood, CO 80111.

November 17-20: **1986 DOE-EPRI Contractors Review: Biological Effects of Electric and Magnetic Fields,** Sheraton Denver Tech Center, CO. Contact: W/L Associates, 600 S. Frederick Avè., Suite 401, Gaithersburg, MD 20877, (301) 948-0642.

Upcoming Meetings

July 20-25: **Summer Meeting of the IEEE Power Engineering Society (PES),** Mexico City, Mexico. Contact: IEEE Society Special Services, IEEE, 345 East 47th St., New York, NY 10017, (212) 705-7893.

July 28-30: **21st Annual Microwave Power Symposium,** Crowne Plaza Hotel, Memphis, TN. Contact: International Microwave Power Institute (IMPI), 13542 Union Village Circle, Clifton, VA 22024, (703) 830-5588.

July 30-August 3: **1986 International Tesla Symposium,** Colorado College, Colorado Springs, CO. Contact: IEEE Pikes Peak Section, Suite 115, 330-A West Uintah, PO Box 150, Colorado Springs, CO 80901.

August 15-16: **International Symposium on Recent Advances in Microwave Technology and Future Challenges,** University of North Dakota, Grand Forks, ND. Contact: Banmali Rawat, Dept. of Electrical Engineering, Box 7165, University of North Dakota, Grand Forks, ND 58202, (701) 777-4331.

August 20-22: **11th Annual Conference of the Australian Radiation Protection Society,** Sydney, Australia. Contact: D.A. Woods, Office of the Supervising Scientist, PO Box 387, Bondi Junction, NSW 2022, Australia, (02) 387-0666.

September 8-11: **16th European Microwave Conference,** National Concert Hall, Dublin, Ireland. Contact: Microwave Exhibitions & Publishers, Convex House, 43 Dudley Rd., Tunbridge Wells, Kent TN1 1LE, U.K.

September 13-16: **39th Annual Conference on Engineering in Medicine and Biology,** Marriott Hunt Valley Inn, Baltimore, MD. Contact: Susan Leone, Suite 700, 1101 Connecticut Ave., NW, Washington, DC 20036, (202) 857-1199.

September 14-19: **1986 IEEE/PES Transmission and Distribution Conference and Exposition,** Convention Center, Anaheim, CA. Contact: Charles White, South Carolina Electric and Gas Co., PO Box 764, Columbia, SC 29218, (803) 748-3518.

September 16-18: **IEEE International Symposium on Electromagnetic Compatibility,** Town and Country Hotel, San Diego, CA. Contact: George Ufen, GRU Associates, 1105 East Commonwealth Ave., Fullerton, CA 92631, (714) 738-0903.

September 17-19: **International Utility Symposium on the Health Effects of Electrical and Magnetic Fields: Research, Communication and Regulation,** Constellation Hotel, Toronto, Ontario, Canada. Contact: John O'Grady, Ontario Hydro, Suite H8 D4, 700 University Ave., Toronto, Ontario M5G 1X6, Canada, (416) 592-3395.

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NMR Imaging Health and Safety: An Annotated Bibliography

Summarized below are some recent papers and conference abstracts on the health effects, interference to ferromagnetic and medical devices and site planning problems associated with nuclear magnetic resonance imaging (NMRI). These listings are excerpted from a forthcoming Microwave News *report available for $18.95 (prepaid) from PO Box 1799, Grand Central Station, New York, NY 10163.*

(Note: B = magnetic field; dB/dt = time-varying magnetic field; F.R.G. = Federal Republic of Germany; G = gauss; SAR = specific absorption rate; and T = Tesla.)

Anonymous, "Safety of NMR" (editorial), *The Lancet, i,* pp.913-914, April 20, 1985.

Reviews the bioeffects of B, dB/dt and RF fields used in NMRI and summarizes the recommended U.K. guidelines. Hazards of cardiac pacemaker EMI and implants, such as ferromagnetic aneurysm clips and metallic prostheses, are discussed, as are NMRI risks to pregnant women.

Peter J. Bore, "Safety of NMR," *The Lancet, i,* pp.1107-1108, May 11, 1985.

Criticizes the April 20 *Lancet* editorial (see above) as incomplete and for oversimplifying the known and potential hazards of NMRI. Numerous suspected bioeffects, as well as physical hazards, are mentioned. In light of what is unknown, states Bore, "It is disturbing to hear clinicians claim that NMR is completely safe...we must deal more comprehensively with the topic...."

William G. Bradley, Jr., W. Ross Adey and Anton N. Hasso, *Magnetic Resonance Imaging of the Brain, Head and Neck,* Rockville, MD: Aspen Systems, 1985.

Presents the fundamentals of NMRI. Adey's chapter, "Tissue Interactions with Electromagnetic Fields," reviews bioeffects at the cellular and molecular levels due to B, ELF dB/dt, RF and ELF-modulated RF fields, as well as their relevance to NMRI. Adey recommends prudence in screening patients for NMRI and in the duration and frequency of exposure – despite its extensive use without reports of lasting adverse effects – since "mechanisms underlying tissue-field interactions are not fully understood." He also states that NMRI "would appear contraindicated in pregnancy."

Thomas F. Budinger and Paul C. Lauterbur, "Nuclear Magnetic Resonance Technology for Medical Studies," *Science, 226,* pp.288-298, 1984.

A major review article which summarizes NMRI technology: its development, mechanisms of interaction and clinical applications. Discusses safety and concludes that, at present, NMRI is considered safe, except for interactions with implants and medical electronic devices. The authors state, "Clinical studies involving fields beyond 2 T will require an extension of safety studies...."

Joseph Fetter, et al., "The Effects of Nuclear Magnetic Resonance Imagers on External and Implantable Pulse Generators," *PACE, 7,* pp.720-727, 1984.

Explains that the effects of NMRI on pacemaker function vary according to model and lead configurations, as well as with the strength of the B, dB/dt and RF fields. The authors make recommendations for scanning patients with external pacemakers or implantable single or dual chamber devices. They suggest that patients with the more complex, dual chamber devices should not undergo NMRI.

John R. Fowler, et al., "Magnetic Field Hazard," *The New England Journal of Medicine, 314,* p.1517, 1986.

This letter describes an unusual and potentially fatal accident involving a forklift and an NMRI unit. While a technician was installing a 1.5 T unit, operating at 0.5 T, the extension tines of the forklift – each approximately 2 meters long and weighing 50 Kg – were suddenly yanked off the machine into the magnet chamber, propelling the technician across the room, causing him serious injury. The rescue effort was hampered by the pull of the B field on badges, scissors and rescue equipment, and a policeman was requested to leave the scene because of concern over his gun. Later, members of the rescue team discovered a rather benign but bothersome hazard – erasure of their automated bank cards.

D.M. Kean, et al., "The Effects of Magnetic Resonance Imaging on Different Types of Microsurgical Clips," *Journal of Neurology, Neurosurgery and Psychiatry, 48,* pp.286-287, 1985.

Presents test results on the effects of strong B fields in NMRI on microsurgical clips to detect whether the fields induce heating or produce a force sufficient to move or dislodge the clips. Of 47 clips examined, 34 moved in the B field. No measurable temperature rise was induced by RF. The authors conclude that NMRI is contraindicated for patients with ferromagnetic aneurysm clips.

D. McRobbie and M.A. Foster, "Cardiac Response to Pulsed Magnetic Fields with Regard to Safety in NMR Imaging," *Physics in Medicine and Biology, 30,* pp.695-702, 1985.

Examines the effects of various, strong dB/dt fields on the cardiac functions of anesthetized rats. ECG traces were recorded and compared to readings taken in the absence of the fields. Superficial muscular responses, including limb movements and abdominal contractions, were observed. No changes were found for a number of ECG parameters, nor were there other abnormalities, such as extrasystoles and arrhythmias. Small and transitory increases in heart rate were attributed to increased demand upon the heart by the repeated and large muscle contractions experienced by the rats and not to a direct effect of the magnetic field.

D. McRobbie and M.A. Foster, "Pulsed Magnetic Field Exposure During Pregnancy and Implications for NMR Fetal Imaging: A Study with Mice," *Magnetic Resonance Imaging, 3,* pp.231-234, 1985.

Describes an investigation of the possible effects of strong dB/dt field exposures on 23 pregnant mice and on postnatal development of their offspring. Pregnancies, litter sizes and growth rates of the exposed offspring were normal. Long-term effects were not studied.

William Pavlicek, "Safeguards Help Minimize Potential MRI Hazards," *Diagnostic Imaging, 7,* pp. 166-169, 250, 1985.

A staff physicist at the Cleveland Clinic reviews the potential safety hazards to patients and staff due to B and RF fields and suggests safety measures to avoid them. He recommends a limited-access boundary at B = 15 gauss and posted warning signs at B = 5 gauss near NMRI units. RF burns can be prevented with proper design and maintenance of RF coils, removal of metal objects from patients and selection of proper attenuation values by the operator. Also stressed is the importance of patient screening for metallic implants, aneurysm clips and cardiac pacemakers.

Frank G. Shellock and John V. Crues, "Changes in Corneal Temperature Associated with High-Field (1.5 Tesla)

Magnetic Resonance Imaging: Experience in 118 Patients," presented at *4th Annual Meeting of the Society for Magnetic Resonance Imaging,* March 1986, abstracted in *Magnetic Resonance Imaging, 4,* p.95, 1986.

Describes temperature changes in the corneas of 118 patients under high-field (1.5 T) NMRI. The average corneal temperature increased from 32.7 ± 0.7° C to 33.1 ± 0.6° C. The largest change in temperature was 3° C and no temperature exceeded 34.8° C. Although the temperature increases were significant, the authors conclude that "this temperature elevation is far below the threshold for producing thermally-induced damage."

Frank G. Shellock, Daniel J. Schaefer and John V. Crues, "Thermal Responses to Different Levels of Radiofrequency Power Deposition During Clinical Magnetic Resonance Imaging at 1.5 Tesla," *Ibid.,* p.94.

Evaluates the temperature changes induced at three different SARs: 0.06 W/Kg (brain scans), 0.41 W/Kg (knee scans) and 0.70 W/Kg (lumbar spine scans). Although significant increases in body temperatures were found, "temperature elevation was not considered to be of physiological importance." Significant increases in skin temperatures were also found during brain and lumbar spine scans, "but these temperature alterations were also minimal."

Maria Stuchly, Stephane Mohanna and David Lecuyer, "Exposure to Fields from Magnetic Resonance Imaging," presented at the *8th Annual Meeting of the Bioelectromagnetics Society (BEMS),* Gaithersburg, MD: BEMS, June 1986.

A survey of 0.15, 0.5 and 1.9 T NMRI devices by these members of the Canadian Radiation Protection Bureau indicates that, outside the magnet core and coils, the "RF magnetic field and electric field strengths are less than the values corresponding to 0.05 mW/cm² (0.04 A/m, 14 V/m)." The proposed, voluntary exposure guidelines for Canada are: B = 2 T, dB/dt = 3 T/s, and SAR = 2 W/Kg and 1 W/Kg averaged over any 25% of the body mass for exposures less than 15 min. or over 15 min., respectively. For operator exposures, only a B standard was proposed (0.01 T for 8 hr/day) because of lack of data. These guidelines will be officially published in a year.

T.S. Tenforde and T.F. Budinger, "Biological Effects and Physical Safety Aspects of NMR Imaging and *In Vivo* Spectroscopy," Lawrence Berkeley Laboratory Report No. LBL-20053, August 1985. To be published in *NMR in Medicine: Instrumentation and Clinical Applications,* S.R. Thomas (ed.), New York, NY: American Association of Physicists in Medicine, 1986.

In this extensive summary of the mechanisms of interaction, bioeffects, physical hazards and exposure guidelines associated with B, dB/dt and RF fields from NMRI, the authors report that no adverse behavioral or physiological effects have been found in mammals exposed to B fields up to 2 T and that animals exposed briefly to similar fields do not show cardiac effects. They argue, however, for additional studies on the effects of prolonged exposure on the cardiac and central nervous systems and of exposure to high B fields (2 to 10 T) on cellular, tissue and animal systems. For dB/dt, they conclude that induced tissue current densities less than 1 uA/cm² have not caused harmful effects, although findings of behavioral and physiological alterations have been reported. They note that a dB/dt of 1-2 T/s would induce such maximum current densities in critical organs such as the heart and the brain. With respect to RF fields, they find that more research is needed on the mechanisms of non-thermal effects. Though epidemiological studies do not indicate a cancer risk from NMR devices, the authors state that long-term health assessments are "advisable" and may elucidate the carcinogenic risks of EM fields. They warn that patients with metallic implants may face a "serious risk" due to B and dB/dt interactions and that an EMI hazard exists to pacemakers in B fields greater than 1.5 mT and for dB/dt's of greater than approximately 75 mT/s. Regarding exposure guidelines, the authors believe that the U.S. dB/dt limit of 3 T/s "appears reasonable" and that the F.R.G. guideline for a maximum current density of 3 uA/cm² seems to be consistent, although not "extensively justified on the basis of laboratory data." On the other hand, they conclude that the 20 T/s (rms) U.K. guideline appears "excessive." Includes 476 references.

Barry Vinocur, "Don't Ignore Impact of Siting on Quality of MR Images," *Diagnostic Imaging, 7,* pp.205-208, 1985.

Discusses location, shielding, B field strength and design of patient preparation area. Concludes that high field systems have greater siting problems as they require more shielding and general site preparation.

Roger J. Willis and William M. Brooks, "Potential Hazards of NMR Imaging: No Evidence of the Possible Effects of Static and Changing Magnetic Fields on Cardiac Function of the Rat and Guinea Pig," *Magnetic Resonance Imaging, 2,* pp.89-95, 1984.

Reports no detectable alterations in the normal cardiovascular function of anesthetized rats and guinea pigs after exposure to: (1) B = 0.16 T; (2) sine, triangular and square modulated dB/dt fields from 0.1-2 Hz, similar to those used in NMRI; (3) rapidly switching fields, greater than 2 T/s for 25 ms and timed to occur at different stages in the cardiac cycle, simulating a power failure or shutoff of the superconducting magnet; and (4) AC fields of 50 Hz for periods of up to 90 minutes.

H.R. Withers, K.A. Mason and C.A. Davis, "MR Effect on Murine Spermatogenesis," *Radiology, 156,* pp.741-742, 1985.

Sixty-six hours of continuous exposure to a 0.3 T B field from NMRI did not produce any significant cytotoxicity in spermatogenic cells of mice.

Stuart W. Young, "Hazards and Site Planning," in *Nuclear Magnetic Resonance Imaging: Basic Principles,* New York, NY: Raven Press, pp.127-137, 1984.

Focuses on the concerns and problems faced in NMRI site preparation: includes a model floor plan with B field contours and discusses their influence at various distances on the surrounding environment. Briefly reviews known and potential bioeffects of B, dB/dt and RF fields, as well.

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PEMFs and Chick Eggs (continued from p.1)

In one series of experiments, the Juutilainen team exposed chick eggs to 0.1-80 A/m (rms) 100 Hz sinusoidal, square and pulsed waveforms for the first 52 hours of development and found a consistent effect at field strengths above 1.0 A/m for bipolar signals (those that oscillate above and below the zero level). They saw no change after exposure to a unipolar signal. Because the rate of change of the magnetic field, and therefore the induced current, was identical for the unipolar and bipolar pulses, they conclude that "the teratogenic effects of low frequency magnetic fields are not due to the induced electric fields." This result is consistent with the work of Dr. Abe Liboff of Oakland University in Rochester, MI, on DNA synthesis (*Science, 223,* pp.818-820, 1984, and see *MWN,* October 1983).

In a paper to appear soon in *Radiation and Environmental Biophysics,* Juutilainen's research team reports no significant differences among the three types of signals, contrary to the results of Drs. Jose Delgado and Jocelyne Leal (*Journal of Anatomy, 134,* pp.533-551, 1982, and *137,* pp.513-536, 1983; see also correction in *140,* p.721, 1985). Nor did the Finnish team find support for a power intensity window in this series of experiments. Overall, Juutilainen observed a smaller percentage of abnormalities in both exposed and control eggs than did Delgado and Leal.

In his forthcoming paper, Juutilainen reports that temperature measurements showed that the eggs had not been heated during the exposures. Based on the types and locations of the observed malformations, he suggests that "the developing nervous system, especially the anterior part of the neural tube, is an important target of the magnetic field effects."

Speaking at the *International Scientific Conference on Work with Display Units* (video display terminals or VDTs) in Stockholm, Sweden, on May 12, Juutilainen said that two key variables are the temperature of incubation and the eggs' storage time: increasing either raises the abnormality rate.

In a second paper, which has also been accepted for publication in *Radiation and Environmental Biophysics,* Juutilainen and coworker Keijo Saali report additional evidence of a threshold at 1 A/m from studies with sinusoidal magnetic fields between 30 Hz and 100 kHz. Above 30 Hz, the rate of abnormalities among the chick embryos does not increase with greater magnetic fields (10 or 100 A/m). Here again, they hypothesize a "direct interaction between the organism and the magnetic field," instead of a mechanism based on induced currents.

Studies at 1, 10 and 16.7 Hz produced results that "seemed to be different from those obtained at higher frequencies." Significant effects at 0.1 A/m, the weakest applied field, were found at 1 and 16.7 Hz, but not at 10 Hz — supporting the observation of intensity windows observed by Delgado and Leal with chick eggs and by Drs. Ross Adey and Carl Blackman in their brain-calcium studies.

Juutilainen and Saali measured mechanical vibrations in their exposure system and ruled them out as a cause of the observed abnormalities.

Swedish Mice Study: Effects Still Significant

New data from the Karolinska Institute in Stockholm continue to indicate a statistically significant increase in external fetal malformations among mice exposed to sawtooth pulsed magnetic fields. A replication study is already underway.

Preliminary results released in January raised widespread concern, but some experts adopted a wait-and-see attitude because the controls had fewer abnormalities than predicted by historical statistics — 0.7 percent v. 1.4 percent (see *MWN,* March/April 1986).

After increasing the number of control and exposed fetuses by approximately 75 percent, Drs. Bernhard Tribukait, Eva Cekan and Lars-Erik Paulsson reported that the rate of malformations among the control mice (1.35 percent) was about equal to the norm. Nevertheless, the number of fetuses with external malformations was still significantly higher (at the 0.02 level) for the mice exposed to 15 uT sawtooth pulses. There were 7 abnormal fetuses with a total of 10 malformations among the exposed mice, compared to only one malformation among the controls.

The mice exposed to 1 uT sawtooth pulses also had a higher, though less significant, rate of external abnormalities: 4 malformed fetuses, 1 with 2 malformations.

In an interview in her office at the Karolinska Institute, Cekan said that she is still "a little skeptical about the experimental results because the only observed effect concerned malformations." There were no differences in body weights, resorptions and fetal deaths between exposed and control mice. Cekan contrasted the PEMF results with those from her previous teratological studies with ionizing radiation that showed changes in all these indices. "I'm still uncertain whether the effect could be due to chance," she said.

The Karolinska study is continuing, as more mice are being exposed to square wave, Delgado-Leal-type pulses. The preliminary results showed that these signals have no effect at either 1 or 15 uT. Cekan said that the experiment should be completed in the fall.

Meanwhile, due to the intense interest in the Karolinska results — especially with respect to the potential risks to pregnant VDT operators — a replication study is already underway. At the Stockholm VDT conference, Paulsson announced that Dr. Gunnar Walinder at the University of Agriculture in Uppsala, Sweden, has been awarded a grant of 500,000 Swedish Krona (approximately $70,000) to repeat the experiment. There will be one change, however: the Uppsala group will use a CBA strain of mice. The Karolinska group used C3H mice.

Poland: TV PEMFs Affect Rats

PEMFs from black-and-white and from color television sets affected rats in a study at the Institute of Occupational Medicine in Lodz, Poland. At the Stockholm VDT conference, Dr. Henryk Mikolajczyk reported that the offspring of female rats exposed before and during pregnancy to TV radiation suffered "detectable" but ambiguous macroscopic effects. Male rats had lower testicle weights following exposure.

The rats were exposed to broad-band electric fields of 1.35-1.73 V/m and 0.63-0.81 V/m in front of, respectively, the black-and-white and color TV sets. The electrostatic potential was 2-3 kV/m.

At a press conference, Mikolajczyk said that he believes "there is some risk" for pregnant VDT operators.

Mild and Sandstrom in Sweden

At the Stockholm VDT conference, Monica Sandstrom of the University of Umea, Sweden, and Dr. Kjell Hansson Mild of the National Board of Occupational Safety and Health in Umea reported negative results.

They exposed chick embryos for 42-47 hours to 20 kHz triangular (sawtooth) pulses with a rise time of 45 usec and a fall time of 5 usec, with peak-to-peak magnetic fields of 0.1, 1.5 and 16 uT (0.08, 1.25 and 13.3 A/m) and corresponding rates of change of 0.03, 0.3 and 3.3 T/sec. They detected no significant differences in the number or types of abnormalities at any of the three intensities, compared to the controls.

Interestingly, the Umea team's sawtooth pulses match those used in the experiments at the Karolinska Institute, which showed a significant increase in external abnormalities among the mice fetuses (see box on p.10).

Sandstrom and Mild pointed out that the numerous chick-PEMF experiments all differed in at least one of the principal exposure parameters. This fact, coupled with the reports of frequency and intensity windows, led them to interpret their own results with caution and stopped them from drawing any far-reaching conclusions. Nevertheless, they did state that "It is quite likely that other factors than the pulsed magnetic field are of importance for causing an effect on embryonal development."

To highlight the variations among the experimental setups, Sandstrom and Mild showed how the magnitude and direction of the induced current passing through the chick embryos differed in the various studies: Delgado-Leal and Sandstrom-Mild placed their eggs in the coils with a horizontal magnetic field; Juutilainen stood his eggs with the blunt end up in a vertical magnetic field; and a University of Rochester, NY, team placed the long axes of the eggs perpendicular to the magnetic field *(Journal of Anatomy, 139,* pp.613-618, 1984, and *MWN,* June 1984).

Sisken and Pilla in the U.S.

A research team headed by Drs. Betty Sisken and Arthur Pilla has found no significant increase in the numbers or types of abnormalities among chick embryos exposed to PEMFs with complex waveforms.

The eggs were exposed to two different types of bipolar magnetic fields: (A) pulses of 250 usec followed by 6 usec of opposite polarity, repeated at 3.8 kHz for a burst duration of approximately 50 msec, with each burst repeated at 2 Hz, for an average magnetic field of 0.1 gauss (0.1 G = 10 uT = 8.3 A/m) and rates of change of 0.01 G/usec (1 T/sec) main polarity and 0.4 G/usec (40 T/sec) opposite polarity; (B) pulses of 200 usec followed by 20 usec of opposite polarity, repeated at 4.4 kHz for a burst duration of approximately 5 msec and repeated at 15 Hz for an average magnetic field of 0.5 G and rates of change of 0.08 G/usec main polarity and 0.8 G/usec opposite polarity. The second pulse is used by Electrobiology, Inc. (EBI), to treat bone fractures.

When eggs were exposed to pulse B for seven days, there was a doubling in the percentage of abnormal chick embryos, but this increase was not significant. There was a smaller increase in abnormalities when the eggs were exposed to pulse A for seven days.

In a paper to be published in the *Journal of Bioelectricity* later this year, the researchers suggest that, based on an analysis of the electrochemistry of ion binding at the cell surface, "the effective portions of both signals occur during magnetic field collapse" – that is, for the 6 and 20 usec pulse segments of opposite polarity.

Sisken, who is with the Department of Anatomy at the University of Kentucky in Lexington, has previously reported positive results when she amputated one of the embryo's limbs immediately before applying PEMFs. Speaking at the 1983 meeting of the Bioelectromagnetics Society in Boulder, CO, Sisken said that delaying PEMF exposure for 24 hours protected the embryo from abnormalities. Pilla is at the Mt. Sinai School of Medicine in New York City.

(continued on p.15)

ONR PEMF Project Delayed

A problem with the mechanical vibration recorders – as delivered by the manufacturer – has delayed the Office of Naval Research's (ONR) international PEMF project.

"We've fixed it," Paul Wagner of the Environmental Protection Agency's (EPA) Office of Radiation Programs in Las Vegas, NV, told *Microwave News.* Wagner and EPA's Richard Tell designed the exposure systems, which will be used in five labs in the U.S., Canada, Spain and Sweden to study the effects of PEMFs on chick embryos.

The experiments were scheduled to begin this spring but have now been pushed back until the fall. Under the study protocol, the eggs cannot be exposed in the summer or winter in order to limit variations in ambient temperatures.

The ONR project is designed to replicate the original Delgado-Leal chick embryo experiments or, alternatively, to identify the cause, if other than PEMFs, for the eggs' abnormal development (see *MWN,* January/February 1986).

UPDATES

BIOLOGICAL EFFECTS

Interest in UV-A Growing...A new FDA study indicates that UV-A radiation used by many commercial suntanning salons and often claimed to be "safer than the sun" may, in fact, lead to skin cancer and premature skin aging. The study, by Dr. Victoria Hitchins at the FDA's Center for Devices and Radiological Health (CDRH), found that UV-A at levels comparable to those emitted by standard tanning devices produced a three-to-fourfold increase in the mutation rate of exposed mouse cells—indicating potential cancer-causing effects. Although UV-A, with longer wavelengths than UV-B radiation used in older tanning devices, may be less likely to cause severe sunburn and corneal burns, its greater skin-penetrating ability may induce serious long-term damage, warned Dr. C. David Lytle, acting director of the center's biophysics division. Lytle added that repeated UV-A exposure may also cause cumulative and permanent eye damage, including cataracts and retinal lesions, and urged the use of protective goggles, even when eyes are closed, during tanning sessions. These new findings are consistent with those of Drs. Meyrick Peak and Jennifer Peak, of the Argonne National Lab, who showed that UV-A can cause breaks and cross-links in cellular DNA (see *MWN,* January/February 1986). For more information about the CDRH findings, contact: Dr. Victoria Hitchins at (301) 443-7110 for research inquiries and Ms. Diana Woods at (301) 443-4190 for consumer questions....Also, watch for the forthcoming paper, "Artificial Suntanning: Spectral Irradiance and Hazard Evaluation of Ultraviolet Sources" by H.P. Gies, C.R. Roy and G. Elliot in the June issue of *Health Physics*....On Saturday, May 10, 1986, *The New York Times* reported on independent studies of Nepalese villagers and Australian aborigines indicating that excessive exposure to sunlight can cause cataracts, and therefore suggesting that wearing sunglasses with dark lenses could protect the eyes from UV radiation. However, in a letter to the *Times* (May 26), Dr. Robert Sekuler, of the Neurobiology-Physiology and Ophthalmology Department at Northwestern University in Evanston, IL, warns that many dark sunglasses not only do not block UV, but place the wearer at increased risk by allowing the pupils to open wider, exposing the eyes to higher doses of invisible, yet harmful radiation. "Instead of rules of thumb," Sekuler recommends, "consumers should get reliable industry-wide labeling."...See also *Newsweek's* June 9 cover story: "Danger in the Sun: A Good Tan May Be Hazardous to Your Health."

COMMUNICATIONS

All Clear on Vashon Island... Washington state epidemiologists have found no evidence that a satellite communications complex is causing cancer among residents of Vashon Island near Seattle. In a May 14 letter, Dr. Samuel Milham and Steve Norsted informed island residents that there is no excess cancer among people living near the Alascom earth station in Paradise Valley. Residents there had reported a cluster of nine cancer cases, including five among women under forty. The satcom station handles telephone traffic between the mainland U.S. and Alaska (see *MWN,* March/April 1986). A cancer registry at the Fred Hutchinson Cancer Research Center listed the same number of cancer cases before and after the Alascom station became operational in 1983. (Milham and Norsted emphasized that the latency period for solid tumors is ten years.) Jay Becker, the editor of the *Vashon-Maury Island Beachcomber,* told *Microwave News* that he is satisfied that there is no cancer cluster but said he is not sure that all the island residents agree.

COMPATIBILITY & INTERFERENCE

Power Surge Downs Rocket... The loss of a NASA Delta rocket and a $57.5 million weather satellite on May 3 has been blamed on two power surges in the rocket engine's electrical system. The May 12 *Aviation Week* reports that telemetry data show that that there were two 150 amp spikes, one lasting about 6-8 milliseconds, the other about 14-15 milliseconds; these spikes caused the main engine to shut down after the voltage in its battery dropped from 28 to 11 volts. Following the loss of power, the Delta rocket began to tumble and was destroyed by ground controllers. There was immediate speculation that a stray radio signal might have been responsible for the engine malfunction, but this possibility was later discounted. On May 10, the *Washington Post* disclosed that after a 1974 accident the electrical system of the second and third stages of the Delta rocket were modified to protect against short circuits, but that, on the advice of Rockwell International, NASA decided not to modify the first stage — the one that malfunctioned in May....See also the timely paper by Boeing's George Ketterling and the Air Force's Major Raymond Vogel and Shirley Briggs, "EM Transient Protection Requirements for Avionics LRUs" (LRUs are electronic line replacement units), in the April 1986 issue of the *IEEE AES Magazine,* published by the Aerospace and Electronic Systems Society.

Open Door Policy... President Reagan's E-4B emergency command plane, a Boeing 747 electronically equipped to serve as a control center in the event of nuclear war, can be an EMI menace. Residents of San Bernardino, CA, not far from March Air Force Base where the E-4B is parked when the President is at his ranch, have had sporadic difficulties with their remote-control garage door openers over the last several years. "It had us buffaloed for a long time," Dr. Larry Murdock of Genie Garage Doors told the Associated Press (April 4), but then he noticed that the problems always accompanied the President's visits. Although the White House press office refused to confirm or deny the allegations, *The Sun,* a San Bernardino paper, reported on April 8 that the Air Force had acknowledged that the E-4B might be responsible. Murdock, who has a doctorate in physics, told *The Sun* that the garage doors returned to normal when the President went back to Washington, DC.

EMI-RFI Market... Frost & Sullivan, Inc., is forecasting an upward trend through the end of the decade for the EMI test equipment industry, due to both the virtual "omnipresence" of electronic and digital devices and the need to comply with FCC rules. The firm's 239-page report, *Electromagnetic and Radiofrequency Interference Test Equipment* (No.1521), predicts a compound annual industry growth rate of 12%, from sales of more than $180 million

in 1984 to nearly $320 million by 1989. Shielded screen rooms, the number one seller, are expected to account for 50% of the market. The largest annual percentage increases are expected in the computer industry (15%) and in the U.S. government (14%). A copy of the report is available for $1,800 from Frost & Sullivan, Inc., 106 Fulton Street, New York, NY 10038, (212) 233-1080.

GOVERNMENT

Gearing Up for Star Wars... Research on the "Star Wars" missile defense system is intensifying, prompting growing interest in health effects associated with exposure to weapon systems that use high-power, pulsed microwave or millimeter-wave radiation. As Dr. Jim Toler of the Georgia Institute of Technology in Atlanta noted at last year's Bioelectromagnetics Society (BEMS) meeting in San Francisco, CA, there are virtually no data on which to base a safety standard for these types of radiation. Now the Army and the Air Force are coming to the rescue. The Walter Reed Army Institute of Research (WRAIR), with labs in Washington, DC, and Forest Glen, MD, will soon begin experimental studies using two different high-power pulsed sources: two 200 million watt (MW) peak power units operating in the 2.5-3.0 GHz frequency range, produced and tested by the Sandia National Labs, and a 10 MW peak power unit (10 GHz) designed by the Naval Research Labs. The WRAIR also has several large anechoic chambers and other pulsed and continuous wave generators in the 0.9-35 GHz range. The WRAIR's interdisciplinary research team is headed by Lt. Col. Edward Elson, MD. In the months ahead, the Walter Reed group will explore the possibility of collaborating with other researchers who wish to make use of the lab's unique equipment. Meanwhile, the Air Force School of Aerospace Medicine (AFSAM) at Brooks Air Force Base, TX, has put the word out that it is looking for a contractor to do research on the "behavioral effects of ultrashort, high peak power pulsed microwave radiation." According to a notice published in the May 21 *Commerce Business Daily* by the AFSAM, those who wish to do this work must have security clearances. In fact, they will need a clearance just to apply. One AFSAM staffer told *Microwave News* that the biological studies themselves will not be classified, but that the principal investigator will need clearance to attend classified briefings. For more information, contact AFSAM's James Merritt at (512) 536-3583. The AFSAM has already sponsored a number of research contracts: Toler and his associates at Georgia Tech prepared a report on "The Effects of High Peak Power Pulsed Millimeter Waves," which includes a literature review – the basis for Toler's 1985 BEMS paper – and they have also designed a millimeter-wave (35 GHz) exposure system for future biological studies. Toler's report to the Air Force is in press and should be ready for distribution at the end of the summer. In addition, the Air Force sponsored research at the University of Utah, which yielded a paper, "Absorption of Millimeter Waves by Human Beings and Its Biological Implications," by Drs. Om Gandhi and Abbas Riazi. Writing in the February 1986 *IEEE Transactions on Microwave Theory and Techniques,* Gandhi and Riazi conclude that there are "potential problems" associated with irradiation in the millimeter-wave frequency band, including "extremely high superficial SARs even for incident power densities of 5-10 mW/cm^2 recommended in safety guidelines. They also urge continued study of occular effects due to energy deposited in the cornea and of the differences in thresholds for perception between millimeter waves and infrared radiation. How exactly might microwaves be used in the Star Wars program? *Microwave Systems News and Communications Technology* gives some hints in a special report, "SDI Offers Challenges and Advances in Technology," in its March 1986 issue. It is doubtful that anyone sees high-power microwaves as a "hard-kill" directed energy weapon, more likely are their potential as a "soft-kill" or "hard-jam" weapon, according to the authors of the report: These systems either burn out the electronics of missiles, aircraft and radars or irreversibly upset their operation.

Radio Marti Compensation... The FCC has approved five new compensation claims to Florida AM radio stations for expenses incurred in offsetting Cuban interference. On January 22, Miami's WNWS was awarded $113,271 and, on February 5, WIOD, also of Miami, was granted $84,027. Then, on February 25, the FCC awarded WVCG of Coral Gables $245,751 for anticipated expenses for increasing nighttime power. More recently, on April 4, WEAT of West Palm Beach was granted $14,397 and, on April 11, WINZ in Miami was awarded $31,460. The first and only previous FCC award ($12,265) was made to WSUN of St. Petersburg in March 1985 (see *MWN,* April 1985). All of the awards to date are for costs incurred *before* Radio Marti went on the air at 1180 kHz on the AM band. Interestingly, despite all the fears, Cuba has not jammed Radio Marti; in fact it has hardly retaliated at all. Compensation is authorized under the law that set up Radio Marti. In 1984, the FCC scrapped the original $250,000 ceiling on claims and ruled that the cost of protective equipment was also reimbursable. Despite the FCC's approval of the six awards, none of the stations has actually received any money, at least partly because the United States Information Agency (USIA), Radio Marti's parent agency, has yet to ask Congress for the funds.

MEASUREMENT

Infrared Radiation (IR)... Barnes Engineering Co. has published the *Handbook of Infrared Radiation Measurement* to help others find solutions to industrial problems involving the measurements of temperature and heat flow. The well-illustrated, typescript, 82-page volume covers the fundamentals of IR and the instruments necessary to measure it. The handbook is available for $6.95 from Barnes Engineering Co., 44 Commerce Rd., PO Box 53, Stamford, CT 06904, (203) 348-5381.

MEETINGS

Wroclaw EMC... Researchers from Bulgaria, England, Japan and the U.S.S.R. will participate in a session on "EM Emissions Related to Earthquakes" at the *8th International Wroclaw Symposium on EMC,* which will be held June 24-26 in Poland. In other sessions, papers will address EMC standards in Czechoslovakia, mechanisms of millimeter

wave bioeffects, EMI problems related to TV transmitters, suggested human exposure guidelines in Italy and RFI in shipboard power lines. For more information, contact: EMC Symposium, Box 2141, 51-645 Wroclaw 12, Poland.

Biomedicine and EM Fields... Last December, the Institution of Electrical Engineers (IEE) in London, England, held an *International Conference on Electric and Magnetic Fields in Medicine and Biology*. Thirty-three papers from the meeting have now been published, covering childhood cancer and power lines, electrical stimulation and bone healing, a magnetic nerve stimulator, effects associated with a 750 kV power line and many other topics. A copy of the paperback volume is available in the U.S. for $56.00 from PPL Dept., IEEE Service Center, 445 Hoes Lane, Piscataway, NJ 08854, (201) 981-0060, ext.382. Credit card orders are accepted. If you do not prepay, add $2.25 for postage and handling. *Non-U.S. residents should contact the IEE, Savoy Place,* London WC2R 0BL, U.K., (01) 240-1871, ext.222.

DOE-EPRI Contractors Meeting... The 1986 review of research by contractors to the Department of Energy (DOE) and to the Electric Power Research Institute (EPRI) will be held at the Sheraton Denver Tech Center in Colorado, November 17-20. The number of presentations will be smaller this year because the New York State Power Line Project has come to an end. A block of rooms has been reserved at the special rate of $50/night, plus tax; call (303) 779-1100 for reservations. For more information, contact Dr. William Wisecup, W/L Associates, 600 S. Frederick Ave., *Gaithersburg, MD 20877, (301) 948-0642.*

POWER LINES

Texas Developments...A consortium of utilities has decided to abandon the proposed 153-mile Walker-Matagorda, TX, DC power line and has petitioned the Federal Energy Regulatory Commission (FERC) for permission to do so. The utilities plan to use existing AC lines in lieu of the planned ±400 kV line. Central Power & Light Co., Houston Lighting & Power Co. and Southwestern Electric Power Co. gave up on the project on May 1, almost two years after a state Public Utilities Commission (PUC) administrative law judge recommended against construction of the line because of potential public health risks. The PUC then remanded the case for further hearings (see *MWN,* November 1984), but the utilities filed suit in District Court in Austin challenging the PUC's jurisdiction in questions of public health. The utilities were initially victorious but then suffered a reversal that would have required a new trial. As a result, they decided to make do with their AC lines....Meanwhile, Houston Lighting & Power Co. is preparing its appeal of the $25 million decision it lost last November (see *MWN,* November/December 1985). The judgment, which cited the utility for "reckless disregard" of *children's health in siting a 345 kV power line across school* property, was based primarily on potential health risks.

Funds for Bioeffects Research... When should government officials stop paying for studies on a particular risk? Professor Granger Morgan of Carnegie Mellon University in Pittsburgh, PA, poses this question with respect to 60 Hz health effects in an editorial in *Science* magazine (May 23). Citing the $25 million award for punitive damages against Houston Lighting and Power Co. over the siting of a power line and the trend toward slashing ELF research budgets (see *MWN, November/December 1985 and above*), Morgan writes, "We have invested enough to produce a body of science that, in its current state, will support vigorous adversarial debate and rancor for years to come and are now truncating government research funding before producing enough science to resolve the question of risk." In a telephone interview, Morgan explained that much more work must be done on ELF bioeffects since we are still formulating the questions to be answered – a far cry from devising the appropriate stopping rules. Morgan's editorial was much discussed at the June Bioelectromagnetics Society meeting in Madison, WI. Indeed, at the opening session, Dr. Ross Adey of the VA Hospital in Loma Linda, CA, called it "irresponsible." Criticisms centered on the fact that Morgan did not distinguish between risk-related studies and pure or fundamental research on the biological action of electromagnetic fields. And while the amounts already spent on ELF research studies might appear to be large they are minuscule when contrasted with the size of the utilities that build and operate the power lines. (Note that there is a typographical error in the fifth line of the first paragraph of Morgan's editorial: the word "effect" should be replaced with "effort.")

Interference... Three recent papers from the IEEE Power Engineering Society: (1) "Carrier Frequency Interference from HVDC Systems" by Neal Patterson of Montreal Engineering Co. in Canada, in the November 1985 *IEEE Transactions on Power Apparatus and Systems;* (2) "Effect of Power Lines on AM Radio Broadcast Radiation Patterns" by R.C. Madge and D.E. Jones of Ontario Hydro in Toronto, Canada; and (3) "Electromagnetic Interference Measurements at 900 MHz on 230 kV and 500 kV Transmission Lines" by the BPA's V.L. Chartier in Vancouver, WA, R. Sheridan and J.N. DiPlacido, of Chas. T. Main, Inc. in Boston, MA, and M.O. Loftness, a consultant in Olympia, WA. The latter two papers appeared in the April 1986 *IEEE Transactions on Power Systems.*

STANDARDS

Computer EMI in Canada... The Canadian Department of Communications has proposed amending its EMI rules for digital equipment. The March 8 proposal would make the Canadian regulations essentially the same as those adopted by the FCC in the U.S. – the limits for conducted and radiated emissions, for both Class A and B devices, are identical. Copies of the Canadian standard are available from the Standards Code and Information Center, NBS, Admin. Bldg. A629, Gaithersburg, MD 20899, (301) 921-2092. Ask for No. TBT 86.45. Or write directly to S.N. Ahmed, Engineering Programs, Dept. of Communications, 300 Slater St., Ottawa, Ontario K1A 0C8, Canada.

Satcom Antennas... The Electronics Industries Association (EIA) has issued a proposed revision of its 1973 recommended standard, EIA-411, *Electrical and Mechanical Characteristics of Earth Station Antennas for Satellite Earth*

Communications. The detailed proposal has a chapter on on-site antenna measurements, including specifics on protection against radiation hazards. For more information, contact Standards Sales Dept., EIA, 2001 Eye St., NW, Washington, DC 20036, (202) 457-4900. Refer to proposal No.1661.

IEC on Short-Circuit Currents... The International Electrotechnical Commission's (IEC) Technical Committee No.73 has issued a new standard for the calculation of the effects of short-circuit currents for AC systems with rated voltages up to 72.5 kV. The 49-page standard covers the electromagnetic effect on rigid and slack conductors as well as the thermal effect on bare conductors. A copy of IEC Publication No.865 (1986) will soon be available for $47.00, plus $5.00 postage and handling, from the International Sales Dept., American National Standards Institute, 1430 Broadway, New York, NY 10018.

VDTs

NIOSH Pregnancy Study...NIOSH has moved a step closer to starting its planned epidemiological study of reproductive risks among VDT operators. The federal Office of Management and Budget (OMB), which rejected NIOSH's study protocol last December, conditionally approved virtually the same study plan on appeal in June. The decision came just weeks after witnesses at two separate congressional hearings suggested that the OMB was blocking the study because of pressure from Bell South, one of the companies that agreed to participate in the project but objected to the protocol (see *MWN,* January/February 1986).

Resources...A Swedish research team has found a possible association between VDT use and operators' skin problems. The 13-member team from the National Board of Occupational Safety and Health (NBOSH), in conjunction with the Karolinska Institute and the Huddinge Hospital, found that "there may be a relation between VDT work and an aggravation of seborrheic dermatitis, acne and rosacea, and possibly also the provocation of poikiloderma of Civatte." The results are included in a five-part study published in the *Scandinavian Journal of Work and Environmental Health, 11,* pp.457-493, 1985: "Subjective Symptoms and Discomfort" (Part I), "Physical Exposure Factors" (Part II), "Ophthalmologic Factors" (Part III), "Refraction, Accommodation, Convergence and Binocular Vision" (Part IV) and "Dermatologic Factors" (Part V). The authors caution that the skin problems may have resulted from either physical or psychological factors and note that none of the observed skin disorders resembled VDT-related rashes reported in Finland in 1982. The study also found that VDT operators reported vision-related problems more often than other office workers, although ophthalmologic and optometric tests failed to identify the causes of the high rate of complaints....Australian researcher Dr. Michael Repacholi dismisses radiation emissions as potential health risks for VDT operators. In "Video Display Terminals — Should Operators be Concerned?" Repacholi states that, "The answer to the question on VDTs posed by the title of this paper...is a categorical NO in relation to radiation exposure" (emphasis in original). The paper appeared in *Australasian Physical & Engineering Sciences in Medicine, 8,* pp.51-61, 1985. Following a review of selected published radiation research, Repacholi questions whether the Delgado effect — fetal damage due to low-level magnetic fields — can be confirmed. "There is no current theory that predicts [that] developmental or other effects could occur from exposure to magnetic field strengths so much lower than the Earth's magnetic field," he writes. "If the effects were found to occur at these low fields, all electronic devices used in the home or workplace would be called into question." Repacholi is chief scientist at the Royal Adelaide Hospital....In a second review article, Dr. Kenneth Foster of the University of Pennsylvania in Philadelphia concludes that ambiguous and incomplete data have fueled concern about possible reproductive risks for VDT operators. Writing in the March-April issue of the *American Scientist* on "The VDT Debate," Foster states that the available evidence does not establish an association between VDT use and reproductive problems or even the likelihood that such a connection might exist. He criticizes the research to date on reproductive clusters among VDT workers and challenges the view that VDT radiation emissions might be capable of causing damage.

ETC...

Debating the Debate... Dr. Ross Adey's extended review of Dr. Robert Becker's *The Body Electric* and Dr. Nicholas Steneck's *The Microwave Debate,* (see *MWN,* June 1985) — much discussed in the non-ionizing radiation community — has now been answered by both authors. Adey's piece appeared in the January/February 1986 issue of *The Sciences*, the magazine of The New York Academy of Sciences. Becker's response is in the magazine's May/June issue, and Steneck's is in the July/August issue.

PEMFs and Chick Eggs

(continued from p.11)

Rooze and Hinsenkamp in Belgium

Drs. M. Rooze and M. Hinsenkamp have found that the 5 msec, 15 Hz EBI pulses can increase the lengths of the bones in chick embryos. Their studies indicate that PEMF stimulation initiates, as well as accelerates, bone formation earlier than in controls.

Writing in *Reconstruction Surgery and Traumatology (19,* pp.87-92, 1985), they also report that PEMF stimulation increases embryonic weights, with more pronounced gains the longer the exposure. Rooze and Hinsenkamp are at the Erasmus University Hospital in Brussels, Belgium.

In an earlier study with quail eggs, also using an EBI signal (though they do not specify which one), the researchers found evidence that it is the electric field, not the magnetic field, that is biologically active. (See their paper in *Interactions Between Electromagnetic Fields and Cells,* A. Chiabrera, et al., eds., New York, NY: Plenum, 1985.)

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Of related interest, see Dr. W.C. Parkinson's paper, "Comments on the Use of Electromagnetic Fields in Biological Studies," *Calcified Tissue International, 37,* pp.198-207, 1985. ●

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HAWAIIAN HOT SPOTS

Cancer Rates Higher Near Honolulu Broadcast Towers

The cancer incidence in eight out of nine census tracts with broadcast towers in Honolulu, HI, is "significantly higher" than in nearby tracts without sources of radiofrequency (RF) radiation, according to a study by the Hawaii Department of Health.

Dr. Bruce Anderson and Alden Henderson, the authors of the report prepared for the Honolulu City Council, conclude that their study design "does not allow for drawing a cause-and-effect relationship between cancer incidence and RF radiation." They recommend additional research and the adoption of an "interim" standard for public exposures to RF radiation "until more information is available on possible long-term effects."

In a telephone interview, Henderson told *Microwave News* that the study points to a "potential problem" but that there is little chance of a follow-up: "The RF problem has low priority – there are only two of us and there are many other pressing environmental issues."

Marilyn Bornhorst, the Honolulu Councilwoman who requested the study, said that, "Our goal is to try to get the towers out of the city." Until recently, broadcast antennas were sited in down-

(continued on p.14)

Lualualei Leukemia Cluster

Between 1979 and 1985, there were nine cases of leukemia – more than four times the expected number (2.1) – among children living within five miles of the U.S. Navy's communications complex at Lualualei, on the island of Oahu in Hawaii, according to the Cancer Research Center of Hawaii (CRCH). Since 1986 no cases have been reported, however.

A full-scale study of the leukemia cluster was never carried out. "We wanted to get funding to take measurements in the homes of the leukemia cases as well as in those of controls," Dr. Loic LeMarchand of CRCH told *Microwave News*, but "unfortunately we did not get the money and then the rates were back to normal."

There were two leukemia cases in 1982 and three in 1983, and one in every other year between 1979 and 1985, except for 1981, when none were reported.

The study would have been difficult to execute, LeMarchand ex-

(continued on p.15)

Major Cancer-ELF Studies Planned in Sweden

Swedish health officials are planning one of the most ambitious epidemiological studies ever undertaken on the possible relationship between power line magnetic fields and cancer. Dr. Anders Ahlbom of the National Institute of Environmental Medicine in Stockholm will direct the case-control study.

The study will include those who lived within 300 meters of a 220 kV or 400 kV power line for at least one year between 1960 and 1983 and who developed any type of childhood cancer, adult brain tumor or leukemia and some of those who developed breast cancer – a total of approximately 1,200 cancer cases, according to preliminary estimates. The study is expected to cost approximately $500,000 and is tentatively scheduled to be completed in 1991.

The epidemiological study is only one of five 50 Hz projects that are now regarded as high priorities by the Swedish Minister of Energy. (The Swedish electrical distribution system operates at 50 Hz, compared to 60 Hz in North America). The total cost of the five projects will be about $1 million.

The other projects will include: an investigation of cancer promotion in cell cultures; a lifetime exposure study (with cancer as the end point) of experimental animals exposed to 50 Hz magnetic fields; an occupational cancer registry study of electrical workers; and an effort to estimate the electric and magnetic field exposures in a number of different occupations. The tissue culture study will be headed by Dr. Kjell Hansson Mild; the other three will be run by Professor Bengt Knave. Mild and Knave are both with the Swedish National Board of Occupational Safety and Health (NBOSH). Mild is based in Umea, and Knave is in Solna (near Stockholm).

In a telephone interview from Stockholm, Ahlbom said that given current gaps in knowledge, it is important to carry out both well-designed epidemiological studies and basic science research on mechanisms.

Mild will also be responsible for the assessment of exposures in Ahlbom's epidemiological study. The magnetic fields inside homes will be measured, as well as estimated, based on the distance from, and the loadings of, the power lines. Dr. David Savitz of the University of North Carolina in Chapel Hill, and Dr. John Bonnell, who recently retired from the Central Electricity Generating Board in London, U.K., will serve as consultants to Ahlbom's research team, as will Knave.

Ahlbom and coworkers are planning to test the study protocol at one 220 kV power line near Stockholm and then at all the major lines in Stockholm county. Once the feasibility phase is completed, they will take on all the major lines in the country.

On his return from Sweden, where he attended a planning meeting in early May, Savitz told *Microwave News* that he was "very impressed" with what he learned. He said that the Swedish researchers should be able to get a good handle on dosimetry because they have a historical record of the loadings on the lines.

Leukemia Among Finnish Electrical Workers

The incidence of leukemia among Finnish electrical linemen and cable joiners was more than three times the expected rate, according to the preliminary results of an epidemiological study by Jukka Juutilainen of the University of Kuopio, E. Pukkala of the Finnish Cancer Registry and E. Läärä of the University of Oulu.

In an abstract scheduled for presentation at the *2nd Hungarian Symposium on Magnetotherapy*, held in May (see *MWN*, March/April 1987), Juutilainen reported that the cancer incidence was highest among linemen and cable joiners, relative to all types of electrical employees, and that these workers "probably had the strongest electromagnetic exposure[s]." He warned against drawing any conclusions, given the small number of cases.

The three researchers will report results on other types of cancer at a later date. Their data were collected by the Finnish Cancer Registry and Central Statistical Office of Finland.

Juutilainen, who also has been studying the effects of pulsed magnetic fields on chick embryos (see *MWN*, May/June 1986), was unable to attend the Hungarian symposium.

Canadian EMF Committee Gets to Work

The newly-organized Canadian Working Group on Electric and Magnetic Fields (EMFs) is in the process of identifying key research areas and gaps in knowledge related to recent reports linking EMFs to health problems, especially cancer.

At its first meeting, held in Ottawa on March 23, the working group adopted the following statement of goals:

> The purpose of the group is to assess the existence and scope of health effects of electric and magnetic fields related to the generation and use of electricity in order to identify knowledge gaps, to foster research to fill these gaps and to educate the Canadian public on the state of scientific understanding.

Also, staffers from the Canadian Electrical Association,

Health and Welfare Canada, Hydro Quebec and Ontario Hydro briefed the group about their ongoing EMF projects. Chairwoman Dr. Maria Stuchly asked members to assemble a list of possible funding sources.

The EMF group was set up last year, after union officials became concerned about the health risks associated with exposure to EMFs (see *MWN*, November/December 1986). Its next meeting is scheduled for July 6 in Toronto.

Members of the working group are: Jim Bolan, Canadian Union of Public Employees; Gary Cwitco, Communication Workers of Canada; Raymond Del Bianco, Canadian Electrical Association; Dr. Yang Mao, Health and Welfare Canada; Dr. A.M. Muc, Ontario Ministry of Labour; Dr. Robert Phillips, Hospital for Sick Children; Dr. Michel Plante, Hydro Quebec; Dr. Sol Sax, Ontario Hydro; Dr. Maria Stuchly (Chairwoman), Health and Welfare Canada; and Dr. Gilles Thériault, McGill University.

For more information, contact: Dr. Maria Stuchly, Bureau of Radiation and Medical Devices, Room 233, Health and Welfare Canada, Environmental Health Center, Tunney's Pasture, Ottawa, Ontario K1A 0L2, Canada, (613) 954-0306.

Assorted Notes

• On April 29, the Texas Public Utilities Commission granted Houston Lighting & Power Co.'s (HL&P) request to reroute its 345 kV power line. In late 1985, a jury awarded a school district $25 million in punitive damages for HL&P's having put the line on school property without proper permission (see *MWN*, November/December 1985), and last year the Texas Supreme Court refused to grant the utility permission to use the line pending its appeal (see *MWN*, November/December 1986). According to court papers HL&P filed in May, the rerouting around the school is costing $4.26 million and will be completed by August or early September.

• At its May 11 meeting in Tampa, the chairman of the Florida Electric and Magnetic Fields Advisory Committee, Dr. Jack Parker, raised a question about how to deal with power intensity windows: Do you ignore them because of the absence of a clear dose-response relationship or do you set a rule to cover the lowest window? The committee plans to asks its consultants about this problem (see *MWN*, March/April 1987).

• In our last issue, we cited skeptical comments on *Science News*'s coverage of the power line-cancer risk. In its April 25 edition, the science weekly published two responses to the letters. After noting his initial skepticism about a cancer link, USC's Dr. Joseph Bowman went on to write, "The epidemiologists have given the physicist's paradigm a resounding kick in the butt, so now is the time for biophysical scientists to get to work. ...Whatever the eventual outcome of the issue, the physicist's arrogance is no longer justified, and must be replaced with some humble research." Dr. Ross Adey cited the ability of some marine vertebrates to detect electric fields as weak as nanovolts/meter and concluded that, "It is truly the miracle of living matter that extremely weak environmental and intrinsic electromagnetic fields exercise powerful influences on intracellular enzyme systems that govern signaling within cells, cellular metabolism and cell growth."

• The IEEE Power Engineering Society is set to meet in San Francisco, July 12-17. Not a single paper will address bioeffects of AC power line fields. There will, however, be one session on "The Effect of Color on the Acceptance of Transmission Lines," chaired by G.A. Davidson of Stone & Webster Engineering Corp.

Ambient Power Distribution Line Fields Measured

The 60 Hz electric and magnetic fields from 2-14.4 kV power distribution lines in the streets of Montreal, Canada, are "relatively strong," according to a survey by Dr. Paul Héroux of the Institut de Recherche d'Hydro-Québec. Typical values are 32 V/m and 0.16 μT (1.6 mG), respectively, for the electric and magnetic fields.

By comparison, Héroux notes that his data indicate that "a person walking the streets would be above the threshold determined by Liboff et al. between [20% and 77%] of the time" – referring to a study by Dr. Abraham Liboff, which showed that 15 Hz-4 kHz sinusoidal magnetic fields could enhance DNA synthesis in human fibroblasts (see *MWN*, October 1983, and *Science, 223*, pp.818-820, 1984). Héroux cautions that ambient – in contrast to *in vitro* – exposures "vary considerably."

Héroux observes that the magnetic fields vary much less than the electric fields. Also, measured at a height of 1 m, the magnetic fields from underground cables can exceed those from overhead lines – 0.5-1.9 μT vs. 0.15-1 μT.

Based on measurements over 223 km of roads, the magnetic fields were greater than 0.04 μT 90% of the time, greater than 0.16 μT 50% of the time, greater than 0.51 μT 10% of the time and greater than 1.08 μT 1% of the time. See Héroux's paper in *Bioelectromagnetics, 8*, pp.135-148, 1987.

HIGHLIGHTS

Diapulse Back on Market

Fifteen years after the Food and Drug Administration (FDA) ordered Diapulse® – a medical device using pulsed high frequency electromagnetic fields – off the market, the agency has agreed to its use for the treatment of post-operative swelling and pain.

At the end of March, a New York federal court approved a joint FDA-Diapulse Corporation of America proposal to allow the company to market its device for "adjunctive use in the palliative treatment of post-operative edema and pain in superficial soft tissue."

The Diapulse unit uses pulsed 27.12 MHz radiation with 80-600 pulses per second, each having a width of 65 usec. Its peak power is 293-975 watts, with an average power of 1.5-38 watts.

Diapulse was developed by Dr. A.J. Ginsberg in the 1940s and was first marketed in the early 1960s. Following years of acrimonious disputes, the FDA forced it off the market in 1972.

"We got caught in the thermal vs. non-thermal effects controversy," Diapulse Corp. Vice-President Bern Siler told *Microwave News,* "because the device causes no significant temperature rise."

The FDA's Roger Schneider agrees that was part of the problem. "Back in the early days, the agency's compliance staff and its medical advisors were simply not prepared to believe that electromagnetic energy could bring about non-thermal, beneficial effects," he said in a telephone interview. Schneider, the associate director for science at the FDA's Center for Devices and Radiological Health in Rockville, MD, added that Diapulse officials did not appreciate the kinds of medical data needed to satisfy the FDA. "They should have had better-designed experiments to argue their case because in those days anybody who claimed non-thermal effects was thought to be a quack."

Under the settlement, Diapulse Corp. can only market its unit for a small fraction of its original treatment claims. Because the unit was first sold before the 1976 medical device amendments, which codified the FDA's rigorous premarket approval (PMA) process, the company did not have to pass PMA review for any of its original claims – including the now-approved treatment of post-surgery swelling and pain.

The FDA's recent decision was based, in part, on an oral surgeon's "quite dramatic results," in which Diapulse therapy reduced edema and pain, Schneider said. These data were collected some time ago but only convinced the FDA after they were recently supplemented and reanalyzed.

Diapulse Corp. plans to ask the FDA's permission to expand the device's applications, according to Siler. Among its possible future uses are for healing soft tissue wounds and spinal cord injuries (see box).

The Diapulse unit costs $10,500; it can also be leased. Siler said that the company had survived for the last 15 years through sales in European countries, including Austria, England, France and Switzerland. The company is based in Great Neck, NY.

Treating Spinal Cord Injuries with Diapulse

Dr. Wise Young of the New York University (NYU) Medical Center in New York City has successfully used Diapulse radiation to treat cats with acute spinal cord injuries. In functional studies, up to half the cats that received Diapulse therapy shortly after injury recovered within two months, while none of the controls significantly improved.

"The phenomenon is real," Young told *Microwave News* in a telephone interview. "The major problem now is how it works."

Young has found one important clue: Diapulse therapy reduces the amount of calcium accumulating at the site of injury. He speculated that because blood clotting is a calcium-dependent process, Diapulse could affect the clotting mechanism.

The FDA's Roger Schneider, who coordinated the FDA's recent review of Diapulse, called the Young results "impressive."

Young, the director of the NYU Medical Center's Neurosurgery Laboratories, said that he is in the process of preparing papers for publication on his research with cats. He is presently working with tissue culture, he explained, in an effort to try to understand the mechanism of interaction.

Faulty VDT Screens

Certain types of commonly used anti-static VDT screens stop working after six months, according to a Swedish survey of over 100 carbon-treated nylon mesh electrostatic shields. Dr. Mats Berg of the Karolinska Hospital and Ingvar Langlet of the National Institute of Radiation Protection reported this "remarkable" finding in a letter to *The Lancet* (April 4, 1987), England's leading medical journal.

"After some months the carbon film seems to be transformed into a non-conducting state," they concluded. Screens with metal nets or metallized plastic do not deteriorate.

In a telephone interview from his office in Stockholm, Langlet, a physicist, said that the only way one can be certain a shield is still effective is by measuring the static charge: "You cannot say anything about the quality of a screen without testing it in the workplace." When asked whether his results might apply in the U.S.,

Langlet replied, "It could be the same situation as in Sweden."

Berg and Langlet tested the screens as part of an investigation of VDT-related skin rashes. In a letter to *Microwave News*, Berg, who is in the Department of Dermatology, wrote that they are in the midst of a study of 4,000 office workers – 2,000 VDT operators and 2,000 controls. The results should be published in about a year.

Langlet said that the vast majority of the screens tested were the "Power Screens" made by Power System AB, based in Stockholm. Screen Data Corp. of Whippany, NJ, one of the leading sellers of anti-static, carbon-impregnated nylon mesh screens in the U.S., is a subsidiary of Power System, and its screens are the same, according to Screen Data's Mike Kling.

Screen Data and Sun-Flex Inc. of Novato, CA, the other leading U.S. manufacturer of carbon-nylon mesh screens, now use essentially the same carbon-embedded mesh for their monochrome VDT filters. Tony Gault, president of Sun-Flex, said that the fiber is made in the U.S. and is woven into mesh in Switzerland.

Representatives from Screen Data and Sun-Flex challenged the Swedish findings. "We have not had any complaints about our screens; they should last indefinitely," Ed Thomson, Sun-Flex's manager of communications, said.

Langlet recommended that VDTs be retrofitted to guarantee anti-static protection. He said that, in Sweden, the cost of retrofitting a VDT is about the same as two anti-static filters – $150.00.

The reason for the deterioration of the screens is unclear. Langlet suggested that it may have something to do with the action of electrical forces, possibly from air pollutants in the office environment. But he did say that the loss of the anti-static properties is not simply due to age: "We found some unused, old screens and, when tested, they still worked." Another, different problem, he added, is that some of the screens are not properly grounded.

Herman Kappel, president of Kantek Inc. in New York City, another maker of carbon mesh screens, offered a simple test to identify whether an anti-static screen is still working: "If dust is accumulating on the screen, you know something is wrong." Indeed, *The Lancet* letter noted, "Female operators often report that eye make-up is deposited on the VDT screen at the end of the working day."

VDT screens are a $70-million-a-year market in the U.S., industry sources estimate – though there are no reliable statistics available. While some screens exclusively protect against glare, others add an anti-static component and still others also claim to shield very low frequency radiation.

FM Station Accepts 10 μW Limit

A Denver, Colorado FM station, KYGO, has agreed to a set of stringent precautions to limit radiation levels at a camp on whose land its radio tower is located, according to the camp's lawyers.

Attorneys Bruce DeBoskey and Joe Silver, who negotiated the settlement for Beryl and Maelma Main, owners of the Lighted Lantern Square Dance Camp, said that under an agreement signed on June 12, KYGO has reduced power from 100 kW to 1 kW and will operate from an alternate antenna during the camp's summer season. If the radio station opts to use the tower in the fall, it will continue to broadcast at only 1 kW and will erect a fence around all areas of camp property where fields exceed 10 $\mu W/cm^2$.

A recent Environmental Protection Agency (EPA) and Federal Communications Commission (FCC) survey of the radiation levels near the KYGO tower revealed that, "Many people could... visit areas where power densities exceed 1,000 $\mu W/cm^2$." The main camp building is within 100 feet of the tower, and the EPA-FCC team found radiation levels of approximately 100 $\mu W/cm^2$ in the commissary and up to 300 $\mu W/cm^2$ on the patio/deck (see *MWN*, March/ April 1987).

After the EPA-FCC measurements were released earlier this year, Wayne Phillips, KYGO's general manager, told the *Denver Post* that the station plans to relocate. Phillips did not return calls from *Microwave News*. KYGO is owned and operated by Jefferson-Pilot Broadcasting Inc.

Beryl Main has developed non-Hodgkin's lymphoma and intends to pursue a claim that his cancer was caused by the FM antenna. If he does, his suit will be another in a series seeking to link radiofrequency (RF) radiation with cancer (see *MWN*, May/June and September/October 1986).

Last year a California FM station closed down rather than comply with the FCC's RF rules (see *MWN*, March/April 1986).

Difficult Times for EBI

A Food and Drug Administration (FDA) advisory panel has recommended the removal of Electro-Biology Inc.'s (EBI) bone growth stimulator from the market. After reviewing data on patients who had been treated with the device, the Orthopedic and Rehabilitation Devices Panel questioned the efficacy of the EBI stimulator, which uses pulsed electromagnetic fields.

The panel's recommendation, made at a May 7-8 meet-

ing, is not binding; FDA regulators must decide whether to stop the use of the device, which has been on the market since 1979. An FDA spokesman said that the panel members did not find any safety problems with the device; they only questioned its efficacy. The chairman of the panel is Dr. Michael Mayor of the Dartmouth-Hitchcock Medical Center in Hanover, NH.

The FDA spokesman added that only EBI's device is under review at the moment, but that other stimulators will undergo a similar long-term assessment.

In its response, EBI charged that the panel's decision "was based on very limited data," and that the company "will vigorously attempt to rebut the panel's conclusions." Nevertheless, one FDA official told *Microwave News* that the agency is taking the panel's recommendation "very seriously." The FDA could take two to six months to decide the fate of the EBI device.

In some ways, the panel's May decision flows directly out of its discussions at an October 31, 1986 meeting. At that time, panel members voiced the need for double blind studies with concurrent controls to demonstrate the efficacy of electromagnetic bone growth stimulators. As Dr. Randall Lewis, an orthopedic surgeon based in Washington, DC, argued, "I cannot envision any circumstance under which historical control[s] would be adequate." Lewis also stated that "double blind studies are not unethical." Trying to show efficacy without double blind studies has long been controversial (see *MWN*, May 1981).

In other developments, American Medical Electronics Inc. (AME) and Biolectron Inc. petitioned the FDA in March to limit the use of EBI's stimulator for non-union fractures of greater than nine months duration. (AME, Biolectron and EBI are the only three FDA-approved bone growth stimulators.) The two competitors complained that some doctors were using the EBI device for "fresh" fractures and argued that, since the data for the three devices are comparable, they should all be used in the same way – only for fractures nine months or older. EBI said that it will contest the petition, which it regards as "anti-competitive."

And in early June came news that EBI has won a favorable ruling on its long-running patent infringement lawsuit against AME. Official details were not available at press time, but there is speculation that, if the ruling holds, AME may discontinue operations.

Military Systems: A Review

Outlined below is a system-by-system update of recent developments in several major military radar and communications projects.

PAVE PAWS

The maximum time-averaged radiation level in the communities near the Air Force's PAVE PAWS 420-450 MHz radar on Cape Cod was 0.139 $\mu W/cm^2$, according to a survey by the Air Force's Engineering Installation Group (EIG) from Keesler Air Force Base (AFB), MS. The highest reading was taken at a height of 86 feet, atop a fire tower 3.2 miles from – and in direct line-of-sight to – the radar. At all other sites the power densities were significantly less; none exceeded 0.03 $\mu W/cm^2$ at a height of 6 feet.

The survey was prompted in part by a need to monitor exposures of maintenance and construction personnel and in part to assist the Massachusetts Department of Public Health in its investigation of an abnormally high cancer incidence in the Cape Cod area.

On the base, EIG found a maximum field of 3.7 mW/cm^2 atop one of 17 lampposts (38 feet high) and readings of over 1 mW/cm^2 atop 6 others. EIG recommended that the radar be turned off when workers are on these lampposts. At one of 7 security camera locations, each approximately 15 feet high, a level of 745 $\mu W/cm^2$ was measured. At 6 feet above ground level near the lampposts and the security cameras, EIG measured a maximum 1.85 mW/cm^2 field, with many of the measurements below 1 mW/cm^2.

According to *Aviation Week* (May 18), the Air Force had been planning to increase power at the Cape Cod PAVE PAWS radar by 6 dB – a factor of four – but is now holding off. A 6 dB increase at Beale AFB, CA, may occur first, however, if the Air Force receives the necessary funding for fiscal 1989. Meanwhile, the fourth PAVE PAWS radar – at Eldorado Air Force Station, TX – was completed in May.

The EIG's measurements, which have an uncertainty of ±2 dB, are reported in *Radiofrequency Radiation Survey for the AN/FPS-115 PAVE PAWS Radar, Cape Cod AFS, MA: 18-30 September 1986* (Report No.86-33), which was obtained by *Microwave News* under the Freedom of Information Act. For further information, contact: Kevin Gilmartin, USAF Electronic Systems Division, Hanscom AFB, MA 01731, (617) 377-4064.

GWEN DEIS

The Air Force recently issued a draft environmental impact statement (DEIS) for the Ground Wave Emergency Network (GWEN), a 150-175 kHz communications system designed to survive a nuclear electromagnetic pulse (EMP).

In the DEIS, the Air Force concludes that electric fields from the "relay nodes" would be 50 V/m or less – a safety level recommended by John Mitchell of the AF School of Aerospace Medicine at Brooks AFB, TX (see *MWN*, January/February and November/December 1986). Magnetic fields at the fence would be approximately 30 mA/m.

For continuous UHF transmissions, the Air Force estimates that there would be a maximum exposure of

2.9 μW/cm² for a six-foot-tall human 20 feet from the transmitting antenna, inside the public exclusion area – or 1 μW/cm² allowing for the transmitter's 40% duty cycle.

The GWEN DEIS is also available from Hanscom AFB. The Air Force plans to issue a final EIS in August.

OTH-B

The Air Force has released EISs for two planned Over-the-Horizon-Backscatter (OTH-B) radar systems. In an August 1986 DEIS for the proposed central OTH-B radar, to be located in North and South Dakota and/or in Minnesota, the Air Force concludes that power levels in accessible areas would be below the 1982 ANSI limits – 36-1.15 mW/cm² at the OTH-B's operating frequencies of 5-28 MHz.

The Air Force has developed an "Operational Plan for [RF] Interference Avoidance" to limit potential interference to other users of the OTH-B frequencies and its harmonics, including TVs, CB radios, amateur radios and air-to-ground communications, according to the DEIS.

Similar analyses accompany the Air Force's final EIS for the proposed OTH-B radar in south-central Alaska, released in January 1987.

Both EISs are available from Lt. V.G. Brown, ESD/SCO, Hanscom AFB, MA 01731, (617) 271-5364.

The only completed OTH-B, in Maine, is undergoing trials, but delays in computer software development are slowing the process. General Electric, which built the Maine radar, recently received the contract for the Alaska facility.

In other OTH-B news, the Navy has announced plans to seal off a small wilderness island off the coast of Alaska as the initial site for a new, relocatable OTH radar (ROTHR), *Defense Week* reported (November 24, 1986). The Navy hopes to begin operating the ROTHR by 1989. Finally, Australia has announced plans to build a three-station OTH-B radar system; and Japan will send a delegation to the U.S. to study the OTH-B radar, and may build its own.

EMPRESS II

Congressional opposition to the Navy's plan to site its Electromagnetic Pulse Radiation Environment Simulator for Ships (EMPRESS II) on Chesapeake Bay continues to increase (see *MWN*, January/February and March/April 1987). Republican Senator John Warner of Virginia, a former Secretary of the Navy, has introduced an amendment to the Defense Department's fiscal 1988 authorization bill to block *permanently* the Navy's Chesapeake Bay siting recommendation. Democratic Representative Roy Dyson of Maryland, who has in the past led efforts to block siting on a yearly basis, has offered a similar amendment in the House and predicts he has enough votes to pass the measure.

Project ELF

The Navy has suspended further development of the Satellite Laser Communications (SLC) system, which would use blue-green lasers to communicate with submerged submarines, supplementing or replacing Project ELF (see *MWN*, May 1985). The Navy has refused to fund the SLC at $100 million over the next two to three years, a decision which Defense Advanced Research Projects Agency officials complain will kill the project, according to the March 2 *Defense News*.

Meanwhile, Project ELF is "moving toward operational capability," a Defense Department official told *Aviation Week* (March 9): The long-contested transmitter antenna sites in Wisconsin and Michigan are almost completed and submarine receivers are in production.

FROM THE FIELD

Epidemiological Evidence for an EMF-Cancer Link: An Exchange

Excerpted below is an edited and shortened version of An Epidemiologic Perspective on Electromagnetic Fields (EMFs) and Cancer *by Professor Philip Cole, chairman of the Department of Epidemiology at the University of Alabama in Birmingham, which was prepared for the state of Florida's Electric and Magnetic Field Advisory Panel (see* MWN, *March/April 1987). Drs. Nancy Wertheimer and David Savitz's responses to Cole have also been edited and shortened. Savitz revised his comments before making them available to* Microwave News.

Cole's Perspective

Wertheimer and Leeper (1979)...The paper...brought to the fore the question of EMF and cancer among children. The paper represents that all forms of childhood cancer, but especially leukemia, are increased about two- to three-fold among children who are exposed to "high current" configurations in their household wiring....

I was most struck by two aspects of the paper which I do not believe have been mentioned by others and which cause me to be unable to place confidence in it. The first is the complete absence of the analytic methods of epidemiology. Even the primary associations are described only in terms of statistical significance. There are no relative risks (RRs)....

The second problem is what I can only term the paper's "inordinate consistency." There are about 30 (not necessarily independent) comparisons made. When these comparisons are expressed in terms of RRs, they can be seen all (but one) to lie in the range of 2.0 to 3.0....

Finally, the paper represents that the positive results pertain to leukemia, to lymphoma and to nervous system and other cancers of childhood. And...Wertheimer has represented that similar findings pertain to most forms of cancers of adults. In short, it appears that Wertheimer proposes that she has provided evidence that EMF increases considerably the risk of

all forms of cancer, both of children and of adults. This stretches credulity....

With regard to interpretation of the Wertheimer and Leeper 1979 report, there can be little doubt about the possibilities of chance and confounding. Neither of these two factors can explain the results at all. The consistency of the results obviates chance....Thus, we are left with the question, "Is the study biased or does it reflect causality or is there an element of both?" The answer is that it is biased. No other study approaches this one in strength or consistency of findings, despite better methodology....[T]he Savitz study must be regarded as generally superior and, perhaps, much superior. This is especially so for exposure assessment. This, in turn, should cause the Savitz study to be more strongly positive and the more consistent of the two. It is, unarguably, neither.

The Savitz Study (1986)...The [draft] Savitz study must be viewed as the definitive work, to date, on the question of EMF and cancer among children. Its only limitations are those put forward by Dr. Savitz himself: 1) it is somewhat small; 2) cooperation, especially of the controls, was deficient; and 3) results may pertain uniquely to the Denver setting. I consider only criticism number (2) to have...[valid] implications. I also believe that the analysis section is thorough...and the interpretation reasonable, even though it is not an interpretation that I wholly share. The further point that Dr. Savitz has advanced – that exposure measurement needs to be improved, perhaps goes without saying, but it is not clear that it could have been done better.

I consider the Savitz study to be an essentially null study and one that is, in any case, very different in its results from the Wertheimer and Leeper (1979) report. My opinion is based on three observations: 1) The amount of data generated and the number of RRs presented are enormous. Yet, there are nearly as many RRs below 1.0 as above.... 2) There is no consistent dose-response.... 3) A crucial age-effect is missing....

This interpretation is offered of the Savitz study: The results presented show a slight but inconsistent trend to the positive. There is no dose-response relationship and no internal consistency in the data. The study may be viewed as only suggestive of a weak effect. It argues strongly against any major or consistent effect. It is consistent with nullness.

Other Epidemiologic Studies...Most of these studies were done in an occupational setting and used industry or job title as an indicator of EMF exposures. However, four of the studies pertain to residential EMF exposures....This is not an exhaustive review....The proportionate mortality studies [PMRS] provide the most limited and potentially flawed data pertaining to cancer and EMFs, while [retrospective follow-up studies (RFUS)] are the most methodologically sound. The case-control studies [CCS] occupy an intermediate position. The residential studies are discussed separately.

PMRS...The six most pertinent studies [are Milham (1982), Wright (1983), Coleman (1983), McDowall (1983), Calle (1985) and Milham (1985)]....A diversity of occupations involving potential EMF exposures were considered in these studies and all subjects were assumed to have experienced such exposures. However, it is probably true that many of these workers were, in fact, exposed little or not at all....

The PMRS provide little or no evidence that EMF exposures are a cause of human leukemia. They are not convincing mainly because of the inherent limitations of a PMR....In summary, the PMRS are interpreted as, essentially, negative.

CCS...[McDowall (1983), Pearce (1985), Lin (1985), Flodin (1986) and Stern (1986)] have a number of methodologic limitations for the purpose of evaluating the relationship between EMFs and cancer. For example, no direct measurements of EMFs were made in any of them and, with the exception of Lin's study, no attempt was made to evaluate dose-response. Furthermore, the men in these studies may have been exposed to other carcinogens which may explain their apparent excess of these cancers. Nonetheless, there is a clear tendency for positive findings in these studies. This is highly unlikely to be due to chance. It is also difficult to imagine how a bias or confounding by some factor could explain the consistent positive findings. However, a possible explanation of these positive findings is a propensity of investigators to report only positive results....

RFUS...None of the [five Swedish RFUS, Vagerö (1983), Vagerö (1985), Olin (1985), Barregard (1985) and Törnqvist (1986)]...found an excess of leukemia and four of the five found no excess of cancer of the nervous system. The fifth study...[did].

The results of the RFUS clearly contradict the CCS. The RFUS also suffer limitations as do the CCS. For example, two of the studies were quite small and so do not provide persuasively negative results....However, on the whole, the methodology of these RFUS is better than that of the CCS. More importantly, these RFUS were designed specifically for the purpose of investigating the role of the EMFs in the etiology of cancer....For these reasons, considerably more weight should be placed on the results of the RFUS, than on the CCS....The occupational RFUS provide moderate or strong evidence that EMFs have no meaningful role in the etiology of cancer.

Residential Studies of EMFs and Cancer...Fulton (1980) conducted a CCS of childhood leukemia and residential wire configurations in Rhode Island. These investigators did not find a positive association....However, the validity of this study was challenged by Wertheimer. She claimed that the control distribution of residences was biased....The result of this bias would be to provide underestimates of the RRs. She re-analyzed a subset of Fulton's data, presumably correcting for this urban bias, and reported a statistically significant positive association. Fulton did not respond to her criticisms of his study. Thus, the findings and interpretation of Fulton's study are unclear and it must be considered a non-persuasive negative study.

Tomenius (1986) conducted a CCS of childhood cancer and EMFs in Sweden....An overall statistically significant RR of 1.4 was reported for all cancers....However...among the exposed, there is an *inverse* trend between distance of dwelling from the relevant electrical configuration and cancer risk. This observation argues against a causal interpretation of the weak overall positive finding.

Wertheimer and Leeper (1982) conducted a CCS of adult cancer in relation to residential wire configurations. They reported a strong and remarkably consistent positive association between overall cancer and EMFs....However, as in her study of childhood cancer, the coding of residential wire configurations was not done blinded and hence the positive findings may reflect observer bias. This study also suffers other limitations similar to those described above for her study of childhood cancer.

McDowall['s] (1986)...RFUS [showed]...no overall excess of all cancer mortality, nor of leukemia....There was a slight, nonsignificant excess of lung cancer mortality. However, this could not be directly attributed to EMFs. A limitation of this study is that some of these people probably moved away from these residences subsequent to 1971, introducing a dilution of the outcome. Nonetheless, this is a sound epidemiologic study which provides additional evidence that exposure to EMFs is unrelated to the occurrence of human cancer.

New Information...[I]f it were true that EMFs cause leukemia

among children...then one might reasonably expect that during this century the childhood leukemia death rate would have risen more or less progressively....It is evident that power consumption has risen strikingly, there having been nearly a 100% increase in every decade. At the same time, leukemia mortality rates have shown a rise of about 40% per decade up to about 1950 and, typically, a *decline* thereafter....

These results for leukemia and CNS neoplasms, taken together, suggest that either there is no causal relationship between exposure to EMFs and these conditions in children or that, if there is any effect, it must be very small....

Conclusions: The collective pattern of results that emerges from the epidemiologic reports is that of a weak, transitory effect that is not supported by consistent dose-response relationships or other internal characteristics of the data. A summation can only be that either there is no relationship between EMFs and cancer in human beings or if there is an effect it must be of very low magnitude even among people who are moderately to heavily exposed.

The above interpretation is fully supported by the absence of a temporal correlation between per capita electric power consumption and mortality rates of leukemia and CNS cancer among children in the United States.

Wertheimer's Response

...Dr. Cole seems to be reaching too hard to find explanations that deny the generally consistent positive findings of the studies. He says, for instance, that our study cannot be wrong because of chance or confounding, so it must be wrong because of bias; then, not believing that the Savitz results have the same problems with bias, he says they must be wrong because of uncooperative controls....Dr. Cole then recognizes that the major flaws of the occupational studies are unlikely to have produced the positive results found, so he concludes that those positive results are wrong because negative results were not published (though one must realize that powerful funding sources exist that welcome the finding and reporting of negative results), etc.

...I agree with Dr. Cole that it is particularly important to perceive the pattern of a number of epidemiological studies in evaluating a field. However, the strength of effect he looks for may be hard to attain for 60 Hz EMFs, because control groups will be universally exposed to this agent, diluting the risk ratios....

Responding to Dr. Cole's criticisms of our 1979 paper...He criticizes our method of data presentation. While our presentation was simple, I believe it was adequate (especially since Dr. Cole seems to have been able to compute the RRs and ARs he wanted from the data provided)....

Dr. Cole is skeptical about the similarity of risks seen for several different analyses. This is less surprising when one considers that the various analyses he refers to are simply different perspectives on the same basic data....

Finally, Dr. Cole suggests that since the Savitz study was superior to ours, Savitz should have gotten stronger, more consistent findings than we did. Actually, the differences between Savitz's results and ours (which are not so great) may have little to do with how well either study was done. The differences could be real: For instance, our work covered an era when young children usually stayed at home, but in the era Savitz covered children more often spent time at day-care centers, away from the home. Further, divorce, with division of the child's time between different homes, was probably more common in the era Dr. Savitz covers. Both of these factors, by decreasing the time the child spent in the coded home, may well have weakened Dr. Savitz's results.

Concerning the Savitz study: Dr. Cole contends that the Savitz data show as many RRs under as over 1.0, and that therefore the study is null and fails to confirm our findings. However, many of the RRs (such as those relating to electric fields) that are under 1.0 were not intended to test our hypotheses. No one claimed they should be over 1.0....I don't myself think that counting RRs from non-independent tables is a very useful way to evaluate a study, but at least the results do seem to show that, no matter how one cuts the data, high-exposure homes generally have a greater cancer risk than low-exposure homes....

Concerning other studies cited by Dr. Cole: Dr. Cole discusses a number of studies linking cancer with occupational EMF exposures (although he omits an interesting study by Swerdlow (1983), linking eye cancer (mostly melanoma) to electrical occupations....

I would agree that, in general, these studies cannot cast much light on our present problem because 50-60 Hz exposure cannot be assessed very well from occupational titles alone, and because, although "something seems to be going on," it may have to do with fumes and solvents rather than EMF exposure. However, my rough attempt to sort out probable exposures on the basis of job titles did not suggest that fumes and solvents are the whole story, or even the major part of the story.

I am concerned that Dr. Cole seems to put the most weight on what he sees as negative results from five RFUS studies [Vagerö (1983), Vagerö (1985), Olin (1985), Barregard (1985) and Törnqvist (1986)]; yet each of these studies has either little convincing evidence of 50-60 Hz exposure, or little convincing evidence that the cancer rates were unaffected, or both....

In Tomenius's study only the 200+ kV lines were shown to produce excess exposure. For these power lines a significantly increased cancer risk of 2.1 was, in fact, seen....When...[I reworked his data], a positive dose-relationship with distance is seen....

The problems of the McDowall (1986) study are severe, for he provides no evidence whatever that his "exposed" homes actually do receive increased 50 Hz EMF exposure. In fact... there is little reason to expect such exposure....

Concerning Dr. Cole's contention that childhood cancer rates should have increased in this century if power lines were responsible for a fair share of childhood cancer: This is a naive assumption....There is actually little reason to suppose that exposure to 60 Hz EMFs has increased over the century simply because use of electricity has increased: High power use need not produce high EMFs.

As both the Savitz study and Kaune's work in Washington state showed, the EMF exposure at a house is not related to the total power use in that house. Furthermore, as power use has increased, technology has changed in a number of ways that *reduce* field exposure....

Perhaps most important is the clear finding of the Savitz study that buried distribution wires – a recent technology – generally produce less field in nearby homes than the old-fashioned overhead wires. In connection with this advent of buried wire construction, Dr. Cole's table of changes in the cancer rate of children from 1920-1980 actually fits nicely with the changes expected in EMFs produced in homes by power lines: The years when the old overhead wires were carrying more and more current (1920 into the 1960s) show increasing cancer rates, but these rates seem to have decreased since buried wires became common in the new suburbs....