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No Consensus on Cellular Phone RF Radiation Levels in Brain

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

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

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

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

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Florida Lawsuit Blames Couple's Rare Leukemia on EMFs

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

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

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

(continued on p.12)

« Power Line Talk »

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

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The *ABA Journal* and *Electrical World* paint a dire picture of what could happen to utilities and insurance companies in the face of EMF lawsuits, adding to the growing literature on the subject (see *MWN*, M/A92 and N/D93). "This new litigation has the potential to open up a legal abyss that would dwarf the one created by asbestos," writes Roy Krieger in the January 1994 *ABA Journal*, which is published by the American Bar Association. He goes on to say that the "stage appears set" for the EMF-cancer debate to be resolved in the courtroom—not in the laboratory. "More studies exist that appear to link EMF exposure to an increased risk of cancer than existed linking asbestos exposure to an increased risk of cancer at a similar embryonic stage of asbestos litigation," he concludes. Dr. Robert Park of the American Physical Society, a longtime skeptic of EMF health effects, comments on the *ABA* article in his weekly e-mail column under the headline, "Electromagnetic Fields Attract Sharks." He notes that public concern over EMF health effects is "rising irrespective of

its validity" but agrees that growing EMF litigation could eclipse asbestos suits. In the December 1993 *Electrical World* article, James Pierobon outlines what could happen if a plaintiff wins a case: "A decision against a utility would send shock waves through the electric utility industry and alter how utilities site power lines," he writes. "It could drive up the cost of insurance and compel many states to reassess the need for EMF regulations." Pierobon also says that even if a utility successfully defends an EMF suit, the legal costs can be very high, citing, as an example, the \$2 million San Diego Gas & Electric Co. spent defending itself in the Zuidema case (see *MWN*, J/A91, N/D92 and M/J93)...The 376-page, fall issue of *Shepard's Expert and Scientific Evidence Quarterly*, a legal journal, is devoted primarily to EMF litigation, with chapters by John Burke Jr., Bruce DeBoskey, Linda Erdreich, Bruce Kelman, Marc Klein, Norman Sandler, John Ward and Michael Withey. The quarterly also features excerpts of expert testimony from the Zuidema case by Drs. Seymour Grufferman, Samuel Milham, Vikas Sukhatme and Peter Wright. For copies, contact: Shepard's/McGraw-Hill Inc., 555 Middle Creek Parkway, PO Box 35300, Colorado Springs, CO 80935, (800) 541-3334. A one year subscription costs \$350; a single issue is \$90.00.

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

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

Big Budget Increase for NERP

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

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

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

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

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

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The **Pennsylvania Power & Light Co.** (PP&L) and residents of **Scranton** have reached an agreement under which the utility will bury part of a new 2.7-mile, 138 kV line and build the rest in an industrial area, away from homes. The proposed settlement was filed on January 14 with the state Public Utility Commission (PUC), which is expected to decide whether to accept it by the middle of February, ac-

EMF Mitigation Tutorial

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

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

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

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

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

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

Swedes Issue EMF Assessment; Action on Limits Due in Spring

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

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

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

The board summarizes its views as follows: suspicion of

a link between magnetic field exposures and childhood leukemia is "strong," suspicion of a link between occupational magnetic field exposures and cancer is "reasonable" and suspicion of a link between residential magnetic field exposures and cancer in adults is "weak."

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

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

Exposure Assessment Resources

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Legal Notebook

Decision Due in Seattle Electrical Worker Case

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

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

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

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

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

Slater School Case Moves Forward

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

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

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

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

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

New York Landowners Settle Marcy-South Case

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

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

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

"There was no point for the NYPA to spend any more

time, energy or money on this controversy," the utility's assistant general counsel, Arthur Cambouris, told *Micro-wave News*. He said that the landowners had a "difficult time showing that market value was diminished in 1985 as a result of the power line" and that the NYPA "doesn't need to spend many tens of thousands of dollars to make that point when we can resolve this amicably." Cambouris also said that the easement the NYPA planned to use as an access road would have been returned to the Criscuolas anyway, because the utility decided to use another route.

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

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

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

CT Court Allows Discovery in Compensation Case

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

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

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

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

Two years ago, a Swedish electrician who developed a brain tumor received a workers' compensation award for his

illness. That was the first time a government recognized occupational exposure to EMFs as a cause of cancer (see *MWN*, N/D92).

Two Charges Dropped in Meadow Street Case

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

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

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

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

HIGHLIGHTS

Motorola Employee's Suit Claims Cell Phone Tests Caused Tumor

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

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

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

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

In an interview with *Microwave News*, Gina Fietsam, one of Kane's attorneys, countered: "We have the test data from

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

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

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

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

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

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

Brain Tumor Class Action Denied; Individual Claims Refiled

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

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

In St. Petersburg, FL, one of two main defendants has been dropped from the case brought by David Reynard, who alleges that cellular phone radiation caused or promoted the brain tumor that killed his wife (see *MWN*, M/J92). The claim against the service provider, GTE Mobilnet of Tampa Inc., was dismissed in ear-

ly November. Compared with the case against NEC, the manufacturer of the phone, it would be "more difficult to establish a case against GTE under conventional products liability law," explained John Lloyd, Reynard's attorney. Lloyd, based in St. Petersburg, said the case was dismissed without prejudice and could be refiled. GTE Mobilnet is part of GTE Corp. in Stamford, CT.

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

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

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

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

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

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

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

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

Among the task group's other conclusions are:

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

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

Electromagnetic Fields (300 Hz-300 GHz), Environmen-

Industry Epidemiological Studies

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

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

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

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

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

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

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

Induced currents for 10 Hz-1 kHz may not exceed 10 mA/m². Above and below that range, the limit is a function of frequency. The investigation levels for 50/60 Hz are 13-16 gauss and 10-12 kV/m for magnetic and electric fields, respectively.

For 100 kHz-10 GHz the basic restrictions continue to limit average whole-body SARs to 0.4 W/Kg—now averaged over 15 minutes, as opposed to 6 minutes. Partial-body SARs in the fetus, head, neck and trunk are now 10 W/Kg averaged over 6 minutes. For limbs, SARs can reach 20 W/Kg. For 10-300 GHz, the maximum power density is 10 mW/cm².

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

EPA Assails ANSI RF/MW Standards as Seriously Flawed

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

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

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

EPA's Recommendations

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

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

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

FDA-CDRH's Comments

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

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

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

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

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

The complete text of the guidelines, "Restrictions on Human Exposure to Static and Time-Varying Electromagnetic Fields and Radiation," appears in *Documents of the NRPB*,

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

Miscarriage Risk for Therapists Using Microwave Diathermy

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

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

The Johns Hopkins researchers did not do their own exposure measurements, but based them on those published by the Food and Drug Administration (FDA). In 1980, Paul Ruggera reported that leakage from certain MW diathermy units reached as high as 15 mW/cm², but only 8.32 mW/cm² for SW devices. Physical therapists, who use diathermy to increase the blood flow to patients' deep muscle tissues, receive significant exposures only if they give many treatments and stand close to the leakage area, according to Ouellet-Hellstrom and Stewart.

The FDA proposed an exposure standard of 10 mW/cm²

at 5 cm for MW diathermy devices, but it was never adopted (see *MWN*, F81 and J/F82).

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

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

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

Stronger Dose-Response in Finnish VDT-Pregnancy Study

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

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

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

In 1992, the Finnish researchers reported that workers using terminals with ELF EMFs greater than 3 mG, measured at 50 cm, had an almost three-and-a-half times greater

risk of miscarrying than women who used low emission VDTs (see *MWN*, M/A92 and M/J92). At that time, they did not detail how the risk changed with the number of hours at a high or low EMF VDT. Their paper was published in the November 1, 1992, issue of *AJE*.

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

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

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

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

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

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

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

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

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

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

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

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

Glazer: What FP&L Knew and When

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

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

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

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

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

later. Her husband, who moved from the house in 1989, was diagnosed in 1992 at the age of 54.

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

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

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

No Consensus on Cellular Phone RF Radiation Levels in Brain (continued from p.1)

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

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

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

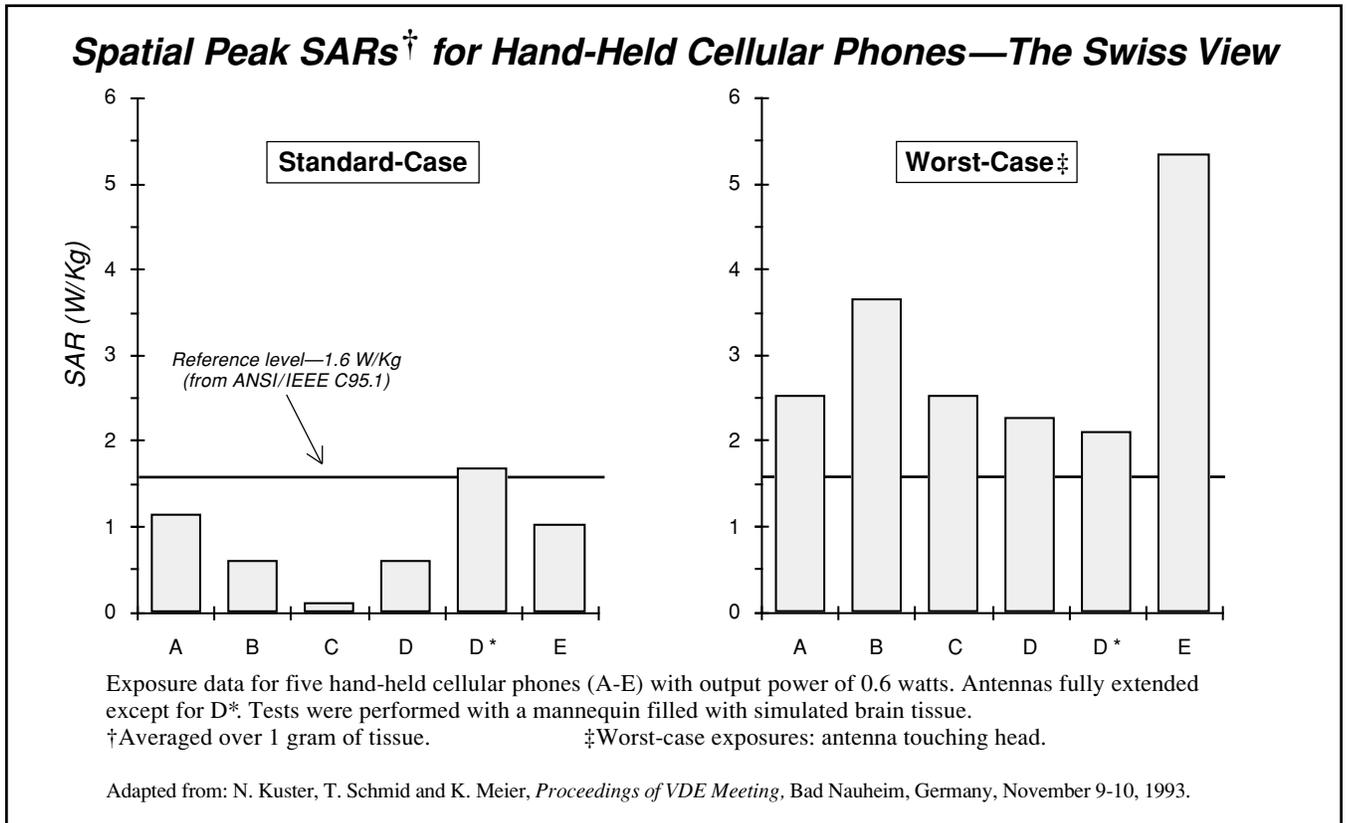
Gandhi’s and Kuster’s methods are quite different. In many ways, Gandhi’s model is more complex and more realistic, taking into account the shielding provided by the human ear and the electrical properties of the bone in the skull.

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

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

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

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



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

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

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

of the Bioelectromagnetics Society in Copenhagen, Denmark.

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

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

— Commentary on Cellular Phones —

Dr. Om Gandhi’s Science by Press Release

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

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

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

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

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

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

—making him a one-man judge and jury on the safety of cellular phones.

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

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

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

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

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

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

Cellular Phone Dosimetry Studies

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

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

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

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

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

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

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

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

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

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

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

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

UPDATES

GWEN

Additional Sites Scrapped...An amendment to the 1994 Defense Appropriations Bill signed on November 11 by President Clinton eliminates funding for expansion of the Air Force's Ground Wave Emergency Network (GWEN) during fiscal year 1994, which ends September 30, 1994. The DOD now says that it will drop plans for all GWEN sites that are not yet completed. The GWEN communications system operates at 150-175 kHz from a network of towers around the country and is designed to withstand the EMP of a nuclear blast. After more than 50 towers—out of the 83 that were planned—had been finished and put into operation, further construction was put on hold in 1990 pending completion of a safety assessment by the National Academy of Sciences' National Research Council. The NAS-NRC committee concluded in May 1993 that radiation exposures from the system posed a "minimal or non-existent" public health risk (see *MWN*, M/J93), and the Air Force resumed construction. Recent opposition to GWEN has centered more on budget considerations than on health issues. After the defense appropriation was signed into law, the amendment's sponsor, Rep. Martin Sabo (D-MN), and seven other congressmen wrote to then-Secretary of Defense Les Aspin, requesting a review of the need for additional GWEN facilities. (In 1990, Aspin, then a representative from Wisconsin, was one of two congressmen who requested the NAS-NRC assessment; see *MWN*, M/J90.) Calling the system "a relic of the Cold War," they noted that existing towers already provide a "basic back-up capability." In a January

14 letter, Emmett Paige Jr., an assistant secretary of defense, responded that, "Contracts for planned construction at all remaining sites are being terminated." Paige later confirmed that there would be no money for GWEN construction in the Pentagon's 1995 budget request, according to Charles Monfort, Sabo's legislative director. Monfort also said that, in September, the Senate rejected an amendment, introduced by Sen. Harry Reid (D-NV), to dismantle the GWEN system completely.

MAGLEV

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

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

MEASUREMENTS

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

MEDICAL APPLICATIONS

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

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

MEETINGS

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

MRI

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

EMF Papers

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

PEOPLE

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

STANDARDS

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

STATE REGULATIONS

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

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

TECHNOLOGY

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

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